RESEARCH ARTICLE

Turkish version of the Reinforcement Sensitivity Theory of Personality Questionnaire: Adaptation study

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ABSTRACT

Objective: This study aimed to adapt the Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ) to the Turkish language and measure its factor structure and psychometric properties.

Method: In total, 418 volunteers (301 women) participated in the study. Participants were undergraduate students at Adnan Menderes University, Aydin, Turkey, and were aged between 18 and 26 years (M=21.53). They completed the Turkish version of the RST-PQ, Behavioral Inhibition System/Behavioral Activation System (BIS/BAS) Scales, Big Five Personality Characteristics Scale (BFPCS), Eysenck Personality Questionnaire Revised-Abbreviated Form (EPQR-A), State-Trait Anxiety Inventory (STAI), and UPPS Impulsive Behavior Scale.

Results: Both exploratory and confirmatory factor analyses supported a six-factor structure aligned with the original questionnaire: Flight Freeze System (FFS), BIS, and four factors that are related to BAS, which are reward interest, goal-drive persistence, reward reactivity, and impulsivity. Cronbach's alpha reliability coefficients of six factors were found to be 0.79, 0.93, 0.78, 0.87, 0.79, and 0.69, respectively. The convergent and divergent validity of the scale was supported by correlations with the existing personality/trait scales.

Conclusion: Our findings revealed that the Turkish version of RST-PQ has favorable reliability and validity in the Turkish student sample. The strengths and limitations of the questionnaire were further discussed in the study.

Keywords: Approach, avoidance, behavioral activation, behavioral inhibition, reinforcement sensitivity theory

INTRODUCTION

Many systematic personality theories have been put forward since the early twentieth century. Among these theories, reinforcement sensitivity theory (RST) of personality asserts that, in general, humans encounter a variety of situations eliciting specific behaviors, emotions, and cognitions. The main argument of the theory is that such psychological reactions are the products of hypothetical motivational systems in the brain, which are sensitive to a given stimulus or a condition (i.e., danger or novelty). In fact, it is suggested that this very stable functioning of the brain itself is what constitutes unique personalities (1). RST was initially presented by Gray (2,3) and revised by Gray and McNaughton following the advances in neuroscience (4).

The original RST consists of three major systems of emotion: the Fight–Flight System (FFS), Behavioral Inhibition System (BIS), and Behavioral Activation System (BAS). FFS is activated in the presence of an unconditioned aversive stimulus, paving way to the emotions of rage and panic (5). BIS is sensitive to conditioned aversive stimuli (e.g., public speech) and omission/termination of rewards. This system is responsible for avoidance behavior, anxiety, and worry (6). BAS operates approach behavior to the conditioned appetitive or rewarding stimuli and induces in the individual positive affect such as joy and hope (5).

Gray and McNaughton (4) revised the theory (r-RST) by modifying the functions of the systems mentioned above. In the revised theory (r-RST), one may not notice any major alterations in how BAS functions; nevertheless, it is notable that BAS not only reacts to conditioned stimuli but is also sensitive to all rewarding stimuli (7). At this step, BAS is assumed to be multidimensional and functioning in coordination with other systems such as working memory and executive control. This is mainly because the organism might have to pass through many different processes/stages to gain a reward for itself (5).

The most notable change in the revised theory is arguably about the functions of FFS and BIS. The "freeze" subsystem has been included in FFS, and FFS is now labeled as a fight–flight–freeze system (FFFS). FFFS has been assumed to be sensitive to both conditioned and unconditioned aversive stimuli, making it the primary mechanism responsible for active avoidance behavior. To elaborate, if threatening stimuli are purely aversive and should be avoided, FFFS is activated to elicit fear and avoidance behaviors (5). On the other hand, BIS has no longer been responsible for reactions to conditioned aversive stimulus but for the resolution of goal conflict in general (8). When FFFS and BAS are activated simultaneously by a stimulus that contains both aversive and appetitive valence, the organism experiences anxiety as a consequence of conflict. Corr (5) states that when conflict is salient, BIS evaluates the risks, attempts to benefit from past experiences, and seeks out possible "way-out" to resolve conflict. In humans, BIS activation leads to worry and ruminative thinking and weighing up the possible risks in life. If individuals go through these conflict-resolution processes frequently, they may become more vulnerable to psychiatric conditions such as generalized anxiety disorder or obsessive–compulsive disorder (5).

Several attempts have been made to develop a psychometric instrument based on the revised theory, such as Jackson-5 (9), the Reinforcement Sensitivity Questionnaire (10), and the Fight, Flight, Freeze Questionnaire (11). However, these attempts had their own theoretical and statistical shortcomings. For example, BIS-related items of the Jackson-5 scales do not correspond with what the theory postulates (1). Additionally, although reward processes and experiences cannot be handled in one dimension, most of these scales have only one factor related to BAS. Considering these limitations, discrepancies in the study outcomes would be inevitable. For example, Harnett et al. (12) administered both BIS/BAS Scales (13) and Jackson-5 (9) to participants to examine how these psychometric tools correlate with affective states. Contrary to the expectations and theoretical assumptions, the original BIS scale displayed higher levels of correlation with anxiety, depression, and stress in comparison to the revised BIS in Jackson-5. Ultimately, it was unavoidable to develop an instrument that could evaluate the personality dimensions postulated by the revised RST with a high-reliability level.

For reasons discussed above, Corr and Cooper (1) developed the Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ). Their study revealed a six-factor structure with unitary BIS (thematic facets: motor planning interruption, cautious risk assessment, obsessive thoughts, and behavioral disengagement) and FFFS (thematic facets: flight, active avoidance, and freeze) factors and four BAS factors (reward interest, goal-drive persistence, reward reactivity, and impulsivity). However, Corr and Cooper (1) did not include the fight component of the fear system into the FFFS factor because of both theoretical and empirical considerations. Thus, while mentioning this factor, naming it as FFS would be more appropriate than FFFS.

This study aimed to introduce the Turkish version of the RST-PQ by analyzing its factor structure and psychometric properties. We expected to replicate the six-factor structure found in the original study and provide favorable construct validity and internal consistency.

METHOD

Participants and Procedure
A total of 418 volunteers (301 women and 117 men) agreed to participate in the study. Participants were undergraduate students at Aydın Adnan Menderes University, Turkey, and were between the ages of 18 and 26 (M=21.53).

The ethical approval of the current study was obtained from the Ethical Board of The Institution of The Social Science of Aydın Adnan Menderes University. Volunteers were informed about the purpose of the study, and they provided written informed consent. They completed the questionnaires in the classroom. No compensation was provided for the participation.

Instruments

Behavioral Inhibition System (BIS) and Behavioral Activation System (BAS) Scales

BIS/BAS Scales were developed by Carver and White (13) to measure sensitivities to punishment and reward proposed by the original RST. It is a self-report Likert-type questionnaire. The response interval of items ranges from 1 (very true for me) to 4 (very false for me). The scale consists of four factors: a BIS factor (7 items) and three BAS factors (reward responsiveness, 5 items; drive, 4 items; and fun-seeking, 4 items). The scale was adapted to Turkish by Sisman (14). Cronbach's alpha coefficients of the adaptation version are 0.69 for BIS, 0.57 for BAS reward responsiveness, 0.69 for BAS drive, and 0.63 for BAS fun-seeking. It also revealed sufficient levels of test–retest reliability (ranging between 0.59 and 0.69) and good validity.

Big Five Personality Characteristics Scale (BFPCS)

BFPCS is a self-report questionnaire designed by Benet-Martínez and John (15) under the name of "The Big Five Inventory." The scale has 44 items in total with five subscales, which are openness to experience (10 items), neuroticism (9 items), extraversion (8 items), agreeableness (9 items), and conscientiousness (9 items). The responses in this Likert-type scale range from 1 (disagree strongly) to 5 (agree strongly). It was adapted to Turkish by Sumer and Sumer (16) as a part of a study conducted in 56 countries on personality characteristics (17). Cronbach's alpha values of the subscales of the Turkish version of the scale ranged from 0.64 to 0.77.

Eysenck Personality Questionnaire Revised-Abbreviated Form (EPQR-A)

EPQR-A was designed by Francis et al. (18) to evaluate dimensions of Eysenck Personality Theory which are neuroticism, extraversion, and psychoticism. This shortened version of the original EPQ (19) consists of 24 items and an additional lie factor. Each subscale has six items, and they are responded to as either "yes" or "no." It was adapted to Turkish by Karanci et al. (20).

Cronbach's alpha values are 0.78 for extraversion, 0.65 for neuroticism, 0.42 for psychoticism, and 0.64 for lie scale. Moreover, the Turkish version of the scale demonstrated sufficient test–retest reliability (between 0.69 and 0.82) and validity.

Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ)

RST-PQ is a self-report questionnaire designed by Corr and Cooper (1) to measure the dimensions of revised RST. It has 65 items under six factors, which are BIS (23 items), FFFS (10 items), BAS reward interest (7 items), BAS drive (7 items), BAS reward reactivity (10 items), and BAS impulsivity (8 items). The rating is based on a four-point scale, and its internal consistencies were 0.78 for FFS, 0.93 for BIS, 0.75 for reward interest, 0.86 for goal-drive persistence, 0.78 for reward reactivity, and 0.74 for impulsivity. The scale also correlated with well-established personality scales, indicating good convergent validity. In this study, the original version of the scale was translated into the Turkish language by the authors of the study, then translated back to English by a specialist, who was blinded to the original items, in the English language to check if the intended meaning of the items was preserved. Having received some recommendations from a highly experienced psychiatrist, some final modifications were made to be able to preserve the exact meaning of items.

State-Trait Anxiety Inventory (STAI)

Developed by Spielberger et al. (21), STAI aims to measure state and trait anxiety in two dimensions. The instrument has 40 items in total with 20 items for each dimension. For this study, only trait subscale was distributed to the participants. The trait subscale's responses are four-point Likert-type range from 1 (almost never) to 4 (almost always). The scale was adapted to Turkish by Oner and Le Compte (22). The scale has good reliability that Cronbach's alpha of trait subscale ranged between 0.83 and 0.87.

UPPS Impulsive Behavior Scale

The scale was designed to assess dimensions of impulsivity by Whiteside and Lynam (23) and adapted to Turkish by Yargic et al. (24). The instrument has 45 items and dwells on four dimensions: Premeditation (11 items), urgency (11 items), sensation seeking (12 items), and perseverance (11 items). The rating of the items is Likert-type, ranging from 1 to 4. The total Cronbach's alpha of the adapted Turkish scale was

0.84. The scale also revealed good construct validity through significant associations with substance use, self-mutilating behavior, and personality disorder.

Data Analysis

Initially, exploratory factor analysis (EFA) was conducted to explore the factor structure of the scale. Before running EFA, Kaiser–Meyer–Olkin's (KMO) measure of sampling adequacy and Bartlett's test of sphericity were utilized to test whether the data suits EFA. Two EFAs were conducted separately, first for the combined BIS and FFS items representing avoidance motivations and then for the BAS items representing approach motivations. Factors were extracted using principal component analysis and were further rotated using oblique rotation. The rationale behind conducting separate EFA and using oblique rotation was that theoretically BIS and FFS are correlated factors, and BAS subfactors are also correlated among themselves. As the factors are correlated, it is suggested to use oblique rotation (25). Parallel to what has been argued above, Corr and Cooper (1) have also implemented the same process in the original study of scale development.

For the next step, confirmatory factor analysis (CFA) was conducted to provide further evidence for the factor structure of the scale. Model fit was evaluated by examining χ^2 goodness of fit index, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root means residual (SRMR). A nonsignificant χ^2 test indicates a reasonable model fit, but this is almost impossible in a large sample size (e.g., above 200). For this reason, we also reported χ^2/df values expected to be below 3.0 (26). Whereas RMSEA values below 0.08 are acceptable, the values below 0.06 suggest a good fit (27). CFI values are expected to be above 0.90 (28). SRMR score below 0.08 indicates a good model fit.

The divergent and convergent validity of the scale was established by correlations with well-known and validated personality scales introduced above. Internal consistency reliability estimates of the factors were calculated by Cronbach's alpha value. All analysis was conducted with the SPSS 23 and AMOS 23 software package.

RESULTS

Exploratory Factor Analysis

For combined BIS/FFS items, the KMO sampling adequacy value was 0.921, and Barlett's sphericity test provided a significant result (p<0.0001), proposing that the data were suitable for factor analysis. EFA with forced two-factor extraction indicated that the two-factor structure explains 38.57% of the total variance. Factor 1 reflected the FFS, and Factor 2 reflected the BIS. Items were all loaded on their designated factor, except for item number 64 (I often find myself lost for words), which was cross-loaded but had factor loading above 0.50. This item had also been cross-loaded in the original study, but the authors did not omit the item from the scale due to its strong theoretical connection with the BIS and inspected further by CFA, too. All factor loadings were found above 0.45 except for item 7 (0.40) and item 10 (0.33) in BIS, and most of them were found to be above 0.60 (Table 1).

For 32 BAS items, the KMO value was 0.874, and Barlett's sphericity test yielded a significant result (p<0.0001), again implicating that data were suitable for factor analysis. EFA with forced four-factor extraction revealed that the four-factor structure explains 44.49% of the total variance. Most items were loaded on their designated factors and had a factor loading above 0.40. Although some of them were cross-loaded, there was no clear deviation of items from their respective factors. Factor loadings of BAS items can be found in Table 2.

Confirmatory Factor Analysis

A one-factor CFA model representing combined FFS and BIS did not fit the data adequately: $\chi^2(488)=1622.629$, p<0.0001, $\chi^2/df=3.33$, RMSEA=0.075, CFI=0.78, and SRMR=0.08. Next, a two-factor structure model where FFS and BIS were separate latent factors was tested. This model demonstrated an adequate model fit in terms of $\chi^2/df=2.31$, RMSEA=0.056, and SRMR=0.06 but not for CFI=0.88, which suggested a mediocre model fit ($\chi^2(487)=1124.682$, p<0.0001). Having inspected factor loadings, another CFA analysis was conducted without BIS items loaded below 0.35 (items 7 and 10). These items also had lower factor loadings in EFA compared with other BIS items. This revised two-factor model demonstrated adequate model fit, $\chi^2/df=2.13$, RMSEA=0.052, CFI=0.92, and SRMR=0.057 ($\chi^2(423)=900.085$, p<0.0001). All factor loadings were above 0.41, and most were above 0.50 (Table 1).

A one-factor CFA model representing total reward sensitivity provided poor model fit: $\chi^2(463)=2428.266$, p<0.0001, $\chi^2/df=5.25$, RMSEA=0.10, CFI=0.53, and SRMR=0.11. Next, a four-factor structure model where all reward factors were separate latent factors was tested. These four-factor structure model fit indexes

Table 1: Factor loadings of FFS and BIS items for EFA and CFA

Factors	Items	EFA		CFA		Corrected item-total correlations	Cronbach's alpha upon item removal
		FFS	BIS	FFS	BIS		
FFS	9	0.54	0.16	0.52		0.46	0.78
	19	0.56	0.10	0.41		0.42	0.78
	39	0.57	0.24	0.53		0.44	0.78
	45	0.68	0.20	0.55		0.55	0.77
	46	0.49	0.14	0.42		0.41	0.78
	48	0.63	0.30	0.62		0.52	0.77
	52	0.52	0.29	0.47		0.41	0.78
	58	0.53	0.14	0.46		0.43	0.78
	59	0.52	0.28	0.49		0.44	0.78
	62	0.70	0.41	0.73		0.60	0.77
BIS	1	0.30	0.63		0.62	0.57	0.92
	2	0.15	0.70		0.68	0.62	0.92
	6	0.32	0.69		0.67	0.63	0.92
	7*	0.07	0.400		0.34	0.35	0.92
	10*	0.04	0.333		0.28	0.30	0.92
	17	0.40	0.66		0.65	0.63	0.92
	18	0.44	0.55		0.53	0.52	0.92
	21	0.26	0.72		0.68	0.66	0.92
	29	0.24	0.65		0.63	0.59	0.92
	33	0.10	0.56		0.50	0.10	0.93
	34	0.35	0.65		0.64	0.60	0.92
	42	0.29	0.60		0.57	0.56	0.92
	43	0.32	0.61		0.61	0.56	0.92
	47	0.45	0.78		0.78	0.75	0.91
	49	0.47	0.61		0.60	0.58	0.92
	50	0.34	0.75		0.73	0.70	0.92
	55	0.43	0.47		0.45	0.46	0.92
	56	0.37	0.77		0.75	0.73	0.91
	57	0.15	0.65		0.58	0.57	0.92
	60	0.25	0.68		0.60	0.64	0.92
	61	0.19	0.72		0.66	0.65	0.92
	63	0.42	0.54		0.52	0.51	0.92
	64	0.56	0.52		0.51	0.51	0.92

*: Items should be used cautiously; FFS: Flight–Freeze System; BIS: Behavioral Inhibition System; EFA: Exploratory factor analysis; CFA: Confirmatory factor analysis.

were as follows: $\chi^2(458)=1240.297$, $p<0.0001$, $\chi^2/df=2.70$, RMSEA=0.064, and SRMR=0.07, which suggested adequate model fit, while CFI=0.81 value was below the cutoff point 0.90. To detect problematic items, we considered both statistical and theoretical aspects of them. First, items 15, 22, and 54 had factor loadings below 0.35. Second, although factor loading of item 53 (If I see something I want, I act straight away)

was satisfying (0.44), this item belongs to the impulsivity facet but crossly loaded on goal-drive persistence in EFA, just like did in the original questionnaire. Considering this both theoretical and statistical incongruity, we rerun CFA removing items 15, 22, 54, and 53. This model provided acceptable model fit, $\chi^2(338)=735.370$, $p<0.0001$, $\chi^2/df=2.18$, RMSEA=0.05, CFI=0.90, and SRMR=0.06 (Table 2).

Table 2: Factor loadings of BAS items for EFA and CFA

Factors	Items	EFA				CFA				Corrected item-total correlations	Cronbach's alpha upon item removal
		RI	GDP	RR	Imp	RI	GDP	RR	Imp		
	11	0.59	0.27	0.21	0.19	0.57				0.49	0.75
	13	0.71	0.41	0.23	0.04	0.71				0.61	0.73
	14	0.70	0.23	0.18	0.16	0.65				0.59	0.74
RI	15*	0.43	0.04	0.04	0.22	0.32				0.31	0.80
	26	0.56	0.21	0.29	0.06	0.53				0.46	0.76
	32	0.72	0.32	0.26	0.21	0.74				0.64	0.73
	35	0.59	0.36	0.25	0.18	0.58				0.47	0.76
	5	0.35	0.77	0.12	-0.09		0.76			0.71	0.85
	12	0.45	0.78	0.20	-0.04		0.76			0.71	0.85
	20	0.41	0.75	0.24	0.04		0.75			0.68	0.85
GDP	31	0.20	0.73	0.23	-0.03		0.65			0.62	0.86
	41	0.33	0.85	0.23	-0.05		0.86			0.79	0.83
	54	-0.05	0.47	0.14	-0.08		0.34			0.34	0.89
	65	0.35	0.79	0.24	-0.06		0.78			0.73	0.84
	3	0.39	0.26	0.41	0.02			0.39		0.35	0.78
	4	0.48	0.18	0.57	0.14			0.59		0.51	0.76
	8	0.50	0.19	0.54	0.08			0.62		0.48	0.76
	16	0.27	0.18	0.60	0.14			0.48		0.48	0.77
	23	0.48	0.13	0.49	0.41			0.61		0.47	0.77
RR	24	0.05	0.46	0.47	0.36			0.43		0.38	0.78
	25*	-0.04	0.22	0.70	0.23			0.34		0.48	0.77
	30	0.08	0.30	0.66	0.41			0.45		0.52	0.76
	36	0.22	0.16	0.64	0.16			0.47		0.46	0.77
	37	0.43	0.01	0.57	0.36			0.60		0.47	0.77
	22*	0.05	0.01	0.06	0.42				0.26	0.23	0.69
	27	0.02	-0.06	0.22	0.58				0.30	0.32	0.67
	28	0.18	-0.09	0.05	0.76				0.56	0.54	0.62
Imp	38	0.46	-0.03	0.24	0.61				0.71	0.52	0.63
	40	0.06	-0.08	0.30	0.52				0.42	0.38	0.66
	44	0.32	-0.05	0.18	0.45				0.52	0.37	0.66
	51	0.21	-0.12	0.19	0.45				0.47	0.35	0.66
	53*	0.27	0.35	0.37	0.47				0.44	0.35	0.67

*: Items should be used cautiously. BAS: Behavioral Activation System; EFA: Exploratory factor analysis; CFA: Confirmatory factor analysis; RI: Reward interest; GDP: Goal-drive persistence; RR: Reward reactivity; Imp: Impulsivity.

After testing separate CFA for the FFS/BIS and BAS, the final CFA models were tested with all factors. First, the first-order six-factor model where all items loaded on their respective latent factor was tested. This model provided an adequate model fit in terms of the $\chi^2/df=2.01$, RMSEA=0.049, and SRMR=0.07, with the exception of CFI being equal to 0.80 ($\chi^2(2000)=4443.223$, p<0.0001). Next, a higher-order (second-order) CFA model was tested. In this model, higher-order latent factors were punishment sensitivity, which FFS and BIS loaded on, and reward sensitivity, which four BAS factors loaded on, respectively. Once again, this model provided adequate model fit in terms of $\chi^2/df=2.07$, RMSEA=0.05 but not for CFI=0.79 and SRMR=0.088 ($\chi^2(1999)=4151.547$, p<0.0001).

Table 3: Descriptive statistics, intercorrelations, and Cronbach's alpha coefficients

	FFS	BIS	RI	GDP	RR	Imp
FFS		0.404**	-0.119*	-0.077	0.059	0.192**
BIS			-0.141**	-0.243**	-0.078	0.247**
BAS						
RI				0.430**	0.471**	0.315**
GDP					0.344**	-0.029
RR						0.415**
Imp						
M	24.78	62.09	18.19	21.49	30.14	20.34
SD	6.06	12.59	3.92	4.12	4.76	4.22
Min	10.00	32.00	9.00	8.00	17.00	11.00
Max	40.00	91.00	28.00	28.00	40.00	32.00
Skewness	-0.13	0.08	0.20	-0.39	-0.21	0.21
Kurtosis	-0.45	-0.62	-0.50	-0.23	-0.25	-0.36
Alpha	0.79	0.93	0.78	0.87	0.79	0.69

*: p<0.05; **: p<0.01; FFS: Flight–Freeze System; BIS: Behavioral Inhibition System; BAS: Behavioral Activation System; RI: Reward interest; GDP: Goal-drive persistence; RR: Reward reactivity; Imp: Impulsivity; SD: Standard deviation; Min: Minimum; Max: Maximum.

Descriptive statistics and intercorrelations between RST-PQ Turkish version factors are provided in Table 3. A significant, moderate, and positive correlation between FFS and BIS was found and aligned with the theory and original scale. There were also significant positive correlations of BAS factors with one another, except for the goal-drive persistence and impulsivity.

Internal Consistency Reliability and Validation with Other Personality Scales

For the internal consistency reliability, Cronbach's alpha estimates were measured as 0.79 for FFS, 0.93 for BIS, 0.78 for reward interest, 0.87 for goal-drive persistence, 0.79 for reward reactivity, and 0.69 for impulsivity. They pointed out that factors have moderate to good levels of internal consistency. Results are given in Table 3.

The correlations of RST-PQ with other scales are presented in Table 4. For the FFS, there were significant positive correlations with the original BIS, neuroticism of the five-factor, and Eysenck personality scales. FFS had moderate positive correlations with both UPPS urgency and STAI. The results for BIS were similar to FFS, but its correlations with the original BIS scale, five-factor and Eysenck neuroticism scales, and UPPS urgency were moderate to large. Particularly, BIS's correlation with STAI was notable as STAI is one of the important measures of anxiety.

The most evident correlations of BAS factors with the scales were listed as follows: The reward interest correlated moderately with o-BAS fun-seeking and drive, openness to experience, and extraversion scales. For the goal-drive persistence, there were moderate positive correlations with drive and reward responsiveness of o-BAS, the conscientiousness of the five-factor model, and UPPS perseverance but negative correlation with STAI. Reward reactivity had moderate correlations with all o-BAS reward factors and extraversion scales. Finally, impulsivity had moderate positive correlations with fun-seeking in BIS/BAS Scales and UPPS urgency.

DISCUSSION

In this study, we aimed to adapt the RST-PQ into the Turkish language. EFA revealed two defensive/avoidance factors, with clear differentiation of FFS and BIS, and four approach factors representing reward interest, goal-drive persistence, reward reactivity, and impulsivity. Factor loadings for items were all above satisfactory level, indicating that EFA results provided a good factor structure for the scale.

As for the CFA results, separate CFA models for FFS/BIS and BAS factors provided an acceptable, even better global model fit than the combined models, similar to the original study. Although some items were problematic regarding their factor loadings and omitted temporarily to determine whether the CFI would reach the acceptable level, we preferred not to remove these items permanently from the scale. The main rationale behind this decision is that their factor loadings were

Table 4: Correlations of RST-PQ with other personality scales

	FFS	BIS	RI	GDP	RR	Imp
BIS/BAS Scales						
BIS	0.362**	0.562**	-0.112*	-0.082	0.115*	0.222**
BAS-RR	0.192**	0.076	0.276**	0.429**	0.594**	0.300**
BAS-FS	0.019	0.037	0.422**	0.047	0.453**	0.623**
BAS-D	-0.002	-0.130*	0.354**	0.513**	0.345**	0.349**
Big Five PCS						
O	-0.270**	-0.176**	0.563**	0.340**	0.250**	0.184**
C	-0.163**	-0.275**	0.247**	0.646**	0.168**	-0.252**
E	-0.228**	-0.406**	0.442**	0.352**	0.480**	0.230**
A	-0.042	-0.172**	0.195**	0.289**	0.191**	-0.062
N	0.381**	0.761**	-0.331**	-0.381**	-0.233**	0.193**
EPQR-A						
E	-0.206**	-0.385**	0.415**	0.285**	0.427**	0.211**
N	0.278**	0.646**	-0.217**	-0.300**	-0.153**	0.200**
P	-0.151**	-0.074	0.048	-0.184**	-0.019	0.204**
L	-0.078	-0.065	-0.024	0.192**	-0.111*	-0.253**
UPPS Imp						
Premeditation	-0.036	-0.023	0.120*	0.493**	0.061	-0.244**
Urgency	0.327**	0.491**	-0.090	-0.332**	0.069	0.499**
Sen. Seek.	-0.360**	-0.142*	0.343**	0.151**	0.218**	0.338**
Perseverance	-0.167**	-0.263**	0.358**	0.643**	0.224**	-0.095
STAI						
Trait anxiety	0.331**	0.795**	-0.325**	-0.465**	-0.252**	0.179**

*: p<0.05; **: p<0.01. FFS: Flight–Freeze System; BAS: Behavioral Inhibition System; RI: Reward interest; GDP: Goal-drive persistence; RR: Reward reactivity; Imp: Impulsivity; BAS: Behavioral Approach System; RR: Reward responsiveness; FS: Fun-seeking; D: Drive; O: Openness; C: Conscientiousness; E: Extraversion; A: Agreeableness; N: Neuroticism; P: Psychoticism; L: Lie; Sen. Seek.: Sensation seeking.

quite satisfactory in the EFA results. Moreover, before deleting the items, only the CFI was below the acceptable level; still, it was pretty near this border. Finally and most obviously, further studies to be conducted in diverse samples are required to conclude that this scale is well established, valid, and reliable. It is possible that these items may have better factor loadings in future studies. Therefore, we decided to retain these items in the scale but advised researchers for the careful use and evaluation of them.

Internal consistency of the factors ranged from acceptable to very good, which were quite similar to the original study. The comparisons between the Turkish version of the scale and other well-established personality scales revealed that the findings were in line with the theoretical framework, providing further evidence for the validity of the scale. Of interest, both FFS and BIS have a significant and positive correlation with the o-BIS, neuroticism scales, and urgency scale of UPPS impulsivity. The urgency factor of impulsivity is

characterized by highly negative emotions and impulsive behaviors to alleviate emotional distress (23); therefore, the discussion of its relation with FFS and BIS was plausible. BIS demonstrated a robust correlation with STAI-trait, lending further support to its affective specificity. A weak correlation between FFS and STAI-trait and a strong correlation between BIS and STAI-trait supported the fear and anxiety distinction postulated by the revised RST (4). In general, correlational results imply that the more people have elevated FFS and BIS, the more they are nervous, neurotic impulsive, and experience negative emotions and the less they are open to new experiences and extroverted.

For BAS factors, there are theoretically sensible correlations between other scales. To be more specific, goal-drive persistent persons are likely to be more conscious and less impulsive. This personality characteristic mainly reflects the ability to sustain motivation on difficult or tedious tasks to achieve a final reinforcer, especially when the immediate reward

is unavailable (5,23). On the other hand, reward-sensitive people are more likely to be extroverts, who can be labeled for their tendency to seek new and funny experiences.

Our correlational results are not distinct from the original study (1) and another adaptation study of the Polish version of the scale (29). FFS and BIS do not show similar correlations with other personality scales, especially with neuroticism and STAI-trait, suggesting that these measures are not identical in nature. On the other hand, the multidimensional nature of BAS representing subprocesses in the approach behavior should be preserved in future studies because BAS factors have their unique functions in reward-related behaviors (1,5).

According to the revised RST, fear is activated when withdrawing from a dangerous situation (active avoidance), and anxiety is activated when approaching such situations (e.g., risk assessment) (30). Although this differentiation was based on the outcomes of studies designed with rodents, psychometric studies provided preliminary evidence for how fear and anxiety differentiate in humans (31). To test this hypothesis in humans, researchers created threat scenarios modeled after rodents' reactions to threats. Results indicate that while anxious participants were more likely to approach the threat, fearful ones preferred to avoid it (32). A recent study using a genetic approach did reveal the association of gene targeting anxiety with the BIS but not with the FFFS (33). In short, cross-species validation of the distinction between fear and anxiety and their differential functions in threatening situations has been emerging. Thus, the revised RST scale and its translated versions would be valuable tools for researchers in future studies.

Psychometrically sound as the findings were, the study has some critical limitations. First of all, the participants were undergraduates, so our result might not be generalized to other populations. In future studies, sampling from a clinical and older population would be highly informative for cross validation of the current scale. Self-report assessment of the hypothetical motivational systems highlights the second limitation. Objective or behavioral criteria such as reaction time to rewarding stimuli should be established for the robustness of the validity of the relevant factors. Student GPAs, for example, would be an objective criterion for evaluating the goal-drive persistence when considering the content of this factor. Especially for the FFS and BIS distinction, more rigorous experimental and neuroscientific studies are required.

Contribution Categories		Author Initials
Category 1	Concept/Design	O.T.S., C.D.
	Data acquisition	O.T.S.
	Data analysis/Interpretation	O.T.S., G.S., C.D.
Category 2	Drafting manuscript	O.T.S., G.S.
	Critical revision of manuscript	O.T.S., G.S., C.D.
Category 3	Final approval and accountability	O.T.S., G.S., C.D.
Other	Technical or material support	O.T.S., G.S., C.D.
	Supervision	C.D.

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