Five reinforcement sensitivity theory (RST) of personality questionnaires: Comparison, validity and generalization

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ABSTRACT

There are six purpose-built Reinforcement Sensitivity Theory (RST) personality questionnaires currently in use to measure the fight-flight-freeze system (FFFS), the behavioural inhibition system (BIS), and the behavioural approach system (BAS). They differ in their conceptualizations and operational constructs, and this poses a problem for their differential validity and the generalizability of results, and comparison of results from different studies. This paper examined the psychometric properties of five of these RST questionnaires, with a total sample of 821 participants, taken from the factor structures for the Croatian translations of BIS/BAS scales, SPSRQ, Jackson-5, RSQ and RST-PQ. Data were analysed by correlational and confirmatory factor analyses. We found some of these questionnaires achieved marginal to adequate fit indices, and they showed ambiguity in terms of convergent validity for all three general behavioural systems. These findings highlight the difficulties with generalization and comparison of results with the use of different RST questionnaires. Based on these findings, as well as the ongoing debate concerning how best to measure RST constructs, we provide information on how to interpret results from the studies conducted with different RST scales.

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Reinforcement sensitivity theory (RST) provides a neuropsychological account of the major systems that underlie personality, namely, the Behavioural Approach System (BAS), and two defensive systems, the Behavioural Inhibition System (BIS) and the Fight-Flight-Freeze System (FFFS) (Corr, 2008). The BAS mediates reactions to reward and non-punishment. Its outputs are positive emotions, the motivation to approach biological reinforcers, and to engage in activities that lead to consummatory behaviour (Gray & McNaughton, 2003). The FFFS is responsible for the active avoidance and escape from aversive stimuli, while the BIS is responsible for passive avoidance and the detection and resolution of goal-conflict. In its long history, RST has encouraged the development of a number of different questionnaires (for a summary, see Torrubia, Ávila, & Caseras, 2008; Corr, 2016). In the last six years alone, three new questionnaires have been developed: the Jackson 5 (J5; Jackson, 2009), Reinforcement Sensitivity Theory Personality Questionnaire (RST-PQ; Corr & Cooper, 2016), and the Reinforcement Sensitivity Questionnaire (RSQ; Smederevac, Mitrović, Čolović, & Nikolašević, 2014). In fact, more recently, there is a fourth revised RST questionnaire (Reuter, Cooper, Smillie, Markett, & Montag, 2015), which we do not discuss further because it postdates the collection of data reported in

this paper. Together with two of the most frequently used questionnaires – BIS/BAS Scales (Carver & White, 1994) and Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Avila, Moltó, & Caseras, 2001) – there are now six personality questionnaires that compete to provide a viable operational account of RST's three major neuropsychological systems.

When planning a study within RST, researchers have to choose among competing RST questionnaires. This raises question: do the results of the study depend on choice of the questionnaire? At present, there is a lack of empirical work examining the structural and psychometric properties of these questionnaires. This study aims to remedy this state of affairs.

1. RST questionnaires

The most widely used RST questionnaire, the BIS/BAS Scales (Carver & White, 1994), was designed upon original (unrevised) RST (Gray, 1982). This scale has several shortcomings within the context of revised RST (Corr, 2016; Corr & McNaughton, 2008, 2012; McNaughton & Corr, 2008). It emphasized the BIS and BAS, and did not differentiate the FFFS as a separate system of personality (although items capturing variance associated with the FFFS are scattered across the BIS scale, and can be separated from it; Corr & McNaughton, 2008).

SPSRQ was also developed upon original RST. It contains Sensitivity to Punishment (SP) and Sensitivity to Reward (SR) scales. Several studies

show problematic psychometric properties of the translated versions of this questionnaire. In order to achieve a two-factor structure, many researchers have had to adjust translated versions by excluding items. In this way, the original Spanish version contains 48 items (Torrubia, Avila, Moltó, & Caseras, 2001), French version 35 (Lardi, Billieux, d'Acremont, & Van Linden, 2008), and English 39 (Cogswell, Alloy, van Dulmen, & Fresco, 2006); and, without excluding items, the Romanian version has a three-factor solution (Sava & Sperneac, 2006) – in addition to sensitivity to reward and punishment, there was a BAS 'financial' factor relating to earning money but this was correlated 0.67 with the Reward factor. Aluja and Blanch (2011) developed a short version of SPSRQ (SPSRQ-20) in order to enhance its psychometric properties. Besides problems of construct validity, the main issue with this questionnaire is that it is based upon the original version of RST, where impulsivity is assumed to be the underlying trait of the BAS. Several studies suggest that extraversion, rather than impulsivity, should be considered as underlying the BAS dimension (Depue & Collins, 1999; Smillie, Pickering, & Jackson, 2006). For this reason, the clearest statistical difference between BIS/BAS Scales and SPSRQ is found between BAS subscales and SR.

One of the recent RST questionnaires, J5 (Jackson, 2009) contains five scales: BAS, BIS, Fight, Flight, and Freezing. The author's validation data of this questionnaire show some theoretically ambiguous results. First, the BAS and BIS correlate positively – this is not surprising given that some of the 'BIS' items seem to have a definite BAS flavour reflecting social comparison or competition (item example "*I aim to do better than my peers*"). Second, the Fight scale is not correlated with the putative FFFS-related Flight and Freezing scales, which makes forming a unidimensional FFFS scale inappropriate. However, this result is consistent with evidence that fight and aggression (both reactive and proactive) are related to the BAS (for more detail see Corr, 2013, 2016; Corr & Cooper, 2016).

The shortcomings of these RST questionnaires motivated other authors to develop new, and preferably better, ones. RSQ (Smederevac et al., 2014) contains five scales, the same as J5. In contrast, it shows more theoretically congruent BIS and FFFS scales, but shares the same problem of Fight scale with J5. Finally, RST-PQ (Corr & Cooper, 2016) has six scales: BAS (with four subscales), BIS and FFFS, accompanied by a seventh separate measure of Defensive Fight. The four BAS subscales are Reward Interest, Goal-Drive Persistence, Reward Reactivity, and Impulsivity. The RST-PQ was specifically modelled on revised RST, taking into account previous findings concerning the problematic (i.e., cross-loading) nature of Fight with the BAS. Item examples of the questionnaires can be found in *Supplementary material*.

The key assumption for a valid RST questionnaire is that the scale scores should reflect stable individual differences in activity of the brain behavioural circuits responsible for approach and avoidance motivation (e.g. Tal Gonen, Pearlson, & Hendler, 2014). When comparing the criterion validity of the questionnaires, the BIS/BAS Scales and SPSRQ had been widely studied, while newer psychometric measures, particularly RST-PQ and RSQ, awaits for more extensive validation. Studies have related the BAS with higher activity on the left frontal cortex (e.g. Amodio, Master, Yee, & Taylor, 2008; Harmon-Jones & Allen, 1997), and the BIS with septo-hippocampal circuits (e.g. Gray & McNaughton, 2003; Levita et al., 2014). For the sake of continuity of the research within RST, it is important to establish the relations between new RST questionnaires with the earlier ones. In other words, it is important to establish the convergent validity of the new RST questionnaires with the BIS/BAS Scales and SPSRQ.

Available data on convergent validity of the RST questionnaires are limited to comparison of two questionnaires (e.g. Caci, Deschaux, & Baylé, 2007; Cogswell et al., 2006; Davis et al., 2007; Dufey, Fernández, & Mourgues, 2011; Knyazev, Slobodskaya, & Wilson, 2004; Krupić & Corr, 2014; Sava & Sperneac, 2006; Smillie, Jackson, & Dalgleish, 2006; Wallace, Malterer, & Newman, 2009), or three questionnaires (Caseras, Avila, & Torrubia, 2003; Smederevac

et al., 2014; Smillie & Jackson, 2005). Authors of recent RST questionnaires provide most of the development and validation data within their publications, but there has been a noticeable absence of any attempt to provide convergent validation evidence with all of them in the same study —this is the purpose of this study.

Four models will be tested. In the first model, labelled the BAS, BIS and FFFS (see Fig. 1), the approach dimension should be constituted by BAS scales and subscales, one (passive) avoidance dimension should be constituted by BIS scales, and finally, another (active) avoidance dimension should be constituted by (Defensive) Fight, Flight, and Freezing scales. Corr (2013) has outlined difficulties in measuring defensive fight by self-report measures. He argues that language may not be adequate to capture fine conceptual differences between instrumental and defensive aggression. Thus, the second model, labelled the BAS, BIS, Flight/Freeze, will test the three-factor solution without fight scales from RST-PQ, J5 and RSQ. Third model (the BAS, BIS, Flight/Freeze, and a separate Fight) will test a four-factor structure, where the Fight factor will be added along with the three factors from the previous model. Finally, Corr (2008, 2013, 2016) has outlined the importance of the BAS sub-goal processes: (a) identification of the biological reinforcer; (b) planning behaviour; (c) executing the plan; and (d) reward reactivity. Thus, the fourth model will test the model assuming the four RST-PQ BAS subscales, BIS, Flight/Freeze and Fight model.

2. Method

2.1. Participant and materials

An online-sample of 821 participants (415 males), $M_{AGE} = 22.31$, $SD = 4.16$ (age range from 16 to 54) completed five RST questionnaires, which were translated into the Croatian language using double-blind translation procedure. Psychology students helped in recruitment of the participants in exchange for course credits.

2.2. Measures

The BIS/BAS Scales (Carver & White, 1994) contains 24 items that form the BIS scale (7 items), and three subscales related to BAS functioning: Drive (4 items), Fun Seeking (4 items) and Reward Reactivity (5 items), along with four filler items. Items were answered on four-point Likert type scale (1 — very false for me, 4 — very true for me).

SPSRQ-20 (Aluja & Blanch, 2011) is short 20-item version of SPSRQ (Torrubia et al., 2001) containing two 10-items scales: the Sensitivity to Punishment (SP) and the Sensitivity to Reward (SR) with yes/no response format.

The Jackson-5 contains 30 items, equally distributed across five scales: BAS, BIS, Fight, Flight and Freezing. The answer format is a 5-point Likert-type scale (1 = completely disagree; 5 = completely agree).

The RSQ (Smederevac et al., 2014) questionnaire has 29 items distributed across five scales, namely: BAS (6 items), BIS (7 items), Fight (6 items), Flight (5 items) and Freezing (5 items). The response format is 4-point Likert scale (1— Completely disagree; 2 — Somewhat disagree; 3 — Somewhat agree; 4 — Completely agree).

Finally, the RST-PQ (Corr & Cooper, 2016) contains 73 items that comprise five scales: BAS (32 items), BIS (23 items), Flight-Freeze System (FFS 10 items), and Defensive Fight (8 items). RST-PQ defines BAS as a multidimensional construct: Reward Interest (7 items), Goal-Drive Persistence (7 items), Reward Reactivity (10 items), and Impulsivity (8 items). Items are answered on four-point Likert-type scale ("*How accurately does each statement describe you?*" 1 = Not at all; 4 = Highly).

All questionnaires were previously validated and used in Croatian language (e.g. Križanić, Greblo, & Knezović, 2015).