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Participants

Method

Inclusion Criteria

The following inclusion criteria were met by 145 participants: (a) a primary diagnosis of obsessive-compulsive disorder (OCD) based on the *Diagnostic and Statistical Manual of Mental Disorders* (text revision, *DSM-IV-TR*; American Psychiatric Association, 2000; German version: Saß et al., 2003), (b) age > 17 years, and (c) the presence of an obsessive thought (OT) that would likely cause distress when spoken aloud. Exclusion criteria were acute suicidality or self-harm, a current *DSM-IV-TR* substance use disorder, or current *DSM-IV-TR* schizophrenia or other psychotic disorder. OCD and comorbid diagnoses were assessed with the Structured Clinical Interview for Mental Disorders (SCID; German version: Wittchen et al., 1997). The identification of an OT and the severity of the OCD were assessed with the Yale–Brown Obsessive-Compulsive Scale (Y-BOCS; German version: Hand & Büttner-Westphal, 1991). The SCID and Y-BOCS were administered by trained doctoral students under supervision of the first author. Demographic data, suicidality, and self-harm were also assessed before enrollment in the study.

Statistical Analyses

Potential differences between the experimental groups on sex, marital status, years of education, and comorbid disorders were analyzed with chi-square tests or Fisher's exact test if the assumption of expected frequencies was violated. One-way analysis of variance (ANOVA) was used to compare the three experimental groups on participant characteristics. Levene's test was used to test for homogeneity of variances. When homogeneity could be

assumed, Tukey's test was applied as a post hoc comparison; otherwise, Games–Howell post hoc tests were used.

Results

Six participants had to be excluded: Two did not experience any distress during thought activation; two others' activated thoughts were not OTs but were consistent with worrisome thoughts; technical problems occurred with one participant; and for one other, more than 63% of the data was missing. The final numbers were $n = 48$ for RumOCD, $n = 46$ for RumMood, and $n = 45$ for distraction. Groups did not differ in sex, age, martial status, years of education, number of concurrent comorbid disorders, OC or depressive symptoms, or positive or negative state affect (Supplemental Table 1). More participants in the RumOCD group took psychopharmacological medication (including antidepressants, anxiolytics, benzodiazepines, and others) compared to the other groups. Participants in the RumMood group had higher symptom-focused trait rumination than those in the other groups, with a medium-sized effect. Taking the sections of the Y-BOCS symptom checklist as categories, the largest group of activated obsessions were contamination related (38.8%), followed by miscellaneous obsessions (28.0%, e.g., fear of making a mistake), aggressive obsessions (24.5%), sexual obsessions (3.6%), religious obsessions (2.2%), obsessions with need for symmetry/exactness (2.2%), and somatic obsessions (0.7%). Reliabilities (Cronbach's alpha) of all questionnaires were high (Supplemental Table 1).

Manipulation Checks

Method

Measures

Four questions were used to check whether different aspects of the experimental manipulation worked (manipulation checks). On an 11-point Likert-type scale from 0 (*not at*

all) to 100 (*very much so*), participants had to indicate (a) their ability to follow the instructions of the statements presented during the experimental manipulation, (b) the degree of rumination caused by the statements, (c) the degree of their focus on obsessive-compulsive (OC) symptoms when the statements were presented, and (d) the degree of their focus on mood when the statements were presented.

Statistical Analyses

One-way ANOVA was used to compare the three experimental groups on two manipulation checks (degree of focus on instructions and degree to which the statements caused rumination). Levene's test was used to test for homogeneity of variances. When homogeneity could be assumed, Tukey's test was applied as a post hoc comparison; otherwise, Games–Howell post hoc tests were used. The remaining two manipulation checks regarding the content of the rumination (OC symptoms vs. mood) were analyzed using a 3 × 2 mixed-model ANOVA with group (RumOCD, RumMood, distraction) as a between-subjects factor and focus of rumination (OC symptoms vs. mood) as a within-subject factor.

Results

Supplemental Table 1 shows the results of the manipulation checks. All participants were able to follow the instructions of the statements presented during the experimental manipulation on average to a high degree, and we did not find differences between experimental groups. The statements instigated a far higher degree of rumination in both rumination groups compared to distraction. The interaction between focus of rumination and experimental group was significant with a medium effect size, indicating that the RumOCD group ruminated more on OC symptoms than the RumMood group, and the RumMood group ruminated more on depressive mood than the RumOCD group. Participants in the distraction group showed lower levels of rumination about OC symptoms and depressive mood than the

rumination groups.[1] This means we managed to instigate rumination in both rumination groups to a similar degree and also to vary the focus of the rumination as expected.

A Priori Power Calculation for the Main Analysis: Immediate Effects of Rumination

To determine a realistic effect size for the a priori power calculations, we reanalyzed the data reported by Wahl et al. (2019), using the planned contrasts described below. Taking the lower effect size ($\eta_p^2 = .06$) for the comparison between the two rumination groups combined and the distraction group, a power analysis revealed that with a power of .80, an alpha error probability of .05, a one-tailed test, and an allocation ratio n_1/n_2 of 2, sample sizes of 76 (Group 1) and 38 (Group 2) are required. Thus, our study was sufficiently powered to replicate the previous immediate effects of rumination on the main outcome.

Further Details of the Statistical Analyses for the Immediate Effects of Rumination

Box plots were used to visually inspect all continuous data for outliers. OT frequency resulted in five outliers at baseline and return to baseline, respectively. Analyses were repeated without the outliers with no differences from the results that included the outliers, so no participants were excluded.

To test the effects of the experimental manipulation we investigated the changes from T2 to T3. Analyses were repeated including all time points (T1 to T4), in line with Wahl et al. (2019), and except for slight changes in the effect sizes, results remained the same.

The Intermediate Effects of Rumination

Given the persistence of the rumination effect in the Santa Maria et al. (2012) study, we expected that those who ruminated would show less of a decrease in OC severity (Hypothesis 5a) and negative affect (Hypothesis 5b) and less of an increase in positive affect (Hypothesis 5c) over the follow-up period compared to those who were distracted. We also

[1] We repeated the mixed-model ANOVA including only the rumination groups in a 2 × 2 design to see if results would hold up when distraction was excluded. This also resulted in a significant interaction between experimental group and focus of rumination, confirming that the rumination groups differed in the intended content.

predicted that those who ruminated on OC symptoms would show less of a decrease in OC severity (Hypothesis 6a) and negative affect (Hypothesis 6b) and less of an increase in positive affect (Hypothesis 6c) over the follow-up period compared to those who ruminated on mood.

Method

Procedure

An ecological momentary assessment (EMA) was used for the follow-up assessments of OC severity and affect, for which each participant was provided a smartphone. They were told that they would receive three prompts to answer questions on an app, approximately 2 hr (T5), 4.5 hr (T6), and 24 hr (T7) after the end of the laboratory experiment (Supplemental Figure 1). Participants returned the smartphones after completing the EMA.

Measures

OC severity and affect during the follow-up period were assessed with a modified version of the Y-BOCS and the PANAS at three time points (T5–T7) using self-developed software. For the modified Y-BOCS, the phrasing of the items assessing severity of OTs (five items) and compulsions (five items) was changed such that (a) only the severity of the activated OT and the associated compulsion were assessed and (b) the referenced time period was the last 30 min. Participants rated each item on a scale of 0 (*minimal severity*) to 4 (*extreme severity*). The sum across all 10 items was used as the OC severity score, separately for each time point. The introduction of the PANAS was also changed in a way that the referenced time period was the last 30 min.

Statistical Analyses

For the follow-up analyses, we had an average of 16.8% missing values at T5, 23.8% missing values at T6, and 17.5% missing values at T7. Since multilevel analysis can account for missing values better than repeated-measure variance analysis (Newman, 2014), multilevel analyses were used to examine the effect of the experimental group (main

predictor) on OC severity (modified Y-BOCS; outcome) and state affect (modified PANAS; outcome) during the follow-up period. In line with the analyses described above, we specified two contrasts: Contrast 1 compared the linear trend from T5 to T7 between the combined RumOCD/RumMood and distraction conditions. Contrast 2 compared the linear trend from T5 to T7 between RumOCD and RumMood. We were particularly interested in the interaction between the linear time component and the respective contrast, denoting differential linear temporal change, depending on the respective contrast level. Analyses were repeated controlling for baseline symptom-focused rumination (RSQ: symptom) or medication, including their respective interactions with time. Results did not change and for brevity, we report only the simpler models without the covariates.

Visual inspection of the data did not indicate violations of our final models' assumptions, that is, linear associations between time and the respective outcome variables, homogeneity, and normal distribution of the residual's variances. The model contained a random intercept and a random slope coefficient for the continuous time variable. Parameters were estimated with the maximum likelihood estimation method. Unstandardized and standardized estimates are reported. To obtain standardized estimates, each variable was standardized ($M = 0$; $SD = 1$) before the analysis (Ferron et al., 2008; Lorah, 2018). Following Selya et al. (2012), we calculated Cohen's f^2 (Cohen, 1988) as an indicator of local effect size for the estimates. Prior to calculating the f^2, we defined only a random intercept for each model to assure that the reduction of variance was accounted for only by the fixed effects and not by the random effects. Cohen's f^2 can be interpreted as 0.02 for a small effect, 0.15 for a medium effect, and 0.35 for a large effect (Cohen, 1988). Adopting the generalizability approach (Cranford et al., 2006) we report between- and within-person reliability coefficients (R_{KF} and R_C, respectively) for the EMA outcome variables. R_{KF} is the reliability of a measure across all days, while R_C is the reliability of change in ratings over time across individuals.

Coefficients of .61–.80 are interpreted as moderate and .81–1.00 as substantial (Shrout, 1998). Level of significance was set at $p < .05$.

Results

Neither for OC severity (Hypothesis 5a), nor negative affect (Hypothesis 5b), nor positive affect (Hypothesis 5c) did we find differences in the combined linear change of RumOCD and RumMood from T5 to T7 compared to distraction (Supplemental Table 2, Supplemental Figure 2A). The linear trend of RumOCD differed from the linear trend of RumMood for OC severity (Hypothesis 6a) and positive affect (Hypothesis 6c), both with a small effect size. For negative affect (Hypothesis 6b), we did not find a significant difference between the linear trends of RumOCD and RumMood (for all results: Supplemental Table 2, Supplemental Figure 2B). On average, the increase in OC severity from T5 to T7 was 2.48 units higher for RumOCD compared to RumMood, and the decrease in positive affect was 2.5 units lower for RumOCD compared to RumMood. All reliability coefficients of the EMA measures were substantial (Supplemental Table 2).

Discussion

We found evidence of an interesting differential effect of focus of rumination. While rumination per se (both types) and distraction did not differ in their intermediate effect on OC symptoms or affect, rumination about OC symptoms maintained OC severity and reduced the increase in positive affect compared to rumination about mood, for 24 hr. However, negative affect was not affected by rumination about OC symptoms. One limitation of the intermediate analyses is that the EMA measures—although modifications of established measures—were not validated. Overall the intermediate results are consistent with the idea that cognitive underlying mechanisms might become particularly relevant in the intermediate term.

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Supplemental Table 1

Demographics, *Comorbidity*, *Obsessive-Compulsive and Depressive Symptoms*, *Rumination*, *State Affect*, *Manipulation Checks*, *Cronbach's Alpha*, *and Test Statistics for Differences Between Experimental Groups*

Variable	Experimental group			Statistics				
	RumOCD (n = 48)	RumMood (n = 46)	Distraction (n = 45)	α	$\chi^2(2)$	p	η_p^2	$F(2,136)$
Female, N (%)	28 (58.33)	30 (65.22)	32 (71.11)		1.67	.43		
Marital status					1.03	.61		
With partner (married or with partner)	21 (43.75)	24 (52.17)	24 (53.33)					
Without partner (single, divorced, widowed)	27 (56.25)	22 (47.83)	21 (46.67)					
Years of education [a]					7.50	.06		
9–10	29 (61.70)	19 (43.18)	18 (40.00)					
12–13	18 (38.30)	23 (52.27)	27 (60.00)					
< 9	—	2 (4.55)	—					
Psychopharmacological medication, N (%)	41_c (85.42)	30_d (65.22)	28_d (62.22)		7.31	.03		
Age, M (SD)	34.44 (11.69)	32.57 (10.99)	35.16 (14.47)			.59	.01	0.53
No. concurrent comorbid disorders M (SD)	1.52 (1.74)	1.41 (1.38)	1.49 (1.39)			.94	.001	0.06
OC symptoms (Y-BOCS: total scale)	22.33 (6.72)	21.30 (6.11)	19.93 (6.92)	.84		.22	.02	1.55
Obsessions (Y-BOCS: obsessions scale)	11.29 (3.66)	13.15 (15.54)	10.56 (3.52)	.72		.40	.01	0.93
Compulsions (Y-BOCS: compulsions scale)	11.02 (3.74)	10.28 (3.72)	9.38 (4.10)	.81		.13	.03	2.12
OC symptoms (OCI-R total)	27.88 (13.32)	28.65 (11.27)	25.00 (12.36)	.82		.34	.02	1.10
Depressive symptoms (BDI-II)	21.29 (11.60)	25.76 (11.19)	21.47 (10.70)	.92		.10	.03	2.37
Symptom-focused rumination (RSQ: symptoms)	18.79_c (5.25)	21.59_d (5.04)	18.80_c (4.96)	.83		.01	.06	4.63
Self-focused rumination (RSQ: self)	17.13 (4.19)	17.50 (3.90)	17.20 (4.72)	.74		.91	.001	0.10
Positive state affect (PANAS: PA)	26.40 (5.73)	24.85 (6.40)	25.91 (7.19)	.84		.50	.01	0.70
Negative state affect (PANAS: NA)	19.25 (6.09)	20.70 (6.71)	19.89 (7.28)	.84		.58	.01	0.55
Manipulation checks, M (SD)								
Ability to follow instructions of statements	73.75 (20.64)	72.37 (24.64)	80.87 (16.12)			.12	.03	2.19
Degree of rumination caused by statements	73.10_c (18.93)	72.15_c (24.45)	49.40_d (31.68)			< .001	.16	12.73
Focus of rumination [b]						.003 [b]	.08 [b]	5.94 [b]
OC symptoms	68.06 (27.72)	57.50 (30.13)	37.27 (28.77)					

Variable	Experimental group			Statistics				
	RumOCD (n = 48)	RumMood (n = 46)	Distraction (n = 45)	α	$\chi^2(2)$	p	η_p^2	$F(2,136)$
Depressive mood	47.50 (35.30)	53.59 (31.66)	35.67 (29.31)					

Note. Different subscripts (c, d) indicate differences between groups with $p < .05$. BDI-II = Beck Depression Inventory, Revised; NA = negative affect; OC = obsessive-compulsive; OCI-R = Obsessive-Compulsive Inventory, Revised; PA = positive affect; PANAS = Positive and Negative Affect Schedule; RSQ = Response Styles Questionnaire; RumMood = rumination about mood; RumOCD = rumination about obsessive-compulsive symptoms; Y-BOCS = Yale–Brown Obsessive-Compulsive Scale.

[a] Three missing values.

[b] Interaction between focus of rumination and experimental group.

Supplemental Table 2

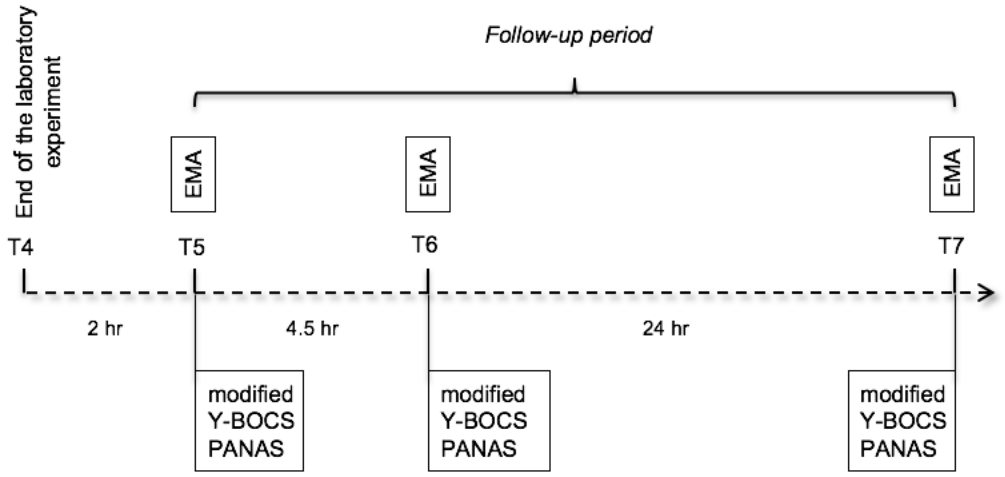
Unstandardized and Standardized Coefficients, *Standard Errors,* p*, and Cohen's* f^2 *Values for the Planned Contrasts 1 and 2 With Experimental Group as Predictor and OC Severity and Positive and Negative Affect as Outcomes*, *and Reliability Coefficients*

Measure	EMA outcome variable											
	OC severity (mod. Y-BOCS)				Positive affect (mod. PANAS PA)				Negative affect (mod. PANAS NA)			
	unCOEF (*SE*)	sCOEF (*SE*)	*p*	f^2	unCOEF (*SE*)	sCOEF (*SE*)	*p*	f^2	unCOEF (*SE*)	sCOEF (*SE*)	*p*	f^2
Fixed effect												
Contrast 1 * Time	0.46 (0.90)	0.05 (0.10)	.613	0	-0.12 (0.77)	-0.02 (0.10)	.874	0	-0.31 (0.74)	-0.04 (0.09)	.677	0
Contrast 2 * Time	2.48 (1.07)	0.27 (0.12)	.021	0.02	-2.50 (0.92)	-0.32 (0.12)	.007	0.04	1.52 (0.88)	0.19 (0.11)	.084	0.02
Reliability coefficient												
R_{KF}	0.98				0.98				0.98			
R_C	0.95				0.95				0.93			

Note. RumOCD = rumination about obsessive-compulsive symptoms; RumMood = rumination about mood; Contrast 1 = RumOCD and RumMood combined vs. distraction; Contrast 2 = RumOCD vs. RumMood; EMA = ecological momentary assessment; mod. = modified; OC = obsessive-compulsive; PANAS = Positive and Negative Affect Scale; PA and NA = positive and negative affect, respectively; R_C = within-person reliability coefficient; R_{KF} = between-person reliability coefficient; sCOEF = standardized model coefficient; unCOEF = unstandardized model coefficient. The reference group for the contrasts is always the second group (i.e., for Contrast 1: distraction; Contrast 2: RumMood). For example, for the interaction Contrast 2*Time (OC severity), the value 2.48 is the value of RumOCD compared to RumMood.

Supplemental Figure 1

Procedure of the Follow-Up Period

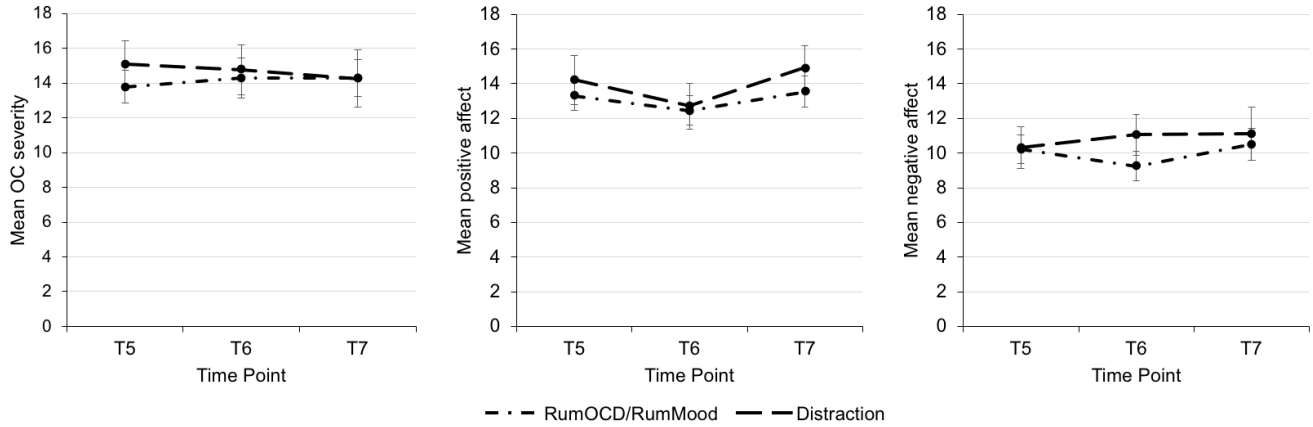


Note. EMA = ecological momentary assessment; PANAS = Positive and Negative Affect Schedule; Y-BOCS = Yale–Brown Obsessive-Compulsive Scale.

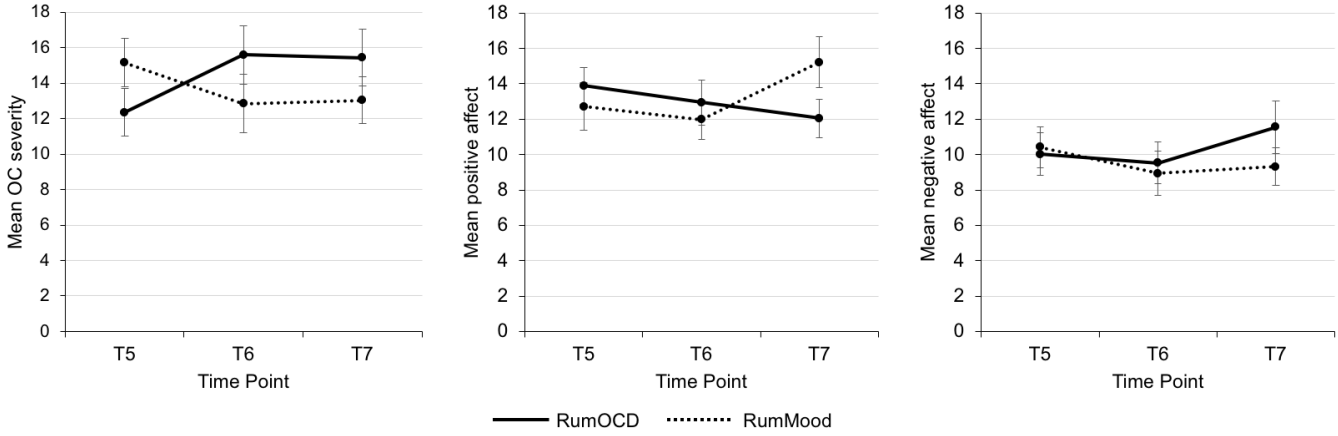
Supplemental Figure 2

Mean Ratings of OC Symptom Severity, *Positive and Negative Affect Across the Follow-Up Period*

A



B



Note. Bars represent standard errors. Panel A: Combined rumination conditions versus distraction. Panel B: Comparison of rumination conditions. OC = Obsessive-compulsive; RumMood = rumination about mood; RumOCD = rumination about obsessive-compulsive symptoms; T5, T6, and T7 = 2 hr, 4.5 hr, and 24 hr after the end of the study, respectively.