



Review

Reinforcement Sensitivity Theory of Personality Questionnaires: Structural survey with recommendations



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ABSTRACT

The Reinforcement Sensitivity Theory (RST) of personality has attracted considerable psychometric attention and there now exists a number of questionnaires to measure its three main systems: the *fight-flight-freeze system* (FFFS, related to fear), the *behavioural inhibition system* (BIS, related to anxiety), and the *behavioural approach system* (BAS, related to hope and pleasure). This article provides an assessment of the structural properties of these questionnaires in the light of (a) theoretical issues, (b) operational translations, and (c) factor analytic solutions. This review highlights the different theoretical perspectives underlying these descriptive models. To clarify this literature and to assist RST researchers, this article outlines a number of recommendations to guide the choice of questionnaire(s) and interpretation of results – this discussion serves, too, to highlight some of the unresolved issues in RST that call for further conceptual and empirical attention.

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1. Introduction

The Revised Reinforcement Sensitivity Theory (RST) of personality is widely known to personality researchers. Its popularity reflects the importance attached to the general idea that underlying human personality is a small number of neurobehavioural systems responsible for appetitive and aversive motivation (Corr, 2013). RST is increasingly recognized as providing an integrative framework for the neurobiology of personality (e.g., Kennis, Rademaker, & Geuze, 2013) and, in consequence, it has attracted considerable empirical attention.

The most recent version of RST (Corr & McNaughton, 2012; Gray & McNaughton, 2000; McNaughton & Corr, 2004, 2008) postulates three major neuropsychological systems (RST-3): the *fight-flight-freeze system* (FFFS) is activated by all forms of aversive stimuli (including frustrating nonreward); the *behavioural approach system* (BAS) by all forms of appetitive stimuli (including relief of nonpunishment); and the *behavioural inhibition system* (BIS) by all forms of goal conflict, with one major class being (equal) co-activation of the FFFS and BAS. As is well known, 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). What is less apparent is the hidden complexity in and between these systems which renders any attempt to provide a psychometric description of them far from straightforward – indeed, as shown in this article, prone to confusion.

Over the past forty plus years, questionnaire measures of RST-2 and RST-3 have proliferated, with each bringing new issues that need

consideration and which generate debate. In consequence, the RST field is becoming increasingly muddled – an unwelcome state of affairs because it is bound to impede the scientific progress of RST as it relates not only to personality but to psychopathology and the wider reaches of everyday behaviour. Researchers are now faced with a large (and somewhat bewildering) diversity of questionnaires from which to choose – in itself, this is causing goal conflict in the literature.

As is widely known, the most significant change to revised RST is the separation of FFFS/fear and BIS/anxiety processes – although there are important developments in the BAS too. Although these two defensive systems were contained in the early version of RST (Gray, 1982), they were not adequately distinguished and, as a result, research focused almost exclusively on the BIS and BAS and, by so doing, conflated FFFS/fear and BIS/anxiety. Although understandable at the time, this was rather unfortunate because the FFFS and BIS always had very different behavioural functions and distinct neuropsychopharmacological bases (Corr & McNaughton, 2012; McNaughton & Corr, 2004). In terms of the importance of this separation, this is now recognized especially in the psychopathological literature (Bijttebier, Beck, Claes, & Vandereycken, 2009). However, until recently, one major limitation of this literature has been the absence of appropriate psychometric measures of FFFS-fear and BIS-anxiety (Sylvers, Lilienfeld, & laPraririe, 2011; see Dissabandara, Loxton, Diaz, Daglish, & Stadlin, 2012).

The aims of this article are to provide a handy summary of all purpose-built RST questionnaires, to assess their structural properties and, in the style of a property surveyor, to highlight problems and to make recommendations to enable researchers (especially those new and non-committed to the field) to make a rationally-informed choice.

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2. RST questionnaires: structural survey

Most of the available RST questionnaires are based on the original BIS/BAS model (RST-2). A detailed review of this literature has already been given by [Torrubia, Avila, and Caseras \(2008\)](#), so only a summary is provided here. It is worth noting that, although the newer class of RST measures have tackled the separation of FFFS and BIS, most still adhere to the unrevised notion of the BAS, conceived as a unitary dimension.

For ease of illustration, comparison of all RST questionnaires is shown in [Table 1](#).

2.1. Scales for unrevised RST-2

Below is a description of attempts to provide psychometric measures for RST-2, focusing mainly on unitary defence and approach systems, with the exception of the first questionnaire reviewed.

2.2. Gray-Wilson Personality Questionnaire (GWPS)

The first full-blown attempt to measure the specific factors of RST was made by Gray's own research group. The *Gray-Wilson Personality Questionnaire* (GWPS; [Wilson, Barrett, & Gray, 1989](#); [Wilson, Gray, & Barrett, 1990](#)) measures six typical rodent-reactions to reinforcement: BAS (*Approach* to rewarding stimuli, and *Active Avoidance* of punishment, to signals to safety); BIS (*Passive Avoidance* of punishment by inactivity and submission, and *Extinction* of behaviours that have not led to reward); and FFS (Fight-Flight System; *Fight*, defensive aggression to threat, and *Flight* from punishing stimuli). The GWPS is noteworthy for separating components relating to the FFS and BIS – note, 'freeze' was not added to the FFS until the 2000 revision ([Gray & McNaughton, 2000](#)).

Although these six scales showed satisfactory internal consistencies (perhaps related to item redundancy and their narrow, specific content), factor analysis provided only limited confirmation of the a priori structure (see also [Wilson, Barrett, & Iwawaki, 1995](#), for a later replication). The strongest associations were between Fight and Approach, and between Flight and Passive avoidance.

Table 1
Summary and comparison of unrevised and revised RST questionnaire.

Questionnaire	FFFS	BIS	BAS
Unrevised (RST-2)			
GWPS	√ FI, Fi	√ PA, Ex;	√ Ap, AV
GRAPES	x	√	√
BIS	x	√	x
BIS/BAS	x	√	√ RR ¹ , D, FS
SPSRQ	√ ?	√	√
Revised (RST-3)			
J-5	√ FI, Fi, Fz	√	√
RSQ	√	√	√
rRST-Q	√ FI, Fi, Fz	√	√
RST-PQ*	√	√	√ RI, G-DP, RR ² , Imp

Note. GWPS = *Gray-Wilson Personality Questionnaire* ([Wilson et al., 1989](#)); GRAPES = *General Reward and Punishment Expectancy Scales* ([Ball & Zuckerman, 1990](#)); BIS = BIS scale ([MacAndrew & Steele, 1991](#)); BIS/BAS = BIS/BAS scales ([Carver & White, 1994](#)); SPSRQ = *Sensitivity to Punishment and Sensitivity to Reward Questionnaire* ([SPSRQ; Torrubia, Avila, Molto, & Caseras, 2001](#)); J-5 = *Jackson-5* ([Jackson, 2009](#)); RSQ = *Reinforcement Sensitivity Questionnaire* ([Smederevac et al., 2014](#)); revised Reinforcement Sensitivity Theory Questionnaire ([Reuter et al., 2015](#)); RST-PQ = *Reinforcement Sensitivity Theory-Personality Questionnaire* ([Corr & Cooper, 2015](#)); * = additional scale for Defensive Fight). Abbreviations: FI = Flight, Fi = Fight, Fz = Freeze; PA = Passive Avoidance, Ex = Extinction; Ap = Approach, AV = Active Avoidance, RR¹ = Reward Responsiveness, D = Drive, FS = Fun-Seeking, RI = Reward Interest; G-DP = Goal-Drive Persistence, RR² = Reward Reactivity, Imp = Impulsivity.

2.3. General Reward and Punishment Expectancy Scales (GRAPES)

A different approach to the GWPS is the *General Reward and Punishment Expectancy Scales* (GRAPES; [Ball & Zuckerman, 1990](#)) which does not focus on specific rodent-defined typical behavioural reactions to reinforcing stimuli but rather on a more cognitive interpretation of Gray's model. It is appropriate to note here that there is still ambiguity in RST concerning the role of behavioural and cognitive components ([Zinbarg & Mohlman, 1998](#)) and this issue has not yet been resolved in revised RST – for example, there is almost certainly a significant cognitive component to the BIS, as seen in the cognitive biases evident in anxiety ([Wytykowska, Corr, & Fajkowska, 2015](#)). However, Gray's own approach was to focus on behavioural *outputs* of RST systems as they can better be matched to prototypical animal learning paradigms – this fact is demonstrated in the explicit rationale for the development of the GWPS, discussed above (and in conversations between the author and Jeffrey Gray).

Despite the theoretical appeal of this scale, it has not been used widely in RST research.

2.4. BIS scale

Another measure of punishment sensitivity is the *BIS scale* ([MacAndrew & Steele, 1991](#)), which is an MMPI-derived, criterion-keyed, tool to measure BIS sensitivity. Items were selected on the grounds: (1) that they differentiated between three different samples of females (psychiatric outpatients, putative normal subjects, and incarcerated prostitutes who are assumed to have an underactive BIS); and (2) they correlated positively with the Neuroticism scale and negatively with the Extraversion scale of the Eysenck Personality Questionnaire (EPQ). The final scale comprised 30 items, which would appear to measure anxiety-related cognitions, emotions, and behaviours. It is doubtful that this scale adds much to existing anxiety scales and, thus, is infrequently used. In addition, it does not separate the FFFS from the BIS, and does not include a measure of the BAS.

2.5. Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ)

The very first attempt to provide a specific measure of RST is the *Susceptibility to Punishment Scale* ([Torrubia & Tobena, 1984](#)). In accordance with the original notion of the BIS, item content was related to habitual behaviours in response to cues of punishment, frustrative non-reward and novel stimuli. Psychometric evidence shows adequate internal consistency and good convergent and discriminant validity. This scale was later expanded to include a measure of *sensitivity to reward* (SR), which is now part of the *Sensitivity to Punishment and Sensitivity to Reward Questionnaire* (SPSRQ; [Torrubia, Avila, Molto, & Caseras, 2001](#)). Principal component analysis confirmed that these two scales are orthogonal. They correlate with other personality variables in accordance with predictions, namely SP highly positively with neuroticism, and SR positively with extraversion. By virtue of its general nature of reward and punishments sensitivities, the SPSRQ has been widely used in RST research. Its limitations are: (a) a lack of separation of the FFFS/fear and BIS/anxiety; and (b) a lack of sub-components and scales for the BAS, which is now accepted by many researchers as being multidimensional (e.g., [Carver & White, 1994](#); [Corr, 2008](#); [Dawe, Gullo, & Loxton, 2004](#)).

2.6. BIS/BAS scales

By far and away the most popular RST questionnaire is the [Carver and White \(1994\) BIS/BAS scales](#). This includes one scale to measure the BIS, and three scales to measure BAS functioning (*Drive, Reward Responsiveness, and Fun Seeking*). Reliability and validity data are excellent. In relation to the BAS, oblique factor analysis indicated a three-factor

structure. However, in the original publication, there is no clear theoretical justification for this subdivision of the BAS – and personal communication with Charles Carver confirms that this was just the way these BAS items fell out of the factor analysis. This statistical serendipity suggested a line of research which has since confirmed that, in psychometric terms, the BAS is a multidimensional construct (this is discussed further below). This psychometric model is now available in a short-scale (Carver, Meyer, & Antoni, 2000), a parent report version for the assessment of children (Blair, 2003), and a self-report version for children (Colder & O'Connor, 2004). From the perspective of RST, the major problem with this questionnaire is the lack of separation of FFFS and BIS.

Although the Carver and White (1994) BIS scale was developed with only one general avoidance system in mind, following a theoretical decomposition of the scale (Corr & McNaughton, 2008), recent studies report that two factors may be extracted, specifically relating to FFFS (fear) and BIS (anxiety) (e.g., Beck, Smits, Claes, Vandereycken, & Bijttebier, 2009; Heym, Ferguson, & Lawrence, 2008; Poythress et al., 2008). However, a problem with this research is that the putative FFFS-fear subscale has only a few items (2 or 3, depending on the study), which are reverse-keyed ones, suggesting the possibility that, without further support, their differentiation from BIS items may be a measurement artefact unrelated to substantive content.

2.7. Scales for revised RST-3

A number of questionnaires to measure the constructs of revised RST have been developed (Corr & Cooper, 2015; Jackson, 2009; Reuter, Cooper, Smillie, Markett, & Montag, 2015; Smederevac, Mitrovic, Colovic, & Nikolasevic, 2014). These questionnaires are discussed in order of publication date.

2.8. The Jackson-5

The eponymously named Jackson-5 (Jackson, 2009) is composed of clusters of items that measure 5 factors: BAS, BIS, Fight, Freezing, and Flight. Although the Jackson-5 should be seen as a promising start to constructing a revised RST questionnaire, a number of problems attend its theoretical fidelity. 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 et al., 2004; Quilty & Oakman, 2004; Smillie, Jackson, & Dalgleish, 2006; Smillie, Pickering, & Jackson, 2006). Secondly, 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 with others', 'Aim better than peers') – conceptually, such 'BIS' items would be better aligned with the BAS; and, in practise, are correlated with BAS measures from other RST questionnaires (Krupić, Križanić, Ručević, Gračanin, & Corr, 2015).

This item construct problem is highlighted by inspection of Jackson's (2009) Table 2 which shows that the highest correlation of the BIS is with the BAS ($r = .27$). In addition, BIS correlations with FFFS Freezing and Flight are close to zero (.05 & .03, respectively), which is not consistent with revised RST and may suggest that these sub-scales are bloated specifics; and the BIS scale correlates just as much with the sub-scales of the Carver and White BAS scales (.25–.32) as it does with specific anxiety (.26) and fear (.35) scales, and only .25 with the Carver and White BIS scale (slightly less than the correlation with the Jackson-5 BAS scale).

2.9. The Reinforcement Sensitivity Questionnaire (RSQ)

The Reinforcement Sensitivity Questionnaire (RSQ; Smederevac et al., 2014) also has only one BAS factor, and there 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). As in other models, the fight factor correlates highest with the BAS one. This scale seems little better than previously developed unitary RST-2 BIS/BAS scales and is not considered further.

2.10. The revised Reinforcement Sensitivity Theory Questionnaire (rRST-Q)

Of the third attempt, the revised Reinforcement Sensitivity Theory Questionnaire (rRST-Q), Reuter et al. (2015) attempted 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) 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", Q22) which does not seem to reflect defensive fight, at least not as defined by rRST – it seems to relate better to a predatory form of psychopathy, which itself is negatively correlated with the FFFS (Broerman, Ross, & Corr, 2014).

2.11. Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ)

Basing the development of their Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ) on qualitative responses to defensive and approach scenarios, modelled on typical rodent ethoexperimental situations, Corr and Cooper (2015) confirmed a robust six-factor structure: two unitary defensive factors, *fight-flight-freeze system* (FFFS, related to fear) and the *behavioural inhibition system* (BIS, related to anxiety); and four *behavioural approach system* (BAS) factors (Reward Interest, Goal-Drive Persistence, Reward Reactivity, and Impulsivity). Consistent with both theoretical and empirical considerations, the RST-PQ provides a separate scale for Defensive Fight, and this is related to BAS factors, as suggested by previous research (see below).

It should be noted that the RST-PQ, which started development in 2005, has been in circulation since 2009, and has already been translated into different languages (French, German, Argentinian, Serbian, Croatian, Farsi, Hindi and Swedish) and used in published research (for details, see Corr & Cooper, 2015).

2.12. SPSRQ-derived revised RST questionnaire

Another psychometric approach worth mentioning in relation to revised RST is Colder et al.'s (2011) factor analysis of the Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001) in a child sample. This analysis yielded three 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. The implication of these SPSRQ findings has not been explored in an adult sample.

In addition to the above psychometric approaches, more clinically directed work has started to separate the FFFS into lower order facets (e.g., fight, flight and freeze components; Maack, Buchanan, & Young, 2014).

3. Convergence of revised RST scales

Only one study to date has compared the structural convergence of the above revised RST scales (Krupić et al., 2015). Five questionnaires were compared: BIS/BAS scales, SPSRQ, Jackson-5, RSQ, and the RST-PQ. The first thing to note is that confirmatory factor analysis of these separate questionnaires generally yield adequate model fit estimates; however, when convergent validity between these questionnaires is inspected problems are found (Krupić et al., 2015). These mainly

include Fight and BAS, but also the BIS from the Jackson-5. The Jackson-5 BIS loads on a common BAS factor – which is consistent with the correlations reported above. In general, Fight factors do not load on the FFFS (or its facets, flight and freezing), but the BAS – to confuse matters further, Reuter et al. (2015) reported that fight was strongly *negatively* associated with the FFFS (see above).

In addition, there are problems in these different rRST questionnaires with respect to the measurement of the BAS – putatively different BAS processes are conflated in unidimensional models. Specifically, there is a high BAS convergence between: (a) RSQ, Jackson-5 and (RST-PQ) Reward Interest; and (b) BIS/BAS Reward Responsiveness and (RST-PQ) Reward Reactivity. It, therefore, seems that BAS scales from Jackson-5, RSQ and RST-PQ Reward Interest are more concerned with individual differences in identification of the biological reinforcer, whereas Reward Responsiveness from the BIS/BAS scales and RST-PQ Reward Reactivity are more concerned with individual differences in emotional response to reward – such a theoretical model is outlined by Corr (2008) and this drove the development of the RST-PQ.

In closing this section, it is noteworthy that three out of four revised RST questionnaires have taken a retrograde step from the Carver and White (1994) BIS/BAS scales in adopting a unitary vision of the BAS. This might be the inevitable result of not starting with a multidimensional theoretical model to drive the development of item content and construct structure, leading to an insufficient number of items to sample the multidimensionality of the BAS. This is unfortunate.

4. Revised RST-3 questionnaires: recommendations

Those new to the RST field may well ask, which (revised) RST questionnaires should be used? This is a reasonable question and deserves a psychometrically principled answer. Given the evaluation of the literature outlined above, the following conclusions seem justified – or, at the very least, worthy of consideration.

4.1. FFFS

A major step-forward in the RST literature has been the development of psychometric measures of the FFFS, as distinct from those of the BIS.

The RST-PQ offers a unitary measure of the FFFS, and the Jackson-5 and rRST-Q offer specific scales for flight and freezing. Although tempting to use only the latter sub-scales, one issue running through this literature is the possibility of bloated specific factors emerging that fail to capture the full breadth of the main systems. To illustrate, in the development of the RST-PQ it would have been trivially easy to develop separate measures of flight and freezing; however, these did not naturally ‘fall out’ of the exploratory factor analysis of a large and comprehensive sample of FFFS-relevant items *even though such items had been specifically written and included*.

The recommendation is that, if FFFS sub-scales are to be included, then the much broader-based RST-PQ unidimensional one should be used as well.

4.2. BIS

Revised RST has allowed finer-grained definition of the BIS, and differentiation from the FFFS, although it is intriguing that different conceptions of the BIS exist: this presents a problem of choice. Given that RSQ’s FFFS and BIS are nearly perfectly correlated, it would not seem sensible to use this if a differentiation of these two defensive systems is needed. However, for a more general defensive construct then this could be used, as well might the Carver and White (1994) BIS scale, or the SPSRQ sensitivity to punishment scale. In relation to the Jackson-5, given the problems identified above with the BIS scale (especially its apparent lack of convergent and discriminant validity), it cannot be recommended as a valid measure of the BIS.

This leaves the RST-PQ and rRST-Q, and both are viable candidates. Given the lack of conceptual development of the rRST-Q BIS scale, and its small number of items, it should seem preferable to use the RST-PQ BIS scale, as this contains items that sample a broader domain of this defensive construct, encompassing motor planning interruption, obsessive thoughts, worry, and behavioural disengagement.

4.3. BAS

The authors of the revised RST questionnaires are in evident disagreement concerning the dimensional nature of the BAS; and, arguably, in comparison with the Carver and White (1994) BIS/BAS BAS scale, developments in this regard have been retrograde. As the theoretical conditions and empirical results reviewed above indicate, the BAS is multidimensional; and especially, there is an important distinction between reward sensitivity and impulsivity (this comes out in the comparison of RST-3 questionnaires; Krupić et al., 2015).

Given these considerations, it is not advisable to use any of the unidimensional BAS scales, as least not on their own. The extensive work that went into the development of the RST-PQ BAS scale points to its utility as the most appropriate measure of the rRST BAS – if for no other reason than it allows a test of the dimensional nature of the BAS: do the four sub-scales show unique predictive power, or are they redundant? This is an open empirical question that must be tested with the use of a multi-scale BAS instrument. It is especially important to separate reward interest and reactivity (which themselves are different) from impulsivity, which serves a different function in the causal cascade from appetitive exploration to final capture of the desired object (for discussion of this model, see Corr, 2008).

4.4. Fight

Defensive fight and aggression has played an ambiguous, and increasingly fraught, role in RST-3. The evidence seems clear enough: variations in fight (in its defensive and instrumental, but not specifically psychopathically predatory, forms) covary with variations in the BAS (the details of this are discussed elsewhere: Corr, 2013; Corr & Cooper, 2015; see also Carver & Harmon-Jones, 2009; Harmon-Jones, 2003). This association was identified by the first RST questionnaire by Gray’s own research team; and, although at the time this finding was seen as an anomaly, it has since been confirmed on numerous occasions, most recently in the RST-PQ.

In terms of choice, the RST-PQ measure offers a short scale to index defensive fight, as does the Jackson-5. However, given the strongly negative correlation between fight and the FFFS in the rRST-Q, the use of this scale cannot be recommended as it seems to represent a form of psychopathy, which should be expected to be associated with the FFFS (Broerman et al., 2014). Given the considerable lack of clarity concerning defensive and instrumental, as well as psychopathic predatory, aggression, it is recommended that these forms be differentiated as far as possible in future RST research.

In summary of this section, choice of RST-3 questionnaire should be based on an explicit rationale informed by the extant data; any other approach privileges blind faith over sighted reason, and this simply will not do in scientific thinking.

5. Conclusion

The major goal of this article was to compare existing RST questionnaires and to draw useful contrasts between them. Inspection of Table 1 highlights the different natures of these questionnaires, with only one revised questionnaire providing a multidimensional view of the BAS – all have differentiated the FFFS and BIS, although, despite the use of the same labels, the construct nature of these scales cannot be vouchsafed.

Although here-and-there, evidence of some theoretical and empirical subsidence is apparent, this survey of revised RST questionnaires shows the general structure to be in fairly good shape. However, there are serious issues with recent psychometric building work and further detailed inspections are advised. This may suggest that a reconfiguration of the internal space is needed if it is to be fit for purpose.

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