



Rumination on unwanted intrusive thoughts affects the urge to neutralize in nonclinical individuals

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ABSTRACT

Rumination on symptoms of mental disorders is involved in the onset and maintenance of these symptoms across a range of mental disorders. The purpose of the study was to investigate whether rumination on unwanted intrusive thoughts (UITs) has an immediate causal effect on discomfort, urge to do something about the UITs (i.e., to neutralize) and frequency of the UITs, as well as on depressed mood. A UIT was activated by asking nonclinical participants to write down a sentence stating that they wished a loved one would die in a horrible car accident. During the experimental manipulation, they were instructed to ruminate on their UIT, to ruminate on negative mood, or to distract themselves by thinking about everyday objects and situations. Individuals who had previously ruminated on the UIT had an attenuated reduction of the urge to neutralize compared to individuals who had previously engaged in rumination on negative mood or those who were distracted. Results indicate that thinking repetitively about a UIT prevents decay of the urge to engage in behaviors to undo it but does not influence discomfort or depressed mood associated with it. This phenomenon may be involved in the maintenance of UITs, for example, in obsessive-compulsive disorder.

1. Introduction

Individuals diagnosed with obsessive-compulsive disorder (OCD) often get stuck in thought processes for prolonged periods of time. From the outside perspective it remains unclear whether they are caught in obsessions and mental forms of neutralizing or whether other thinking patterns keep them occupied for excessively long durations. One of the first indications that repetitive thought processes in OCD are not restricted to obsessions and mental forms of neutralizing came from a study by Freeston and Ladouceur (1997). They identified one of seven major strategies for responding to obsessive thoughts as “analyzing the thought” (p. 339), for example, examining and trying to understand it. This suggests that obsessive-compulsive (OC) symptoms might be followed by rumination on these symptoms and the causes and consequences of these symptoms. For example, if a person is bothered by the obsessive thought “I could inadvertently strangle someone in passing,” this thought might activate ruminations such as “Why can’t I do anything about my abhorrent thoughts? What if someone finds out about my thoughts? What if my thoughts persist?”

Traditionally, rumination has been examined in relation to depressive symptoms and in this context has been defined as “a mode of responding to distress that involves repetitively and passively focusing on

symptoms of distress and the possible causes and consequences of these symptoms” (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008, p. 400). It has been conceptualized as a relatively stable trait variable and is typically assessed with the Ruminative Response Scale (RRS) of the Response Styles Questionnaire (Nolen-Hoeksema & Morrow, 1991). More recent studies have differentiated between brooding (abstract, passive, and unproductive thinking) and reflecting (more adaptive) and have eliminated items of the RRS that potentially reflect depressive symptoms (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). The conceptualization of rumination is still developing. For example, some authors have emphasized the importance of assessing the processes of rumination independent of their content (Ehring et al., 2011; McEvoy, Mahoney, & Moulds, 2010) and conceptualized rumination as one possible form of repetitive negative thinking, along with others such as worry or post-event processing. Authors have stressed that in particular the abstract, evaluative mode of thinking is detrimental compared to more concrete, experiential forms of repetitive thinking (Rimes & Watkins, 2005; Watkins & Moulds, 2005; Watkins, 2008). Rumination can be induced reliably in the laboratory (e.g., Kao, Dritschel, & Astell, 2006; Lyubomirsky & Nolen-Hoeksema, 1995; Philippot & Brutoux, 2008) or as a brief strategy delivered via smartphones (Huffziger, Ebner-Priemer, Koudela, Reinhard, & Kuehner, 2012) with observable

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effects on mood, self-relevant cognitions, problem solving, and other variables.

Numerous studies have demonstrated that rumination is related not only to depressive symptoms (e.g., Kuehner & Weber, 1999; Nolen-Hoeksema, 2000; Rohan, Sigmon, & Dorhofer, 2003; Vanderhasselt, Brose, Koster, & De Raedt, 2016) but also to a variety of other symptoms across mental disorders, including anxiety (e.g., Drost, van der Does, van Hemert, Penninx, & Spinhoven, 2014; Joormann, Dkane, & Gotlib, 2006; Seligowski, Lee, Bardeen, & Orcutt, 2015) and eating disorders (e.g., Holm-Denoma & Hankin, 2010; Naumann, Tuschen-Caffier, Voderholzer, Caffier, & Svaldi, 2015; Nolen-Hoeksema, Stice, Wade, & Bohon, 2007). Prospective and experimental studies have also suggested that rumination is not only related to various symptoms across mental disorders but also involved in the *onset* and *maintenance* of these disorders (e.g., Kuehner & Weber, 1999; McLaughlin, Borkovec, & Sibrava, 2007; Nolen-Hoeksema, 2000; Vanderhasselt et al., 2016). The relevance of rumination for a great variety of mental disorders has led to the assumption that rumination is a transdiagnostic process (Ehring & Watkins, 2008).

There is little research into rumination and its impact on OC symptoms. This is surprising given that rumination has long-lasting detrimental effects across various disorders and variables. Preliminary evidence that trait rumination and obsessive symptom severity are associated comes from studies with nonclinical individuals. Rumination and OC symptoms were moderately related in two independent student samples, even when depression was controlled for (Wahl, Ertle, Bohne, Zurowski, & Kordon, 2011). Grisham and Williams (2009) differentiated between brooding and reflecting and found the first but not the latter to be moderately associated with obsessive symptoms when depression and anxiety were controlled for in undergraduates.

Research with clinical samples has also been limited to cross-sectional studies. Examining the relationship between rumination and OC symptom dimensions in a sample of unselected treatment-seeking participants, Raines and colleagues found that rumination was related to obsessional thoughts/neutralizing but not to other OC dimensions, such as washing or checking (Raines, Vidaurri, Portero, & Schmidt, 2017). Two studies that compared levels of trait rumination in individuals diagnosed with OCD and individuals diagnosed with major depressive disorder did not find any significant differences between these groups (Kim, Yu, Lee, & Kim, 2012; Weber et al., 2014). On the other hand, Meiran and colleagues found trait rumination to be lower in OCD patients than in depressed patients (Meiran, Diamond, Toder, & Nemets, 2011). However, low sample sizes compromised the interpretation of the results from the Meiran et al. (2011) and Kim et al. (2012) studies (11 OCD patients in the Kim et al. study and eight OCD patients in the Meiran et al. study). Watkins (2009) found that brooding was associated with comorbid OCD in a group of unipolar depressed patients. A previous study compared ruminative and obsessive thoughts in individuals with OCD and found that ruminative thoughts were surprisingly common and distressing in OCD, even though individuals were currently *not depressed* (Wahl et al., 2011). Interestingly, this study also showed that rumination can take two forms in OCD: (1) rumination on negative mood and related symptoms such as lack of energy or concentration and (2) rumination on obsessions and compulsions and their causes and consequences.

Taken together these studies indicate that the tendency to ruminate on symptoms is elevated in OCD and that rumination is related to OC symptoms, in particular to obsessive thoughts and mental forms of neutralizing. In the current study we tested if rumination had causal effects on unwanted intrusive thoughts (UITs). To distinguish the two variants of rumination in OCD (Wahl et al., 2011), we modified the original rumination induction by Nolen-Hoeksema and colleagues (Nolen-Hoeksema & Morrow, 1991) and developed an additional version that asked participants to ruminate on UITs (e.g., “Think about the possible consequences of your unwanted intrusive thoughts”). As a control condition, distraction was induced to control for either form of

rumination possibly acting as a distraction. We hypothesized that rumination on UITs would cause an increase in the discomfort associated with these thoughts, the urge to neutralize, and the frequency of UITs in comparison to rumination on negative mood and distraction. Depressed mood was included as an additional outcome variable to investigate whether potential effects of rumination would be specific to UITs or would also affect depressed mood. Most previous studies showed that rumination did not affect depressed mood unless participants were dysphoric prior to the rumination instruction (e.g., Lyubomirsky & Nolen-Hoeksema, 1995; McLaughlin et al., 2007; Nolen-Hoeksema, Morrow, & Fredrickson, 1993). However, a recent study (Jahanitabesh, Cardwell, & Halberstadt, 2017) has suggested that rumination results in increased negative mood irrespective of the mood state prior to the rumination induction. Thus depressed mood was included as an additional exploratory variable without any specific hypothesis.

2. Methods

2.1. Overview

A UIT was activated by asking participants to write down a sentence stating that they wished a loved one would die in a horrible car accident that evening (Rachman, Shafran, Mitchell, Trant, & Teachman, 1996). Participants were subsequently asked to monitor the frequency of the target UIT, associated discomfort, urge to neutralize, and mood before and after an experimental manipulation. During the experimental manipulation, they were instructed either to ruminate on their UIT (rumination on UIT condition), to ruminate on negative mood (rumination on negative mood condition), or to think about and imagine everyday objects and situations (distraction condition). Frequency of UITs was measured at baseline (before the experimental manipulation) and at return to baseline (after the experimental manipulation). It was assessed with a smartphone counter app. Accompanying discomfort, urge to neutralize, and depressed mood were assessed with visual analogue scale (VAS) appraisal ratings. Discomfort, urge to neutralize, and, as an additional variable, depressed mood were assessed at four time points during the study: T1 was immediately after the activation of the UIT, T2 was after the first thought-monitoring phase (baseline), T3 was immediately after the experimental phase, and T4 was after the second thought-monitoring phase (return to baseline). Additionally, positive and negative mood were assessed with the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) at baseline and immediately after the experimental phase.

2.2. Participants

Participants ($N = 82$) were recruited from undergraduate psychology courses and via a university platform that advertised psychological studies ($M_{\text{age}} = 26.51$ years, $SD = 8.89$; 67 female, 15 male). They received either course credit for participation or a shopping voucher as compensation for their time. Clinical measures of OC symptoms (Obsessive-Compulsive Inventory, Revised, OCI-R; $M = 14.46$, $SD = 9.60$) and depressive symptoms (Beck Depression Inventory, Revised, BDI-II; $M = 6.19$, $SD = 4.64$) were low and within the range of previously reported nonclinical samples (e.g., Grisham & Williams, 2009; Olafsson et al., 2014). Brooding (RRS Brooding; $M = 9.95$, $SD = 3.35$) was slightly higher than in previous student samples (e.g., Moulds, Kandris, Starr, & Wong, 2007). Participants were randomly allocated to one of the three experimental conditions (rumination on UIT, $n = 28$; on negative mood, $n = 27$; on distraction, $n = 27$). We used a one-way analysis of variance (ANOVA) to examine whether there were any differences between groups regarding age, OC and depressive symptoms, brooding and state negative and positive affect (PANAS) and a χ^2 test to examine potential differences between groups on gender and education. None of the differences were significant, all $ps > .05$. Table 1 provides means and standard deviations

Table 1
Sociodemographic variables, clinical characteristics, mood and manipulation check variables.

Variable	Experimental group					
	Rumination on UIT <i>n</i> = 28		Rumination on negative mood <i>n</i> = 27		Distraction <i>n</i> = 27	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age (years)	28.32	10.60	25.11	7.36	26.04	8.36
% female	85.7		85.2		74.1	
% 12 years education	92.6		88.5		85.2	
OCI-R total	13.93	9.66	15.33	10.71	14.15	8.65
BDI-II	5.68	4.26	6.11	4.63	6.81	5.12
RRS-brooding	10.43	3.91	10.41	3.28	9.00	2.63
PANAS: positive at T1	3.43	.47	3.54	.47	3.71	.62
PANAS: negative at T1	2.12	.63	2.05	.68	2.19	.66
Manipulation check						
Managed to concentrate	81.61	14.93	84.44	15.26	87.26	11.58
Thinking about oneself	68.18 _a	31.60	86.30 _b	22.70	38.63 _c	34.42
Thinking about UIT	59.21 _a	34.91	37.19 _b	32.51	16.22 _c	21.84

Note. BDI-II = Beck Depression Inventory, Revised; OCI-R = Obsessive-Compulsive Inventory, Revised; PANAS = Positive and Negative Affect Scale; RRS-brooding = Ruminative Response Scale, Brooding; T1 = before baseline; UIT = unwanted intrusive thought. Different subscripts indicate significant differences between groups, $p < .05$.

of the sociodemographic variables, clinical characteristics, and state affect.¹

2.3. Measures

The OCI-R (Foa et al., 2002; German version by Goenner, Leonhart, & Ecker, 2008) is an 18-item self-rating questionnaire about OC symptom severity in six domains: cleaning and washing, checking, obsessions, neutralizing, hoarding and symmetry, and order, with good validity and reliability in the German version (Goenner et al., 2008). The OCI-R was used to assess the severity of OC symptoms. In the current sample, Cronbach's $\alpha = .87$ for OCI-R total.

The BDI-II (Beck, Steer, & Brown, 1996; German version by Hautzinger, Bailer, Worall, & Keller, 1994) was used to assess depressive symptom severity. The reliability and validity of this 21-item self-report measure has been well documented (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961; Hautzinger et al., 1994). In the present study, Cronbach's $\alpha = .76$.

A 22-item German version of the RRS of the Response Style Questionnaire (Nolen-Hoeksema & Morrow, 1991; German version by Kuehner & Weber, 1999) was used to assess habitual rumination. The RRS assesses responses to negative mood that focus on the self or on possible causes and consequences of mood. Each item is rated on a scale of 1 (*almost never*) to 4 (*almost always*). The RRS has good internal consistency (Cronbach's $\alpha = .80$; Nolen-Hoeksema & Morrow, 1991). It has, however, been criticized for item contamination. Therefore, Treynor et al. (2003) deleted items that were similar to depressive symptoms and factor analyzed the remaining items, resulting in three

¹ Although a Kolmogorov-Smirnov test indicated that for the variable age the distribution was not normal, data were analyzed without any corrections since ANOVA is robust against violation of normality if sample sizes are equal and $df \geq 20$ (Donaldson, 1968). Levene tests showed that the assumption of homogeneous variances was not violated for any variable (all $ps > .05$).

factors: brooding, reflecting, and depression. Brooding includes abstract, passive, and unproductive thinking about one's own shortcomings, whereas reflection corresponds to a more adaptive strategy of purposefully analyzing the reasons for depressive symptoms, thus engaging in some form of cognitive problem solving. Depression includes items that reflect depressive symptoms. Brooding was positively related to depressive symptoms concurrently and also in the long-term outcome when Treynor et al. reanalyzed the data; reflection, on the other hand, was negatively correlated with long-term depressive symptoms (Treynor et al., 2003). We therefore used only the brooding scale for this study. Reliability analyses of the brooding items demonstrated sufficiently high Cronbach's alpha in the current sample ($\alpha = .76$).

At baseline and following the experimental phase, state negative and positive affect were assessed with the PANAS (Watson et al., 1988; German version by Krohne, Egloff, Kohlmann, & Tausch, 1996). Participants had to rate how much they felt at that moment that they were described by 10 positive and 10 negative adjectives using a 5-point Likert scale of 1 (*very slightly or not at all*) to 5 (*extremely*). Reliability and validity of the PANAS are well established, and Cronbach's alpha was high in the current sample (at baseline: $\alpha = .83$ for PANAS positive; $\alpha = .86$ for PANAS negative; following experimental phase: $\alpha = .86$ for PANAS positive; $\alpha = .89$ for PANAS negative).

The appraisal ratings of Part 2 of the Revised Obsessive Intrusions Inventory (ROII; Purdon & Clark, 1994) were used to obtain information about the appraisals of the UIT. These were important to get an indication of the similarity between the UIT and clinically relevant intrusions. Participants were asked to refer to the target UIT and rate eight appraisal items of the ROII (unpleasantness; guilt; worry thought will come true; unacceptability; likelihood that thought will come true; importance of control; harm/danger; responsibility) on a 5-point Likert scale of 0 (*not at all*) to 4 (*extremely*). The item "desire to avoid UIT" of the ROII was excluded because it was not applicable to the UIT during the experimental situation.

Discomfort, urge to do something about the UIT (i.e., to neutralize), and depressed mood were each assessed using a VAS ranging from 0 (*not at all*) to 9 (*very much so*). For discomfort and depressed mood, participants were asked how uncomfortable and how depressed, respectively, they felt at that moment. The urge to neutralize was defined as "the extent to which you have the urge to engage in various behaviors to undo the thought, to neutralize it, or to engage in behaviors that would make you feel better, e.g., ripping up the paper, crossing out the sentence, arguing that it does not mean anything, saying a silent prayer." On each VAS participants were asked how much they experienced the urge to neutralize at that moment.

Frequency of UITs during the experiment was assessed with a smartphone counter app. Participants were instructed to press the "+" volume button whenever the target UIT occurred.

As a manipulation check to assess adherence to the instructions and the content of thinking during the experimental phase, three questions were asked at the end of the study: (1) "To what degree were you able to focus on the statements presented?" (2) "When the statements were presented, to what degree were you thinking repetitively about yourself?" (3) "When the statements were presented, to what degree were you thinking repetitively about your unwanted intrusive thought?" Answers to each were given on a VAS ranging from 0 (*not at all*) to 100 (*very much so*).

2.4. Procedure

The study was approved by the Institutional Review Board of the Faculty of Psychology. Fig. 1 depicts the procedure of the experimental session in detail. Participants were tested individually in a small room with a computer. Upon arrival participants filled in the informed consent form, answered sociodemographic questions, and completed the PANAS, BDI, OCI-R, and RRS using the online tool EFS survey (Questback Ltd., 2013). The experimenter told them what the study was

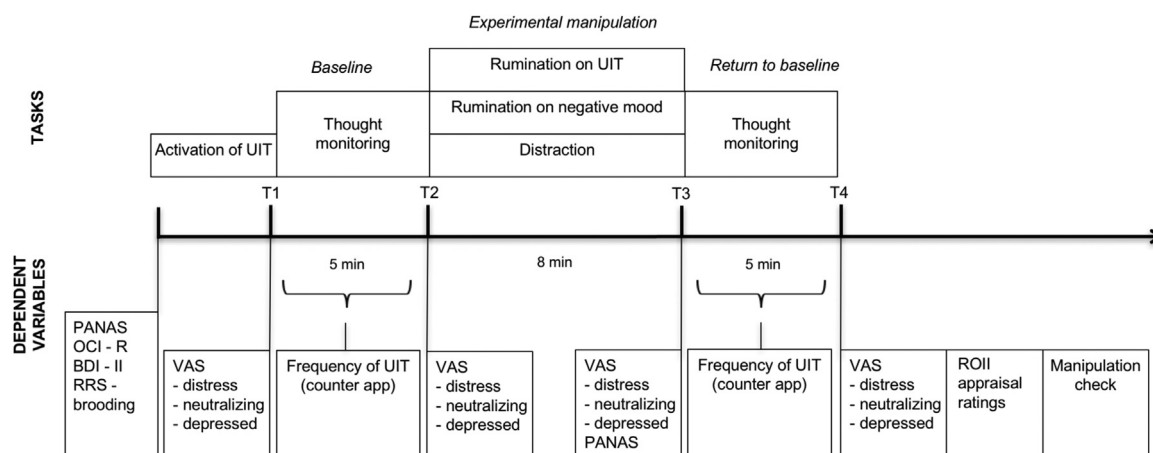


Fig. 1. Procedure of the experimental session. BDI-II = Beck Depression Inventory, Revised; counter app = smartphone counter app; OCI-R = Obsessive-Compulsive Inventory, Revised; PANAS = Positive and Negative Affect Scale; ROI = Revised Obsessive Intrusions Inventory; RRS-brooding = Ruminative Response Scale, Brooding; UIT = unwanted intrusive thought; VAS = visual analogue scale.

about:

UITs and their relation to other internal experiences” and subsequently provided a standardized written description of a UIT. “We are interested in your experiences with unwanted and unpleasant intrusive thoughts, which suddenly—and often unexpectedly—enter our consciousness. Almost everybody experiences these thoughts occasionally. They intrude against our will and interrupt other thoughts that we are having. Sometimes they come out of the blue, and sometimes they are totally at odds with our values and beliefs. They can take the form of thoughts, images, impulses, or doubts.

This introduction was followed by the activation of the UIT.

2.4.1. Activation of the UIT

Activation of the UIT was based on a paradigm that was used previously to study neutralizing in nonclinical individuals (Rachman et al., 1996; Van den Hout, Kindt, Weiland, & Peters, 2002; Van den Hout, van Pol, & Peters, 2001). Participants were provided with a pen and a sheet of paper and then given the following verbal instructions by the experimenter: “I want you to think of a loved person. Take a moment to get a clear picture of this person in your mind. Do you have a clear picture of a loved one in your mind?” When participants signaled that they were ready, the experimenter continued: “Now I want you to write down the following sentence: ‘I wish that person x would die in a horrible car accident this evening.’ Please replace ‘person x’ with your beloved person.” After writing down the sentence, participants were told that any thoughts, images, or impulses about the beloved person dying in the car accident were going to be referred to as the target UIT in the following study. If participants refused to write down the sentence, they were encouraged to do so for the sake of the study, but if they still refused, no further attempts to persuade them were made and the procedure continued as intended. Three people refused to write down the sentence. Immediately following the writing of the UIT, measures were taken on discomfort, urge to neutralize, and depressed mood on VASs (T1). Subsequently participants were asked to monitor the occurrence of the target UIT for 5 min (baseline). A baseline/return to baseline design was used to investigate whether the rumination differentially influenced the changes in the dependent variables during the course of the experiment.

2.4.2. Thought-monitoring instructions (baseline and return to baseline)

During the baseline and return-to-baseline phases participants were asked to think about whatever they wanted to think about and to monitor the occurrence of the target UIT. The instructions were provided on the computer screen using the online tool EFS survey as

follows:

During the next 5 min, you may think about anything you like. You might think of your target unwanted intrusive thought, but you do not have to. However, if at any time you think of your target unwanted intrusive thought, please record the occurrence of each thought by pressing the “+” key on the smartphone once for each occurrence. It is important that you continue in the same way for the full 5 min (adapted from Marcks & Woods, 2005)

During the thought-monitoring phase individuals were seated facing a blank computer screen. At the end of the thought-monitoring phase (baseline) a second rating on the VAS was completed (T2) and participants were then asked to follow one of three instructions for 8 min—rumination on UIT, rumination on negative mood, or distraction—depending on random allocation to one of these groups at the beginning of the session.

2.4.3. Experimental manipulation

The instructions for the rumination on UIT group were a modified version of the original rumination induction (e.g., Blagden & Craske, 1996). They were tailored to focus on repetitive thinking about UITs and their causes and consequences. Two experts on rumination were subsequently asked to rate consistency with the original instructions. Discrepancies were discussed in the research team and appropriate changes were made where necessary. The final set of 28 rumination cards reliably resulted in moderate rumination on UITs in 13 healthy individuals in pilot work. On a VAS of 0 (*not at all*) to 9 (*excessive rumination*), the average rating was $M = 4.36$ ($SD = 2.41$). Examples of the modified rumination task include “Think about: the possible consequences of your UIT”; “Think about: how passive or active you feel because of your UIT.” “Think about: the amount of certainty you feel in relation to your UIT.”

The instructions for the rumination on negative mood group were based on a widely used paradigm for depressive rumination (Ball & Brewin, 2012; Blagden & Craske, 1996; Huffziger, Reinhard, & Kuehner, 2009; Morrow & Nolen-Hoeksema, 1990). Participants were presented with 28 short statements to prompt rumination on the causes and consequences of negative mood (e.g., “Think about: the possible consequences of your current mental state.” “Think about: how passive or active you feel.” “Think about: the amount of certainty you feel right now.”). Finally, instructions for the third group, distraction, followed from the original distraction task developed by Nolen-Hoeksema and colleagues (Morrow & Nolen-Hoeksema, 1990). Participants were asked to concentrate and focus on 28 neutral images or scenes (e.g., “Think about: the fuzz on the shell of a coconut.” “Think about: a freshly painted

door.” “*Think about*: a band playing outside.”) The wording of the three different instructions was kept as similar as possible. The statements were presented on the computer screen as a PowerPoint presentation. Participants were asked to concentrate and focus on each statement for as long as they wanted during a total time of 8 min. They were told that they could navigate back and forth through the set of statements using the mouse.

Immediately after the experimental phase a third rating of the three VAS measures and the PANAS were completed (T3), followed by a second thought-monitoring phase for 5 min (return to baseline). Instructions were identical to those for the first thought-monitoring phase. At the end of this phase, the fourth ratings of the three VAS measures (T4) and the appraisal ratings of the ROII were completed. Finally, the manipulation check was filled in. Participants were thoroughly debriefed and received course credit or shopping vouchers in compensation for their time.

2.5. Statistical analysis

Data were visually inspected for outliers using box plots. Thought frequency resulted in two outliers and they were adjusted such that the outlying case was assigned a value one unit above the second highest value in the distribution (Winsorizing). We checked for skew and kurtosis of distributions and used Kolmogorov–Smirnov tests to test whether assumptions of normal distributions were met. Some of the variables were not normally distributed. Levene statistics were used to test for homogeneity of variances. With few exceptions, homogeneity could be assumed. Because ANOVA is robust against violations of the assumptions if sample sizes are equal and $df \geq 20$ (Donaldson, 1968), an ANOVA was used to compare the three experimental groups on the manipulation check variables, mood measures (PANAS), and appraisal ratings (ROII). Games–Howell post hoc tests were conducted if appropriate to account for unequal variances. For the repeated measure analysis of the dependent variables distress, urge to neutralize, depressed mood, and frequency of UITs, the Greenhouse–Geisser correction was used to adjust the degrees of freedom since Mauchly’s tests demonstrated that the assumption of sphericity was not met. Alpha was set at .05. For the analysis of the four dependent variables (distress, urge to neutralize, depressed mood, and frequency of thoughts) we applied Bonferroni corrections to control for multiple testing, adjusted $\alpha = .0125$.

3. Results

3.1. Manipulation check and mood (PANAS) prior to experimental manipulation

To ensure that condition instructions were generally adhered to, we compared the experimental groups on the variable managed to concentrate on the statements. There were no significant differences between groups, $F(2, 79) = 1.14, p = .33$, and the degree of concentration on the statements was generally high. Table 1 shows means and standard deviations for the manipulation check variables per experimental group. To assess the effectiveness of the experimental manipulation, groups were compared on the content of thinking during the experimental phase. Results showed a significant group effect on the degree to which participants were thinking repetitively about themselves, $F(2, 79) = 17.36, p < .001, \eta^2 = .31$. Post hoc analysis using Games–Howell statistics to account for unequal variances demonstrated that the rumination on negative mood group was thinking repetitively about themselves to a greater extent than the rumination on UIT group, $d = .66, p < .05$. The rumination on UIT group was significantly different from the distraction group, $d = .89, p < .05$. There was also a significant effect on the degree to which participants thought repetitively about their UITs during the experimental phase, $F(2, 79) = 13.79, p < .001, \eta^2 = .26$. Post hoc Games–Howell tests

demonstrated that the rumination on UIT group had significantly higher scores than the rumination on negative mood group, $d = .65, p < .05$. The rumination on negative mood group thought significantly more about the UIT than the distraction group, $d = .76$. Taken together, these findings suggest that the experimental manipulation resulted in instruction-congruent content of repetitive negative thinking during the experimental phase, or in short, the experimental manipulation worked.

Neither negative nor positive mood (PANAS negative and PANAS positive) were significantly different between groups prior to the experimental manipulation: for negative mood, $F(2, 79) = .28, p = .76$; for positive mood, $F(2, 79) = 1.97, p = .15$. Table 1 shows means and standard deviations of mood before the experimental manipulation per group.

3.2. Effects of experimental manipulation on discomfort, urge to neutralize, and mood

General linear model (GLM) analysis was used to analyze the data in a 3 (Experimental Condition) \times 4 (Time) mixed-model design with experimental condition (rumination on UIT, rumination on negative mood, distraction) as the between-group factor and time (T1, T2, T3, T4) as the within-subject factor. If our hypothesis was confirmed, the experimental phase should have had a differential effect in the three groups, resulting in a significant interaction of group and time. Table 2 shows means and standard deviations of discomfort, urge to neutralize, and depressed mood per group and time point. For discomfort, there was a significant effect of time, $F(2.06, 162.69) = 78.94, p < .001, \eta_p^2 = .50$, reflecting an overall reduction of discomfort from T1 to T4 across all experimental groups. However, neither group differences, $F(2, 79) = .90, p = .41$, nor the interaction between group and time, $F(4.12, 162.69) = 1.91, p = .11$, was significant. Analysis of urge to neutralize also resulted in a significant main effect of time, $F(2.64, 208.33) = 90.57, p < .001, \eta_p^2 = .53$, which was qualified by the crucial significant interaction between time and group, $F(5.27, 208.33) = 3.33, p < .01, \eta_p^2 = .08$, reflecting differences between the experimental groups in the decrease of urge to neutralize from T1 to T4. The main effect of experimental group was not significant, $F(2, 79) = 1.90, p = .16$. Fig. 2 depicts the means and standard deviations of urge to neutralize graphically.

To better understand the interaction of time and experimental group, a separate GLM analysis was carried out, using a 3 (Experimental Condition) \times 2 (Time) mixed-model design including only T2 and T3. The changes between T2 and T3 are crucial for the study, since they reflect the time points immediately before and after the experimental phase. GLM analysis was followed up with paired *t*-tests, separately for each experimental group. An effect of the experimental manipulation would be reflected in a significant reduction of urge to neutralize for those who ruminated on negative mood and those who were distracted but no significant changes for those who ruminated on the UIT. The analysis resulted in a significant main effect of time, $F(1, 79) = 44.65, p < .001, \eta_p^2 = .36$, which was qualified by a significant interaction between time and group, $F(2, 79) = 3.62, p < .05, \eta_p^2 = .08$; the main effect of experimental group was not significant, $F(2, 79) = 2.4, p = .09$. Urge to neutralize, on average, decreased significantly from T2 to T3 for those individuals who ruminated on negative mood, $t(26) = 5.19, p < .01, d = 0.73$, and those who were distracted, $t(26) = 5.23, p < .01, d = 1.03$, but not for individuals who ruminated on the UIT. This means that the experimental manipulation had a specific effect on individuals who were instructed to ruminate on the UIT. It appears to have reduced a general decrease in urge to neutralize over time.

Depressed mood was included as an additional outcome variable to investigate whether the effects of rumination would be specific to variables associated with the UITs or would also affect depressed mood. There was no main effect of experimental group, $F(2, 79) = .70$,

Table 2
Discomfort, urge to neutralize, depressed mood, thought frequency, and items of the ROI separately for experimental groups and time points.

Variable	Experimental group					
	Rumination on UIT		Rumination on negative mood		Distraction	
	n = 28		n = 27		n = 27	
	M	SD	M	SD	M	SD
VAS discomfort						
T1	5.21	2.13	5.52	2.23	5.67	2.17
T2	4.14	2.56	3.22	1.50	3.78	2.41
T3	3.82	2.29	2.78	1.93	2.93	2.00
T4	2.79	2.10	1.90	2.06	2.26	1.89
VAS urge to neutralize						
T1	6.00	2.36	6.30	2.76	6.15	2.45
T2	4.79	2.99	3.96	2.41	4.52	2.55
T3	4.00	3.01	2.26	2.25	2.15	1.90
T4	3.46	2.62	1.93	2.20	1.93	1.82
VAS depressed mood						
T1	3.61	2.71	4.15	2.46	4.22	2.44
T2	3.50	2.70	2.33	1.71	3.11	2.26
T3	2.75	2.27	1.67	1.73	2.11	2.08
T4	1.93	1.94	1.41	1.67	1.89	2.06
Thought frequency baseline	10.46	6.34	9.85	6.50	10.81	7.16
Thought frequency return to baseline	6.32	4.53	5.00	4.37	4.96	3.45
PANAS—positive at T3	3.27	0.55	3.37	0.61	3.52	0.68
PANAS—negative at T3	2.03	0.65	1.97	0.63	2.12	0.79
ROII unpleasantness	2.89	1.07	2.81	1.85	3.26	0.94
ROII guilt	1.64	1.45	1.85	1.35	2.15	1.38
ROII worry thought comes true	1.61	1.42	1.74	1.53	1.89	1.19
ROII unacceptability	2.89	1.29	2.96	1.16	3.22	1.09
ROII likelihood thought comes true	1.04	1.00	0.74	0.66	.48	0.64
ROII importance to control thought	2.29	1.12	2.00	1.27	2.11	1.34
ROII harm/danger	1.61	1.32	2.19	1.62	1.48	1.53
ROII responsibility	1.36	1.25	1.04	1.13	1.30	1.27

Note. Discomfort, urge to neutralize, and depressed mood were each rated on a visual analogue scale (VAS) of 0 (*not at all*) to 9 (*very much so*). PANAS = Positive and Negative Affect Scale, after experimental phase; ROII = Revised Obsessive Intrusions Inventory; T1 = before baseline; T2 = after baseline; T3 = after experimental phase; T4 = after return to baseline.

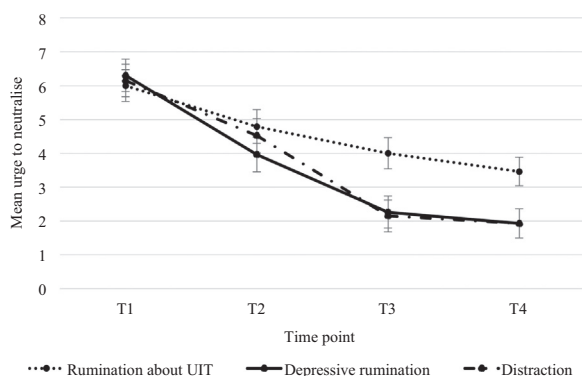


Fig. 2. Means of urge to neutralize by group. Error bars represent standard errors.

$p = .50$. The interaction between group and time reached marginal significance, $F(4.12, 162.73) = 2.34, p = .06$. Additionally, there was again a significant effect of time, $F(2.06, 162.73) = 41.00, p < .0001$,

$\eta_p^2 = .34$, reflecting a reduction of depressed mood from T1 to T4 across all experimental groups. Follow-up analysis including only the crucial interval between T2 and T3 resulted in a significant main effect of time, $F(1, 79) = 18.17, p < .001, \eta_p^2 = .19$; neither the main effect of experimental group, $F(2, 79) = 2.22, p = .12$, nor the interaction between experimental group and time, $F(2, 79) = .28, p = .76$, were significant, and no further follow-up analyses were carried out.

3.3. Effects of experimental manipulation on thought frequency

Table 2 shows thought frequencies of the target UIT per experimental group at baseline and return to baseline. GLM analysis was used to analyze the data in a 3 (Experimental Condition) \times 2 (Time) mixed-model design with experimental condition (rumination on UIT, rumination on negative mood, distraction) as the between-group factor and time (baseline, return to baseline) as the within-subject factor. The time factor was significant, $F(1, 79) = 66.14, p < .001, \eta_p^2 = .46$, reflecting an overall decrease of thought frequency from baseline to return to baseline. However, neither the group effect, $F(2, 79) = .28, p = .76$, nor the interaction of group and time, $F(2, 79) = .66, p = .52$, was significant.

3.4. Additional analysis: Positive and negative mood and appraisal ratings of UITs

The PANAS was included to check whether the experimental phase had an influence on negative or positive state affect. There were no significant differences between groups for negative affect, $F(2, 79) = .31, p = .73$, or positive affect, $F(2, 79) = 1.16, p = .32$.

As an additional analysis, we examined the appraisal ratings of the ROI to obtain information about the significance of the activated UIT. Ideally, the appraisals should have been obtained immediately after the activation of the UIT. However, in pilot work the appraisal ratings interfered with the activation of the UIT. For this reason they were embedded at the end of the experimental session and, as a consequence, could have been influenced by the experimental manipulation. We thus used one-way ANOVAs to assess the overall levels of appraisals and potential influences of the experimental manipulation. Means and standard deviations of the ROI appraisals are shown in Table 2, separately for each group. Overall, ratings of unpleasantness ($M = 2.99, SD = 1.01$), unacceptability ($M = 3.02, SD = 1.18$), and importance of controlling the thought ($M = 2.13, SD = 1.27$) were higher than ratings of UITs in nonselected samples of psychology students (Belloch, Morillo, Lucero, Cabedo, & Carrio, 2004, p. 397) and also higher than in individuals who were selected on the basis of high OC symptoms (Purdon & Clark, 1994). This indicates that the thought activation successfully resulted in a UIT that was similar in terms of appraisals to more clinically relevant intrusive thoughts. Only one appraisal rating was influenced by the experimental manipulation, that is, the perceived likelihood that the UIT might come true, $F(2, 79) = 3.42, p < .05$. Games–Howell post hoc analysis demonstrated that individuals who previously ruminated on the target UIT considered it more likely that the UIT would come true than individuals who were previously distracted, $p < .05$.

4. Discussion

The current study examined whether rumination on UITs and their causes and consequences had an immediate effect on the discomfort associated with these thoughts, the urge to do something about the thoughts (i.e., to neutralize) and the frequency of the UITs as well as on depressed mood. A UIT was activated by asking participants to write down a sentence stating that they wished a loved one would die in a horrible car accident that evening. Individuals who had previously ruminated on the UIT experienced a smaller decrease of the urge to neutralize than individuals who had previously engaged in rumination

on negative mood or those who were distracted. Contrary to expectations, we did not find any effects of rumination on the UIT on the discomfort associated with the UIT or the frequency of the UIT. Since we expected to find an *increase* in the urge to neutralize after ruminating on the UIT compared to the two other conditions, our hypotheses were not confirmed. However, we did not anticipate a *general reduction* of the urge to neutralize over time. Results showed that this reduction in the urge to neutralize was considerably smaller in individuals who ruminated on the UIT compared to participants in the other two conditions. Thus these findings suggest that when individuals thought repetitively about the UIT, the urge to do something about the UIT, for example, to rip up the paper or cross out the sentence, did not dissipate.

The finding that rumination affected exclusively the urge to neutralize and not discomfort or frequency of thoughts can be very plausibly explained by the additional analysis of the appraisal ratings. The experimental condition influenced only the perceived likelihood that the UIT would come true. It was higher in individuals who had previously ruminated on the UIT compared to those in both other conditions. Thus it appears plausible that ruminating on the UIT raised the perceived probability that this thought would come true, and as a consequence, the urge to neutralize did not fade as much as in the other two conditions. Since the study did not control the temporal order of appraisal changes and urge to neutralize, it is of course also possible that rumination increased the urge to do something about the UIT, which in turn changed the perceived likelihood of the UIT coming true.

Analysis of the appraisals of the UIT demonstrated that they were generally higher than in a sample of participants who were selected on the basis of high OC scores (Purdon & Clark, 1994). Thus we feel confident that the activated UIT can be seen as an analogue thought to obsessions, associated with negative appraisals, distress, and an urge to do something about it, although on a lower scale than obsessional thoughts, and that the study allows us to draw preliminary conclusions about rumination and its effects on obsessional thoughts. It appears that rumination affects primarily the urge to perform a compulsion, possibly the actual performance of compulsions, but not the frequency of obsessions or the associated distress. Studies including individuals diagnosed with OCD should follow in order to draw further firm conclusions about the causal effects of rumination on obsessions or compulsions. The current study also demonstrates that it is important to discriminate between different contents of rumination (UIT vs. negative mood), since in the current study only rumination on the UIT had an effect on urge to neutralize. Further studies with individuals diagnosed with OCD should keep the distinction between these two forms of rumination.

Findings are consistent with previous research on rumination and OC symptoms (Grisham & Williams, 2009; Raines et al., 2017; Wahl et al., 2011) and the finding that “analyzing” is a significant response to unwanted intrusive and obsessive thoughts (Freeston & Ladouceur, 1997). The current study extends these by suggesting that rumination has an imminent causal effect on the urge to act upon the thought. Future studies should include behavioral assessments of neutralizing to examine whether only the tendency to neutralize or the actual performance of a neutralizing action, for example, crossing out the sentence or ripping up the piece of paper on which the sentence was written, is influenced by rumination on the UIT. Results also align with those of other laboratory studies that found imminent effects of rumination in the laboratory on psychological variables such as desire to eat (e.g., Naumann et al., 2015). Interestingly, results regarding the influence of rumination on other forms of intrusive thoughts, such as intrusive memories or self-deprecating thoughts (Watkins, 2004; Zetsche, Ehring, & Ehlers, 2009), have been inconsistent. Sometimes the frequency of thoughts was increased by rumination (Guastella & Moulds, 2007; Watkins, 2004; p. 397), sometimes not (Ball & Brewin, 2012; Zetsche et al., 2009). These mixed findings might reflect the difficulty of assessing transient experiences as intrusive thoughts in a valid way; see below for a detailed discussion.

As an additional analysis, we examined whether rumination

affected depressed mood. Neither rumination on the UIT nor rumination on negative mood affected depressed mood or state affect. This is not a surprise, given that rumination is thought to have an effect on depressive mood only if individuals are already dysphoric prior to experimental induction of rumination, which has been shown in the majority of studies (e.g., Lyubomirsky & Nolen-Hoeksema, 1995; McLaughlin et al., 2007; Nolen-Hoeksema et al., 1993; for other results, however, see Jahanitabesh et al., 2017). The important conclusion for the present study is that rumination on a UIT had a specific effect on urge to neutralize.²

The specificity of results invites speculation about the mechanisms underlying the relationship between rumination and OC symptoms. It seems unlikely that rumination first affects mood, and, as a consequence, the urge to neutralize, since we did not find any effects on mood. Grisham and Williams (2009) suggested that rumination on obsessive thoughts might increase the accessibility of the intrusive thoughts by a quicker spread of activation in the semantic network due to further elaborations of the UIT during rumination. However, if this was the case we should have seen an increase in the frequency of intrusive thoughts, which we did not find in the present study, and thus this explanation seems unlikely. Instead, the present results suggest that rumination primarily modifies the appraisal of the intrusive thought—and thereby maintains a stronger urge to act upon it. Our findings are therefore consistent with cognitive models of OCD that emphasize that the dysfunctional appraisal of the intrusive thoughts is the crucial factor turning an otherwise normal intrusive thought into a long-lasting obsession (e.g., Rachman, 1997). It would be interesting to examine in future studies whether particular dysfunctional appraisals are affected by or related to the effects of rumination, for example, the belief that experiencing an intrusive thought makes it more likely to happen, thought–action fusion (e.g., Hansmeier, Exner, Rief, & Glombiewski, 2014).

The present findings must be considered in light of the study's limitations. For this special issue, challenges and limitations are discussed with a particular emphasis on methodological difficulties. We were faced with two main methodological challenges. First, the activation of a personally relevant, intrusive thought in nonclinical participants, similar to obsessive thoughts in emotional response and appraisal, is difficult and required thorough pilot work. In a previous pilot paradigm we activated a personally relevant UIT by asking participants to identify which thought of the ROII (Purdon & Clark, 1994) was most upsetting for them. Unfortunately, this technique did not result in a sufficiently emotional reaction or appraisals that were close to appraisals in individuals scoring high on OC symptoms. We solved the problem by using a different form of activation, namely, the writing of the sentence wishing a loved one would die. Although this is not necessarily an idiosyncratic, naturally occurring thought, it has resulted in distinct anxiety in previous studies (Rachman et al., 1996; Van den Hout et al., 2001) and in the present study resulted in appraisal ratings that were even higher than those in individuals who were selected for high OC thoughts (Purdon & Clark, 1994). It has to be noted as a further limitation that we did not include a direct manipulation check for the activation of the UIT, such as a before-and-after state measure of anxiety.

Second, studies that attempt to measure transient mental events such as UITs by self-report should discuss the appropriateness of their thought assessments. In the current study thought frequency was assessed with a smartphone counter app. This method presumes that people can appropriately monitor their thoughts, identify a target thought, and act correspondingly. Similar methods were used in previous studies (Grisham & Williams, 2009; Marcks & Woods, 2005) and

² It is also important to note, however, that in a clinical sample of dysphoric individuals diagnosed with OCD, mood and symptoms might well be affected by depressive rumination.

there is evidence that individuals can accurately estimate thought frequencies. Lin and Wicker (2007) found a high agreement of key presses and retrospectively estimated number of UITs, $r = .81$. What, however, if UITs do not appear as distinct entities but are intermingled with other thoughts or appear in meta-thoughts about having a UIT? Will they still be adequately assessed with this technique? The current method also does not adequately account for chains of thoughts. Anecdotal reports from participants during debriefing confirm that some participants experienced lengthy episodes of the UIT, for which they pressed the button only once. In this case one press does not adequately reflect the continuous thinking about the UIT.

Additional limitations include one-item measures for the main dependent variables, which raises questions regarding validity, and an exclusive reliance on self-report for neutralizing, particularly against the background that rumination on a UIT seems to affect only the urge to neutralize. In a next step, behavioral assessments of neutralizing such as a count of diverse activities (e.g., ripping up the paper, crossing out the sentence, internally saying that it does not mean anything, or saying a prayer) should supplement the self-reported urge to neutralize (Rachman et al., 1996). Finally, that the study was conducted with a nonclinical sample can be viewed as a limitation. However, research supports the view that differences between UITs and obsessions are quantitative rather than qualitative in nature (e.g., Radomsky et al., 2014; Salkovskis & Harrison, 1984) and many authors share the view that research in nonclinical samples can validly inform our understanding of the cognitive processes in OCD (Abramowitz et al., 2014). Additionally, appraisal ratings in the current study make us confident that the findings are relevant for clinical obsessions. Nevertheless, the study needs to be replicated in individuals diagnosed with OCD.

Notwithstanding these limitations, new insights can be gained from the current study. To our knowledge it is the first time that immediate causal effects of rumination on UITs were examined. Results show that rumination on the UIT diminished the urge to neutralize to a smaller degree than rumination on negative mood or distraction. Distress associated with the UIT, frequency of the UIT, and negative mood were not affected by either form of rumination. Insight into the maintenance of OCD may be helped by including behavioral measures of urge to neutralize, by studying individuals diagnosed with OCD longitudinally, and by focusing on operating mechanisms and potential mediating factors such as dysfunctional beliefs (e.g., thought–action fusion).

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