Psychological Assessment

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Online First Publication, February 4, 2016. http://dx.doi.org/10.1037/pas0000273

CITATION

Corr, P. J., & Cooper, A. J. (2016, February 4). The Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ): Development and Validation. *Psychological Assessment*. Advance online publication. http://dx.doi.org/10.1037/pas0000273

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1040-3590/16/$12.00 http://dx.doi.org/10.1037/pas0000273

The Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ): Development and Validation

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We report the development and validation of a questionnaire measure of the revised reinforcement sensitivity theory (rRST) of personality. Starting with qualitative responses to defensive and approach scenarios modeled on typical rodent ethoexperimental situations, exploratory and confirmatory factor analyses (CFAs) revealed a robust 6-factor structure: 2 unitary defensive factors, *fight–flight–freeze system* (FFFS; related to fear) and the *behavioral inhibition system* (BIS; related to anxiety); and 4 *behavioral approach system* (BAS) factors (Reward Interest, Goal-Drive Persistence, Reward Reactivity, and Impulsivity). Theoretically motivated thematic facets were employed to sample the breadth of defensive space, comprising FFFS (Flight, Freeze, and Active Avoidance) and BIS (Motor Planning Interruption, Worry, Obsessive Thoughts, and Behavioral Disengagement). Based on theoretical considerations, and statistically confirmed, a separate scale for Defensive Fight was developed. Validation evidence for the 6-factor structure came from convergent and discriminant validity shown by correlations with existing personality scales. We offer the Reinforcement Sensitivity Theory of Personality Questionnaire to facilitate future research specifically on rRST and, more broadly, on approach-avoidance theories of personality.

Keywords: personality, approach, avoidance, goal conflict, reinforcement sensitivity theory

Supplemental materials: http://dx.doi.org/10.1037/pas0000273.supp

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During a typical day, the average person may encounter a variety of situations that elicit specific emotions, motivations and behavioral reactions. These include encountering a dangerous-looking barking dog, the sight of a spider, or alarms sounding; thought of mistakes in one's work, chewing over a difficult problem, or being unable to get a particular thought out of one's mind; and striving to achieve a goal, experiencing pleasure of achievement, interest in a new idea or project, and the desire to eat that delicious cake. In personality terms, these are examples of the activation of fear, anxiety, and approach systems, respectively (Corr, DeYoung, & McNaughton, 2013). Not only are these experiences frequent and ubiquitous, they are also pervasive in their shaping of many other forms of everyday behavior.

The idea that underlying human personality are neurobehavioral systems responsible for appetitive and aversive motivation has gained widespread currency in recent years (Corr, 2013; for a review, see DeYoung & Gray, 2009). Within this general research area, one of the most prominent neuroscience theories of personality is the reinforcement sensitivity theory (RST; Corr & McNaughton, 2012; Gray & McNaughton, 2000; McNaughton & Corr, 2004, 2008). The most recent version of RST postulates three major neuropsychological systems (RST-3): one positive, the behavioral approach system (BAS); and two negative, the fight-flight-freeze system (FFFS) and the behavioral inhibition system (BIS; Gray & McNaughton, 2000). The BAS is activated by appetitive stimuli; the FFFS by aversive stimuli; and the BIS by conflicting stimuli (e.g., coactivation of FFFS and BAS). This is a revision of the original RST formulated by Gray (1982) that laid emphasis upon only two of these systems, the BIS and the BAS (RST-2). This general theoretical framework has increasingly been seen as offering an integrative model for the neurobiology of personality (e.g., Kennis, Rademaker, & Geuze, 2013).

Despite the passing of 15 years since the Gray and McNaughton (2000) revision of RST, there is still no comprehensive psychometric measure of the three revised systems. In addition, since 2000, there has been further theoretical elaboration of RST to include five processes/systems (RST-5; Corr & McNaughton, 2012): 2 valuation inputs to compute the gain and loss associated with any situation, and three motivation outputs systems (FFFS, BIS, and BAS), which are activated once the stimuli valuation problem has been solved. This article is concerned with the output systems.

The most significant change in revised RST (rRST) is the separation of FFFS/fear and BIS/anxiety processes, which are postulated to have different functional properties and distinct neuropsychopharmacological bases (Corr & McNaughton, 2012; Mc-

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We are grateful to Sonya Tsancheva for providing data from 317 participants, which we included in this Study 2.

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Naughton & Corr, 2004, 2008). Although these two systems were contained in the early version of RST (Gray, 1982), they were not adequately distinguished or defined. In support of this theory, which is based on extensive rodent data reviewed by Gray and McNaughton (2000), in humans different types of evidence support FFFS/BIS separability: psychometric measures of fear and anxiety are differentiated in CFA (Cooper, Perkins, & Corr, 2007); predictive validity studies point to their different functions (Perkins, Kemp, & Corr, 2007); and different facial expressions have been identified for each system (Perkins, Inchley-Mort, Pickering, Corr, & Burgess, 2012). The importance of this FFFS/BIS separation is increasingly recognized in psychopathological research (Bijttebier, Beck, Claes, & Vandereycken, 2009), where the absence of appropriate psychometric measures of fear and anxiety has been highlighted as a significant obstacle to research progress (Sylvers, Lilienfeld, & LaPraririe, 2011). It now also plays a prominent role in LeDoux's (2015) theory of the anxiety disorders. The call for more appropriate measures of revised RST has come also from other researchers (e.g., Dissabandara, Loxton, Dias, Daglish, & Stadlin, 2012).

In relation to the BAS, there is evidence that it has multiple processes and, in psychometric terms, is multidimensional, reflecting incentive motivation and pleasure experience components (Depue & Collins, 1999; Smillie, Cooper, Wilt & Revelle, 2012; summarized by Corr et al., 2013; see also Corr, 2016). As discussed below, the implications of this multidimensionality have not been properly considered by more recent psychometric measures of revised RST.

The majority of RST-inspired personality measures are based on the original BIS/BAS model and are problematic as regards revised RST (for this reason, in this article they are not considered further; a thorough review of this literature is given by Torrubia, Avila & Caseras, 2008). However, a number of revised RST questionnaires for use with adults have been developed over recent years (Jackson, 2009; Reuter, Cooper, Smillie, Markett, & Montag, 2015; Smederevac, Mitrovic, Colovic, & Nikolasevic, 2014). As a summary and comparison of all RST questionnaires has already been given by Corr (2016), only the most germane aspects of them as they relate to this article are discussed.

The eponymously named Jackson-5 (Jackson, 2009) is composed of clusters of items that measure five factors: BAS, BIS, Fight, Freezing, and Flight. It has a number of limitations. First, there is only one BAS factor, which is not consistent with Carver and White's (1994) multidimensional model, theoretical models of the BAS (Corr, 2008; see below), or the differentiation of reward sensitivity and rash impulsivity (Dawe, Gullo, & Loxton, 2004; Quilty & Oakman, 2004; Smillie, Jackson, & Dalgleish, 2006; Smillie, Pickering, & Jackson, 2006). Second, the BIS scale is problematic, with many of the items suffering from a lack of face validity (e.g., "Prefer projects to prove my ability"; "Want to do well compared to others"; "Aim better than peers")—conceptually, such BIS items would be better aligned with the BAS, and in fact are correlated with BAS measures from other RST questionnaires (Krupić, Križanić, Ručević, Gračanin, & Corr, 2015; see Table 2 from Jackson, 2009; this matter is discussed further in Corr, 2016).

Of the other two putative rRST questionnaires, Reuter et al. (2015) attempt to measure the FFFS, BIS, and FFFS, along with Fight, but this too has only one BAS factor, and the correlations between the BAS and BIS (−0.29) and FFFS (−0.41), respectively, are larger than indicated by either theoretical or psychometric considerations. In addition, Fight is strongly *negatively* correlated with the FFFS (−0.78), which may reflect the nature of some of the scale content (e.g., "I am a rather quick-witted person", Q.22), which does not seem to reflect defensive fight, at least not as defined by rRST—it may relate to a predatory form of psychopathy, which itself is negatively correlated with the FFFS (Corr, 2010). Of the third rRST questionnaire (Smederevac et al., 2014) this, too, only has one BAS factor, and there is too little differentiation of the BIS and FFFS scales (path coefficients range from 0.73–86, which after correcting for measurement error implies unity of these two constructs).

Other, more clinically directed, work has also started, for example separating the FFFS into lower order facets (e.g., fight, flight and freeze components; Maack, Buchanan, & Young, 2015). In children, there has been few attempts to develop revised RST measures, and only one study has a direct bearing on this topic (Colder et al., 2011): From a factor analysis of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001), this pointed to the existence of separate defensive factors (putatively FFFS-related fear/shyness, and BIS-related anxiety, and conflict avoidance), and four approach factors (drive, impulsivity/fun seeking, responsiveness to social approval, and sensory reward), which, once again, attests to the multidimensionality of the BAS.

In sum, existing rRST questionnaires fail to provide a *comprehensive* descriptive model; and, as noted above, all of the existing ones have significant theoretical and operational limitations. Also, they have not followed a theoretically driven process in the development of scale items based on the typical human reactions to defensive and approach RST-defined scenarios. The latter point is important because using "face validity" on its own to develop test items begs the question of the nature of the expressions of the FFFS, BIS, and BAS in humans, as measured by questionnaire (Corr, 2013).

The major aim of this article is to address these drawbacks with the development and validation of the Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ).

Operational Definition of the RST-PQ

The development of the RST-PQ was based on a theoretical analysis of rRST, namely the specific component processes of the FFFS, BIS, and the BAS. In terms of theoretical impetus, this approach provided operational criteria for the construction of thematic facets that defined these three broad domains. Theoretical elaboration of these constructs is given elsewhere (Corr, 2008, 2013), therefore only a summary is given below (for further information, see the online supplemental material, Appendix A).

Fight–Flight–Freeze System (FFFS)

The FFFS adds *freeze* to the original (Gray, 1982) *fight–flight system* (FFS). It is a general purpose punishment sensitivity system responsible for mediating reactions to *all* aversive stimuli (in contrast, the original, 1982, theory assigned the FFS to reactions to *unconditioned* aversive, pain-inducing, stimuli only). An important distinction made by Gray and McNaughton (2000; Mc-

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Naughton & Corr, 2004, 2008) concerns the situational factors that constrain viable defensive behaviors. They divide punishment stimuli into those that can be avoided, which they assign to the FFFS, and those that cannot be avoided and, thus, must be faced (i.e., approached), which they assign to the BIS. When there is no motivation to approach a danger (hence, the BIS is not engaged), stimuli that can simply be avoided elicit the following defensive behaviors, according to defensive distance, or perceived threat, high-to-low, respectively: *flight and active avoidance*; and for stimuli that cannot be easily avoided, *fight* and *freeze*. These prototypical ethoexperimental animal responses have been modeled in human beings with some success (e.g., Blanchard, Hynd, Minke, Minemoto, & Blanchard, 2001; Perkins & Corr, 2006). There is now also evidence that such human behavioral analogues of rodent defensive paradigms are sensitive to drugs used to treat fear and anxiety in human patients (Perkins et al., 2009, 2013).

In relation to the FFFS-related Fight component, there are good theoretical and empirical reasons for believing that it is problematic in human beings, especially as measured by questionnaire. For reasons discussed below, and detailed in the online supplemental material (see the online supplemental material, Appendix D), the decision was made to separate it from FFFS, BIS, and BAS factors.

Behavioral Inhibition System (BIS)

Revised RST contends that the BIS is responsible for the resolution of goal conflict in general (e.g., between BAS-approach and FFFS-avoidance, as in foraging situations—but also in other forms of conflict, both within and between the FFFS and BAS). Activation of the BIS entails the inhibition of prepotent conflicting behaviors, the engagement of risk assessment processes, and the scanning of memory and the environment to help resolve concurrent conflict. In typical animal learning situations, BIS outputs have evolved to permit an animal to enter a dangerous situation (i.e., leading to cautious "risk assessment" behavior) or to withhold entrance (i.e., passive avoidance) if the conflict is sufficiently intense.

The BIS resolves conflicts by increasing, by recursive loops, the negative valence of stimuli (these input to the FFFS), until behavioral resolution occurs in favor of either BAS-mediated approach (perception of danger has diminished) or FFFS-mediated active avoidance or escape (perception of danger is now more apparent and/or increased). In terms of cognitive aspects, BIS activation leads to: (a) worry and rumination about possible danger; (b) obsessional thoughts about the possibility that something unpleasant is going to happen (especially when the threat is oblique and cannot be immediately avoided); and (c) behavioral disengagement, especially when the threat is unavoidable and no amount of risk assessment and worry helps resolve the conflict.

We believe that it is unrealistic to assume that FFFS-fear and BIS-anxiety processes are uncorrelated, but this does not imply that they cannot conceptually and operationally be separated. Revised RST suggests that FFFS and BIS are oblique factors, contributing to a higher order "Neuroticism" factor—however, this general factor is assumed to be more than FFFS/BIS (e.g., RST-unrelated cognitive dysregulation). There are several reasons for this assertion. First, rRST argues that these systems are often coactivated (e.g., BIS activation causes the FFFS to increase the negative valence of goals that are in conflict). Second, activation of the FFFS can lead to BIS activation (i.e., the existence of incompatible goals; e.g., activation of freezing and flight tendencies of comparable intensity).

Behavioral Approach System (BAS)

Although the BAS has received much less theoretical attention than the two defensive systems, there is compelling evidence that it is multidimensional, both on the basis of empirical evidence (e.g., Carver & White, 1994) and theoretical grounds. In terms of the latter, although the primary function of the BAS system is to move the animal up the temporo-spatial gradient, from a start state, toward the final biological reinforcer, this primary function must be supported by a number of subprocesses. In particular, some form of "subgoal scaffolding" is required (Corr, 2008). This process consists of (a) identifying the biological reinforcer, (b) planning behavior, and (c) executing the plan (i.e., "problem solving") at each stage of the temporo-spatial gradient.

It is not assumed that the dedicated machinery of these complex functions are performed by the BAS; it is more plausible to assume that the operations of the BAS interface with, and are supported by, other systems (e.g., working memory, executive control, etc.). However, it is assumed that the BAS has specific processes that coordinate these functions as they relate to approach behaviors. For the above reasons, BAS behavior may be expected to entail a series of subprocesses, some of which sometimes oppose each other, for example impulsivity and restraint (Carver, 2005).

There seems an obvious difference between the reward interest, goal planning and drive-persistence, that characterize the early stages of approach, and the behavioral and emotional excitement as the animal reaches the final biological reinforcer (reward responsivity and impulsivity). Emotion in the former case may be termed "anticipatory pleasure" (or "hope"); in the latter case something akin to an "excitement attack" of high pleasure/joy. Some of these processes are contained in the Carver and White (1994) BIS/BAS scales. For a summary of these BAS components, see the online supplemental material (Appendix A).

Study 1: Preliminary Development of RST-PQ

The RST-PQ was designed with several features in mind. First, we used theoretically driven thematic facets to guide item development—these served as conceptual anchors. Second, we avoided the ambiguity associated with saturation of factors with emotion words. Third, we used a variety of methods to generate item content. This structured approach ensured that we remained faithful to the assumptions of rRST, while at the same time not ignoring some major issues in the literature (e.g., the ambiguous role of Fight).

The first task was to develop a large pool of candidate items. These were derived from two main sources: (a) commonly used RST questionnaires (e.g., Carver & White, 1994, BIS/BAS Scales) and (b) qualitative responses to 19 scenarios (see below).

Method

Fifty-one participants (21 males; $M = 38.4$ years, $SD = 15.95$) completed the Life Situations Questionnaire, which asked them to describe their motivations, actions and emotions in response to 19

situations written conceptually to be aligned with the domain content of the RST-PQ scales (for the full list, see the online supplemental material, Appendix B).

Ethics approval was obtained from the department of Psychology, Swansea University.

Thematic analyses were conducted on these qualitative responses with the intention of writing a large number of items that, then, could be statistically whittled down to a manageable number. These items were written using standard guidelines for clear and comprehensible self-report personality measures (e.g., Osterlind, 2009). They needed to be unambiguous, short statements, without compound clauses and reflecting unipolar activity of the relevant system. A decision was made to avoid the use of reverse worded items, since recent work has suggested that such items are ineffective in dealing with response acquiescence, and may cause spurious multidimensionality in responses by confusing participants (van Sonderen, Sanderman, & Coyne, 2013). All items were developed to be answered using a response key to the question *How accurately does this statement describe you?* Participants responded to each question using a four-point Likert-style scale with the following response options: *not at all*, *slightly*, *moderately*, and *highly*.

The initial RST-PQ item pool, consisting of 248 candidate items (available from the second author), was tentatively categorized using the conceptual model (see the online supplemental material, Appendix A, Table S1). These items were then administered to 724 participants, 226 males, mean age of 25.20 (SD = 9.42), and 498 females, mean age of 24.30 (SD = 8.80) recruited from university (who participated for course credit; n = 630) and general public (who participated out of interest; n = 94) populations—no financial incentives were given here or in any of the other studies reported in this article. All participants were over the age of 18 years and were native English language speakers, or were studying a university degree in English. There were no other eligibility criteria for participation, and no further demographic characteristics were recorded. Some participants completed the pen-and-paper version (n = 151; the remainder an online version). Item screening and exclusion criteria are presented in the online supplemental materials (see the online supplemental material, Appendix B).

Results and Discussion

Separate exploratory factor analyses (EFA; using Mplus 6.12; Muthén & Muthén, 2010), within the FFFS, BIS, and BAS domains, were conducted on retained items (the full item content and the results of these EFAs may be obtained from the second author). Factors were extracted from the sample correlation matrix using a robust weighted least squares estimator and factors were rotated using an oblique Geomin rotation. Items chosen for deletion had substantive factor loadings across more than one factor in each domain, or had very low factor loadings across all of the factors in each domain. Examining the items in these three broad RST domains separately reduced the complexity of the resultant EFAs, and so allowed us to more easily identify deficient items within each domain. The number of factors extracted was based on the results of a parallel analysis. As a rule of thumb, we used a factor loading value of 0.32 (i.e., 10% of the variance), as a cutoff when making decisions concerning the retention or exclusion of items. Retention of items was also guided by theoretical considerations and face validity.

The outcome of the above procedures resulted in the following. Fifteen FFFS-designated items, measuring thematic facets of Active Avoidance, Flight and Freeze. Twenty-seven BIS-designated items, measuring thematic facets of Behavioral Disengagement, Obsessive Thoughts, Cautious Risk Assessment, Motor Planning Interruption and Worry. Thirty-six BAS-designated items, measuring thematic facets of Drive-Persistence, Goal Planning, Impulsivity, Reward Interest, and Reward Responsiveness. In relation to the BAS, analysis of the five factor rotated solution showed that most items had reasonably strong primary loadings on their target factor, although a number of the Goal Planning items cross-loaded on the factor comprised mainly of Drive-Persistence items.

By these various forms of statistical scrutiny and exploratory factor analyses, the initial pool of (248) items was reduced to 78 psychometrically sound items.

Study 2: Exploratory Factor Analysis

The aim of Study 2 was further to refine the initial pool of 78 items, and to explore their factor structure to develop a psychometrically robust set of FFFS, BIS, and BAS scales. The results of this study were then subjected to replication in Study 3.

Method

Participants. Four hundred eighty-six participants (145 males, M_{age} = 22.39, SD = 6.10; 341 females, M_{age} = 23.53, SD = 7.88), recruited via an email sent to students and staff at Swansea University and Goldsmiths, University of London, UK, provided data. Ethics approvals were obtained from the Departments of Psychology at these two institutions.

Materials and procedure. Participants completed the questionnaire online. After supplying demographic details, they were asked to read the instructions for the questionnaire and then answer the questions. Following completion, participants received a debriefing on the nature of the measure they had completed.

Data analysis. We began the data analyses by using exploratory factor analysis (EFA) to examine the 78-item RST-PQ item pool. Two EFAs were conducted separately, first for the combined FFFS/BIS items, and then for the BAS items. The purpose of these EFAs was to examine the factor structure of the items and to identify further any items that may have deficient psychometric properties. The EFAs were carried out using Mplus 6.12 (Muthén & Muthén, 2010). Factors were extracted using a robust weighted least squares estimator and were rotated using an oblique Geomin rotation. The number of factors extracted was based on the results of a parallel analysis. The decision to conduct separate analyses for the BIS/FFFS and BAS items was motivated by the desire to isolate problematic items in a less complex model. We then tested a combined model with all the surviving RST-PQ items in Study 3.

Results and Discussion

Exploratory factor analysis—BAS. Thirty-six BAS items developed during the preliminary analysis were entered into this EFA. The results of the parallel analysis suggested four factors

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Table 1
Factor Loadings for Exploratory Factor Analyses (EFA) and Confirmatory Factor Analyses (CFA) of BAS Items in Studies 2 and 3

Thematic facets	EFA				CFA			
	F1: RI	F2: GDP	F3: RR	F4: Imp	F1: RI	F2: GDP	F3: RR	F4: Imp
Reward interest								
I am usually one of the first to spot a new opportunity.[a]	**.38**	**.48**	−.15	.09				
I am always finding new and interesting things to do.	**.69**	.25	.01	.02	**.78**			
I regularly try new activities just to see if I enjoy them.	**.78**	.15	−.07	−.01	**.68**			
I get carried away by new projects.	**.44**	.16	.10	.02	**.58**			
I take a great deal of interest in hobbies.	**.44**	.17	.07	−.12	**.60**			
I am very open to new experiences in life.	**.60**	.05	.08	.16	**.63**			
I am a very active person.[b]	**.56**	.22	−.05	−.05	**.33**			
I am always "on the go."[b]	**.40**	**.33**	−.01	.01	**.58**			
Drive-persistence								
I put in a big effort to accomplish important goals in my life.	.10	**.75**	−.01	−.17		**.76**		
I am motivated to be successful in my personal life.	.12	**.64**	.13	.01		**.75**		
I often overcome hurdles to achieve my ambitions.	.20	**.64**	−.06	.02		**.76**		
I feel driven to succeed in my chosen career.	−.07	**.81**	−.02	.12		**.81**		
I am very persistent in achieving my goals.	.04	**.85**	−.04	.00		**.84**		
Goal planning								
I think it is necessary to make plans to get what you want in life.	.18	**.54**	.18	**−.33**		**.50**		
I will actively put plans in place to accomplish goals in my life.	.07	**.73**	.09	**−.31**		**.78**		
I am good at saving money for holidays.[a]	−.03	.24	.02	**−.41**				
I find it useful to make lists of what I need to do.[a]	−.08	.26	.26	−.20				
I try to achieve small goals first before tackling the bigger goals in life.[a]	−.07	.08	.19	−.12				
Reward reactivity								
I am especially sensitive to reward.	.01	.04	**.62**	.00			**.49**	
Good news makes me feel over joyed.	.26	.11	**.56**	−.10			**.61**	
I love winning competitions.	.02	.06	**.44**	.16			**.53**	
I get a special thrill when I am praised for something I've done well.	−.06	.12	**.71**	.04			**.67**	
I get very excited when I get what I want.	−.08	.17	**.59**	.25			**.70**	
I always celebrate when I accomplish something important.	.26	.08	**.44**	.09			**.69**	
I find myself reacting strongly to pleasurable things in life.	.27	−.05	**.63**	.20			**.70**	
I often feel that I am on an emotional high.	.26	−.05	**.39**	.29			**.55**	
Sometimes even little things in life can give me great pleasure.	**.46**	−.14	**.55**	−.11			**.40**	
I often experience a surge of pleasure running through my body.	**.32**	−.07	**.30**	.16			**.44**	
Impulsivity								
I think I should "stop and think" more instead of jumping into things too quickly.	.02	.06	.11	**.48**				**.52**
I sometimes cannot stop myself talking when I know I should keep my mouth closed.	−.10	.02	.13	**.55**				**.47**
I often do risky things without thinking of the consequences.	.13	.02	−.05	**.75**				**.67**
I find myself doing things on the spur of the moment.	**.37**	−.03	.06	**.55**				**.77**
I'm always buying things on impulse.	−.04	−.03	.17	**.47**				**.49**
I would go on a holiday at the last minute.	.28	.03	.02	**.35**				**.45**
I think the best nights out are unplanned.	.18	.02	−.01	**.45**				**.51**
If I see something I want, I act straight away.	−.03	**.35**	.07	**.57**				**.67**
Factor Correlations								
1. Reward Interest								
2. Goal-Drive Persistence	.34				.52			
3. Reward Reactivity	.11	.28			.59	.41		
4. Impulsivity	.21	−.01	.21		.48	.05	.55	

Note. Factor loadings > .30 ($p < .001$) are in boldface. BAS = behavioral approach system; RI = Reward Interest; GDP = Goal-Drive Persistence; RR = Reward Reactivity; Imp = Impulsivity.
[a] Item deleted from final questionnaire. [b] Items moved from a priori Goal-Drive Persistence to Reward Interest factor.

should be extracted. Inspection of a five factor solution revealed that the fifth factor was ill-defined in terms of its resultant factor loadings (the first five eigenvalues were 8.74, 4.32, 2.70, 1.71 and 1.46). Therefore, on this basis, we extracted four factors. Table 1 shows the rotated factor loading matrix and the factor intercorrelations. Most items had a substantive factor loading on only one factor, with minimal cross-loading. In selecting items, we used the loadings to guide our choice, as well as considerations of face validity—the virtue of the latter decision was checked in Study 3.

Factor 1 was composed of items reflecting the facet of Reward Interest. One item (Question 6: "I am usually one of the first to spot a new opportunity") crossed loaded on factors 1 and 2 and was, thus, deleted from the final questionnaire. Factor 1 was composed of 7 items (two were moved from a priori Drive-

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Persistence factor: "I am an active person" and "I am always 'on the go'"). Factor 2 was composed of items reflecting Drive-Persistence and 2 Goal Planning items (the remaining 3 Goal Planning items either crossed loaded or did not load on a factor and were deleted from the final questionnaire). This combined Goal-Drive Persistence factor had 7 items after removal of the two items to the Reward Interest factor. Factor 3 was comprised of items reflecting Reward Reactivity, containing 10 items. Factor 4 was composed of items reflecting Impulsivity, a total of 8 items.

In general terms, items loaded most strongly on the BAS facet that they were designed to measure. This structure replicated that found for the BAS items during the development phase, save the combination of drive-persistence and goal-planning, which formed a unitary factor that we now call Goal-Drive Persistence. The factor intercorrelation matrix shows that the BAS facets are moderately positively correlated with each other, with the exception of Goal Drive-Persistence and Impulsivity facets.

Exploratory factor analysis—FFFS and BIS. The set of FFFS and BIS items in this EFA comprised the 42 items that had been developed in the preliminary analysis. The results of the parallel analysis suggested two factors should be extracted. The first three eigenvalues were 15.43, 3.24, and 2.16.

Table 2 shows the rotated factor loading matrix for the two factor solution and their intercorrelations, with items sorted into thematic facets. We used this factor loading matrix to examine the nature of the factors obtained and to examine the relationships of each of the items with each of the factors. Factor 1 reflected the FFFS, and Factor 2 the BIS. In the reduced scales, we eliminated items that cross-loaded, did not load on either factor, or did not load on their designated factor. This led to 10 items for the FFFS and 23 items for the BIS—an understandable outcome as the BIS is more complex than the FFFS.

Several things concerning the a priori facets are noteworthy. Flight items that loaded onto the BIS factor were ones involving a broader and more complex emotion than the Flight items that loaded on the FFFS factor. Throughout the development of this questionnaire, we have noticed that BIS items tend to be more diffuse in nature and less tied to specific situations, which might suggest that FFFS is more situation specific than the BIS, which reflects a more abstract type of defensive emotion.

In relation to Active Avoidance items that loaded onto the BIS factor (e.g., "I am an avoidant sort of person"), these were either rather general, requiring the respondent to sample a broader affective space, or entail a goal conflict aspect. Avoidance is a complex process, because according to RST there is FFFS-related active avoidance and BIS-related passive avoidance. Our study suggests that FFFS avoidance items relate to simple phobic avoidance of a specific type.

Concerning Motor Planning Interruption, several of these items spanned both FFFS and BIS factors. Of the retained items in the BIS scales, these were the most problematic. We made the decision to retain these because they all loaded on the BIS factor, some exclusively loaded on the BIS factor, and all had highest loadings on the BIS factor (save 1 item that had equal loading with the FFFS factor). These items also have strong theoretical links to the functioning of the BIS. We inspected the goodness of fit of these items in the CFA of Study 3.

The final version of the RST-PQ is given in the online supplemental material (see Appendix C).

Study 3: Confirmatory Factor Analysis

The aim of Study 3 was to replicate the factor structure for the FFFS, BIS, and BAS developed in Study 2 using the final version of the RST-PQ

Method

Participants and procedure. Eight hundred thirty-one participants (178 males, $M_{age} = 24.33$, $SD = 8.71$; 653 females, $M_{age} = 24.22$, $SD = 9.16$) were recruited from universities in England and Wales, from which ethics approvals were obtained. They were recruited via an email sent to students and staff, or using a pen and paper version of the measure completed in small groups of 10–20 students. Some participants completed the pen-and-paper version ($n = 361$; the remainder an online version).

Data analysis. All CFA analyses were conducted with the Mplus 6.12 software program (Muthén & Muthén, 2010) using a mean and variance adjusted weighted least squares estimation of the sample covariance matrix. Model fit was ascertained using the minimum fit function χ^2. As χ^2 values are potentially inflated by large sample sizes, fit was also examined using two practical fit indices: Root mean square error of approximation (RMSEA; Steiger, 1990), and the comparative fit index (CFI; Bentler, 1990). The RMSEA provides a measure of model fit relative to the population covariance matrix when the complexity of the model is taken into account. RMSEA values of $< .05$ are suggestive of good fit and .05 to .08 as moderate fit. The CFI provides a measure of the fit of the hypothesized model relative to the baseline or independent model, with values usually ranging from 0.00 to 1.00. For the CFI, values above .95 are suggestive of good model fit and values above 0.90 suggest adequate model fit.

Results and Discussion

We initially tested the FFFS/BIS and BAS items separately, based on the psychometric structures found in Study 2. Starting with the BAS items, we initially tested a one factor CFA model, where all of the BAS items were free to load on a single latent factor. Given the multifactorial structure for these items shown in Study 2, we expected this one-factor model to show poor global model fit, which it did, $\chi^2(464, N = 831) = 5{,}657.44$, $p < .0001$; CFI = 0.60; RMSEA = 0.116. A four-factor CFA model based on the factor structure, shown in Study 2, was then tested (see Table 1). Each BAS item was free to load on its respective factor and was fixed at 0 for the other factors. All latent factors were free to correlate and all of the observed variable error terms were uncorrelated. This model showed acceptable global fit, $\chi^2(458, N = 831) = 1{,}830.36$, $p < .0001$; CFI = 0.90; RMSEA = 0.060. All factor loadings were above 0.33, and most were above 0.50.

All latent factors were significantly positively correlated with each other, with the exception of the Impulsivity and Goal Drive-Persistence factors, which were not significantly correlated. This four-factor model showed significantly better model fit than the one-factor model, $\chi^2(6) = 872.56$, $p < .0001$. We also tested a higher order CFA model where the Reward Interest, Drive-Goal Persistence, Reward Reactivity and Impulsivity factors loaded onto a second order reward sensitivity factor. The global model fit indices for this higher order model were a little poorer than for the

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Table 2
Factor Loadings for Exploratory Factor Analyses (EFA) and Confirmatory Factor Analyses (CFA) of FFFS and BIS Items in Studies 2 and 3

Thematic facets	EFA		CFA	
	F1: FFFS	F2: BIS	F1: FFFS	F2: BIS
Flight				
I would run fast if I knew someone was following me late at night.	**.52**	−.01	**.51**	
I would run quickly if fire alarms in a shopping mall started ringing.	**.43**	.02	**.41**	
I would leave the park if I saw a group of dogs running around barking at people.	**.40**	−.01	**.45**	
I often remove myself (flee) from situations and people that are starting to upset me.[a]	.31	**.38**		
I have rushed out of the house after an unpleasant argument with a relative/partner.[a]	−.10	**.36**		
Active avoidance				
I am an avoidant sort of person.[a]	.16	**.42**		
There are some things that I simply cannot go near.	**.55**	.07	**.59**	
I often find myself not wanting to touch certain objects.[a]	.30	.19		
I go out of my way to avoid getting into arguments and confrontations.[a]	.28	.20		
I would not hold a snake or spider.	**.77**	−.16	**.49**	
Freezing				
I would be frozen to the spot by the sight of a snake or spider.	**.85**	−.18	**.53**	
Looking down from a great height makes me freeze.	**.36**	.04	**.50**	
I would instantly freeze if I opened the door to find a stranger in the house.	**.58**	.08	**.58**	
I would freeze if I was on a turbulent aircraft.	**.45**	.09	**.56**	
I am the sort of person who easily freezes-up when scared.	**.57**	.28	**.93**	
Motor planning interruption				
I take a long time to make decisions.	**.36**	**.36**		**.63**
When nervous, I find it hard to say the right words.	**.35**	**.47**		**.65**
When nervous, I sometimes find my thoughts are interrupted.	.19	**.50**		**.59**
I often find myself lost for words.	**.32**	**.35**		**.60**
My behavior is easily interrupted.	.04	**.49**		**.48**
Cautious risk assessment				
I like to find out everything about a new partner before committing to them.[a]	.21	.19		
My friends would say I am a cautious person.[a]	**.32**	.14		
I would be very cautious traveling in a foreign country for the first time.[a]	**.49**	.07		
I worry a lot.	**.33**	**.64**		**.80**
People are often telling me not to worry.	**.31**	**.54**		**.71**
I often worry about letting down other people.	.23	**.48**		**.60**
The thought of mistakes in my work worries me.	.25	**.46**		**.54**
When trying to make a decision, I find myself constantly chewing it over.	**.32**	**.39**		**.59**
Obsessive thoughts				
I find myself thinking about the same thing over and over again.	−.01	**.85**		**.82**
I am often preoccupied with unpleasant thoughts.	−.12	**.79**		**.70**
It's difficult to get some things out of my mind.	−.01	**.79**		**.74**
My mind is dominated by recurring thoughts.	−.08	**.89**		**.80**
My mind is sometimes dominated by thoughts of the bad things I've done.	−.11	**.73**		**.67**
I often find myself thinking about the health of relatives/friends even when I know they are not ill.[a]	**.31**	.28		
I often wake up with many thoughts running through my mind.	.08	**.60**		**.64**
I'm always weighing-up the risk of bad things happening in my life.	.13	**.59**		**.64**
Behavioral disengagement				
I often find myself "going into my shell."	.19	**.57**		**.62**
I feel sad when I suffer even minor setbacks.	.08	**.63**		**.60**
I often feel depressed.	−.19	**.85**		**.77**
I have often spent a lot of time on my own to "get away from it all."	.01	**.55**		**.50**
I sometime feel "blue" for no good reason.	−.12	**.74**		**.68**
When feeling "down," I tend to stay away from people.	.01	**.49**		**.48**
Factor 1				
Factor 2	.40		.56	

Note. Factor loadings > .30 ($p < .001$) are in boldface. FFFS = fight–flight–freeze system; BIS = behavioral inhibition system.
[a] Item deleted from questionnaire in Study 2.

single order model, $\chi^2(460, N = 360) = 2{,}198.18$, $p < .0001$; CFI = 0.87; RMSEA = 0.067, and it showed significantly poorer model fit compared with the single order model, $\chi^2(2) = 99.55$, $p < .0001$.

Next, the second set of models tested the structure of the FFFS and BIS items together. In the first model, we tested a one factor CFA model, where all of the FFFS and BIS items were free to load on a single FFFS/BIS latent factor. This one-factor model showed weak global model fit, $\chi^2(495, N = 831) = 4{,}335.81$, $p < .0001$; CFI = 0.81; RMSEA = 0.097. Next, we tested a two factor CFA model; in this model, the FFFS and BIS items were free to load on their respective latent factor and were fixed at 0 for the other factor

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(see Table 2). The two latent factors were free to correlate with each other and all of the observed variable error terms were uncorrelated. This model showed acceptable global fit, $\chi^2(494, N = 831) = 2{,}808.99$, $p < .0001$; CFI = 0.90; RMSEA = 0.075. All factor loadings were above 0.40, and most were above 0.50. The BIS and FFFS latent factors were significantly positively correlated at 0.56. The two-factor model showed significantly better model fit compared with the one-factor model, $\chi^2(1) = 315.92$, $p < .0001$.

Combined FFFS, BIS, and BAS analysis. Having tested separate CFA models for the BAS and FFFS-BIS, respectively, we then sought to test CFA models with the combined pool of items. We began by initially testing a single order factor model, and then compared this with a higher order factor model. In the first model we tested, all items freely loaded on their respective latent factor and were fixed at 0 for all other latent factors. The model fit indices for this model were as follows: $\chi^2(2{,}000, N = 831) = 6{,}563.46$, $p < .0001$; CFI = 0.87; RMSEA = 0.052. This indicates acceptable global model fit in terms of the RMSEA, although it should be noted that the CFI value is a little below a rule of thumb cutoff point used for assessing acceptable model fit (0.90). Despite this, all items had a robust loading on their respective factor.

We then tested a higher order CFA model, with the FFFS and BIS factors loading on a second order punishment sensitivity factor, and the Reward Interest, Drive-Goal Persistence, Reward Reactivity and Impulsivity factors loading on a second order reward sensitivity factor. The global model fit indices for the higher order model were a little poorer than for the single order model, $\chi^2(2{,}008, N = 360) = 7{,}095.49$, $p < .0001$; CFI = 0.82; RMSEA = 0.055, and showed significantly poorer model fit compared with the single order model, $\chi^2(8) = 181.67$, $p < .0001$.

Table 3 presents the descriptive statistics and correlations for the RST-PQ scales. The BAS factors had moderately large positive correlations with each other, with the exception of the correlation between Goal Drive-Persistence and Impulsivity, which was close to 0. The BIS and FFFS factors were significantly positively correlated. Correlations between the four BAS factors and FFFS and BIS were generally close to 0, although Reward Reactivity and Impulsivity had modest positive correlations with the FFFS and BIS scales.

Study 4: RST-PQ Validation With Other Personality Measures

To address the construct validity of the RST-PQ, we explored the correlations with well-established measures of general personality. In addition to the expected correlations with the five-factor and the Eysenck Personality Questionnaire—Revised (EPQ-R; Eysenck & Eysenck, 1991) models (FFFS and BIS positively correlating with Neuroticism, and BAS subscales correlating with Extraversion), we hypothesized that the Carver and White (1994) BIS scale would correlate substantially with both the RST-PQ FFFS and BIS scales. In addition, we predicted that RST-PQ BIS would correlate much higher than the FFFS with STAI anxiety. We also expected this FFFS scale would correlate with specific fear scales, and the BIS scale more specifically with social anxiety.

Method

Participants and procedure. Three hundred sixty-two participants (87 males, $M_{age} = 23.34$, $SD = 6.71$; 275 females, $M_{age} = 21.68$, $SD = 7.45$) were recruited from universities in England and Wales. Participants completed the questionnaires online. After supplying their demographic details, participants were asked to read the instructions for the questionnaire and then complete the questions. Following completion, participants received a debriefing on the nature of the measures they had completed. Appropriate ethics approval was obtained for this study.

Materials. We measured a broad range of personality constructs, comprising specific scales of BIS and BAS, trait anxiety, and various fears, along with general dimensions of personality. These questionnaires sampled the personality space of most relevance to the validation of the RST-PQ.

The Reinforcement Sensitivity Theory Personality Questionnaire. The version of the RST-PQ described in Study 3 was utilized in this study (see the online supplemental material, Appendix C).

Carver and White (1994) BIS/BAS Scales. The Carver and White (1994) BIS/BAS Scales are a measure comprising a BIS scale (7 items) and three BAS scales: Reward Responsiveness (5 items), Drive (4 items) and Fun Seeking (4 items). Each item is

Table 3
Descriptive Statistics and Scale Correlations for Study 3

RST-PQ Scales	1	2	3a	3b	3c	3d
1. FFFS		.44	−.08	.07	.21	.16
2. BIS			−.06	−.06	.16	.17
3. BAS						
3a. Reward Interest				.41	.48	.43
3b. Goal-Drive Persistence					.33	.02
3c. Reward Reactivity						.42
3d. Impulsivity						
M	24.07	56.00	18.48	21.23	28.62	19.82
SD	6.22	13.54	3.91	4.34	4.88	4.64
Min	10.00	25.00	7.00	7.00	10.00	8.00
Max	40.00	92.00	28.00	28.00	40.00	32.00
Skewness	.17	.25	.00	−.43	−.28	.09
Kurtosis	−.58	−.42	−.22	−.38	−.22	−.42
Alpha	.78	.93	.75	.86	.78	.74

Note. FFFS = fight–flight–freeze system; BIS = behavioral inhibition system; BAS = behavioral approach system; Min = minimum; Max = maximum.

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answered using a four-point Likert scale, ranging from 1 (*very false for me*) to 4 (*very true for me*). Previous research has shown the scales have satisfactory internal reliability and construct validity (Carver & White, 1994; Gomez, Cooper, & Gomez, 2005). Cronbach's alpha values for Reward Responsiveness, Drive, Fun-Seeking and BIS were 0.84, 0.79, 0.75, and 0.79, respectively.

The Mini-IPIP Five-Factor Model Personality Scale. The Mini-IPIP was developed as a short-form measure of the five-factor model (FFM) personality traits, using items from the International Personality Item Pool (IPIP; Goldberg, 1999). Donnellan, Oswald, Baird, and Lucas (2006) showed it has acceptable reliability and showed similar patterns of relationships with the longer IPIP-FFM when correlating the measure with facets of the FFM and other relevant personality measures. Cooper, Smillie, and Corr (2010) replicated its factor structure. The Mini-IPIP is a 20-item scale, with 4 items measuring each of the FFM traits. Each item is a phrase describing a behavior (e.g., "*Am the life of the party*"), and participants were instructed to indicate how accurate this phrase is for them, using a five-point Likert-type scale. Scores for individual items from each scale were summed to produce a total score for each of the five scales. In the current study, Cronbach's alpha values for Extraversion, Neuroticism, Agreeableness, Conscientiousness, and Intellect were 0.82, 0.73, 0.74, 0.72, and 0.76, respectively.

The State–Trait Anxiety Inventory. The State–Trait Anxiety Inventory Form-Y2 (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) is a 40-item self-report measure of trait and state anxiety. Only trait anxiety was measured in the current study. Items were rated on a four-point Likert-type response format, ranging from 1 (*almost never*) to 4 (*almost always*). Items are summed to form a total score for trait anxiety. It has very good reported reliability and validity (Spielberger et al., 1983). Cronbach's alpha for the STAI was 0.90.

Fear Survey Schedule. The Fear Survey Schedule (FSS; Wolpe & Lange, 1977) has been used in numerous studies over the last three decades and is arguably the most reliable and valid measure of fear available. The FSS comprises a list of items representing specific aversive stimuli such as *worms* or *angry people*. Different versions of the FSS, ranging in length from 8 items to 108 items, have been developed. Arrindell (1980) derived a five factor solution from the FSS based on a subset of 52 FSS items; the five factors represent Tissue Damage Fear (e.g., fear of bodily damage, illness, and death; 12 items), Agoraphobia (13 items), Social Fear (13 items), Fear of Sexual or Aggressive situations (8 items), and Animal Fear (4 items). This five-factor version of the FSS was used in the current study. Respondents indicated, using a scale of 0 (*no fear*) to 4 (*very much fear*), how much they would be disturbed by each item. Total scores for each factor were derived by summing scores across the items within each respective factor. Cronbach's alpha values for Tissue Damage Fear, Agoraphobia, Social Fear, Fear of Sexual or Aggressive situations, and Animal Fear were 0.81, 0.80, 0.84, 0.72, and 0.68, respectively.

The Eysenck Personality Questionnaire—Revised. The EPQ-R (Eysenck & Eysenck, 1991) is a 100-item questionnaire that provides scores for Extraversion, Neuroticism, Psychoticism, and Lie. Respondents indicated their agreement with each statement using a dichotomous yes/no response format. The EPQ-R has been used extensively in past research, and has been shown to have good reliability and validity. In the current study, Cronbach's alpha values for Extraversion, Neuroticism, Psychoticism, and Lie were 0.81, 0.83, 0.72, and 0.73, respectively.

Results and Discussion

Table 4 shows the intercorrelations between the RST-PQ factors and scales with well-established measures of personality, as well as the intercorrelations between the RST-PQ factors. First, the intercorrelations between the RST-PQ factors in this sample are very similar to those reported above in Study 3, and are described more fully there. In terms of the correlations between the RST-PQ factors and the other personality measures, for the RST-PQ FFFS factor, significant positive correlations are evident with the Carver and White (1994) BIS scale, but none of their BAS scales; with FFM neuroticism and the same measure from the EPQ-R; and with all of the FSS scales; but, of interest, it is only weakly correlated with STAI anxiety. For the RST-PQ BIS factor, significant positive correlations are evident with Carver and White BIS scale, with FFM neuroticism and the same measure from the EPQ-R (highly); and with all of the FSS scales (about the same extent as with the RST-PQ FFFS factor); and, of interest, strongly with STAI anxiety. Gender is significantly correlated with RST-PQ FFFS, but not RST-PQ BIS.

In terms of RST-PQ BAS factors, the following is evident. Reward Interest positively correlates with all Carver and White (1994) BAS subscales, and with FFM Extraversion and Openness, and negatively with FFM Neuroticism. No relations are seen with the FSS, and a weak negative correlation with STAI anxiety. These associations characterize well the nature of the reward interested individual: Open, extraverted, and emotionally stable. For Goal-Drive Persistence, positive correlations are evident for Carver and White Drive and Reward Responsiveness, but not Fun Seeking, and also with FFM Conscientiousness, EPQ-R Extraversion and negatively with Psychoticism. These associations characterize well the nature of the goal-drive persistent individual: Driven, conscientious, and agreeable. For Reward Reactivity, positive correlations are seen for all of the Carver and White BAS subscales, FFM and EPQ-R Extraversion, characterizing an individual scoring high on this scale as someone who is classically reward oriented along traditional extraverted lines. For Impulsivity, a different picture emerges: As someone who is high on all three Carver and White BAS subscales, low in FFM Conscientiousness, high in Extraversion and high in EPQ-R Psychoticism. It is worth noting that the EPQ-R Lie scale did not correlate highly with any of the RST-PQ scales.

These correlations were broadly in line with expectation, and in general the differentiation seen in the correlations of the FFFS, BIS, and BAS factors with different measures of more well-established personality scales indicated that all RST-PQ scales have some unique correlations that support their different construct characteristics.

Of special note, RST-PQ BIS, but not the FFFS, was very highly correlated with STAI trait anxiety, which points to the separation of FFFS and BIS variance. Also of note, females were more fearful than males, but this was not found for BIS. This finding may be theoretically important: Perhaps the commonly found gender differences on general neuroticism and specific nondifferentiated BIS measures may be due to their saturation with FFFS variance.

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Table 4
Correlations Between RST-PQ and Other Measures of Personality

	RST-PQ factors					
Personality	FFFS	BIS	BAS-RI	BAS-GDP	BAS-RR	BAS-IMP
BIS/BAS scales						
BIS	.40	.53	−.28	−.08	.09	−.14
BAS: D	−.12	−.10	.44	.40	.33	.40
BAS: RR	.05	.08	.34	.23	.45	.20
BAS: FS	−.12	−.06	.47	.04	.36	.58
Five-factor model						
O	−.18	−.01	.23	.07	.12	.16
C	.07	−.13	.07	.38	−.04	−.33
E	−.12	−.27	.42	.20	.36	.45
A	.05	−.01	.19	.22	.15	.10
N	.35	.71	−.30	−.14	−.02	.05
EPQ-R						
E	−.13	−.41	.61	.35	.46	.50
N	.43	.72	−.30	−.18	−.01	−.02
P	−.17	−.02	.10	−.34	−.02	.42
L	.05	−.01	−.03	.17	−.14	−.34
Fear Survey Schedule						
Tissue fear	.26	.31	.08	.15	.29	.22
Social fear	.41	.52	−.10	−.19	.05	−.12
Agor fear	.44	.46	−.07	.24	.08	−.07
Sex fear	.43	.30	.03	.08	.00	−.07
Animal fear	.46	.34	−.09	.14	.00	−.04
STAI						
Trait Anxiety	.23	.82	−.22	−.26	.15	.18
Age	.02	−.09	.06	.01	−.06	−.08
Gender	−.33	−.07	.07	−.15	−.15	−.07
RST-PQ						
FFFS		.41	−.21	−.02	.12	.06
BIS			−.18	−.09	.13	.06
BAS-RI				.43	.49	.36
BAS-GDP					.34	.04
BAS-RR						.39
BAS-IMP						

Note. $N = 362$ for all correlations. RST-PQ = Reinforcement Sensitivity Theory of Personality Questionnaire; FFFS = flight–fight–freeze system; BAS = behavioral approach system; RI = Reward Interest; GDP = Goal-Drive Persistence; RR = Reward Reactivity; Imp = Impulsivity; EPQ-R = Eysenck Personality Questionnaire-Revised; Agor = agoraphobia; O = Openness; C = Conscientiousness; E = Extraversion; A = Agreeableness; N = Neuroticism; E = Extraversion; N = Neuroticism; P = Psychoticism; L = Lie scale.

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Less well supported is the expectation that there would be a differentiation of FFFS and BIS in terms of Fear Survey Schedule (FSS) subscales. Although FFFS was more highly correlated with sex and animal fear, and BIS with social fear, as expected, the differences were modest. Previous statistical evidence indicates that anxiety measures are distinct from FSS subscales (Cooper et al., 2007), the present results show that they relate both to BIS and FFFS—this finding indicates that the "fear" measured by the FFFS is not related to specific fears but is of a more general kind. It may also be the case the FSS fear subscales entail components of anxiety as well as general fear variance. In the context of RST, this is not surprising because fear ratings do not measure FFFS-type behavioral propensities but rather emotional and cognitive aspects of the presentation of fear-related words, which might entail some element of goal conflict and, thus, the association with the BIS as well as the FFFS.

The pattern of correlations provides a nuanced picture of the RST-PQ scales with existing personality measures, showing two main things: (a) FFFS and BIS factors do not have identical correlations with other personality scales, which lends support to their discriminant validity, and (b) the four BAS factors have different profiles of correlations with other personality measures, again supporting their discriminant validity. It is interesting to note that all of the scales from the FFM were associated with these four BAS scales.

Study 5: Defensive Fight

The aim of this study was to develop a separate scale to measure Defensive Fight. As noted in the beginning of the article and discussed further in the online supplemental material (see Appendix D), there is evidence that this construct does not align with the FFFS and is more likely to align with the BAS. We also wanted to see how this scale relates to established measures of personality.

Method

Participants. Six hundred seven participants (167 males, $M_{age} = 21.95$, $SD = 5.83$; 440 females, $M_{age} = 22.54$, $SD = 7.25$) were recruited via an e-mail sent to students and general staff at

Swansea University and Goldsmiths, University of London. Only data from participants who completed all items were included in the sample. The participants were comprised of a subset of the individuals who completed the RST-PQ in Studies 1 and 2 (ethics approval was given for these studies).

Materials and procedure. Fight items were developed during the initial development phase of this project. This procedure resulted in eight items (see the online supplemental material, Appendix D), which were added to the RST-PQ. Participants completed the questionnaire online. After supplying their demographic details, participants were asked to read the instructions for the questionnaire and then complete the questions. Following completion, participants received a debriefing on the nature of the measure they had completed.

Data analysis. Mplus 6.12 was used to run an EFA on the eight Defensive Fight items. Factors were extracted from the sample correlation matrix using a robust weighted least squares estimator. The number of factors extracted was based on the results of a parallel analysis.

Results and Discussion

The results of the parallel analysis suggested one factor should be extracted. The only eigenvalues above one were 4.31 and 1.32. A two factor solution was also inspected; however, in this model a number of the items had substantive loadings on both factors. Factor loadings for each of the eight items are shown in the online supplemental material (see Appendix D). As can be seen, each item had a substantive loading on the factor, with all loadings greater than 0.50.

Defensive fight correlations with other RST-PQ factors and general personality. Correlations between this Fight scale with the RST-PQ scales and other personality measures (i.e., Carver & White, 1994, BIS/BAS scales; Mini-IPIP big-5 questionnaire, and the Spielberger et al., 1983, STAI; see Study 4) are given in the online supplemental material (see Appendix D). The Fight scale has nonsignificant correlations with the FFFS and BIS scales, but small to moderate significant positive correlations with each of the BAS scales. The strongest relationship was with the BAS-Impulsivity scale. Fight also has a significant positive correlation with FFM extraversion and (albeit much smaller) Intellect/Openness, but not Neuroticism, Agreeableness, and Conscientiousness. It has a significant positive correlation with Drive and Reward Responsiveness from the BIS/BAS scale, but not Fun-Seeking and BIS. Last, it has a small positive correlation with the STAI.

As predicted, the Fight scale correlated more with BAS factors than the FFFS or BIS, which supports the justification above for keeping it separate from these defensive systems.

General Discussion

Our aim was to develop and validate a theoretically driven revised reinforcement sensitivity theory (RST) of personality questionnaire (PQ): RST-PQ. Exploratory analyses revealed a robust six-factor structure, with clear differentiation of FFFS and BIS, and four separate BAS factors comprising Reward Interest, Goal-Drive Persistence, Reward Reactivity, and Impulsivity. On a separate sample, CFA supported this six factor structure. Psychometric properties (especially internal reliabilities) for the scales of the RST-PQ were acceptable. In addition, we developed a separate Fight scale, which comprised a single factor; and, as expected, this factor related to the BAS and not to the FFFS/BIS. Validation evidence comes in the form of convergent and discriminant correlations with existing personality scales.

Turning to the specific elements of the three main systems, the FFFS was defined by three facets: flight, freeze, and active avoidance, and so in human questionnaire studies this primary defensive system might be retitled the "flight–freeze–avoidance system" (FFA). In relation to the BIS, results largely confirmed theoretical prediction, with differences between Worry, Obsessive Thoughts, Behavioral Disengagement, and Motor Planning Interruption. However, the thematic facets of Cautious Approach and Risk Assessment were not successfully recovered. There are several possible reasons for this outcome. We may simply have failed to develop appropriate items to measure these facets. We suspect, though, that these facets are being tapped by worry, obsessive thoughts, and motor planning interruptions, which are more salient and proximal to the self-reporter. In contrast, caution and risk assessment may be best measured by peer, or experimenter, observations as seen in the case of rodent ethoexperimental studies from which these constructs were first identified (Gray & McNaughton, 2000). In support of this claims, there is some evidence that risk assessment can be identified in human facial expressions (Perkins et al., 2012). These thematic factors served as useful conceptual anchors in the development of the principal domains of the FFFS, BIS, and BAS that compose the RST-PQ.

For reasons discussed in the Introduction, we developed a separate Fight scale. Our results confirm previous work in showing that Fight correlates with BAS factors. Given the literature, previous empirical data, and the results of our studies, we believe that defensive fight should be considered separately from the FFFS, BIS, and BAS factors. We acknowledge that our fight items may not have sufficiently differentiated between defensive and offensive aggression; however, we avoided the temptation to develop highly specific items keyed to the FFFS—this might not have been impossible to achieve, but its theoretical relevance would be called into question. Instead, we preferred to let our defensive items (which are quite different from offensive, predatory ones), as it were, speak for themselves, statistically speaking. In any event, the need to separate Fight from the FFFS (or BIS) is consistent with the ambiguous findings of other RST researchers (e.g., Reuter et al., 2015, who found it to be highly *negatively* correlated with FFFS flight and freezing; and Smederevac et al., 2014, who found it unrelated to flight and freezing, but related to the BAS).

Turning to the behavioral approach system (BAS), the notion that approach behavior is complex and multidimensional was confirmed by our analysis, which showed four robust factors: Reward Interest, Goal-Drive Persistence, Reward Reactivity, and Impulsivity. These results support the theoretical model (Corr, 2008), which postulates the need to include goal-planning, behavioral restraint, and temporal bridging across time spans when reward is not immediately available, but also the pleasure and nonplanning, rapid responding of impulsivity when close to the biological reinforcer. Our results point to the importance of this cascade of processes, some of which oppose each other, in the successful attainment of desired reward. These results support the work of Carver and White (1994), which inspired the search for multiple BAS processes, but challenge all recent psychometric

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attempts to measure rRST with a single unidimensional BAS factor (Jackson, 2009; Reuter et al., 2015; Smederevac et al., 2014)—as we showed, impulsivity in particular stands apart from the other BAS factors.

Additional Validation Evidence

During the development and validation of the RST-PQ, several groups and individuals around the world have used it for their various research purposes. It has been translated into different languages, including French, German, Spanish, Serbian, Croatian, Farsi, Hindi and Swedish. Results suggest the factor structure reported in this article survive these translations (e.g., in Krupić et al., 2015). To date, there have been several publically available reports, which speak to the validation and utility of the RST-PQ: Attachment styles (Jiang & Tiliopoulos, 2014), social attitudes (Corr, Hargreaves-Heap, Tsutsui, Russell, & Seger, 2013), eating styles (Tsancheva, 2014), and perfectionism (Stoeber & Corr, 2015).

In terms of limitations of our research approach, future work will need to use broader samples, stratified by age, gender and ethnicity, and country of origin—our data relied largely on undergraduate populations. Although we provided evidence for the convergent and discriminant validities, we acknowledge that considerably more empirical work is needed to establish the predictive validity of the RST-PQ scales across different fields (e.g., experimental and applied). In addition, we have not offered any behavioral or neuroscientific data to support the validity of these scales. Such work could include noninvasive EEG, for example in relation to the BIS (McNaughton, Swart, Neo, Bates, & Glue, 2013) and BAS (e.g., Cooper, Duke, Pickering, & Smillie, 2014; Wacker, Chavanon, & Stemmler, 2010). In these future endeavors, it will also be important to estimate the incremental validity of the RST-PQ over alternative descriptive models (e.g., Carver & White (1994) BIS/BAS scales), including the more recent rRST-directed ones. In addition, future work should more clearly separate RST central processes (e.g., the septo-hippocampal BIS) and associated processes related to the emotional and cognitive generation of anxiety, worry and rumination (e.g., involving the recruitment of working memory and more "frontal" processes; see Corr & McNaughton, 2012). For example, BIS activation may be *necessary* condition for the generation of anxiety, but it is not a *sufficient* one—something that has not been sufficiently clarified in the RST personality literature.

Conclusions

We report the development and validation of a new psychometric measure of the rRST of personality: The RST-PQ. It contains six robust factors, one for the FFFS, one for the BIS, and four for the BAS. In addition, a scale for Fight is offered. Convergent and discriminant validation evidence, in the form of correlations with existing personality scales, were generally supportive. The RST-PQ is offered as a heuristic psychometric model and instrument to explore further the implications of approach and avoidance processes across a wide landscape of human personality and behavior.

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Received March 18, 2015
Revision received November 19, 2015
Accepted November 23, 2015 ■

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