How Reinforcement Sensitivity Theory Relates to Self-Determination Theory

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Highlights

- Scales of RST and goal-orientation within SDT are assessed

- The BIS and FFS did not predicted goal importance

- Various BAS scales differentially predicted intrinsic and extrinsic goal importance

- Data support discriminative validity of the BAS subscales

Abstract

Reinforcement Sensitivity Theory (RST) and Self-Determination Theory (SDT) are two well-known theoretical frameworks in the fields of personality and motivation. Despite their rich histories, they have not yet been studied together. Here we examine their empirical relationships with special emphasis on the behavioural approach system (BAS) of RST. Based on a community sample of 314 participants, our study examined relationships between: (1) RST-related personality factors of the RST-PQ and SPSRQ-20 questionnaires; and (2) the Aspiration Index for goal-orientation within SDT. Regression analyses revealed that BAS factors explained intrinsic and extrinsic goals, whereas the defensive behavioural inhibition system (BIS) and the fight-flight-freeze system (FFFS) did not. Furthermore, BAS scales differentially predicted intrinsic and extrinsic classes of goals, which suggests their unique effects should be considered when attempting to provide a theoretical account of human motivation within the RST framework.

Keywords: intrinsic and extrinsic goals, self-determination theory, reinforcement sensitivity theory, motivation, aspiration

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Reinforcement Sensitivity Theory (RST) recognises three brain-behavioural systems underlying personality traits. The Behavioural Approach System (BAS) is responsible for striving to attain important resources for survival and reproduction. The other two systems are defensive in nature: the Fight-Flight-Freeze System (FFFS) and the Behavioural Inhibition System (BIS), respectively, responsible: (a) for the avoidance of threats endangering survival: and (b) the resolution of goal-conflict. The original version of RST was focused on describing the brain-behavioural circuits underlying individual differences in sensitivities to reward and punishment cues (Corr, 2008; Gray, 1982; Gray & McNaughton, 2000). In contrast, more recent formulations focusing on the general notions of attractors and repulsors, as this distinction recognises the ambiguities inherent in 'reward' and 'punishment' – furthermore, refinements to RST point to a stronger role of the FFFS than seen in the original version (Corr & McNaughton, 2012).

Since the 2000 revision of RST, a major concern has been the operational definition of its main components (Corr, 2016; Krupić, Corr, Ručević, Križanić, & Gračanin, 2016; Walker & Jackson, 2017). There is now a reasonably good agreement on the operationalization of the BIS and FFFS (e.g., Krupić, Križanić, & Corr, 2016). However, the same cannot be said of the BAS. Specifically, there is no clear consensus regarding how it should be conceptualised and measured, which has led to the development of a number of RST questionnaires with varying theoretical bases and different number of factors (see Krupić & Corr, 2017). The issue of the dimensionality of the BAS does not arise solely from the revision of the theory; it reflects also the more general problem of translating RST from animal to human contexts.

Four RST questionnaires contain a one-dimensional operationalisation of the BAS (Jackson, 2009; Reuter, Cooper, Smillie, Markett, & Montag, 2015; Smederevac, Mitrović, Čolović, & Nikolašević, 2014; Torrubia, Ávila, Moltó, & Caseras, 2001), while two

questionnaires contain a multidimensional conceptualisation (Carver & White, 1994; Corr & Cooper, 2016) – with only the latter based on revised RST (Gray & McNaughton, 2000) and subsequent refinement of the theory (Corr & McNaughton, 2012) . Moreover, some authors propose to calculate a total BAS score from these multidimensional scales (e.g., Kelley et al., 2019), but this suggestion is not in accord with views regarding the structural properties of the BAS (e.g., Smillie, Jackson, & Dalgleish, 2006; see Corr, 2016).

The problem addressed by our study concerns the predictive validity of unidimensional versus multidimensional BAS conceptualizations in explaining intrinsic and extrinsic goals aspiration within Self-Determination Theory (SDT; Deci & Ryan, 2000). This is relevant both for understanding the role of the BAS and its sub-factors, and, more generally, for the relationships between RST factors and SDT-related human motivation.

Reinforcement sensitivity theory and self-determination theory

Establishing differences between intrinsic and extrinsic motivations has been a major contribution of SDT. Ryan and Deci (2000) define intrinsic motivation as the inherent tendency to seek out novelty and challenges, extending and exercising one's capacities, as well as exploring and learning. Intrinsic motivation increases when environmental circumstances afford beneficial effects on basic psychological needs: autonomy, competence, and relatedness. In contrast, extrinsic motivation is typically driven by environmental cues and incentives. Moreover, the presence of external incentives may undermine intrinsic motivation by shifting the perceived locus of control from internal to external factors (Ryan & Deci, 2000).

Perhaps surprisingly, RST and SDT have not yet been studied together. This might be the result of their different research traditions. While SDT focused on the study of human behaviour, original RST examined the behaviour of laboratory animals (principally rodents),

at least until the 1980s when it started to be extended to human behaviour – although there were some earlier attempts in the 1970s (for a review, see Pickering, Corr, Powell, Kumari, Thornton, & Gray, 1997). Furthermore, SDT focused on cognitive and internal variables, such as interpretations, desires and motives (Deci & Ryan, 1985) that intervene between stimulus and response, which in studies conducted on experimental (non-human) animals were either ignored or considered unimportant – largely because they are so difficult to measure and prone to inferential hazard (see Corr, 2013). After shifting focus from experimental animal to human studies, revised RST (Gray & McNaughton, 2000) paid much more attention to the processes underlying human motivation and behaviour. However, until recently, little attention was paid to central states of motivation (goal representations) as opposed to the behavioural machinery that subserves these goals (e.g., FFFS, BAS and BIS) (Corr & Krupić, 2017). Also, RST has been dominantly focused on behaviours related to survival and reproduction typical of all mammals; in contrast, SDT was always and exclusively interested in human motivation. To characterise the differences between the two theories, we may say that RST has been principally oriented towards lower, while SDT toward upper, levels of Maslow's hierarchy of needs/motives. Only until recently (see Di Domenico & Ryan, 2017), SDT was not interested in the identification of brain-behavioural mechanisms underlying intrinsic and extrinsic motivation, which has been the main focus of RST.

For these and, no doubt, other reasons, some of the well-studied aspects of human functioning within SDT have not yet captured the attention of RST researchers. This is unfortunate because ignoring the relevance of extrinsic and intrinsic motivation only downplays the potential of the RST framework to explain more fully human motivation. The time seems ripe to try to synthesize these two major approaches.

Within SDT, the importance of goals (i.e., aspirations) is studied within goal contents theory (GCT) that recognises intrinsic (i.e., community, personal growth, relationship and

health) and extrinsic (i.e., image, fame and wealth) classes of goals (Kasser & Ryan, 1993, 1996). The standard instrument for the measurement of these goals is the Aspiration Index (AI; Kasser & Ryan, 1993). The sum of goals represents the strength of intrinsic and extrinsic aspirations. In addition, SDT places emphasis on the importance of the *relative* salience of intrinsic and extrinsic aspirations. This quality of motivation is measured by intrinsic versus extrinsic value orientation (Sheldon & McGregor, 2000; Sheldon & Krieger, 2014), which is calculated by subtracting one from the other.

The GCT group of extrinsic goals or motives have been studied also under different theoretical frameworks. For instance, they are highly congruent with the motives reflecting competitive resource acquisition strategies (Bernard, 2013) and the fast lifestyle within life history theory (Figueredo, 2007). Recent studies (Krupić, Banai, & Corr, 2018; Krupić, Gračanin, & Corr, 2016) found these motives to be correlated with the Sensitivity to Reward (SR) scale from the Sensitivity to Punishment Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, et al., 2001) and Impulsivity from the Reinforcement Sensitivity Theory Personality Questionnaire (RST-PQ; Corr & Cooper, 2016). On the other hand, motives defined as intrinsic are congruent with Bernard's (2013) other group of motives, representing cooperation (care for the community, kin, relationships, environment exploration, living a meaningful life) and slow lifestyle (Figueredo, 2007). This category of motives has been found to correlate with other BAS scales (Reward Interest, Goal-Drive Persistence, and Reward Reactivity).

To sum up, there is a paucity of empirical findings examining relationships between RST dimensions and SDT-relevant intrinsic/extrinsic motivation. The empirical studies reviewed above suggest two hypotheses. First, SR and Impulsivity scales should predict extrinsic goal aspiration. Secondly, Reward Interest, Goal-Drive Persistence and Reward Reactivity should predict intrinsic goals aspirations. We expect that the results of the test of

these hypotheses will provide a better understanding of the implications of the different operationalisations of the BAS (one or multidimensional), serving to fill a significant theoretical gap in the RST literature. It should also throw new light on how RST relates to intrinsic and extrinsic motives.

Method

Participants and procedure

The study was conducted in Osijek, Croatia on a community sample of 327 participants (41.3% of males) who completed personality questionnaires administered via an online survey. The average age of participants was 27.75 (SD = 9.88) - 58% were students, 26.7% employed, 12.4% unemployed, and 2.9% in retirement. They were recruited by psychology students in exchange to course credit (ten participants for one credit) and no payment was made for participation.

Instruments

Reinforcement Sensitivity Theory-Personality Questionnaire (RST-PQ; Corr & Cooper, 2016) contains 73 items distributed over BIS, Flight-Freeze System, four BAS scales, and Defensive Fight. The first BAS scale is the seven-item Reward Interest (e.g. "*I regularly try new activities just to see if I enjoy them*"), reflecting an openness to experience and searching for new and potentially rewarding stimuli. The second scale is the ten-item Goal-Drive Persistence (e.g. "*I put in a big effort to accomplish important goals in my life*"), reflecting sustained effort in pursuing goals. The third scale is the ten-item Reward Reactivity scale (e.g. "*Good news makes me feel over-joyed*"), reflecting reactivity on rewarding stimuli. Finally, the eight-item Impulsivity scale (e.g. "*I think I should 'stop and think' more instead of jumping into things too quickly*"), reflects non-planning and fast reactions The remaining three scales assess defensive motivation: BIS scale contains 23 items ("*I worry a lot*"); Fight-

Flight-Freeze contains 10 items ("*I would be frozen to the spot by the sight of a snake or spider*"); and Defensive Fight 8 items ("*I have found myself fighting back when provoked*").

Sensitivity to Punishment Sensitivity to Reward-Short version (SPSRQ-20; Aluja & Blanch, 2011) is a 20-item version of the original SPSRQ (Torrubia et al., 2001). It contains two scales: Sensitivity to Reward (SR; e.g. "*Do you like being the centre of attention at a party or a social meeting*") and Sensitivity to Punishment (SP; e.g. "*Are you often afraid of new or unexpected situations"*).

Aspiration index (AI; Kasser & Ryan, 1993) is a 35-item questionnaire that measures three dimensions of goals: Importance of the goal, likelihood of attaining the goal, and the current level of attainment of the goal. In this study, participants were instructed only to rate the personal importance of four intrinsic goals: Community (e.g., "*To work for the betterment of society*"), Personal growth (e.g., "*To grow and learn new things*"), Relationship (e.g., "*To have good friends that I can count on*"), and Health (e.g., "*To keep myself healthy and well*"); and three extrinsic goals: Fame (e.g., "*To have my name known by many people*"), Image (e.g., "T*o have people comment often about how attractive I look*"), and Wealth (e.g., "*To be a very wealthy person*"). Each of these seven scales contains five items.

As mentioned earlier, some studies suggest that scales from Aspiration Index (AI) can be summarized into general classes of intrinsic and extrinsic motives. Surprisingly, this has often been done according to theoretical assumptions, but without assessing how the model fits the data. For this reason, we conducted two confirmatory factor analyses to examine whether we can use the AI to calculate Total Intrinsic Values and Total Extrinsic Values.

First, we tested a two-factor model consisting of the four intrinsic and three extrinsic goals. Data did not show adequate goodness of fit indices: $\chi^2 = 47.78$, df = 12, $p < .01$, $\chi^2/df = 3.98$, CFI = .976, RMSEA = .098, SRMR = .041. Due to high RMSEA, we removed the AI

Health scale from the model, just as Martos and Kopp (2012) did in their study, which significantly improved the model fit: $\chi^2 = 16.10$, df = 7, $p < .05$, $\chi^2/df = 2.30$, CFI = .992, RMSEA = .064, SRMR = .030. Total extrinsic and intrinsic values (without the Health scale) correlated, r = .48, $p < .01$. Since we obtained a satisfactory two-dimensional model of AI, we were able to calculate the extrinsic versus intrinsic value orientation (Sheldon & McGregor, 2000) by subtracting composites of Total Extrinsic from Total Intrinsic Values.

All Croatian-language versions of the questionnaires used in this study were back-translated into English and have been previously used and validated (e.g., Krupić, Corr et al., 2016; Rijavec, Brdar, & Miljković, 2011). The ethics committee of the Faculty of Humanities and Social Science in Osijek, Croatia approved the study.

Results

Descriptive statistics and Pearson's correlation coefficients are presented in Table 1. All scales, except the SR, had Cronbach's alpha internal consistency coefficients above .70. Concerning zero-order correlations between BAS scales and goals within the GCT, overall, the SR correlated positively with Total Extrinsic Values, while RST-PQ BAS scales and Defensive fight correlated positively with both Total Extrinsic and Intrinsic Values. In addition, the BIS and FFFS scale, but not the SP, correlated positively to Total Intrinsic Values.

- Table 1 –

Table 2 shows the results of ten multiple regression analyses. Controlling for the effects of gender and age, the SPSRQ and RST-PQ scales were entered in the model as predictors of AI scales and composite variables of intrinsic and extrinsic motivation, and the relative extrinsic versus intrinsic value orientation index. Results provided evidence of a clear distinction between the BAS scales. On a general level, Reward Interest and Reward

Reactivity positively predicted intrinsic goals only, while Goal-Drive Persistence predicted both extrinsic and intrinsic goals. In contrast, SR predicted negatively intrinsic, and highly positively extrinsic, goals. The BIS, FFFS and SP scales were not significantly related to any type of goals orientations. Regarding the relative extrinsic versus intrinsic value orientation, Reward Interest was positive, whereas the SR was a negative predictor. As is evident from Table 2, the BAS scales differed in their prediction of AI facets. Overall, the results of regression analyses supported our hypotheses. We expected and observed that Reward Interest, Goal-Drive Persistence and Reward Reactivity would predict the importance of intrinsic goals and that SR, and that Impulsivity would predict the importance of extrinsic goals.

- Table 2 -

Discussion

Our study examined how RST dimensions relate to intrinsic and extrinsic aspirations, which to our knowledge is the first empirical study of its kind. Multiple regression analyses revealed that BIS and FFFS scales did not show any statistically significant associations, whereas the BAS subscales predicted extrinsic and intrinsic goals, almost entirely consistently with our hypotheses. The only unpredicted relationship was found for Goal-Drive Persistence, which predicted intrinsic and extrinsic goal aspirations, whereas Impulsivity lost its predictive power when SR was entered in the model.

Extrinsic goals

The SR scale predicted positively all three extrinsic goals and negatively aspirations toward the community. RST-PQ Impulsivity showed a similar pattern of correlations, but was lower in magnitude as compared with SR. These findings are in line with past studies examining relationships between SR and evolutionarily-evolved motives (Krupić, Gračanin et

al., 2016) and the fast lifestyle within life history theory (LHT) (Krupić et al., 2018). Thus, our findings suggest that high SR individuals are motivated by extrinsic rewards, which might explain why their behaviour is directed towards resources and is accompanied by a lack of concern for the social environment. This finding supports earlier studies pointing to the extrinsic nature of the motivation of individuals high on SR. For example, students high on BAS Drive (similar to Goal-Drive Persistence from RST-PQ) show more interest in studying, while high SR individuals show the opposite inclination (Krupić & Corr, 2014). In a more recent study, high SR individuals were found to be less motivated after negative feedback, while individuals high on other BAS scales were better able to maintain their initial motivation (Krupić, 2017). Overall, it seems that high SR individuals favour a quick pay-off and if they feel they are losing then they give up (quit) quickly.

Intrinsic goals

Other BAS scales correlated with intrinsic goals, which is also consistent with previous findings. Reward Interest positively related to intrinsic (community and personal growth) and negatively to extrinsic (i.e. wealth) aspirations; and it was the only factor that positively related to intrinsic value orientation (see Table 2). This is not surprising given that the content of Reward Interest scale captures the tendency to explore potential rewards from the environment and entails making plans to attain them. In addition, Reward Interest correlates highly with: (a) openness to experience (Corr & Cooper, 2016), which has been related to intrinsic value orientation (Prentice, Kasser, & Sheldon, 2019); (b) explorative behaviour (Krupić, Gračanin et al., 2016); and (c) such individuals are more motivated by challenging tasks (Krupić, 2017), which is in line with the definition of intrinsic motivation.

The two key features of Goal-Drive Persistence are the drive in pursuing goals and the resistance to momentary distraction, both of which are reflected in high correlations with extraversion and conscientiousness (Corr & Cooper, 2016). Persistent individuals believe that

success depends on their effort (Corr & Mutinelli, 2017), which explains their endurance in pursuing goals. In contrast, Goal-Drive Persistence correlates positively with the strength (quantity) of both extrinsic and intrinsic motivation, while it has no relationship with motivation as measured by the relative extrinsic versus intrinsic value orientation. On a facet level, it predicted wealth and image from the extrinsic group of goals and all four intrinsic goals. Finally, Reward Reactivity predicted intrinsic motivation. These data are in line with previous studies that have consistently related this scale to prosocial tendencies, such as commitment to a romantic partner and care for relatives (Krupić et al., 2018; Krupić, Gračanin et al., 2016).

As predicted, the FFFS and BIS did not account for variance in goals. This was expected given the nature of these defensive systems. However, we cannot exclude the relevance of the BIS when there is a need to decide between two or more competing goals - . for instance, the choice between two job offers where one is less well paid but allows more time to be spent with family. Making such a (goal-conflicted) decision may well increase anxiety in individuals with a more reactive BIS – an expectation that still has to be explored.

Contribution to the understanding of how the BAS operates

Our study supports the claim that different RST questionnaires have implications for how we view relationships between BAS and SDT constructs. Importantly, accounting for personality variance in intrinsic and extrinsic motivation is not optimal within a one-dimensional BAS framework. Table 1 shows the discrepancy in the psychometric operationalisation of the SPSRQ (based on original RST) and RST-PQ (based on revised RST). As seen, the SR is exclusively correlated with extrinsic motives, while the RST-PQ scales correlate with both intrinsic and extrinsic motives. According to the original version of the theory, the BAS is conceptually closely aligned to impulsivity (Torrubia et al., 2001) reflecting the desire to attain extrinsically important resources, whereas in the revised version

it is more aligned to extraversion and decomposed into four stages that explain the complex sequence of stages comprising approach motivation (Corr & Cooper, 2016). The results of this study indicate that the operationalisation of the BAS by RST-PQ offers a more comprehensive and nuanced framework to explain human motivation and enables a better integration of findings with other theories and models – in contrast, the SPSRQ is useful in explaining extrinsic motivation only.

Limitations

Our study was based exclusively on self-report questionnaires and, therefore, the results might be distorted by participants' desire to adhere to, what they perceive to be, acceptable responses and they may discard negative responses regarding themselves due to social-desirability responding. Since we did not measure social desirability, we cannot address this possibility in the present study. In addition, to explore this possibility more fully, it would be valuable to use more objective measures of aspirations, such as information of current job position or professional interests.

To conclude, our study examined the relationships between RST constructs, as measured by the SPSRQ and RST-PQ, and intrinsic/extrinsic goals within SDT. The SR of the SPSRQ predicted only extrinsic goals, while the BAS subscales of the RST-PQ predicted both extrinsic and intrinsic goals. These findings indicate a redirection of the focus of RST in the study of approach motivation toward the multidimensional nature of the BAS. In addition, future RST studies should pay much more attention to the *type* of rewarding stimuli, since they seem to trigger different motivational aspects of the BAS.

Our study is the first empirical attempt to examine the relationships of RST constructs with intrinsic and extrinsic motivation, as defined by SDT. It should serve as a starting point

291 for the further exploration of these two well-known and influential theories that, hitherto, have
292 been studied separately.

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Table(s)

Table 1. Correlations between RST dimensions and intrinsic and extrinsic aspirations

				Total Intrinsic goals	*Total extrinsic goals*	*Extrinsic value orientation*	*Extrinsic goals*			*Intrinsic goals*			
	α	M	SD				Fame	Image	Wealth	Community	Personal growth	Relationship	Health
SPSRQ-20													
SR20	*.65*	4.05	2.29	-.01	.53**	-46**	.53**	.45**	.42**	-.04	.04	-.01	.05
SP20	*.83*	4.88	3.03	.03	-.10	.11	-.12*	-.01	-.10	.03	.02	.02	-.06
RST-PQ													
Reward Interest	*.84*	12.09	4.39	.27**	.22**	.06	.21**	.19**	.17**	.31**	.28**	.18**	.30**
Goal-Drive Persistence	*.83*	13.99	4.06	.37**	.28**	.11	.14*	.27**	.30**	.31**	.38**	.33**	.40**
Reward Reactivity	*.79*	18.57	5.02	.32**	.30**	.04	.24**	.32**	.26**	.25**	.30**	.31**	.27**
Impulsivity	*.70*	12.36	4.25	.13*	.27**	-.11	.20**	.31**	.21**	.14*	.11*	.10	.12*
BIS	*.93*	36.47	13.33	.17**	.06	.11	.03	.14**	.02	.16**	.14*	.15**	.11
FFFS	*.80*	14.30	6.31	.14*	-.01	.14*	-.02	.12*	-.03	.14*	.07	.18**	.10
Defensive Fight	*.70*	13.43	3.98	.19**	.29**	-.07	.21**	.29**	.25**	.10	.20**	.19**	.20**
α				*.95*	*.92*	-	*.90*	*.81*	*.87*	*.93*	*.86*	*.91*	*.91*
M				85.00	45.99	39.00	11.73	16.56	17.92	26.64	28.65	30.08	28.62
SD				17.21	15.69	18.44	6.04	5.83	6.38	6.63	5.98	6.05	6.25

* p < .05, ** .01;

Table 2. Multiple regression analysis using RST dimension as a predictors of extrinsic and intrinsic aspirations

	Total Intrinsic goals	*Total extrinsic goals*	*Extrinsic value orientation*	*Extrinsic goals*			*Intrinsic goals*			
				Fame	Image	Wealth	Community	Personal growth	Relationship	Health
Gender	.021	-.166**	.147**	-.133*	-.065	-.223**	.055	-.010	.010	-.024
Age	.150**	.097*	.026	.043	.088	.118*	.085	.156*	.175**	.092
SR20	-.142*	.413**	-.457**	.451**	.351**	.271**	-.157**	-.105	-.124*	-.087
SP20	.041	-.015	-.009	-.059	.013	.006	.041	.090	-.018	-.023
Reward Interest	.190**	-.065	.229**	.032	-.033	-.160*	.302**	.159*	.047	.161**
Goal-Drive Persistence	.204**	.147*	-.050	-.027	.139*	.260**	.129	.233**	.202**	.273**
Reward Reactivity	.159*	.083	-.027	.067	.052	.095	.084	.156*	.203**	.067
Impulsivity	-.117	.007	-.095	-.036	.044	.012	-.038	-.135*	-.155*	-.115
BIS	.063	.069	.017	.065	.100	.016	.055	-.001	.118	.070
FFFS	.092	.017	.086	.043	.026	-.023	.117	.076	.056	.099
Defensive Fight	.092	.102	-.027	.060	.119	.086	.000	.125*	.137*	.111
R	*.48*	*.60*	*.53*	*.55*	*.53*	*.54*	*.48*	*.45*	*.46*	*.46*
R^2	*.23*	*.36*	*.28*	*.30*	*.28*	*.29*	*.23*	*.20*	*.21*	*.21*
F (11. 302)	*8.38***	*15.43***	*10.88***	*11.67***	*10.89***	*11.26***	*8.11***	*8.84***	*7.46***	*7.30***

* p < .05. ** .01;