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Article

Assessment
2019, Vol. 26(4) 684–694

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The Dimensions of Ruminative Thinking: One for All or All for One

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Abstract

The Ruminative Thought Scale (RTS) was developed to measure the ruminative thinking style, presumably common to various psychopathological disorders. However, prior factor-analytic research was inconclusive regarding unidimensionality versus multidimensionality of the RTS. The present study was conducted on a large, heterogeneous Serbian sample (N = 838). A subsample was retested 6 months later providing information about symptoms of depression and various anxiety symptoms. Results showed that a bifactor model of the RTS (representing one general and four group factors) had a better fit than the second-order and one-factor models. The subscale scores were not prospective predictors of symptoms of depression and anxiety, over and above the contribution of the total score. The RTS is a reliable transdiagnostic measure of repetitive thinking. Although there is some clustering of more homogeneous items, there is not enough evidence to support interpretation of the subscales.

Keywords

RTS, transdiagnostic processes, rumination, repetitive thoughts

The Ruminative Thought Scale (RTS; Brinker & Dozois, 2009) is a self-report questionnaire derived from a transdiagnostic perspective of psychopathology. This perspective can be traced back to the work of Martin and Tesser (1996), who defined rumination as a general thinking style characterized by repetitiveness, intrusiveness, uncontrollability, and recurrence. Building on this idea, Brinker and Dozois (2009) suggested that different disorders share this common thinking style, which can present itself differently depending on the thought content, valance, and temporal orientation in various health conditions. Similar arguments were offered by an independent group of researchers according to whom various forms of repetitive thinking, such as rumination, worry, postevent processing, and counterfactual thinking, reflect a single, underlying process (Ehring & Watkins, 2008; Harvey, Watkins, Mansell, & Shafran, 2004; Watkins, 2008).

A common theme advocated within the transdiagnostic approach is that repetitive, perseverative, involuntary cognition reflects a unitary construct whereby its disorder-specific features (in terms of content, temporal orientation, valence, or the level of abstractedness) represent heterogeneous manifestations of this single underlying process. This view contrasts with a more traditional, disorder-specific perspective according to which various forms of repetitive cognitions (e.g., worry and rumination) have more differences than similarities, exhibiting different relations with psychopathological symptoms (e.g., Borkovec, Robinson, Pruzinsky, & DePree, 1983; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). The latter approach inspired the creation of a number of disorder-specific instruments, but only a few transdiagnostic measures exist in the research literature.

The RTS (Brinker & Dozois, 2009) is one such instrument purporting to measure the general thinking style characterized by intrusiveness, recurrence, and a lack of controllability irrespective of thought valence and temporal orientation. Additional, newly developed measures include the Repetitive Thinking Questionnaire (McEvoy, Mahoney, & Moulds, 2010) and the Perseverative Thinking Questionnaire (Ehring et al., 2011). In this article, we opted to explore the RTS for two reasons. Different from the Repetitive Thinking Questionnaire, which was created based on the existing measures developed within the disorder-specific approach to repetitive thinking, the RTS is composed of a new set of items purporting to assess a general thinking style that supposedly permeates across various mental disorders irrespective of thought content, valence, and temporal orientation. Another reason is that compared to the Perseverative Thinking Questionnaire, the RTS includes a

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wider range of perseverative cognitions implicated in psychopathology (e.g., counterfactuals and intrusions related to future; Watkins, 2008).

However, there is some inconsistent research evidence regarding the dimensionality of the RTS. In their validation studies on undergraduate students, Brinker and Dozois (2009) demonstrated that the RTS measures a single construct, possesses incremental validity over a measure of depressive rumination in predicting dysphoria, and has good internal reliability, test–retest reliability, and convergent and divergent validity. In a Turkish sample, Karatepe, Yavuz, and Türkcan, (2013) reached a similar conclusion about the unidimensional nature of the construct measured by the RTS. Hence, these two studies provided initial support for a unitary concept of perseverative thinking as measured by the RTS. However, in an Australian adolescent sample, Tanner, Voon, Hasking, and Martin (2013) found that the RTS measures four rumination factors labeled Problem-Focused Thoughts, Counterfactual Thinking, Repetitive Thoughts, and Anticipatory Thoughts, which were conceptualized as the first-order factors subsumed under one second-order rumination factor. Problem-Focused Thoughts represents an unproductive approach to problems characterized by lengthiness and unclear reasoning (e.g., "Even if I think about a problem for hours, I still have a hard time coming to a clear understanding"). Counterfactual Thinking taps into a "What if . . ." type of thinking similar to upward counterfactuals (i.e., imagining alternative, better scenarios compared to the reality; e.g., "I tend to replay past events as I would have liked them to happen"). Repetitive Thoughts describes mainly one's general tendency to have intrusive, repetitive, and automatic thoughts regardless of time orientation (e.g., "I can't stop thinking about something"). Finally, intrusiveness and repetitiveness captured by Anticipatory Thoughts are primarily related to the future (e.g., "If I have an important event coming up, I can't stop thinking about it"). Tanner et al. (2013) interpreted their findings as a support for a multidimensional view of rumination. In addition, Tanner et al. (2013) suggested shortening the scale based on their exploratory factor analysis by deleting five items (i.e., Items 10, 15, 16, 18, and 19).

One explanation for such contradictory findings is the type of analysis and criteria for factor extraction employed in the aforementioned studies. Namely, Brinker and Dozois (2009) used principal components analysis (PCA) and relied solely on Cattell's (1966) scree test to determine the number of factors. Tanner et al. (2013) also employed PCA; however, they considered additional criteria for determination of the number of factors (Lorenzo-Seva, Timmerman, & Kiers, 2011). Tanner et al. cross-validated their four-factor solution via confirmatory factor analysis (CFA), after removing five items with factor loadings of <.50 or cross-loadings of >.30. However, neither PCA nor CFA (even second-order CFA) can answer the fundamental question as to how much of the RTS item variance is explained by the general construct or factor versus group factors. A more appropriate way to answer the question regarding the dimensionality of an instrument, particularly when the instrument contains item clusters tapping diverse manifestations of a phenomenon, is to rely on bifactor modeling (Reise, 2012; Reise, Bonifay, & Haviland, 2018; Reise, Moore, & Haviland, 2010).

Employing bifactor modeling and contrasting its results with different, appropriate models can shed a light on the nature of perseverative thinking, at least as measured by the RTS, and provide potentially a reconciliation of the two views presented earlier. For example, it would be possible to discern whether this type of repetitive thinking is best considered (a) a simple unitary construct with one common source of variance; (b) a broad unitary construct with multidimensionality caused by clustered items tapping different trait manifestations, which is, however, not sufficient to warrant creation of subscales; or (c) truly multidimensional in nature. Additionally, true multidimensionality can stem from a presence of a general repetitive thinking factor and disorder-specific group factors that are subordinate to the general factor, with an assumption that disorder-specific factors mediate the effects of the general factor on the RTS items. On the other hand, multidimensionality of the repetitive thinking can be explained by a presence of the general and disorder-specific group factors that, in different amounts, directly, independently, and nonhierarchically influence the common RTS item variance.

Bifactor modeling can help one discern which of the aforementioned possibilities can be regarded as the best approximation of reality. An additional advantage of using bifactor modeling to examine the RTS is that this analytic approach can describe how much of the RTS item variance is due to the general rumination factor versus group factors. Hence, this analysis allows one to determine the extent to which the total score of an instrument reflects a single underlying factor even in the cases in which its items form clusters that reflect various content domains (Reise et al., 2010; Reise et al., 2018). In addition, Tanner et al.'s (2013) recommendation to shorten the scale was based on the exploratory factor analysis, which did not take into consideration the amount of the RTS item variance attributable to the general versus group factors. There is a possibility that some items were deleted based solely on their poor saturation with the group factors. However, some of the deleted items might prove to be good measures of the general factor. Bifactor modeling, hence, can shed light on the sources of the RTS item variance leading to more appropriate decisions regarding item retention/deletion.

Another, potentially dubious result of Tanner et al.'s (2013) study that needs replication is the finding that the Anticipatory Thoughts factor, although intrusive and uncontrollable in nature, seems to buffer against psychological distress and is related to adaptive forms of coping. The fact that Anticipatory Thoughts was defined by only two items in this Australian sample casts doubt on this conclusion, requiring further examination of its relations with a broader array of psychological outcomes, such as symptoms and other adaptive/maladaptive forms of rumination.

Given the supposed transdiagnostic nature of the process it measures, one would expect to find significant relations between rumination, as assessed by the RTS, and various psychopathological symptoms. Brinker, Chin, and Wilkinson (2014) have supported this expectation by finding that the RTS rumination was related to the Minnesota Multiphasic Personality Inventory-2–Restructured Form scales measuring the somatic/cognitive complaints, depression, anxiety, stress/worry, specific fears, and anger proneness. Given the cross-sectional nature of this study, however, an alternative explanation is that the obtained correlations were due to a common distress variance. Moreover, given the unanswered question as to how many ruminative dimensions the RTS measures, it is unclear whether one dimension, as Brinker and Dozois (2009) would suggest, or four dimensions, as Tanner et al. (2013) would claim, underlie the obtained relations between the RTS and various psychopathological symptoms.

The present study had two related objectives: (a) to address the question about the RTS dimensionality by using a more appropriate statistical tool such as confirmatory bifactor modeling and (b) to obtain further evidence regarding the scale validity primarily focusing on its potential to prospectively predict psychopathological symptoms.

Method

Participants and Procedure

Three samples were collected for this study. All participants were Caucasian. A student sample was recruited, during regular classes, from various faculties at the University of Novi Sad, Serbia (n = 228, M_{age} =19.85, SD = 0.97). They completed online questionnaires asking about their symptoms, life events, and their characteristic ways of thinking about stressful situations four times, separated by 6 months, over 2 years. The RTS responses were registered during the third wave of data collection, whereas the psychopathological symptom measures were administered during the third and fourth waves. An adult sample consisted of users of an unemployment service agency in the city of Novi Sad, Serbia, who were approached during their regular, scheduled visits to the center (n = 316, M_{age} = 34.73, SD = 10.81). As a part of test battery, they completed two instruments measuring ruminative tendencies (one assessing the general tendency to ruminate and another tapping depressive rumination) and a measure of general distress. The third sample comprised Facebook users recruited via an online invitation provided on a Facebook profile. Participants were asked to recruit others using the "snowball strategy," that is, they were asked to copy the research link on their Facebook profiles in order to make the link visible to their Facebook form. To achieve an adequate power for the planned analyses, the samples were combined (M = 26.5, SD = 6.44; females = 634).

Materials

Ruminative Thought Scale Questionnaire (Brinker & Dozois, 2009). The RTS is a 20-item measure that assesses the tendency to exhibit repetitive, intrusive, recurrent, and uncontrollable thoughts about the past, present, and future. Items were created to have neutral, positive, and negative valence. Respondents are asked to rate, on a 7-point Likert-type scale, how well each item describes them (1 = *not at all descriptive of me*; 7 = *describes me very well*). "I find that my mind goes over the things again and again" is an example of the RTS items. Given that the questionnaire is written in English, the first author translated the items into the Serbian language. Following this translation, another bilingual person, blind to the original items, back-translated the items. There was no discrepancy between the original and back-translated versions of the RTS. The RTS has good internal consistency, test–retest reliability, and convergent validity (Brinker & Dozois, 2009). Alpha coefficient for the present study was .94.

Ruminative Response Styles (RRS). The RRS is a 10-item subscale of the Response Style Questionnaire (Nolen-Hoeksema, Morrow, & Fredrickson, 1993), which measures the tendency to engage in depressive rumination. Treynor, Gonzalez, and Nolen-Hoeksema (2003) reported that the RRS assesses reflection and brooding, the first representing one's reflective proneness with an aim to problem-solve one's current mood and the second reflecting a judgmental approach to one's current mood problems. An example of a reflection item is "Go away by yourself and think about why you feel this way." An example of a brooding item is "Think 'Why do I always react this way.'" The translation procedure for the RRS was similar to the one described previously. The original and back-translated versions of the RRS were comparable. Alpha for the present study was .80 in the adult-unemployed sample.

Psychiatric Diagnostic Screening Questionnaire (PDSQ; Zimmerman & Mattia, 1999). The PDSQ is a 126-item, self-report screening tool designed to assess 13 of the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; American Psychiatric Association, 1994) disorders. The subscales used in this study assess panic disorder (9 items), depressive (21), generalized anxiety disorder (GAD; 10 items), social phobia (14 items), and obsessive-compulsive disorder (OCD; 7 items; Zimmerman & Mattia, 1999, 2001). In previous studies, the PDSQ subscales demonstrated adequate internal consistency, convergent validity, and discriminant validity (Zimmerman & Mattia, 2001). The translation procedure for the PDSQ was similar to the one described previously. The original and back-translated versions of the PDSQ were comparable. In the present study, the alpha coefficients were .85 for depression, .67 for OCD, .80 for panic, .86 for social phobia, and .87 for GAD.

Positive and Negative Affect Schedule (Watson, Clark, & Tellegen, 1988). This measure is a 20-item, self-report tool tapping positive affect (PA) and negative affect (NA). In this study, participants were asked to rate the extent to which they had experienced each particular affect *today* using a 5-point scale with *not at all*, *little*, *moderately*, *quite a bit*, and *extremely*. Psychometric characteristics of this measure were reported previously on Serbian samples and were adequate (Mihić, Novović, Čolović, & Smederevac, 2014). In this study, the alpha coefficients were .85 for PA and .86 for NA.

Data Analytic Strategy

We performed confirmatory bifactor analysis, which can disentangle two sources of item variance: one attributed to the general factor (in our case general rumination factor that potentially underlies all RTS items) and the other source attributable to potential four group factors identified by Tanner et al. (2013). We wanted to examine if the group factors explain any additional item variance above and beyond that accounted for by the general rumination factor. The analyses were conducted using the Lavaan package (Rosseel, 2012) in the *R* statistical software (R Development Core Team, 2008). Three different models were compared:

- Model A: This is the one-factor model with all RTS items loading on one factor, as suggested by Brinker and Dozois (2009).[1]
- Model B specified one second-order factor subsuming four group factors identified in Tanner et al.'s (2013) study. The factors were Repetitive Thinking (Items 1-4), Counterfactual Thinking (Items 6-8), Problem-Focused Thoughts (Items 9, 11-13), and Anticipatory Thoughts (Items 17 and 20). Given the possibility that Tanner et al. might have deleted certain items prematurely, based only on their group factor loadings disregarding their potential saturation with the general factor, we included all RTS items in the analysis. Based on their face validity, Item 18 ("Sometimes even during conversation, I find unrelated thoughts popping into my head") was allowed to load on Repetitive Thinking, whereas Items 14 and 15 were forced to load on Problem-Focused Thoughts ("Sometimes I realize I have been sitting and thinking about something for hours" and "When I am trying to work out a problem, it is like I have a long debate in my mind where I keep going over different points"). Finally, Items 5[2] and 10 were considered additional indicators of Anticipatory Thoughts ("When I am anticipating an interaction, I will imagine every possible scenario and conversation" and "If there is an important event coming up, I think about it so much that I work myself up).
- Model C: This is a bifactor model with a general factor and the four group factors as specified in Model B.

In addition to considering fit indices, we contrasted Models B and C via a chi-square difference test given that the second-order model is nested within the bifactor (Yung, Thissen, & McLeod, 1999). Also, we examined the pattern of factor loadings in various models. For example, if all RTS items had substantial saturation by the general factor, we expected not to find an extensive lowering of the factor loadings on the general factor in Model C, in which the group factors were introduced, compared to the Model A (Brouwer, Meijer, & Zevalkink, 2013). Finally, any changes in the pattern of loadings on the group factors between the bifactor and the second-order models were examined. This comparison can reveal whether the introduction of the general factor lowers substantially the group factor loadings. This comparison is important because it safeguards against incorrectly claiming that there are group factors while, in reality, there is one common source of variance (the general factor) explaining the relations between the groups factors and the RTS items (Chen, West, & Sousa, 2006).

In addition to the factor loadings, omega hierarchical coefficients were considered to examine how much of the total RTS score variance was attributable to the general rumination factor (Reise et al., 2010). We also contrasted omega coefficients (model-based reliability estimates akin to coefficient alpha that reflect the percentage of reliable variance of a multidimensional composite) for potential RTS subscales with their residualized counterparts (i.e., reliability that is left within each subscale once the reliability due to the general factor was controlled; Reise, 2012).

Finally, to discern whether it is meaningful to create RTS subscales rather than use a single total score, we related identified subscales to external criteria. The residual regression method was used in which residual of each subscale was related to a particular criterion after partialling out the total score (Chen, Hayes, Carver, Laurenceau, & Zhang, 2012; Reise et al., 2018).

Results

Data Screening

Data were screened for univariate and multivariate outliers. There were no univariate outliers in the data set. According

Table 1. Descriptive Statistics.

	M (SD)		
	Unemployed adults, 69% female (N = 218)	Students, 65% female (N = 150)	Facebook, 85% female (N = 251)
Total RTS	67.94 (24.59)	64.52 (24.74)	89.68(21.81)
Distress—PDSQ	Not applicable	4.09 (3.38)	5.74(4.70)
Distress—NA	17.53 (7.27)	Not applicable	Not applicable
Brooding—RRS	10.66 (2.63)	Not applicable	Not applicable
Reflection—RRS	9.53 (2.96)	Not applicable	Not applicable

Note. RTS = Ruminative Thought Scale; PDSQ = Psychiatric Diagnostic Screening Questionnaire; NA = negative affect; RRS = Ruminative Response Styles.

Table 2. Fit of the Three Models to the RTS Data.

	χ^2	*df*	CFI	TLI	RMSEA	SRMR
Unitary	2140.18	152	.81	.79	.12-.13	.07
Second-order four-factor model	930.03	148	.93	.92	.07-.08	.06
Bifactor model	633.492	133	.95	.94	.06-.07	.04

Note. df = degrees of freedom; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean square error of approximation; SRMR = standardized root mean square residual. All χ^2 were significant at p <.001.

to Mahalanobis distances, critical $\chi^2(20) = 37.57$, $p < .01$; however, there were 58 outliers, which were excluded from the analyses. Mardia's coefficient (Mardia, 1974) of multivariate kurtosis was 29.31, suggesting that the data were nonnormally distributed. To account for nonnormality, the scaled Sattora–Bentler (1994) chi-square, based on maximum likelihood estimation, was used.

Descriptive Statistics

The mean total RTS score in our study was 74.51 (22.27). Independent *t* test demonstrated that there was a significant difference between this mean score and the one obtained in Brinker and Dozois's (2009) study, $t(1013) = -6.76$, $p < .0001$, Cohen's $d = -0.42$. Additionally, in this study there was a small gender difference with females scoring higher on the total RTS than males ($M_{females} = 75.87$, $SD = 23.46$, and $M_{males} = 69.74$, $SD = 21.90$), $t(895) = 3.49$, $p < .001$, Cohen's $d = 0.23$. To better understand our data, descriptive information was presented for each sample separately (Table 1). Regarding the RTS scores, the Facebook sample had higher scores in comparison to both the student and adult samples. This suggests that the Facebook sample was responsible for the overall increase in the total RTS scores in the combined Serbian sample in comparison to the Canadian norms. Even though all three samples had a larger proportion of females, the Facebook sample was predominantly composed of females, which might have led to increases in the total RTS scores.

Participants in the student and Facebook samples did not experience significant elevations in distress. Although there was a statistically significant difference in the PDSQ scores between these two samples, $t(521) = 4{,}48$, $p < .001$, Cohen's $d = 0.28$, this difference was not clinically meaningful given that the means within the both samples were well below the recommended cutoff scores of 9 (Zimmerman, 2002). The only available measure of distress in the adult sample was NA, which suggested that, in comparisons to the published norms (Watson et al., 1988), this group experienced significant elevations in general distress, $t(971) = 2.68$, $p < .001$, Cohen's $d = .18$. Nonetheless, the adult group had comparable levels of the ruminative thinking to those reported in the student, nondistressed sample.[3]

Comparison of Various RTS Models

The overall model fit (Table 2) of the one-factor model was not satisfactory according to the usual criteria (good fit if comparative fit index ≥ .95, Tucker–Lewis index ≥ .90, root mean square error of approximation ≤ .06, and standardized root mean square residual ≤ .07; acceptable fit if comparative fit index is between .90 and .95 and root mean square error of approximation is between .06 and .08), suggesting that one general factor is not sufficient to explain adequately correlations among the RTS items (Bagozzi, 2010; Cook, Kallen, & Amtmann, 2009; Hu & Bentler, 1998). The second-order four-factor model had an acceptable fit. However, the bifactor model had good fit according to all criteria, implying that the RTS item correlations are best explained by one general factor and the four specific factors. This conclusion was supported by a significant difference in χ^2 values between the second-order and bifactor models, $\Delta\chi^2(15)$

Table 3. Factor Loading for One-Factor, Second-Order, and Bifactor Models.

	Ruminative Thought Scale												
	One-factor		Second-order					Bifactor					
	G	h^2	F1	F2	F3	F4	h^2	G	F1	F2	F3	F4	h^2
1	.72	.52	.78				.61	.71	.31				.59
2	.74	.54	.78				.61	.70	.33				.59
3	.77	.60	.89				.79	.73	.58				.86
4	.77	.60	.87				.76	.73	.47				.76
5	.62	.39				.66	.43	.63				.13	.42
6	.71	.51		.86			.74	.71		.48			.73
7	.66	.44		.81			.66	.66		.51			.69
8	.66	.43		.75			.55	.66		.33			.54
9	.72	.51			.79		.62	.69			.39		.62
10	.73	.53				.75	.57	.70				.26	.56
11	.74	.54			.84		.71	.69			.53		.75
12	.71	.51			.78		.60	.67			.38		.60
13	.71	.51			.84		.70	.66			.56		.75
14	.68	.46			.68		.46	.68			.12		.48
15	.63	.39			.63		.39	.64			.10		.42
17	.65	.43				.71	.50	.64				.32	.51
18	.67	.45	.63				.39	.68	.04				.46
19	.71	.51				.84	.71	.71				.40	.67
20	.75	.56				.88	.78	.72				.64	.93

= 296.54, $p < .01$.Our decision to favor the bifactor over the second-order model is based on its unique ability to model directly relationships between the group factors and the RTS items (Chen et al., 2006). Although the communalities between the second and the bifactor models were virtually indistinguishable (see h^2 columns in Table 3), suggesting that the common variance was the same, this variance is partitioned differently in these two models (Chen et al., 2006, Chen et al., 2012). Given its unique property to model this common variance by both the general and group factors simultaneously, one can make more informative claims about the dimensionality of the construct under study (Reise et al., 2010).

Table 3 displays factor loadings obtained in the three models tested. In the bifactor model, all items had large loadings (range: .63-.72) on the general factor. It is noteworthy, that the size of these loadings was highly comparable to the loadings in the one-factor model, supporting the idea that all RTS items are good measures of the general rumination factor. Hence, the presence of group factors in the bifactor model did not alter the size of the factor loadings on the general factor. Additionally, 14 items had also substantial saturations by their proposed group factors using the cutoff value of ≥.30. Hence, these 14 items, except as being very good measures of the general rumination factor, appear to assess, albeit to a lesser degree, the four group factors. Items 5, 10, 14, 15, and 18 had substantial loadings only on the general factor in the bifactor model. Although they had heavy loadings (range: .63-.75) on their proposed group factors in the second-order model, our results suggest that these items mainly assess the general factor variance. Hence, if one were to focus solely on the second-order model results, one would claim wrongly that these items represent good measures of their prospective group factors.

Consistent with the result regarding the major contribution of the general factor to all RTS items was an omega hierarchical coefficient of .76. This coefficient suggests that 76% of the variance for the composite RTS scores was accounted for by the general factor. Given that the value of the omega coefficient for the whole scale was .97, these two omega coefficient imply that 21% of the reliable total score variance was due to the group factors.

Based on the results of the bifactor model, we created the four subscales using the items with their group factor loadings ≥.30: Repetitive Thought (Items 1-4), Counterfactual Thinking (Items 6-8), Problem-Focused Thoughts (Items 9, 11- 13), and Anticipatory Thoughts (Items 17, 19, 20). The omega coefficients for these RTS subscales were .90 for Repetitive Thoughts, .85 for Counterfactual Thinking, and .87 for both Problem-Focused Thoughts and Anticipatory Thoughts. We also calculated reliability estimates for the residualized subscales, which were as follows: .23 for Repetitive Thoughts, .25 for Counterfactual Thinking, .28 for Problem-Focused Thoughts, and .26 for Anticipatory Thoughts. These substantially smaller residualized reliabilities mean that there was not very much reliable variance once the general factor is

Table 4. Correlations Between the RTS, Its Subscales, the PDSQ Symptoms, and the RRS Subscales.

	RTS total	Repetitive thoughts	Counterfactual thinking	Problem-focused thoughts	Anticipatory thoughts
PDSQ[a]					
Major depression	.21*	.31**	.20*	.15	.10
OCD	.15	.19*	.04	.18*	.12
Agoraphobia	.16	.15	.05	.26**	.10
Panic	.14	.11	.12	.10	.14
Social phobia	.27**	.20*	.32***	.37**	.22*
GAD	.34**	.37**	.28**	.27**	.21*
RRS[b]					
Reflection	.47**	.39**	.29**	.37**	.37**
Brooding	.61**	.54**	.42**	.53**	.49**

Note. RTS = Ruminative Thought Scale; PDSQ = Psychiatric Diagnostic Screening Questionnaire; RRS = Ruminative Response Styles; OCD = obsessive-compulsive disorder; GAD = generalized anxiety disorder.
[a]Correlations were based on a subsample of 121 student participants who returned for fourth wave of data collection; [b]*n* = 316 unemployed adults.
**p* < .05. ***p* < .01.

controlled for (Reise, 2012), suggesting that the utility of the subscales is questionable. However, given that there is no clear guidance as to how much of the variance specific to the potential subscales is needed to consider the subscales meaningful (Brouwer et al., 2012), once the common variance is controlled for, we examined both omega hierarchical coefficients and subscales' capacity to predict incrementally external criteria.

Prospective and Concurrent Validity of the RTS and Its Subscales

Pearson's correlation coefficients among the RTS, its subscales, and the PDSQ symptom measures are presented in Table 4.

The residualized regression approach with the hierarchical entry method was used. The total RTS score was entered in the first step, while the four residualized subscale scores were entered in the second step. Regarding the symptoms measures, 21 cases were identifed as outliers, which were Windsorized (Hoaglin, Mosteller, & Tukey, 1983). Also, the PDSQ-OCD and PDSQ-panic symptoms were nonnormally distributed (skewness > 2.00). Hence, these variables were normalized using Rankit's formula (Gilchrist, 2000). Finally, only those participants who did not satisfy the PDSQ diagnostic criteria at Time 1 were included in the regression analyses. The results are presented in Table 5.

As illustrated in Table 5, the regression models were significant in prediction of depression, social phobia, and GAD. The total RTS score explained a significant proportion of variance in these symptoms, when entered in the first step. In the second step, none of the residualized subscales added to prediction, with the exception of Repetitive Thoughts that predicted an additional 5% of variance in the depressive symptoms, over and above the variance explained by the total RTS score ($sr^2 = .05$). Regarding the OCD and panic symptoms, the regression models were not significant.

To further explore the validity of the total RTS scale and its subscales, we examined their concurrent relations with the RRS on the unemployed adult sample. As shown in Table 4 (lower part), the total RTS scale and all RTS subscales had significant positive correlations with both Reflection (i.e., contemplative thinking with a focus on problem solving) and Brooding (i.e., critical and judgmental orientation toward one's inner experience); however, they were statistically more strongly related to the latter (total RTS scale: $Z = -2.00$, $p < .05$; Repetitive Thoughts: $Z = -2.92$, $p < .01$; Counterfactual Thinking: $Z = -4.49$, $p < .01$; Problem-Focused Thoughts: $Z = -3.31$, $p < .01$; Anticipatory Thoughts: $Z = -2.96$, $p < .01$).

Discussion

The aim of this study was to examine the dimensionality of the RTS. Stemming from the transdiagnostic understanding of psychopathology, the RTS was developed to be a content-independent measure of repetitive, uncontrollable, and intrusive thinking style common to various psychopathological symptoms with a varying temporal orientation (e.g., past, present, future). We compared previously reported factor-analytic models (Brinker & Dozois, 2009; Karatepe et al., 2013; Tanner et al., 2013) with the bifactor model in a large Serbian sample. Our data suggest that the bifactor model can reconcile the differences reported in the previous factor-analytic studies of the RTS.

According to our results, all RTS items measure a single underlying construct (cf. Brinker & Dozois, 2009), but there is also clustering of 14 items that fall into more homogenous subsets. Hence, Tanner et al.'s (2013) recommendation to delete Items 10, 15, 16, 18, and 19 seemed

Table 5. Results of Residualized Regressions Showing Contributions to Various Psychopathological Symptoms.

	Variable									
	Depression		GAD		Social phobia		OCD		Panic	
	β	t	β	t	β	t	β	z	β	z
Step 1										
RTS	.24	3.05**	.32	4.07**	.27	3.49**	.15	1.67	.10	1.06
	R =.24		R = .32		R = .27		R = .15		R = .09	
	Adjusted R^2 = .05		Adjusted R^2 = .10		Adjusted R^2 = .10		Adjusted R^2 = .02		Adjusted R^2 = .00	
	ΔR^2 = .06**		ΔR^2 = .10**		ΔR^2 = .08**		ΔR^2 = .02		ΔR^2 = .01	
Step 2										
RT	.30	2.89**	.11	0.96	−.06	−0.52	.18	1.97	.07	0.53
CT	.06	0.56	.17	1.59	.00	0.02	.00	0.07	.09	0.72
P-FT	.11	1.09	.10	0.98	.16	1.49	.17	1.38	.03	0.21
AT	.11	1.02	.04	0.32	−.00	−0.07	.12	0.98	.11	0.84
	R = .34		R = .35		R = .32		R = .25		R = .13	
	Adjusted R^2 = .09		Adjusted R^2 = .10		Adjusted R^2 = .07		Adjusted R^2 = .02		Adjusted R^2 = −.03	
	ΔR^2 = .12**		ΔR^2 = .12**		ΔR^2 = .10**		ΔR^2 = .06		ΔR^2 = .02	
n	160		147		152		121		120	

Note. GAD = generalized anxiety disorder; OCD = obsessive-compulsive disorder; RTS = Ruminative Thought Scale total score; RT = Repetitive Thoughts; CT = Counterfactual Thinking; P-FT = Problem-Focused Thoughts; AT = Anticipatory Thoughts.
**p < .01.

unjustifiable given their substantial loadings on the general rumination factor.

Our study supports the notion that the RTS assesses dysfunctional aspects of rumination common to various psychopathologies. Namely, this scale correlated significantly higher with the brooding subscale than with the reflections subscale of the RRS. Also, the RTS total score was positively correlated with the symptoms of depression, social phobia, and GAD but had no significant correlations with OCD and panic. Depression, GAD, and social phobia are disorders with a clearer ruminative/worry component—that is, they are more of stewing or brooding types of problems compared to the intrusive nature of thoughts seen in OCD or hypervigilance to and preoccupation with body sensations seen in panic symptomatology. Research inspired by the transdiagnostic approach to repetitive thinking is still not abundant; however, there is some evidence that in OCD and panic symptoms the repetitive thinking style might play a different role compared to other emotional disorders. For example, McEvoy, Watson, Watkins, and Nathan (2013) found that individuals diagnosed with pure panic disorder had the lowest level of rumination (brooding type) compared to those with depression, GAD, and social anxiety disorders. Additionally, Ehring and Watkins (2008) noted, while referring to the differences between obsessions, ruminations, and worry, that individuals with OCD might have elevated levels of worry and rumination but that these repetitive processes need to be discriminated from obsessive thinking. Future research should look at other forms of pathology in which rumination has been implicated, such as self-harm behaviors and bulimia/binge eating.

Our statement that the RTS measures a single common latent variable needs further clarification. According to the results, 14 out of the 19 RTS items had substantial and parsimonious loadings on the four group factors. In line with the previous research (Tanner et al., 2013), these group factors were tentatively termed *Repetitive Thoughts*, *Problem-Focused Thoughts*, *Counterfactual Thinking*, and *Anticipatory Thoughts*. However, in contrast to Tanner et al.'s (2913) conclusion that the RTS assesses various dimensions of ruminative thinking, our data seem to point to a different interpretation. We would argue that ruminative thinking measured via the RTS represents a broad unitary construct with multidimensionality caused by clustered items tapping different trait manifestations, which is, however, not sufficient to warrant creation of the subscales. Based on the size of the factor loadings, we argue that the subscale scores contain more variance attributable to the general factor than to the group factors. Additionally, the omega coefficients for the four subscales were all above .85, implying that the precision with which these subscales assess simultaneously the general and specific constructs is satisfactory. However, their residualized counterparts were in the range from .23 to .28, suggesting that only a modest amount of reliable variance was left within the subscales once the general factor was controlled statistically.

The results of the residualized regression seem to point, overall, to the same conclusion. The general rumination factor was a significant prospective predictor (measured 6 months apart from the symptoms) of depression, social phobia and GAD, supporting the transdiagnostic nature of the RTS. In other words, the general RTS factor predicts future symptoms irrespective of their disorder-specific content and time orientation. Hence, the general factor seems to underlie various forms of repetitive thinking such as depressive rumination, worry, and postevent processing (Borkovec et al., 1983; Clark & Wells, 1995; Nolen-Hoeksema, 2004). Future research should be devoted to understanding the nature of this common process. It should also be noted that there was an incremental contribution of the Repetitive Thoughts subscale, over and above the general factor, in prediction of the depressive symptoms. However, given the modest precision with which this subscale measures its group factor, interpretation of this finding should be considered tentative awaiting future replication. Also, it would be important to repeat similar analyses on clinical samples of depressed individuals. Students who took part in our prospective study were not depressed. Hence, the possibility that the Repetitive Thoughts scale could have added more substantially to the prediction of depressive symptoms in a clinical sample, over and above the general factor, remains to be tested. Finally, Reise et al. (2018) pointed out that the only way to have highly reliable residualized subscales is to have many items within a domain that are highly correlated and, at the same time, demonstrate low correlations with the items from different content domains. In the case of the RTS, given the small number of items comprising the subscales, relatively modest values of the residualized reliabilities are not surprising.

Finally, our study suggested that the items measuring the anticipatory forms of repetitive thinking are more related to brooding than reflection, suggesting their closer link to psychopathology. This finding is in contrast to Tanner et al. (2013), who found this subscale related positively to well-being and protective coping. Such conflicting results are probably due to inconsistencies not only in the number of items used in these two studies but also in different interpretations of their content. Namely, some items (e.g., "When I am looking forward to an exciting event, thoughts of it interfere with what I am working on") tap clearly intrusiveness and repetitiveness while considering future events, whereas others (e.g., "If I have an important event coming up, I can't stop thinking about it") may reflect adaptive preparatory behaviors. Considering together the results of this study, one might wonder if some items, depending on a context, might be interpreted in both functional and dysfunctional ways. Hence, our suggestion is to make the intrusiveness and uncontrollability of the content of the anticipatory domain more obvious.

The issue of gender differences was not addressed in the previous studies that examined repetitive and perseverative thinking styles. A small gender difference was obtained in this study suggesting that women have a stronger tendency to engage in ruminative thinking than men. This finding is in accordance with a substantial body of literature demonstrating a greater propensity of females to engage in various forms of repetitive thinking such as depressive rumination (Butler & Nolen-Hoeksema, 1994) and worry (Stavosky & Borkovec, 1988).

Our study had a number of strengths. For example, the research was conducted on a large, heterogeneous sample, which increases the ecological validity of the findings. It assessed the longitudinal relationship between repetitive thinking and anxiety and depression. Notwithstanding its strengths, there were also specific limitations such as reliance on self-report. The study was also based on adult, nonclinical, Caucasian samples. The extent to which these results might show a downward extrapolation to child/adolescent vulnerability or generalize to clinical samples or other ethnic groups remains unclear. Moreover, given that the adult sample comprised unemployed individuals whereas the Facebook sample was obtained using the snowball strategy, these sampling approaches might have introduced sampling biases. Future studies might benefit from daily diary recording of ruminations, using multiple waves of longitudinal data collection to look more closely at the causal nature of ruminative processes (e.g., Hankin, 2008, 2012). For example, it would be interesting to explore how these processes unfold over time and relate to different trajectories toward psychopathology. It has been suggested that general ruminative thinking in interaction with different environmental contexts and current preoccupations leads to various psychopathological symptoms (Nolen-Hoeksema & Watkins, 2011; Topper, Molenaar, Emmelkamp, & Ehring 2014). Diary studies, employing intensive sampling of thinking, current concerns, and events over an extended period of time, would help one discern whether general repetitive thinking is sufficient to explain development of various psychopathological outcomes and/or whether addition of more specific components (e.g., Anticipatory Thinking) is necessary to improve prediction. Finally, to further support the validity of the RTS, it is advisable to compare it to other well-established measures of repetitive thinking such as worry and obsessive thinking. One can explore if greater distinctions between the RTS subscales can be obtained when comparing them to different measures of repetitive thinking. For example, given various temporal orientations embedded in the items, one can expect a stronger relationship between worry and Anticipatory Thoughts than between the RRS-Brooding and Anticipatory Thoughts.

Conclusion

Our study supports the view of the RTS as a reliable transdiagnostic measure of repetitive thinking. It is advisable to use the total RTS scores, with the exclusion of Item 16, given the high loadings of all items on the general factor.

Homogeneous item clusters, assessing various content domains of repetitive thinking, can also be observed. However, given their low residualized reliabilities and the lack of predictive power, over and above the general factor, we do not recommend creation of the subscales in non-clinical samples.

Acknowledgments

The authors would like to thank Jelena Sokić, Milka Jerković, and Marina Vicanović for their help in data collection.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was supported by the Serbian Ministry of Education and Science (#179006) and by the Provincial Ministry for Science and Technological Development (114-451-1647/2011-01).

Notes

1. In a pilot Facebook study using exploratory bifactor modeling ($N = 278$), Item 16 ("I like to sit and reminisce about pleasant events from the past") was the only one that had low factor loadings on both general and group factors (.34 and .26, respectively). This item is the only one with clear positive content tapping probably nonpathological forms of repetitive thinking such as deriving pleasure through savoring pleasant experiences from the past (Bryant, 2003). Hence, we decided not to include Item 16 in further confirmatory analyses.
2. In Tanner et al.'s (2013) study, Item 5 was considered a measure of Counterfactual Thinking. In our study, a model allowing Item 5 to load on this factor could not converge, suggesting a problem in model specification. Based on this finding and the item's face validity, it was allowed to load on Anticipatory Thought.
3. A reviewer noted that combining three samples and performing the analysis on a combined sample might have influenced results. To examine this possibility, we performed separate exploratory bifactor analyses on the three samples. Across the samples, we obtained comparable estimates of the omega hierarchical coefficients (.78, .78, and .76 in the student, unemployed adult, and Facebook samples, respectively). Also, item loadings and cross-loadings were highly similar across the samples. The results are available from the first author on request.

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