



**Universität
Basel**

Fakultät für
Psychologie



Investigating different forms of rumination in obsessive-compulsive disorder and anger

Inauguraldissertation zur Erlangung der Würde einer Doktorin der Philosophie
vorgelegt der Fakultät für Psychologie der Universität Basel von

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Basel, 2021

Originaldokument gespeichert auf dem Dokumentenserver der Universität Basel
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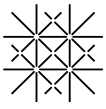
Genehmigt von der Fakultät für Psychologie auf Antrag von

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Datum des Doktoratsexamen: 18.08.2021

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- Heinzl, C. V., Kollárik, M., Miché, M., Clamor, A., Ertle, A., Lieb, R., & Wahl, K. (2020). Is a ruminative thinking style related to obsessive-compulsive symptom severity beyond its associations with depressive and anxiety symptom severity? Manuscript submitted for publication.
- Heinzl, C. V., Lieb, R., Kollárik, M., Kordon, A., & Wahl, K. (2020). Development and preliminary psychometric properties of the Rumination on Obsessions and Compulsions Scale (ROCS). *Journal of Obsessive-Compulsive and Related Disorders*, 27, 1-11. <https://doi.org/10.1016/j.jocrd.2020.100554>
- Heinzl, C. V., Moulds, M. L., Kollárik, M., Lieb, R., & Wahl, K. (2021). Effects of abstract versus concrete rumination about anger on affect. Manuscript submitted for publication.

Basel, 26.05.2021

Carlotta Vivian Heinzl

Acknowledgements

First and foremost, I would like to thank Karina Wahl and Roselind Lieb. The guidance and the opportunities you have given me throughout my PhD have been invaluable to me and I cannot thank you enough for your support. I would also like to thank Prof. Meinlschmidt for serving on my PhD committee. I am very grateful to everyone working at the departments of clinical psychology and epidemiology and the department of clinical psychology and intervention science – you are creating an inspiring and supporting working environment that I am extremely glad to be a part of. Special thanks to Andrea Meyer for sharing his knowledge on any statistical questions I had. I am also extremely thankful for the help of Anita Todd for her language editing, the co-authors of these manuscripts, as well as all the student assistants, students and participants without whom these studies would not exist.

Martin, thank you for going through the ups and downs of PhD life together with me. I cannot count the times when a coffee break and some discussion with you has helped me clear my thoughts and get new energy. Jae, Sarah, Patrizia, Marcia, Marcel, Jogi, Vicky, Andrea Schumacher and Andrea Spitz, thank you for all your tips and help, for the breaks together and for sharing the PhD journey with me.

I would like to say a huge thank you to my family for their constant support, encouragement and patience, and also the extremely strong green tea! And a very big thank you to my friends – especially Anna, Dési, Nadine, and Anke – for being there for me even when meeting in person was difficult, and offering distractions, laughter and encouragement. Special thanks to Anna, Jae, Martin and Sarah for your feedback on this thesis! Last but not least, to Sascha, I cannot thank you enough for all your love and support and for motivating me throughout this journey – whether with talks, working sessions, or breaks and trips to clear my mind. You are the best!

Table of Contents

Acknowledgements..... IV

Abbreviations VI

Abstract 1

1 Introduction 2

2 Theoretical Background..... 2

 2.1 Different forms of rumination in OCD 2

 2.2 Abstract versus concrete rumination about anger 6

 2.2.1 The processing-mode theory in the context of depression..... 6

 2.2.2 Applying the processing-mode theory to rumination about anger. 7

3 Research questions 8

4 Materials and Methods 9

 4.1 Participants..... 9

 4.2 Study design and procedure..... 10

 4.3 Measures..... 11

 4.3.1 Standardized questionnaires. 11

 4.3.2 Rumination on Obsessions and Compulsions Scale (ROCS). 12

 4.4 Analyses..... 12

5 Results 13

 5.1 Different forms of rumination in OCD 13

 5.1.1 Association of RST-rumination with OCD symptom severity..... 13

 5.1.2 Preliminary psychometric properties of the ROCS..... 13

 5.2 Effects of abstract versus concrete rumination about anger on affect 14

6 Discussion..... 16

 6.1 Different forms of rumination in OCD 16

 6.2 Abstract versus concrete rumination about anger 18

 6.3 Strengths and Limitations 18

 6.4 Implications 19

 6.5 Conclusion..... 20

References..... 21

Appendices A–C 34

Abbreviations

HC	Healthy control
MDD	Major depressive disorder
OCD	Obsessive-compulsive disorder
RFCBT	Rumination-focused cognitive-behavioral therapy
ROCS	Rumination on Obsessions and Compulsions Scale
RST-rumination	Rumination as defined in the response styles theory
SCID-I for DSM-IV	Structured Clinical Interview for Axis I Disorders for the Diagnostic and Statistical Manual of Mental Disorders, 4 th edition

Abstract

Rumination has traditionally been investigated in the context of depression or sadness, but it also influences various other mental disorders or types of affect. We examined different forms of rumination in the contexts of obsessive-compulsive disorder (OCD) and anger. In the context of OCD, cross-sectional observational studies were used to analyze associations of rumination as defined in the response styles theory (RST-rumination) with OCD symptoms in 140 individuals with OCD and explore psychometric properties of the Rumination on Obsessions and Compulsions Scale (ROCS), a new measure of OCD symptom rumination and mental neutralizing (two forms of rumination), in individuals with OCD ($n = 99$), major depressive disorder ($n = 74$), or no mental disorder ($n = 35$). In the context of anger, 120 participants were induced to ruminate about anger in an abstract and in a concrete form in randomly allocated order, with anger, negative and positive affect measured before and after rumination. RST-rumination was positively associated with a questionnaire but not an interview measure of OCD symptoms when controlling for depression and anxiety. For the ROCS, a one-factor solution for OCD symptom rumination and a three-factor solution for mental neutralizing emerged and we present correlations indicating convergent and discriminant validity and between-groups comparisons. Abstract and concrete rumination about anger had comparable effects on affect. Regarding OCD, RTS-rumination should be examined further and possibly included in models and treatments of OCD. The ROCS has promising psychometric properties and, following further validation, may be used in research and treatment of OCD. If future studies replicate the comparable effects of abstract and concrete rumination about anger on affect in individuals with high anger and over a longer time, theory and treatments of these forms of rumination may possibly need to be amended.

1 Introduction

Rumination is a transdiagnostic process that contributes to the onset and maintenance of different mental disorders and that exacerbates or prolongs negative affective experiences (for overviews, see Nolen-Hoeksema et al., 2008; Watkins, 2008; Watkins & Roberts, 2020). It can broadly be described as conscious and recurring thoughts about personal concerns that are not immediately cued by the environment (Clark & del Palacio González, 2014; Martin & Tesser, 1996). Various forms of rumination (e.g., Smith & Alloy, 2009) can be subsumed within this definition. For instance, the processing-mode theory of rumination has differentiated abstract from concrete rumination (Watkins, 2008; Watkins et al., 2008). While previous studies have examined different forms of rumination in depression (e.g., Smith & Alloy, 2009) and in other areas, such as social anxiety disorder (e.g., Penney & Abbott, 2014) or posttraumatic stress disorder (e.g., Moulds et al., 2020), research is still needed in other areas. Up to date, little research has been done on rumination in obsessive-compulsive disorder (OCD). Additionally, no studies have yet investigated the effects of abstract versus concrete rumination (as differentiated by the processing-mode theory) about anger. This thesis extends previous research by investigating different forms of rumination in the contexts of OCD and anger.

2 Theoretical Background

2.1 Different forms of rumination in OCD

OCD is a highly impairing mental disorder with a lifetime prevalence of approx. 0.3–3.5% (Fontenelle et al., 2006; Guzick et al., 2017; Lieb et al., 2019). It is characterized by recurrent intrusive and unwanted thoughts, urges, or images (obsessions) that a person typically responds to with repetitive actions (compulsions) aimed at preventing or neutralizing the danger or distress caused by the obsessions

(American Psychiatric Association, 2013). Neutralizing actions can be either overt behaviors (e.g., washing or ordering) or mental actions (e.g., counting or silently repeating certain words; American Psychiatric Association, 2013). This thesis examines three forms of rumination that individuals diagnosed with OCD may experience: rumination as defined in the response styles theory (RST-rumination), OCD symptom rumination, and mental neutralizing.

The response styles theory (Nolen-Hoeksema, 1991) has defined rumination as “repetitively and passively focusing on symptoms of distress and on the possible causes and consequences of these symptoms” (Nolen-Hoeksema et al., 2008, p. 400) and to distinguish it from other forms of rumination, the present thesis refers to this construct as RST-rumination. RST-rumination is positively associated with OCD symptom severity (Dar & Iqbal, 2015; Jungmann et al., 2016; Raines et al., 2017; Wahl, Ertle, et al., 2011; Wei et al., 2020). This suggests that RST-rumination may be involved in the development or maintenance of OCD, for instance, possibly as a maintaining factor of OCD symptom severity (see Wahl et al., in press, who also propose a possible mechanism). However, both RST-rumination (e.g., Merino et al., 2016; Treynor et al., 2003) and OCD symptom severity (e.g., Clark et al., 2005; Tellawi et al., 2016) are positively associated with depressive and anxiety symptom severity. Therefore, it is unclear whether depressive and anxiety symptom severity are confounders that account for the association between RST-rumination and OCD symptom severity.

So far, four studies have demonstrated a positive association of RST-rumination with some, but not all, measures of OCD symptom severity while controlling for depressive and/or anxiety symptom severity (Grisham & Williams, 2009; Raines et al., 2017; Shaw et al., 2017; Wahl, Ertle, et al., 2011). These studies investigated samples of students, individuals diagnosed with various mental

disorders, or an online sample with only 0.01% of participants reporting a previous diagnosis of OCD. No studies have used a sample of individuals diagnosed with OCD to examine the association of RST-rumination and OCD symptom severity while controlling for depressive and/or anxiety symptom severity. Additionally, no studies have examined this association using an interview measure of OCD symptom severity such as the Yale-Brown Obsessive-Compulsive Scale (Goodman et al., 1989). A study that investigates this association using a sample of individuals with OCD and additionally the Yale-Brown Obsessive-Compulsive Scale could provide robust evidence for this association in the population that is of most interest for its theoretical and clinical implications.

If RST-rumination is associated with OCD symptoms beyond both variables' associations with depressive and anxiety symptoms, it is conceivable that individuals with OCD also experience an OCD-specific subtype of rumination. In addition to ruminating about general symptoms of general distress, individuals diagnosed with OCD may ruminate specifically about their symptoms of OCD (Wahl, Schönfeld, et al., 2011). We call this form of rumination *OCD symptom rumination* and define it as repetitive, passive thoughts about one's symptoms of OCD as well as their possible causes or consequences (slightly modifying the definition of RST-rumination by Nolen-Hoeksema et al., 2008). This construct is similar to RST-rumination but specifically focused on OCD symptoms. Three recent experimental studies have induced rumination about unwanted intrusive thoughts or rumination about obsessions, which are comparable to OCD symptom rumination (Kollárik et al., 2020; Wahl et al., in press; Wahl et al., 2019). They suggest that these forms of rumination may maintain OCD symptoms, compared to distraction. However, further research on OCD symptom rumination is hindered by the fact that there is no validated measure of this construct so far.

An additional maladaptive and typically repetitive cognitive process that is often experienced by individuals with OCD and that has also been described as obsessive rumination (Wahl, Ertle, et al., 2011) is mental neutralizing. Mental neutralizing can be defined as voluntary and effortful mental actions aimed at preventing, reducing or removing obsessions or the discomfort associated with obsessions (adapted from Freeston & Ladouceur, 1997). It is a common symptom of OCD, with some studies showing that it is experienced by up to 80% of individuals diagnosed with OCD (de la Cruz et al., 2013; Foa & Kozak, 1995; Sibrava et al., 2011). Cognitive-behavioral models of OCD describe neutralizing, including mental neutralizing, as a key maladaptive process that maintains and exacerbates OCD symptoms (Salkovskis, 1985) and its identification is crucial for research and treatment of OCD. For instance, identifying and preventing mental neutralizing is highly important for successful exposure and response prevention, which is a key component of first choice OCD treatment (Hohagen et al., 2015; Koran & Simpson, 2013). However, current measures that assess mental neutralizing (e.g., the Cognitive Intrusions Questionnaire, Freeston et al., 1991; or the Revised Obsessional Intrusions Inventory, Purdon & Clark, 1994b) do not assess all different types of mental neutralizing, and the psychometric properties of their items assessing mental neutralizing are often unclear. In summary, both OCD symptom rumination and mental neutralizing can be considered maladaptive forms of rumination experienced by individuals diagnosed with OCD. However, no comprehensive, validated measures exist for either construct. A questionnaire that assesses these constructs comprehensively, reliably and validly is highly relevant for both research and treatment of OCD.

2.2 Abstract versus concrete rumination about anger

2.2.1 The processing-mode theory in the context of depression. In the area of depression, the processing-mode theory has distinguished abstract from concrete rumination (e.g., Watkins, 2008; Watkins et al., 2008). Whereas abstract rumination is characterized by general and decontextualized analytical and evaluative thinking, concrete rumination is typically more specific, contextualized, experiential and less evaluative (Watkins et al., 2008). The processing-mode theory of rumination proposes that abstract rumination has maladaptive consequences for affect and cognition, whereas concrete rumination has adaptive consequences for such outcomes (Watkins et al., 2008). This distinction has high clinical relevance because it is part of the theoretical foundation of rumination-focused cognitive-behavioral therapy (RFCBT; Watkins, 2016), which includes patients shifting towards a more concrete, instead of an abstract, thinking style.

Multiple experimental studies have supported differential effects of abstract versus concrete rumination on cognitive processes relevant to depression in line with the processing-mode theory (e.g., effects on negative self-judgments, Rimes & Watkins, 2005; Vassilopoulos & Watkins, 2009; or on overgeneral memory, Raes et al., 2008; Watkins & Teasdale, 2001, 2004). For affect outcomes, the evidence is less conclusive. Some experiments that have induced abstract versus concrete rumination have demonstrated differential effects in line with the processing-mode theory on affect (e.g., on negative affect albeit not on positive affect, Kambara et al., 2019; on positive affect in one of two studies, Nelis et al., 2015; or on sadness, Werner-Seidler & Moulds, 2012), while others have reported comparable effects of the two forms of rumination (e.g., on sadness, Sanders & Lam, 2010; on negative affect, Watkins & Moulds, 2005; or on despondency and happiness, Watkins & Teasdale, 2001). Further experiments have reported differential effects of abstract

versus concrete rumination on affect only under specific conditions, such as only for individuals with a diagnosis of depression (Rimes & Watkins, 2005), or only during a failure experience that followed rumination, but not during rumination (Watkins et al., 2008).

2.2.2 Applying the processing-mode theory to rumination about anger.

Although the processing-mode theory has emerged from research on depression and despondency, it has since been applied to multiple other conditions or symptoms such as social anxiety (Van Lier et al., 2015; Vassilopoulos & Watkins, 2009; Wong & Moulds, 2012), alcohol dependence (Grynberg et al., 2016), or intrusive memories (Santa Maria et al., 2012; Schaich et al., 2013; Stavropoulos & Berle, 2020).

Recently, Moeller et al. (2021) have presented a case study with a patient diagnosed with schizotypal personality disorder who experienced rumination about anger. The patient received RFCBT for rumination about anger and reported reduced anger after 10 months (25 sessions) of treatment that was maintained at a 3-month follow-up. Because RFCBT involves shifting from abstract to more concrete thinking, this study provides some preliminary evidence that the processing-mode theory may apply to the effects of rumination about anger on affect.

Multiple studies have suggested that rumination about anger is a maladaptive process. Experimental studies have demonstrated that rumination about a past anger event maintains or increases current anger, compared to distraction or reappraisal (Lievaart et al., 2017; Peuters et al., 2019; Ray et al., 2008). Further experiments have demonstrated that after an anger provocation, rumination about oneself and about the provocation leads to displaced aggression after a triggering event, compared to no rumination or distraction (Bushman et al., 2005; Denson et al., 2006). Although anger or aggression are not part of the diagnostic criteria of OCD (American Psychiatric Association, 2013; however, see Cludius et al., 2020, for a

discussion of anger in OCD), they are included in the diagnostic criteria of multiple other mental disorders (e.g., intermittent explosive disorder, oppositional defiant disorder, or bipolar disorder; Fernandez & Johnson, 2016). This highlights the importance of treatments that decrease anger and aggression, which may be achieved by reducing rumination about anger. A study that examines the effects of abstract versus concrete rumination about anger on affect would help inform the use of RFCBT for individuals who experience high levels of rumination about anger.

3 Research questions

This thesis aimed to examine different forms of rumination in the contexts of OCD and anger. In the context of OCD, we investigated two research questions:

Research Question 1: Is RST-rumination associated with OCD symptom severity when controlling for depressive and anxiety symptom severity? This question was examined in Manuscript 1 “Is a ruminative thinking style related to obsessive-compulsive symptom severity beyond its associations with depressive and anxiety symptom severity?” (Appendix A) and this thesis presents the following hypotheses:

- Hypothesis 1: RST-rumination is positively associated with a questionnaire measure of OCD symptom severity when depressive and anxiety symptom severity are controlled for.
- Hypothesis 2: RST-rumination is positively associated with an interview measure of OCD symptom severity when depressive and anxiety symptom severity are controlled for.

Research Question 2: What are the preliminary psychometric properties of the Rumination on Obsessions and Compulsions Scale (ROCS), a new questionnaire assessing two forms of rumination in OCD? This question was investigated in Manuscript 2 “Development and preliminary psychometric properties of the

Rumination on Obsessions and Compulsions Scale (ROCS)” (Appendix B) by exploring the ROCS scales’ factor structures, internal consistencies, correlations with indicators of convergent and divergent validity, and between-group comparisons.

Because of the exploratory nature of the investigation, no hypotheses were defined.

In the context of anger, we investigated *Research Question 3*: Do abstract versus concrete rumination about anger have differential effects on affect? This question was examined in Manuscript 3 “Effects of abstract versus concrete rumination about anger on affect” (Appendix C), with the hypothesis:

- Hypothesis 3: Abstract rumination about anger leads to a greater increase in (a) anger and (b) negative affect, and a greater decrease in (c) positive affect, relative to concrete rumination.

4 Materials and Methods

4.1 Participants

For Research Questions 1 and 2, data from three similar studies (called *subsamples* in the Analyses and Results sections) were used. Participants in these studies were recruited from six inpatient and outpatient clinics as well as using a university website and newspaper advertisements. They were either diagnosed with mental disorders using the Structured Clinical Interview for Axis I disorders for the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (SCID-I for DSM-IV; American Psychiatric Association, 1994; Wittchen et al., 1997), or – in a healthy control group (HC) – screened and showed no indicators of any lifetime or current mental disorders (according to the SCID-I for DSM-IV screening form). Exclusion criteria were current psychotic symptoms, current substance abuse or dependence, or current suicidal intent. To investigate Research Question 1, data from $n = 140$ individuals diagnosed with OCD (63% female, $M_{age} = 33.74$, $SD_{age} = 11.15$) was

used. Of these participants, 75% were diagnosed with current comorbid major depressive disorder (MDD) and 17% with one or more current comorbid anxiety disorders¹. To investigate Research Question 2, data from $n = 208$ individuals who were either diagnosed with OCD ($n = 99$; 65% female; $M_{\text{age}} = 32.89$, $SD_{\text{age}} = 11.36$), MDD but no OCD ($n = 74$; 59% female; $M_{\text{age}} = 47.08$, $SD_{\text{age}} = 11.15$), or no current or lifetime mental disorders (HC; $n = 35$; 46% female; $M_{\text{age}} = 40.49$, $SD_{\text{age}} = 11.14$), was used. For Research Question 3, $n = 120$ students and individuals from the community (85% female, $M_{\text{age}} = 26.83$, $SD_{\text{age}} = 10.97$) were recruited via a university website and in undergraduate psychology lectures.

4.2 Study design and procedure

For Research Questions 1 and 2, a cross-sectional observational study design was used. After participants provided informed consent, experienced clinicians or well-trained graduate students conducted the SCID-I for DSM-IV or its screening form (see Section 4.1) and the interview measure of OCD symptom severity. Subsequently, participants completed the questionnaires described in Section 4.3. The studies were approved by the Ethics Committee of the University of Lübeck.

Research Question 3 was investigated in an experiment with a $2 \times 2 \times 2$ design, with two within-subjects factors (form of rumination: abstract vs. concrete rumination; and time: pre- vs. post-rumination), and one between-subjects factor (order: abstract vs. concrete rumination first). At the beginning of the experiment, informed consent was taken and participants were then asked to identify a social event from the past 12 months that led to them feeling intense anger. At two subsequent time points, they were asked to recall this event in detail for 20s. After each recall, participants were induced to ruminate in an abstract or a concrete form

¹ Due to data loss, this only includes panic disorder and/agoraphobia for participants in one subsample ($n = 42$). For the remaining $n = 98$ participants, this includes all DSM-IV anxiety disorders.

about the anger event they had recalled, in randomly allocated order (rumination manipulation adapted from Fabiansson et al., 2012; Huffziger & Kuehner, 2009; Nolen-Hoeksema & Morrow, 1993; Rimes & Watkins, 2005; Watkins & Moulds, 2005; Wong & Moulds, 2009; for more details see Appendix C). Current anger, negative affect and positive affect were assessed before and after each recall-and-rumination period. Between the two recall-and-rumination periods, a 3-min film clip was included to reduce possible carry-over effects. The study was approved by the Ethics Committee of the Department of Psychology at the University of Basel.

4.3 Measures

4.3.1 Standardized questionnaires. For Research Questions 1 and 2, the Ruminative Responses Scale (Nolen-Hoeksema & Morrow, 1991; German version by Kühner & Weber, 1999; subscales described by Treynor et al., 2003) was used to assess habitual RST-rumination and problem solving. Depressive and anxiety symptom severity during the past week were assessed with the Beck Depression Inventory (Beck et al., 1961; German version by Hautzinger et al., 1995) and the Beck Anxiety Inventory (Beck et al., 1988; German version by Margraf & Ehlers, 2007), respectively. The Obsessive-Compulsive Inventory-Revised (Foa et al., 2002; German version by Gönner et al., 2008) was used to assess distress associated with OCD symptoms during the past month, with the subscales washing, checking, ordering, obsessing, hoarding, and mental neutralizing. For Research Question 1, the Yale-Brown Obsessive-Compulsive Scale (Goodman et al., 1989; German version by Hand & Büttner-Westphal, 1991) was additionally used as an interview measure of OCD symptom severity during the past week. For Research Question 3, the State-Trait Anger Expression Inventory–State version (Spielberger, 1988; German version by Schwenkmezger et al., 1992) was used to assess current anger, and the Positive

and Negative Affect Schedule (Watson et al., 1988; German version by Krohne et al., 1996) was used to assess current negative and positive affect.

4.3.2 Rumination on Obsessions and Compulsions Scale (ROCS). The ROCS was designed to assess two forms of rumination during the past month: OCD symptom rumination (with 11 items) and mental neutralizing (with 15 items). It additionally measures acceptance (with 4 items). Its items are based on existing literature (for OCD symptom rumination: Nolen-Hoeksema & Morrow, 1991; for mental neutralizing: Freeston et al., 1995; Freeston et al., 1991; Ladouceur et al., 2000; Purdon & Clark, 1994a; 1994b; for acceptance: Freeston et al., 1991; Purdon & Clark, 1994a) as well as the developers' clinical experiences. Appendix B provides further information on the development and the exact phrasing of the ROCS.

4.4 Analyses

Research Question 1 was investigated using two regression models with RST-rumination, depressive and anxiety symptom severity as predictors and the questionnaire (for Hypothesis 1) or the interview measure (for Hypothesis 2) of OCD symptom severity as outcomes. To control for the possible effects of subsamples, they were additionally entered in both models as predictors. For Research Question 2, the preliminary psychometric properties of the OCD symptom rumination and mental neutralizing scales of the ROCS were explored using three groups of analyses: First, in individuals diagnosed with OCD, the factor structure of OCD symptom severity and mental neutralizing were analyzed separately, using two exploratory factor analyses with principal axis factoring and direct oblimin rotation (where applicable). Second, Pearson's correlation coefficients were calculated for the associations of OCD symptom rumination and mental neutralizing with indicators of convergent and divergent validity for individuals with OCD. Third, analyses of variance and pairwise *t* tests (or Kruskal-Wallis or Mann-Whitney *U* tests, when

assumptions were violated) were used to examine differences between individuals with OCD, those with MDD, and those in the HC group. For pairwise comparisons, we report family-wise error corrected p' values. For Research Question 3, separate analyses of variance were used to assess the interaction effect of form of rumination (abstract vs. concrete) \times time (pre- vs. post-rumination) on anger (Hypothesis 3a), negative affect (Hypothesis 3b), and positive affect (Hypothesis 3c). For more detailed analyses (including analyses of different subscales for Research Questions 1 and 2 and manipulation checks for Research Question 3), see Appendices A–C.

5 Results

5.1 Different forms of rumination in OCD

5.1.1 Association of RST-rumination with OCD symptom severity. When controlling for depressive and anxiety symptom severity and subsamples, RST-rumination was positively associated with the questionnaire measure of OCD symptom severity, $b = 0.10$, $SE_b = 0.03$, $\beta = 0.27$, $p = .004$. However, RST-rumination was not associated with the interview measure of OCD symptom severity after depressive and anxiety symptom severity and subsamples were controlled for, $b = 0.25$, $SE_b = 0.22$, $\beta = 0.14$, $p = .26$.

5.1.2 Preliminary psychometric properties of the ROCS.

In the first exploratory factor analysis for OCD symptom rumination items, a one-factor solution emerged with Cronbach's $\alpha = .88$. Item difficulties were moderate. In the second exploratory factor analysis for the mental neutralizing scale, a three-factor solution emerged, with the first factor labelled *arguing with self* ($\alpha = .83$), the second factor labelled *reconstruction and rituals* ($\alpha = .77$), and the third factor labelled *effort against thought* ($\alpha = .69$). The overall mental neutralizing scale had a high internal consistency ($\alpha = .80$). Again, item difficulties were moderate.

The ROCS OCD symptom rumination scale showed a strong correlation with RST-rumination, $r = .56$, $p < .001$, and a small to moderate correlation with problem solving, $r = .22$, $p = .03$. The ROCS mental neutralizing scale showed moderate to strong positive associations with the total scale of the questionnaire assessing OCD symptom severity, $r = .39$, $p < .001$, and its obsessing subscale, $r = .47$, $p < .001$, and moderate positive associations with depressive, $r = .26$, $p = .01$, and anxiety symptom severity, $r = .37$, $p < .001$.

Group differences emerged for both ROCS scales (OCD symptom rumination: $H(2) = 63.19$, $p < .001$, $\eta^2_H = .30$; mental neutralizing: $F(2, 205) = 21.12$, $p < .001$, $\omega^2 = .16$). Individuals in the OCD group did not differ from those in the MDD group regarding their OCD symptom rumination scores, $t(170) = -1.82$, $p' = .07$, Cohen's $d = 0.28$, but reported higher OCD symptom rumination scores than individuals in the HC group, $U = 218$, $p' < .001$, $d = 2.28$. Regarding the mental neutralizing scale, individuals with OCD had higher scores compared to those in the MDD, $t(171) = -2.35$, $p' = .02$, $d = 0.36$, or HC groups, $t(132) = 6.37$, $p' < .001$, $d = 1.33$.

5.2 Effects of abstract versus concrete rumination about anger on affect

There were moderate to very large main effects of time on each outcome variable, indicating higher anger, $F(1, 118) = 16.53$, $p < .001$, $\eta_p^2 = .12$, and negative affect, $F(1, 118) = 8.72$, $p = .004$, $\eta_p^2 = .07$, and lower positive affect, $F(1, 118) = 120.05$, $p < .001$, $\eta_p^2 = .50$, at post-rumination, compared to pre-rumination.

Crucially, there was no form of rumination \times time interaction for any outcome (anger: $F(1, 118) < 0.001$, $p = .998$, $\eta_p^2 < .001$; negative affect: $F(1, 118) = 1.15$, $p = .29$, $\eta_p^2 = .01$; positive affect: $F(1, 118) = 0.14$, $p = .71$, $\eta_p^2 = .01$), indicating that this change over time occurred irrespective of the form of rumination.

FORMS OF RUMINATION IN OCD AND ANGER

Table 1

Summary of Key Results for Different Forms of Rumination in the Contexts of OCD and Anger

Form of rumination		Key results	
Term	Description	Context	Results
RST-rumination	Repetitive, passive thinking about symptoms of distress, their possible causes and consequences ^a	OCD	RST-rumination is associated with a questionnaire, but not an interview measure of OCD symptom severity, when controlling for depressive and anxiety symptom severity in a sample of individuals diagnosed with OCD.
OCD symptom rumination	Repetitive, passive thinking about symptoms of OCD, their possible causes and consequences ^b		The ROCS assesses OCD symptom rumination with one scale. Preliminary psychometric properties are promising.
Mental neutralizing	Mental actions with aim = prevent /attenuate obsessions and distress associated with obsessions ^c		The ROCS assesses mental neutralizing with three subscales (arguing-with-self; reconstruction-and-rituals; effort-against-thought). Preliminary psychometric properties are promising.
Abstract rumination	General, decontextualized, analytical, evaluative thinking ^d	Anger	There are no differential effects of abstract versus concrete rumination about anger on current anger, negative or positive affect.
Concrete rumination	Specific, contextualized, experiential, less evaluative thinking ^d		

Note. OCD = obsessive-compulsive disorder; ROCS = Rumination on Obsessions and Compulsions Scale; RST-rumination = rumination as defined in the response styles theory.

^a Nolen-Hoeksema et al. (2008). ^b adapted from Nolen-Hoeksema et al. (2008). ^c adapted from Freeston and Ladouceur (1997). ^d Watkins et al. (2008).

6 Discussion

There are multiple forms of rumination, many of which have been shown to contribute to the onset or maintenance of various mental disorders or to exacerbate or prolong negative affect (Nolen-Hoeksema et al., 2008; Watkins, 2008; Watkins & Roberts, 2020). This thesis examines different forms of rumination in OCD and anger. Rumination is highly relevant in both contexts, because treatments targeting maladaptive rumination may reduce symptoms of mental disorders or negative affect both for individuals diagnosed with OCD (Wahl et al., in press) and for individuals experiencing problematic rumination about anger (Moeller et al., 2021). The key results presented in this thesis are summarized in Table 1.

6.1 Different forms of rumination in OCD

In the context of OCD, we first investigated whether RST-rumination was associated with OCD symptom severity when controlling for depressive and anxiety symptom severity (Research Question 1). Our results show that when controlling for depressive and anxiety symptom severity, RST-rumination was associated with a questionnaire, but not an interview measure of OCD symptom severity. Thus, our results support Hypothesis 1 but not Hypothesis 2. The different results for the two measures of OCD symptom severity may be explained by the fact that while the questionnaire focuses on assessing the distress associated with OCD symptoms, the interview measure also assesses the time spent on, interference from, resistance against, and control over OCD symptoms (Abramowitz & Deacon, 2006). It is possible that RST-rumination is particularly associated with the distress associated with OCD symptoms but not with the above mentioned other aspects of OCD symptom severity. Alternatively, the different results for the questionnaire, compared

to the interview, measure of OCD symptom severity may be due to common method bias (Podsakoff et al., 2003).

This thesis also explored preliminary psychometric properties of the ROCS' OCD symptom severity and mental neutralizing scales (Research Question 2). Factor analyses suggested a one-factor structure for OCD symptom rumination, while the mental neutralizing scale could be divided into three subscales we labelled arguing with self, reconstruction and rituals, and effort against thought. All scales and subscales had acceptable or good internal consistencies. The OCD symptom rumination scale showed a strong positive correlation with RST-rumination and a moderate correlation with problem solving, which indicate promising convergent and divergent validity, respectively. The mental neutralizing scale showed moderate to strong positive associations with OCD symptom severity and obsessing, indicating promising convergent validity. It also showed moderate positive associations with depressive and anxiety symptom severity, suggesting acceptable divergent validity. Individuals diagnosed with OCD did not report higher OCD symptom rumination than those in the MDD group, although both groups had higher OCD symptom rumination scores than the HC group. This may indicate a confounded assessment with RST-rumination. Following versions of the ROCS should include changes to eliminate this possibility. For the mental neutralizing scale, individuals with OCD had higher scores than those in the MDD or HC groups, further supporting the scale's validity. In sum, the ROCS' OCD symptom rumination and mental neutralizing scales showed promising reliability and validity. Some changes should be made to subsequent versions of the ROCS, such as rephrasing the OCD symptom rumination scale to remove references to RST-rumination (for additional suggested changes, see Appendix B). Following these changes, further investigations of its psychometric properties, and especially of its overall factor structure, are needed.

6.2 Abstract versus concrete rumination about anger

In the context of anger, we demonstrated that anger and negative affect increased and positive affect decreased from pre- to post-rumination about anger. However, contrary to Hypotheses 3a to 3c, these changes over time emerged irrespective of whether participants ruminated in an abstract or a concrete form. Our results are inconsistent with the processing-mode theory, which predicts differential effects of abstract, compared to concrete rumination, on affect (Watkins, 2008; Watkins et al., 2008). They are also inconsistent with a case study by Moeller et al. (2021), which reported reductions in a patient's anger during RFCBT for problematic anger. However, they are consistent with some previous studies that have also reported comparable effects of abstract versus concrete rumination on affect (e.g., Sanders & Lam, 2010; Watkins & Moulds, 2005; Watkins & Teasdale, 2001). It is possible that effects of abstract versus concrete rumination on affect only emerge under specific circumstances, such as only for individuals with more intense baseline anger or when manipulating abstract versus concrete rumination over a longer period of time. This could explain differences to the study by Moeller et al. (2021; compare baseline state anger in our study: $M = 18.34$, $SD = 7.63$, to a baseline score of 23 in their case study; additionally, their study encompassed a longer timeframe of 25 RFCBT sessions over 10 months). Further studies should examine the effects of abstract versus concrete rumination on affect under such circumstances.

6.3 Strengths and Limitations

The strengths of the present thesis include the fact that it uses samples of individuals diagnosed with OCD to examine different forms of rumination in OCD (Research Questions 1 and 2). This provides additional confidence that our results can be applied to models of OCD and eventually treatment of individuals with OCD. The control of possible confounding variables, achieved by controlling for possible

confounders in multiple regression models (Research Question 1) and by using an experimental design (Research Question 3) is an additional strength of this thesis.

Some limitations of this thesis should also be highlighted. For Research Questions 1 and 2, sample sizes were relatively low, which may have limited our ability to detect small to moderate effects for Research Question 1 and precluded an analysis of the overall factor structure of the ROCS for Research Question 2. For Research Question 3, we may not have elicited enough anger for the effects of abstract versus concrete rumination to emerge, and we only investigated short-term effects of these two forms of rumination. More generally, it is unclear to which extent our results can be generalized to other samples of individuals with OCD, MDD, and no mental disorders (for Research Questions 1 and 2) or to other populations than students or individuals from the community (for Research Question 3).

6.4 Implications

This thesis demonstrated an association of RST-rumination with a questionnaire measure of the distress associated with OCD symptom severity, albeit not with an interview measure of more global OCD symptom severity, when controlling for depressive and anxiety symptom severity in a sample of individuals diagnosed with OCD. We also report promising first psychometric properties of the ROCS, a comprehensive measure of OCD symptom rumination and mental neutralizing which may—depending on the results of further studies with larger samples—be used in future research and treatment of OCD. Our results provide a basis for future experimental or prospective studies examining the mechanisms by which RST- and OCD symptom rumination, mental neutralizing, and OCD symptom severity are associated. Depending on such studies, RST- and/or OCD symptom rumination may possibly emerge as maintaining factors of OCD symptoms (Wahl et al., in press). In this case, future studies should examine the effects of treatments

targeting these forms of rumination in OCD. The role of mental neutralizing in maintaining and exacerbating OCD symptoms is already relatively well-established (e.g., Salkovskis, 1985) and the ROCS may be used to assess it during the treatment of individuals with OCD (e.g., during case formulation).

In the context of anger, our results did not support differential effects of abstract versus concrete rumination about anger on affect. Future studies should investigate these effects further in individuals with higher baseline anger (either by including samples with high trait anger or by eliciting stronger anger) and using longer term assessments of affect. If such studies also yield comparable effects of abstract and concrete rumination about anger on affect, the processing-mode theory and RFCBT for rumination in individuals with problematic anger and anger-related mental disorders (e.g., intermittent explosive disorder, Fernandez & Johnson, 2016) may need to be adapted. Moreover, if future studies examine the effects of RFCBT for RST- and/or OCD symptom rumination in the context of OCD, baseline affect and timeframe of assessment should also be considered in their study designs.

6.5 Conclusion

This thesis extends research on different forms of rumination to the contexts of OCD and anger. Our results add to the still relatively limited literature on RST-rumination and OCD symptom rumination in the context of OCD and demonstrate promising first psychometric properties of the ROCS, a new and comprehensive questionnaire of OCD symptom rumination and mental neutralizing. In the context of anger, we demonstrated comparable effects of abstract and concrete rumination, and further studies should examine under which conditions the processing-mode theory and RFCBT may be applied to rumination about anger. To conclude, the results presented in this thesis provide a basis for further research and possibly treatment of different forms of rumination in the contexts of OCD and anger.

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Appendix A (Manuscript 1)

Is a ruminative thinking style related to obsessive-compulsive symptom severity beyond its associations with depressive and anxiety symptom severity?

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Andrea Ertle, Roselind Lieb, Karina Wahl

Submitted to the *International Journal of Cognitive Therapy*

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Is a ruminative thinking style related to obsessive-compulsive symptom severity beyond its associations with depressive and anxiety symptom severity?

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Acknowledgments: The authors would like to thank Andrea H. Meyer for his assistance in preparing the manuscript.

Funding: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The Swiss National Science Foundation (SNSF) is funding the first author's PhD position. The SNSF was not involved in the research or manuscript preparation.

Conflict of Interest: The authors declare that they have no conflict of interest.

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Abstract

Previous studies suggest that a ruminative thinking style (RTS) is positively associated with the severity of obsessive-compulsive symptoms and might be involved in the maintenance of obsessive-compulsive disorder (OCD). We sought to replicate this association in a sample of individuals with OCD, controlling for depressive and anxiety symptom severity, and to extend previous studies by including an interview measure of obsessive-compulsive symptom severity. A sample of 140 individuals diagnosed with OCD participated in a cross-sectional observational study. Participants completed questionnaire measures of an RTS as well as obsessive-compulsive, depressive, and anxiety symptom severity. Obsessive-compulsive symptom severity was additionally assessed with an interview. When statistically controlling for depressive and anxiety symptom severity, an RTS continued to predict the questionnaire, but not the interview measure of obsessive-compulsive symptom severity. We discuss possible explanations for these mixed findings, emphasizing the unique aspects of each measure, and consider implications for further research on OCD.

Keywords: Rumination (cognitive process); obsessive-compulsive disorder; depression (emotion); anxiety; patients

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Is a Ruminative Thinking Style Related to Obsessive-Compulsive Symptom Severity
Beyond Its Associations With Depressive and Anxiety Symptom Severity?

1 Introduction

Obsessive-compulsive disorder (OCD) is a severely impairing mental disorder with a lifetime prevalence of approximately 1%–3% (American Psychiatric Association, 2013; Fontenelle et al., 2006; Guzick et al., 2017; Lieb et al., 2019). It is characterized by recurrent intrusive and unwanted thoughts (obsessions) that are typically followed by mental acts or observable behaviors (compulsions) aimed at reducing the distress or perceived danger associated with these obsessions (American Psychiatric Association, 2013). Previous studies suggest that a ruminative thinking style (RTS) is positively associated with obsessive-compulsive (OC) symptom severity (e.g., Dar & Iqbal, 2015; Wahl et al., 2011). An RTS has been defined as “a mode of responding to distress that involves repetitively and passively focusing on symptoms of distress and on the possible causes and consequences of these symptoms” (Nolen-Hoeksema et al., 2008, p. 400). This concept originated from the literature on depression and the associations between an RTS and symptoms of depression, and many other mental disorders have been investigated extensively (for overviews, see Ehring & Watkins, 2008; Nolen-Hoeksema et al., 2008).

Multiple studies have supported positive associations of an RTS with OC symptom severity. Between-group comparisons have shown a stronger self-reported RTS in individuals diagnosed with OCD compared to those diagnosed with generalized anxiety disorder (Dar & Iqbal, 2015; however, note that Armstrong, Zald, & Olatunji, 2011, did not find such differences) and those without any diagnosis of an Axis I disorder from the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association, 1994; Armstrong et al., 2011; Koch &

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Exner, 2015). Furthermore, an RTS has been positively associated with OC symptom severity in students and the general population (Grisham & Williams, 2009; Jungmann et al., 2016; Shaw et al., 2017; Wahl et al., 2011) as well as in heterogeneous clinical samples of individuals diagnosed with a variety of mental disorders (e.g., anxiety disorders, depressive disorders, and OCD; Dar & Iqbal, 2015; Raines et al., 2017). Recently, Wei et al. (2020) demonstrated this association in a treatment-receiving sample of adolescents and young adults diagnosed with OCD, although these results should be interpreted with caution due to the study's use of an unvalidated two-item measure of an RTS. Two recent experimental studies have shown an RTS to maintain the urge to neutralize unwanted intrusive thoughts (a subclinical analogue to the urge to perform compulsions in response to unwanted intrusions; Kollárik et al., 2020; Wahl et al., 2019). These experimental studies suggest that an RTS might not only be associated with OC symptom severity but might also contribute to its maintenance. Although this literature provides strong support for a positive association of an RTS and OC symptom severity, no study has so far investigated this association in a sample consisting exclusively of individuals with a diagnosis of OCD using a well-established RTS measure. Replicating these results in such a sample would further strengthen the evidence for this association.

Several cognitive mechanisms that might explain a possible functional relationship between an RTS and obsessive thoughts and compulsions have been proposed. For instance, an RTS may facilitate dysfunctional interpretations of intrusive thoughts (Raines et al., 2017; Wahl et al., 2019) that are seen as central to the development and maintenance of OC symptoms in current models of OCD (e.g., Rachman, 1998). However, the high comorbidity of OCD with depression and anxiety disorders (Baer et al., 2017; Lieb et al., 2019) suggests an alternative explanation for the relationship between an RTS and the severity of OC symptoms: It may be due to

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

both constructs' associations with depressive and anxiety symptom severity. This explanation is supported by both depressive and anxiety symptom severity showing medium to large positive associations with OC symptom severity (e.g., Abramowitz & Deacon, 2006; Clark et al., 2005; Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Tellawi et al., 2016) as well as with an RTS (e.g., Merino et al., 2014; Merino et al., 2016; Nolen-Hoeksema, 2000; Rogers et al., 2019; Treynor et al., 2003; Yang et al., 2014).

If the association between an RTS and OC symptom severity can be accounted for by depressive and anxiety symptom severity, then the association should disappear when these confounders are statistically controlled for. So far, only a few studies have statistically controlled for these variables. Wahl et al. (2011) and Raines et al. (2017) conducted studies on samples of students and individuals diagnosed with various mental disorders, respectively. In these studies, an RTS was positively associated with severity of some, but not all, OC symptoms when controlling for depressive symptom severity or negative affect. Only two studies have reported associations between an RTS and OC symptom severity while controlling for both depressive and anxiety symptom severity at the same time. Grisham and Williams (2009) demonstrated a moderate positive relationship of an RTS with OC symptom severity when controlling for depressive and anxiety symptom severity in a student sample. Shaw et al. (2017) conducted an online study with a sample of individuals who had mostly (83%) not reported previous diagnoses of mental disorders. In their study, only one of the OC symptom subscales, responsibility for harm, showed a small positive association with an RTS after controlling for depressive and anxiety symptom severity. The associations of an RTS with the other three subscales (contamination, symmetry, and unacceptable thoughts) as well as total OC symptom severity were not significant after controlling for these possible

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

confounders. To summarize, although there is conflicting evidence, previous studies have demonstrated associations of an RTS with some, but not all, aspects of OC symptom severity when controlling for depressive and anxiety symptom severity. However, none of the previous studies investigated these associations in a sample of individuals diagnosed with OCD. If they can be replicated with individuals diagnosed with OCD, this may help inform cognitive-behavioral models and optimal treatment of OCD. For example, an RTS may emerge as an additional maladaptive response to OC symptoms that maintains these symptoms in the long term (as suggested by Kollárik et al., 2020; Wahl et al., 2019, in press). If this is the case, therapist and individuals with OCD could work collaboratively on identifying an RTS as a potentially maladaptive response to OC symptoms as part of the case conceptualization in cognitive-behavioral therapy, and this assumption would be tested in later behavioral experiments. Moreover, if an RTS maintains OC symptoms, then eventually cognitive-behavioral therapy could be supplemented by specific interventions that target an RTS, for example, an adapted version of rumination-focused cognitive-behavioral therapy (RFCBT; Watkins, 2016), mindfulness-based cognitive therapy (Külz et al., 2019), or interpretive bias modification (Hirsch et al., 2020).

Additionally, none of the previous studies used the Yale–Brown Obsessive-Compulsive Scale (Y-BOCS; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). The Y-BOCS is an interview measure of OC symptom severity that is generally considered the gold standard (e.g., Grabill et al., 2008). Compared to the Obsessive-Compulsive Inventory—Revised (OCI-R; Foa et al., 2002; used by Grisham & Williams, 2009), which focuses on the distress associated with OC symptoms, the Y-BOCS also measures additional aspects of OC symptom severity, such as interference from or control over OC symptoms (Abramowitz & Deacon, 2006). Furthermore, when an RTS is assessed with a self-report questionnaire, using

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

an interview measure of OC symptom severity has the additional advantage of reducing the possibility that associations with an RTS are due to common method variance (e.g., Podsakoff et al., 2003).

This study aimed to investigate the association of an RTS with OC symptom severity with and without controlling for depressive and anxiety symptom severity in a sample of individuals with OCD. We extended previous studies by using an interview measure (Y-BOCS) in addition to a questionnaire (OCI-R; Foa et al., 2002) to assess OC symptom severity. First, we hypothesized that an RTS would be positively associated with both (1a) a questionnaire and (1b) an interview measure of OC symptom severity. Second, we hypothesized that an RTS would remain positively associated with (2a) the questionnaire and (2b) the interview measure of OC symptom severity after depressive and anxiety symptom severity were accounted for. Additionally, we used exploratory analyses to investigate the associations of an RTS with the subscales of both OC symptom severity measures, with and without controlling for depressive and anxiety symptom severity.

2 Materials and Methods

2.1 Participants and Procedure

All participants were recruited and tested in six inpatient and outpatient clinics in Germany as part of three studies investigating psychological mechanisms in OCD. Therefore, three slightly different subsamples were aggregated in this study. In total, data from $N = 140$ individuals diagnosed with OCD were included. Criteria for all diagnoses in this study were based on the *DSM-IV* (American Psychiatric Association, 1994). Exclusion criteria for all participants were current substance abuse or dependence, current psychotic symptoms, or current suicidal intent. Additionally, in Subsample 1, but not the other subsamples, individuals with

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

diagnoses of major depressive disorder or generalized anxiety disorder within the past 12 months were excluded from study participation.

All participants were tested within the first 2 weeks of treatment. Subsamples 1 and 2 completed identical measures of all variables. Subsample 3 also completed these measures, but no interview measure of OC symptom severity was administered. Experienced clinicians or trained graduate students assessed the participants' OCD and comorbid diagnoses using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; Wittchen et al., 1997). During the same session, they measured OC symptom severity using the Y-BOCS (Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). Furthermore, each participant completed the questionnaires detailed in Section 2.2 during the same session. All participants gave their written informed consent. The participants' demographic and clinical characteristics are presented in Table 1. The three subsamples did not differ with regard to age, $F(2, 134) = 0.33, p = .72$, or gender, $\chi^2(2) = 0.86, p = .65$. Because of the different exclusion criteria for Subsample 1 compared to the other two subsamples, we analyzed current comorbidities of anxiety and major depressive disorders. The subsamples did not differ regarding their levels of current anxiety disorder comorbidities, $\chi^2(2) = 4.28, p = .12$, but they differed with regard to their concurrent comorbidities with major depressive disorder, $\chi^2(2) = 24.20, p < .001$. Regarding RTS, depressive, anxiety, and OC symptom severity, we tested for differences between the subsamples using analyses of variance and Gabriel's post hoc tests or, where their assumptions were violated, Kruskal–Wallis and Games–Howell tests. The subsamples did not differ with regard to the questionnaire measures of OC symptom severity or anxiety symptom severity. However, they showed different levels to which they adopted an RTS and different levels of

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

depressive symptom severity, and they differed in the interview measure of OC symptom severity.

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Table 1

Participant Characteristics of the Total Sample and Subsamples

Variable	Total		Subsample 1		Subsample 2		Subsample 3	
	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>
Female	62.59	139	66.67	42	63.64	55	57.14	42
Current comorbidities								
Major depressive disorder	75.00	140	0 _b	42	43.64 _c	55	25.58 _c	43
Any anxiety disorder ^a	17.27	139	12.20	41	25.45	55	11.63	43
	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>	<i>n</i>
Age (years)	33.74 (11.15)	137	33.08 (10.33)	40	33.35 (11.65)	55	34.90(11.41)	42
RTS (RRS brooding)	12.76 (3.38)	140	11.36 _b (2.99)	42	13.73 _c (3.08)	55	12.91 (3.71)	43
Depressive symptom severity (BDI)	15.95 (9.64)	130	11.08 _b (7.66)	39	17.78 _c (9.99)	55	18.44 _c (9.33)	36
Anxiety symptom severity (BAI)	16.64 (11.22)	132	14.67 (9.09)	42	16.19 (12.43)	54	19.64 (11.24)	36
Questionnaire-measured OC symptom severity (OCI-R total)	29.11 (12.86)	139	27.83 (12.81)	42	28.80 (11.89)	54	30.74 (14.15)	43
Interview-measured OC symptom severity (Y-BOCS total)	24.53 (5.96)	93	22.92 _b (6.24)	40	25.74 _c (5.49)	53		0

Note. Different subscripts indicate differences between groups with $p < .05$. BAI = Beck Anxiety Inventory; BDI = Beck Depression

Inventory; OC = obsessive-compulsive; OCI-R = Obsessive-Compulsive Inventory—Revised; RRS brooding = brooding subscale of the Ruminative Responses Scale; RTS = ruminative thinking style; Y-BOCS = Yale–Brown Obsessive Compulsive Scale.

^a Includes all *DSM-IV* anxiety disorders for Subsamples 1 and 2; includes only panic disorder and/or agoraphobia for Subsample 3 due to technical problems resulting in data loss.

2.2 Materials

2.2.1 RTS assessment. To assess the participants' RTS, we employed the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991; German version by Huffziger & Kühner, 2012). The RRS is a questionnaire measuring typical ruminative responses to dysphoric mood with three subscales (Treyner et al., 2003). We used only the brooding subscale (Treyner et al., 2003) as a measure of an RTS that is not confounded with the assessment of depressive symptoms. The brooding subscale consists of five items and has shown adequate psychometric properties in both its English and German versions (Huffziger & Kühner, 2012; Treyner et al., 2003). In our study, the internal consistency of the brooding subscale was acceptable, with Cronbach's $\alpha = .73$.

2.2.2 Assessment of OC symptom severity. We assessed OC symptom severity in two ways. First, we employed the Obsessive-Compulsive Inventory—Revised (OCI-R; Foa et al., 2002; German version by Gönner et al., 2008), an 18-item questionnaire measuring OC symptom severity during the past month. OC symptom severity is operationalized by the distress caused by OC symptoms (Foa et al., 2002). The questionnaire comprises six subscales: washing, checking, ordering, obsessing, hoarding, and neutralizing. The OCI-R has high reliability and good convergent validity (Foa et al., 2002; Gönner et al., 2008). Although the strength of its associations with measures of depressive symptom severity varies, its discriminant validity is generally acceptable (Abramowitz & Deacon, 2006; Foa et al., 2002; Gönner et al., 2008). In the present study, the OCI-R total score had high internal consistency, with Cronbach's $\alpha = .82$.

Second, we used the Yale–Brown Obsessive Compulsive Scale (Y-BOCS; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989; German version by Hand & Büttner-Westphal, 1991), which is a semistructured interview assessing the

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

severity of OC symptoms during the past week. The Y-BOCS comprises two subscales—obsessions and compulsions—with five items each. In this study, a total score of all 10 items was used to measure obsession and compulsion severity in addition to the two subscales. The Y-BOCS has high reliability (Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989; Jacobsen et al., 2003; Woody et al., 1995) and good convergent validity (Abramowitz et al., 2010; Gönner et al., 2008). However, it can be criticized for its high correlations with measures of depression (Clark et al., 2005; Goodman, Price, Rasmussen, Mazure, Delgado, et al., 1989; Rees et al., 2014). In contrast to the operationalization in the OCI-R, OC symptom severity is operationalized more globally in the Y-BOCS, which measures not only the distress associated with but also the interference from, resistance against, control over, and time spent on obsessions and compulsions (Abramowitz & Deacon, 2006).

2.2.3 Assessment of depressive and anxiety symptom severity. We assessed depressive symptom severity during the past week using the Beck Depression Inventory (BDI; Beck et al., 1961; German version by Hautzinger et al., 1995), which consists of 21 items. Its high reliability and validity have been shown in numerous studies (Beck, Steer, et al., 1988; Hautzinger et al., 1995). In this study, the BDI showed excellent internal consistency, with Cronbach's $\alpha = .90$.

Anxiety symptom severity during the past week was measured using the Beck Anxiety Inventory (BAI; Beck, Brown, et al., 1988; German version by Margraf & Ehlers, 2007), a 21-item questionnaire. The BAI has high reliability and good validity (e.g., Beck et al., 1988; Margraf & Ehlers, 2007). In the present study, its internal consistency was excellent, with Cronbach's $\alpha = .91$.

2.3 Analyses

All analyses were conducted using IBM SPSS Statistics, Version 26.0, and a significance level of $\alpha = 5\%$. We examined the distribution of the main variables

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

using visual inspection of histograms and Q–Q plots as well as tests of normality (Kolmogorov–Smirnov and Shapiro–Wilk). Because the values for the questionnaire measures of OC, depressive, and anxiety symptom severity were nonnormally distributed (see the online supplement for the variables' skew and kurtosis statistics), we applied a square-root transformation to these three variables before regression analyses. After we applied these transformations, the assumptions for all analyses were met. Because the three subsamples differed with regard to RTS, depressive symptom severity, and the interview measure of OC symptom severity, we controlled for subsamples in our analyses, using dummy coding where applicable. We investigated Hypothesis 1a and b by conducting linear regression analyses with an RTS predicting each measure of OC symptom severity and controlling for subsamples. For Hypothesis 2a and b, we extended the regression models to include the predictors depressive and anxiety symptom severity. For comparison with previous studies, we report partial correlation coefficients (*prs*) for the association between each predictor and the outcome in addition to regression coefficients in the regression models. For the exploratory analyses, we repeated the regression models from our Hypotheses 1 and 2 with the subscales of each OC symptom severity measure (except for OCI-R hoarding, because hoarding is classified as a separate disorder in the *DSM-5*; American Psychiatric Association, 2013) as outcomes. Although we also controlled for subsamples in these analyses, for brevity, we do not report statistics for these predictors in the exploratory analyses. As additional information, we report zero-order correlations between the main variables in the online supplement. We checked for univariate outliers using boxplots and scatterplots, and for multivariate outliers using Mahalanobis distance (cut-offs based on Kline, 2016). Two multivariate outliers emerged and closer examination of the participants showed discrepancies on the Y-BOCS, but otherwise the participants'

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

characteristics seemed to fit the target population. We excluded these two participants from all analyses using the Y-BOCS subscales and total scores, and when we repeated the outlier analyses, no multivariate outliers emerged.

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Table 2

RTS and Depressive and Anxiety Symptom Severity Predicting Two Measures of OC Symptom Severity

Variable	Model 1								Model 2									
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>pr</i>	<i>df</i>	<i>p</i>	<i>n</i>	<i>B</i>	<i>SE B</i>	β	<i>pr</i>	<i>t</i>	<i>df</i>	<i>p</i>	<i>n</i>		
Predicting OCI-R total ^a									139									123
Subsample 2	-0.30	0.23	-0.12	-1.30	-.11	135	.196		-0.16	0.23	-0.07	-.06	-0.67	117	.503			
Subsample 3	-0.03	0.24	-0.01	-0.12	-.01	135	.907		-0.08	0.26	-0.03	-.03	-0.32	117	.747			
RRS brooding	0.17	0.03	0.47	5.87	.45	135	< .001		0.10	0.03	0.27	.26	2.93	117	.004			
BDI ^a									0.03	0.10	0.03	.03	0.30	117	.768			
BAI ^a									0.33	0.08	0.38	.34	3.92	117	< .001			
Predicting Y-BOCS total									93									89
Subsamples	-1.58	1.27	-0.13	-1.25	-.13	90	.216		-1.85	1.37	-0.16	-.15	-1.35	84	.181			
RRS brooding	0.53	0.20	0.28	2.63	.27	90	.010		0.25	0.22	0.13	.12	1.10	84	.275			
BDI ^a									0.76	0.68	0.15	.12	1.13	84	.263			
BAI ^a									0.43	0.53	0.10	.09	0.80	84	.425			

Note. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; OC = obsessive-compulsive; Model 1 = regression model

including the predictors for subsamples and RRS brooding; Model 2 = regression model including subsamples, RRS brooding, as well as BDI and BAI; OCI-R = Obsessive-Compulsive Inventory—Revised; *pr* = partial correlation coefficient; RRS brooding = brooding subscale of the Ruminative Responses Scale; RTS = Ruminative Thinking Style; Y-BOCS = Yale–Brown Obsessive Compulsive Scale.

^a Values were square-root transformed prior to analysis.

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Table 3

Exploratory Analyses of the RTS and Depressive and Anxiety Symptom Severity Predicting the OC Symptom Severity Questionnaire Measure Subscales, Controlling for Subsamples

Variable	Model 1					Model 2				
	<i>B</i>	<i>SE B</i>	β	<i>pr</i>	<i>p</i>	<i>B</i>	<i>SE B</i>	β	<i>pr</i>	<i>p</i>
Predicting OCI-R washing ^a										
RRS brooding	0.03	0.02	0.09	.09	.298	-0.01	0.03	-0.05	-.04	.638
BDI ^a						0.16	0.09	0.20	.16	.085
BAI ^a						0.01	0.08	0.01	.01	.914
Predicting OCI-R checking										
RRS brooding	0.32	0.10	0.26	.25	.003	0.21	0.13	0.17	.15	.111
BDI ^a						0.08	0.42	0.02	.02	.843
BAI ^a						0.38	0.34	0.13	.10	.264
Predicting OCI-R ordering ^a										
RRS brooding	0.08	0.02	0.40	.38	< .001	0.06	0.02	0.27	.25	.006
BDI ^a						0.001	0.07	0.001	.001	.990
BAI ^a						0.15	0.05	0.29	.25	.006
Predicting OCI-R obsessing ^b										
RRS brooding	0.08	0.02	0.34	.32	< .001	0.04	0.02	0.18	.18	.053
BDI ^a						-0.06	0.07	-0.09	-.08	.368
BAI ^a						0.28	0.06	0.49	.42	< .001
Predicting OCI-R mental neutralizing ^a										
RRS brooding	0.07	0.02	0.27	.26	.002	0.05	0.03	0.21	.18	.048
BDI ^a						-0.03	0.08	-0.05	-.04	.679
BAI ^a						0.12	0.07	0.20	.16	.072

Note. $n = 140$ for Model 1 (regression model including subsamples and RRS

brooding) and $n = 124$ for Model 2 (regression model including subsamples, RRS

brooding, BDI and BAI), with one participant's values missing for both models using

the ordering subscale. BAI = Beck Anxiety Inventory; BDI = Beck Depression

Inventory; OC = obsessive-compulsive; OCI-R = Obsessive-Compulsive Inventory—

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Revised; pr = partial correlation coefficient; RRS brooding = brooding subscale of the Ruminative Responses Scale; RTS = Ruminative Thinking Style.

^a Values were square-root transformed prior to analysis. ^b Values were reverse score square-root transformed prior to analysis.

Table 4

Exploratory Analyses of the RTS and Depressive and Anxiety Symptom Severity Predicting the OC Symptom Severity Interview Measure Subscales, Controlling for Subsamples

Variable	Model 1					Model 2				
	<i>B</i>	<i>SE B</i>	β	<i>pr</i>	<i>p</i>	<i>B</i>	<i>SE B</i>	β	<i>pr</i>	<i>p</i>
Predicting Y-BOCS obsessions										
RRS brooding	0.32	0.11	0.31	.29	.005	0.15	0.12	0.15	.13	.217
BDI ^a						0.22	0.37	0.08	.06	.566
BAI ^a						0.51	0.29	0.22	.19	.086
Predicting Y-BOCS compulsions										
RRS brooding	0.21	0.11	0.19	.19	.074	0.09	0.13	0.09	.08	.477
BDI ^a						0.55	0.39	0.19	.15	.166
BAI ^a						-0.08	0.31	-0.03	-.03	.787

Note. $n = 93$ for Model 1 (regression model including subsamples and RRS brooding)

and $n = 89$ for Model 2 (regression model including subsamples, RRS brooding, BDI

and BAI). BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; OC =

obsessive-compulsive; pr = partial correlation coefficient; RRS brooding = brooding

subscale of the Ruminative Responses Scale; RTS = Ruminative Thinking Style; Y-

BOCS = Yale-Brown Obsessive-Compulsive Scale.

^a Values were square-root transformed prior to analysis.

3 Results

The RTS showed positive associations with both the questionnaire and the interview measure of OC symptom severity when only subsamples were controlled for (see Model 1 in Table 2). When we additionally controlled for depressive and anxiety symptom severity (see Model 2 in Table 2), the RTS continued to predict the questionnaire-based measure of OC symptom severity. However, the association between the RTS and the interview measure of OC symptom severity was not retained after depressive and anxiety symptom severity were controlled for.

Tables 3 and 4 present exploratory analyses for the associations of the RTS with OCI-R and Y-BOCS subscales. Regarding the OCI-R subscales, exploratory analyses showed that the highest association with an RTS, controlling for depressive and anxiety symptom severity, emerged for ordering (Model 2 in Table 3). The next highest effect size, controlling for depressive and anxiety symptom severity, emerged for OCI-R mental neutralizing. Model 2 for OCI-R obsessing showed a similar effect size to OCI-R mental neutralizing but did not quite reach significance. Regarding the Y-BOCS subscales, exploratory analyses demonstrated that neither the obsessions nor the compulsions subscale remained associated with an RTS when depressive and anxiety symptom severity were controlled for (Model 2 in Table 4).

4 Discussion

The present study investigated the association between an RTS and OC symptom severity, controlling for depressive and anxiety symptom severity, in individuals diagnosed with OCD. Before depressive and anxiety symptom severity were controlled for, the RTS was positively associated with two different measures of OC symptom severity (OCI-R and Y-BOCS, Foa et al., 2002; Goodman, Price, Rasmussen, Mazure, Fleischmann, et al., 1989). These findings replicate those reported in previous studies (Dar & Iqbal, 2015; Grisham & Williams, 2009;

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

Jungmann et al., 2016; Raines et al., 2017; Shaw et al., 2017; Wahl et al., 2011; Wei et al., 2020) in a sample consisting exclusively of individuals diagnosed with OCD.

The effect sizes in our study tended to be lower than those reported by previous studies using similar measures (for the questionnaire measure: $pr = .45$, cf. $r = .58$ in Grisham & Williams, 2009; for the interview measure: $\beta = .28$, cf. $\beta = .55$ in Wei et al., 2020). Our results provide further evidence on the association between an RTS and OC symptoms in the population that is most relevant for potential conceptual and clinical implications.

When statistically controlling for depressive and anxiety symptom severity, the RTS remained positively associated with the questionnaire-based measure of OC symptom severity, supporting Hypothesis 2a. Results for this measure replicate those of previous studies on students and individuals diagnosed with various mental disorders (Grisham & Williams, 2009; Raines et al., 2017; Wahl et al., 2011) in individuals diagnosed with OCD. The effect size in our study ($pr = .25$) is in between those of previous studies using similar covariates ($pr = .34$, Grisham & Williams, 2009; $pr = .12$, Shaw et al., 2017). Exploratory analyses show that the RTS was associated with the ordering and mental neutralizing subscales, but not the other subscales of the questionnaire measure of OC symptom severity when controlling for depressive and anxiety symptom severity. The RTS did not retain an association with the interview measure of OC symptom severity when controlling for depressive and anxiety symptom severity and thus Hypothesis 2b was not supported. Similarly, exploratory analyses show that when depressive and anxiety symptom severity were controlled for, the RTS was not associated with either subscale of the interview measure of OC symptom severity.

If future studies can replicate the results for Hypothesis 2a, this would be consistent with the idea that an RTS and OC symptom severity are related

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

independent of both variables' associations with depressive and anxiety severity. The relation between an RTS and OC symptom severity could be explained by an RTS facilitating dysfunctional appraisals of intrusive thoughts (Raines et al., 2017; Wahl et al., 2019). For instance, thinking about one's obsessions with an RTS (e.g., "why do I, of all people, experience these impulses to stab someone?") may facilitate misinterpretations of these obsessions as disclosing some hidden personal characteristic (e.g., "These impulses must mean that I am a dangerous person"). Such dysfunctional interpretations are a presumed key factor in the development and maintenance of OC symptoms (Rachman, 1998). Alternatively, ruminating on intrusive thoughts might increase the accessibility of these thoughts and thus lead individuals to experience intrusive thoughts more frequently (Grisham & Williams, 2009). Further studies with experimental or prospective designs could allow a closer examination of the underlying mechanisms of how an RTS may affect OC symptoms and vice versa. Ultimately, current cognitive-behavioral models of OCD (e.g., Salkovskis, 1985) may need to be extended by including the role of an RTS in the maintenance of OCD.

Depending on future studies, it might be advisable to include supplemental interventions that directly target an RTS in OCD treatment. Our preliminary exploratory analyses suggest that such interventions may be especially warranted for individuals predominantly experiencing ordering and mental neutralizing symptoms, but further replications are needed. Specific supplemental interventions could include adapted versions of RFCBT that aim, among other things, to interrupt the habitual use of an RTS (Watkins, 2016); mindfulness-based cognitive therapy that increases a nonjudgmental, accepting attitude toward OC symptoms (Kütz et al., 2019); or interpretative bias modification that aims to modify the interpretation of potentially ambiguous situations that can be common starting points for excessive ruminative

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

thinking patterns (Hirsch et al., 2020). For example, some of the components of RFCBT could be applied to an RTS in individuals diagnosed with OCD without any or with only small changes. Using functional analysis and self-monitoring, individuals with OCD could learn to identify situations that result in a strong tendency to adopt an RTS. However, other components of RFCBT might have to be tailored to individuals with OCD: While individuals diagnosed with depression might subsequently work on finding alternative, more helpful behaviors or thoughts to replace an RTS, in individuals with OCD, exposure to the original obsessions would have to be considered as a further, potentially more adaptive alternative.

However, if future studies replicate our results for Hypothesis 2b and fail to demonstrate associations between an RTS and OC symptom severity when controlling for depressive and anxiety symptom severity, it seems likely that the high comorbidity of depression and/or anxiety disorders with OCD (Baer et al., 2017; Lieb et al., 2019) is the main reason that an RTS and OC symptom severity are associated. This high comorbidity reflects the positive associations of OC symptom severity with both depressive and anxiety symptom severity (e.g., Clark et al., 2005; Tellawi et al., 2016). At the same time, the latter two constructs are also positively associated with an RTS (e.g., Merino et al., 2016; Treynor et al., 2003). Thus, depressive and anxiety symptom severity could potentially act as confounders that lead to the association between an RTS and OC symptom severity.

The different findings for the two measures of OC symptom severity might be explained in various ways. First, they might be due to the questionnaire (OCI-R) assessing different aspects of OC symptom severity than the interview (Y-BOCS). The OCI-R assesses only the distress associated with symptoms of OCD, whereas the Y-BOCS measures more global OC symptom severity including the time spent on, interference from, distress of, resistance against, and control over OC symptoms

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

(Abramowitz & Deacon, 2006). Consistent with this idea, previous studies show associations between the OCI-R and Y-BOCS (e.g., $r = .41$, Abramowitz & Deacon, 2006; $r = .45$, Deacon & Abramowitz, 2005; $r = .43$, Gönner et al., 2008) that stay below what might be considered good convergent validity in this context (McGuire et al., 2017). It is possible that an RTS is particularly associated with the distress caused by some OC symptoms but not other aspects such as how time consuming OC symptoms are. This may also explain why after controlling for depressive and anxiety symptom severity, Grisham and Williams (2009) reported an association of an RTS with the OCI-R while Shaw et al. (2017) did not find an RTS to be related to the overall score of the Dimensional Obsessive-Compulsive Scale (DOCS; Abramowitz et al., 2010). Similar to the Y-BOCS, the DOCS assesses OC symptom severity more globally. Alternatively, the variance of the OCI-R explained by the RTS could have been at least partly caused by common method variance (e.g., Podsakoff et al., 2003) because these variables were both measured using questionnaires, whereas the Y-BOCS is an interview measure. Future studies should investigate whether these associations are retained when OC symptom severity is assessed using different measures. For instance, comparing the association of an RTS with scores on the DOCS to associations of an RTS with scores on the OCI-R and Y-BOCS may illuminate possible reasons for the differing results in our study further.

Limitations of the present study include the fact that our sample for analyzing the association of an RTS with the interview measure of OC symptom severity was relatively small, which may have limited our power to detect small to medium associations. Furthermore, on average, participants in our study had lower comorbidities (Baer et al., 2017; Quarantini et al., 2011; Torres et al., 2006) and lower scores on the measure of depressive symptom severity (cf. Clayton et al., 1999; MacDonald et al., 1999) than have previously been reported for other OCD

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

samples. This means that our study's results may not be transferable to those of other samples of individuals diagnosed with OCD. Future studies should investigate whether our results can be replicated with different and larger samples of individuals diagnosed with OCD.

To conclude, our study revealed that in individuals diagnosed with OCD, an RTS was associated with a questionnaire-based but not an interview-based measure of OC symptom severity after controlling for depressive and anxiety symptom severity. Further studies should investigate more closely the nature of the relationship of an RTS with the distress associated with OC symptoms and also target the diverging results of the questionnaire and the interview measure of OC symptom severity. Ultimately, psychological treatments of OCD may be supplemented by interventions that specifically target an RTS, as RFCBT (Watkins, 2016) does in the context of major depressive disorder.

RUMINATIVE THINKING STYLE AND OBSESSIVE-COMPULSIVE SYMPTOMS

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Appendix B (Manuscript 2)

Development and preliminary psychometric properties of the Ruminative Thoughts Scale (ROCS)
Obsessions and Compulsions Scale (ROCS)

Carlotta V. Heinzl, Roselind Lieb, Martin Kollárik, Andreas Kordon, Karina Wahl

Published in the *Journal of Obsessive-Compulsive and Related Disorders*



ELSEVIER

Contents lists available at ScienceDirect

Journal of Obsessive-Compulsive and Related Disorders

journal homepage: www.elsevier.com/locate/jocrd

Development and preliminary psychometric properties of the Rumination on Obsessions and Compulsions Scale (ROCS)

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ARTICLE INFO

Keywords:

OCD (Obsessive-compulsive disorder)
Measurement
Compulsions
Rumination
Cognition

ABSTRACT

Individuals with obsessive-compulsive disorder (OCD) use various strategies in response to their symptoms. We present the development of the Rumination on Obsessions and Compulsions Scale (ROCS), a 30-item questionnaire assessing mental neutralizing, OCD symptom rumination, and, additionally, acceptance, using three scales. We provide preliminary evidence for each scale's factor structure, the scales' intercorrelations, and correlations with scales measuring depressive, anxiety, and obsessive-compulsive symptom severity and depressive rumination in individuals with OCD ($n = 99$). Additionally, we investigate differences on the ROCS between individuals with OCD, individuals with major depressive disorder ($n = 74$), and individuals without mental disorders ($n = 35$). We found preliminary support for three mental neutralizing subscales and one-factor solutions for OCD symptom rumination and acceptance. Reliability and first indicators of convergent validity of mental neutralizing were good; one mental neutralizing subscale particularly overlapped with depressive and anxiety symptom severity. We propose adaptations to improve the scale's psychometric properties. Our results additionally provide first indications that the ROCS assesses OCD symptom rumination and acceptance reliably and validly and that future research can use these scales with small or no adaptations. Future studies should investigate factor structure and psychometric properties in large samples of individuals with OCD.

1. Introduction

Obsessive-compulsive disorder (OCD) is a chronic and highly impairing mental disorder which affects approximately 1–3% of all individuals at some point within their lifetime (American Psychiatric Association, 2013; Guzik et al., 2017; Lieb, Hofer, & Wahl, 2019). OCD is characterized by the experience of obsessions, intrusive and anxiety-provoking thoughts, images, or urges, that are typically followed by compulsions, repetitive behaviors that a person feels compelled to perform with the aim of reducing the perceived danger or the distress associated with the obsessions (American Psychiatric Association, 2013). Individuals diagnosed with OCD are typically characterized by a variety of repetitive mental processes, which are often subsumed in the generic term rumination (e.g., Clark & del Palacio González, 2014; Rachman, 1971; Salkovskis, Forrester, & Richards, 1998). In this study, we present the development and preliminary psychometric properties of a questionnaire used to assess two forms of rumination in OCD: First, mental neutralizing, which can be seen as OCD-inherent rumination;

and second, a broader, more general form of rumination, that is, rumination about one's OCD symptoms and their causes and consequences. Additionally, the questionnaire includes a scale to assess an accepting approach to obsessions, as a more adaptive strategy.

According to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013), compulsions can be observable behaviors (e.g., washing one's hands), but also mental behaviors such as repeating words mentally or counting. Studies have shown that up to 80% of individuals diagnosed with OCD perform some type of mental action in order to counter the supposedly threatening consequences or the distress related to their obsessions (e.g., de la Cruz et al., 2013; Foa & Kozak, 1995; Sibrava, Boisseau, Mancebo, Eisen, & Rasmussen, 2011). Previous literature has used various different terms for these mental responses to obsessions, such as covert compulsions (de Silva, Menzies, & Shafran, 2003) or obsessive rumination (Wahl, Ertle, Bohne, Zurowski, & Kordon, 2011). For the purposes of this study, we use the term *mental neutralizing* to describe any intentional mental action a person performs in order to prevent or

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<https://doi.org/10.1016/j.jocrd.2020.100554>

Received 17 December 2019; Received in revised form 29 May 2020; Accepted 5 June 2020

Available online 27 June 2020

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attenuate their obsessions or the distress associated with them (adapted from Freeston & Ladouceur, 1997, p. 344). In cognitive-behavioral models of OCD, mental neutralizing maintains or exacerbates obsessive-compulsive symptoms by preventing a person from reassessing the dysfunctional appraisals and beliefs they have (e.g., Rachman, 1997; Salkovskis, 1985). Mental neutralizing can take various forms. Some of the most common are replacing the obsession with another thought (e.g., bringing to mind positive images of relatives or friends), engaging in rigid mental rituals such as silently repeating prayers in a particular manner or performing counting rituals, or elaborate mental reconstructions of previous situations in order to make sure that nothing terrible has happened (e.g., de Silva et al., 2003; Freeston & Ladouceur, 1997; Gillihan, Williams, Malcoun, Yadin, & Foa, 2012; Purdon & Clark, 1993; Radomsky & Alcolado, 2010; Reuman, Blakey, Jacoby, & Abramowitz, 2017).

A reliable and valid measure of mental neutralizing is highly relevant to both therapy and research. Cognitive-behavioral therapy that includes exposure and response prevention is recommended as the first choice for treatment of OCD (e.g., Koran & Simpson, 2013; National Institute for Health and Care Excellence, 2005). For the exposure to be most effective, all forms of ritualizing, including all possible mental neutralizing variations, should be prevented (Abramowitz, 1996). Therefore, identifying mental neutralizing strategies in advance of the exposure exercises is crucial. This will help individuals with OCD be aware of their mental neutralizing strategies and refrain from performing them during the exposure exercise. Additionally, the identification (and prevention) of mental neutralizing will help therapists and their clients put behavioral experiments into practice that test maladaptive beliefs. However, because forms of mental neutralizing are not usually observable to the therapist, they can be challenging to identify in therapy (Pence, Sulkowski, Jordan, & Storch, 2010; Reuman et al., 2017; Williams et al., 2011). Additionally, previous research on OCD has been criticized for focusing too much on behavioral forms of neutralizing at the expense of mental neutralizing (Belloch, Carrio, Cabedo, & Garcia-Soriano, 2015). An economical method of assessing mental neutralizing validly and reliably is a prerequisite to expanding research in this area. Existing questionnaires used to measure mental neutralizing (e.g., the Cognitive Intrusions Questionnaire, CIQ; Freeston, Ladouceur, Thibodeau, & Gagnon, 1991; or the Revised Obsessional Intrusions Inventory, ROI; Purdon & Clark, 1994b) focus on only some forms of mental neutralizing and exclude others, such as detailed mental reconstructions of previous situations. Furthermore, the forms of mental neutralizing they assess are often measured using only one item with unclear psychometric properties. A comprehensive, reliable and valid measure of mental neutralizing would be valuable for OCD therapy and research.

Apart from mental neutralizing, there are indications that individuals with OCD also often experience a more general form of rumination about their obsessive-compulsive symptoms and their causes and consequences. Rumination has been defined as “a mode of responding to distress that involves repetitively and passively focusing on symptoms of distress and on the possible causes and consequences of these symptoms” (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008, p. 400). Research has shown that levels of symptom rumination are positively associated with OCD symptom severity (e.g., Grisham & Williams, 2009; Raines, Vidaurri, Portero, & Schmidt, 2017; Wahl et al., 2011). Furthermore, Wahl, van den Hout, and Lieb (2019) showed that the experimental induction of rumination on unwanted intrusive thoughts (i.e., thoughts similar to clinical obsessions) attenuated the general reduction of the urge to neutralize these thoughts. These studies suggest that rumination might contribute to the maintenance of obsessive-compulsive symptoms. Several mechanisms might underlie the potential maintaining effect. For instance, by ruminating about the causes, consequences and particularly about the meaning of obsessions, people might further consolidate their dysfunctional appraisals of obsessions. In turn, these intensified dysfunctional appraisals might

maintain the urge to perform compulsions (Wahl, Ehring, et al., 2019; however, note that Kollárik, Heinzl, Hofer, Lieb, & Wahl, 2020, did not find evidence to support this) or increase the frequency of intrusive thoughts (Raines et al., 2017). Alternatively, rumination has been shown to maintain or increase negative mood (for overviews, see, e.g., Nolen-Hoeksema et al., 2008; Thomsen, 2006; Watkins, 2008), and negative mood might in turn increase the frequency of unwanted intrusive thoughts (Freeston, Ladouceur, Provencher, & Blais, 1995). Grisham and Williams (2009) proposed a third possible mechanism: that rumination may increase the accessibility of unwanted intrusive thoughts through increased spreading of activation in the mental network.

For the purposes of our study and new questionnaire, we aim to address a form of rumination which is specific to OCD. Therefore, we modify the original definition of rumination by Nolen-Hoeksema (1991) to define *OCD symptom rumination* as cognitive processes involving the repetitive and passive focusing on one's obsessive-compulsive symptoms, their possible causes and consequences. Its focus on OCD symptoms differs from the traditional focus on symptoms of distress and depressive symptoms (cf. Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008). An example of OCD symptom rumination illustrates this: A person with contamination-related obsessions might repetitively think, “Why do I always go back to washing my hands when I know I could deal with these thoughts in a better way?” or “Why can I not get rid of these thoughts?” or “What if these thoughts persist?”.

To our knowledge, no measure of OCD symptom rumination has been developed yet. Although some questionnaires measure repetitive negative thinking, which includes rumination, across different disorders (e.g., the Perseverative Thinking Questionnaire; Ehring et al., 2011), they might not be sensitive enough to detect rumination about OCD symptoms. Because OCD is highly comorbid with other mental disorders (e.g., depressive disorders; Adam, Meinschmidt, Gloster, & Lieb, 2012; Brakoulias et al., 2017; Ruscio, Stein, Chiu, & Kessler, 2010), these questionnaires may confound OCD symptom rumination with depressive rumination or other similar constructs. Therefore, a measure which allows the specific assessment of rumination about symptoms of OCD, but not other (e.g., depressive) symptoms, is relevant to research and treatment of OCD.

In a questionnaire used to measure responses to obsessive-compulsive symptoms, it will be useful not only to assess maladaptive strategies, but also more adaptive ones, such as the acceptance of obsessions. A more accepting response to obsessions or the anxiety associated with them is the implicit or explicit aim in the majority of evidence-based treatments of OCD (e.g., cognitive behavioral therapy, Bream, Challacombe, Palmer, & Salkovskis, 2017; acceptance and commitment therapy, Twohig, 2009). There are various definitions for acceptance which differ among theoretical frameworks (McAndrews, Richardson, & Stopa, 2019). For the purposes of this study, we define acceptance as “genuinely being open to having [obsessions or anxiety] for as long as they occur—without attempting to change them” (Twohig et al., 2015, p. 167). A number of questionnaires have been developed to assess different forms of acceptance (McAndrews et al., 2019) and Jacoby, Abramowitz, Buchholz, Reuman, and Blakey (2018) have developed an OCD-specific measure of experiential avoidance which can be seen as a process opposed to acceptance (McAndrews et al., 2019). However, to date there is no measure of acceptance that is specific to OCD.

To summarize, literature suggests that individuals with OCD may use mental neutralizing, OCD symptom rumination, and/or acceptance in response to their obsessive-compulsive symptoms. We assume that these three constructs differ on at least three dimensions. First, we propose that mental neutralizing differs from OCD symptom rumination and acceptance in its degree of corresponding content. The content of mental neutralizing often closely corresponds to the content of the specific obsession the person experiences in this situation. For instance, a person may respond to the obsession “I will inadvertently infect others with dangerous germs” by repeatedly thinking “the chances that

this will happen are very low". On the other hand, OCD symptom rumination and acceptance thoughts are more general. Second, we assume that both mental neutralizing and acceptance differ from OCD symptom rumination in their timing. Both mental neutralizing and acceptance are immediate responses to one's obsessions, whereas OCD symptom rumination does not necessarily follow immediately after the occurrence of obsessions. Last, we propose that the functional relationship of mental neutralizing and acceptance differ in that mental neutralizing is aimed at reducing the anxiety caused by obsessions (American Psychiatric Association, 2013), whereas acceptance is aimed at the explicit experience of this anxiety (Twohig et al., 2015). It is unclear whether OCD symptom rumination serves to reduce anxiety in the short term. To conclude, we assume that mental neutralizing, OCD symptom rumination, and acceptance are three conceptually different responses to obsessive-compulsive symptoms, although they may also share similarities.

The aim of the present study was to develop an economical questionnaire (the Rumination on Obsessions and Compulsions Scale, ROCS) that assesses two forms of rumination (mental neutralizing and OCD symptom rumination) as well as acceptance, in response to obsessive-compulsive symptoms, in a reliable and valid way. We set up the item pool and scales, explored the scales' structure and item descriptive statistics, investigated the ROCS scales' intercorrelations and correlations with clinical scales, and compared the ROCS scores between individuals with OCD, major depressive disorder (MDD), and healthy controls (HC). With these preliminary investigations, we aim to provide first indicators of psychometric properties for the ROCS.

2. Material and methods

2.1. Participants and procedure

The study sample included $N = 208$ individuals. Participants with diagnoses of mental disorders were recruited in two inpatient clinics in Germany that specialize in the treatment of OCD. Additionally, individuals without any mental disorders were recruited using advertisements in multiple newspapers as well as on a university website. The Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; Wittchen, Wunderlich, Gruschwitz, & Zaudig, 1997) was conducted by experienced psychologists, psychiatrists, or well-trained graduate students in order to assess the current diagnoses of all participants with mental disorders, according to the Diagnostic and Statistical Manual of Mental Disorders, 4th ed. (DSM-IV; American Psychiatric Association, 1994). Subsequently, participants were asked to complete the questionnaires used in this study. Out of the total sample, $n = 99$ individuals were diagnosed with current DSM-IV-OCD, $n = 74$ participants with current DSM-IV-MDD, and $n = 35$ participants did not report indications of any current or lifetime DSM-IV-mental disorder (judged using the SCID-I screening form) and formed the healthy control group (HC). For the OCD- and MDD-groups, current comorbid disorders were allowed but all individuals with diagnoses of both OCD and MDD were categorized into the OCD group. Participants with current psychotic symptoms, substance abuse or dependence, or suicidal intent were excluded. Demographic and clinical characteristics of all participants are presented in Table 1. This table also shows differences between groups on age, numbers of comorbidities (of depressive as well as other mental disorders), and measures of obsessive-compulsive, depressive, and anxiety symptom severity as well as rumination and cognitive problem solving. These group comparisons were calculated using ANOVAs, Kruskal–Wallis, or chi-square goodness-of-fit tests, which were followed by pairwise comparisons using separate family-wise error corrections for each variable. Informed consent was obtained from all participants and the study was covered by an ethics vote of the University of Lübeck.

2.2. Rumination on Obsessions and Compulsions Scale (ROCS) development

The ROCS was developed on the basis of theoretical considerations as well as clinical experiences with individuals with OCD. The English translation of the ROCS is presented in the appendix; the German version which was used in this study is available as an online supplement¹. The ROCS was constructed to assess mental neutralizing, OCD symptom rumination, and acceptance. The first section (Items 1 to 19) assesses immediate responses to obsessions, that is, mental neutralizing and acceptance. The mental neutralizing scale was developed on the basis of previously identified aspects of mental neutralizing (Freeston et al., 1995; Freeston et al., 1991; Ladouceur et al., 2000; Purdon & Clark, 1994a, 1994b), supplemented by clinical experiences of work with individuals diagnosed with OCD of two authors. On this basis, three items each were developed to measure five theoretically derived aspects of mental neutralizing: arguing with self (e.g., "I argue with myself until I am convinced that nothing terrible will happen"); mental reconstruction (e.g., "The upsetting thought bothers me until I have mentally reconstructed all important situations of the day"); mental rituals (e.g., "I feel compelled to think in a particular order"); replacing the thought with another thought (e.g., "have to think a 'good' thought again and again in order to neutralize the upsetting thought"); and thought stopping (e.g., "I try to suppress the thought"). Four items were developed for the acceptance scale (e.g., "I take the thought just as it is, without judging it") based on the clinical experiences of two authors as well as strategies identified in previous research (Freeston et al., 1991; Purdon & Clark, 1994a). The second section of the ROCS (Items 20 to 30) assesses OCD symptom rumination. It includes items which are loosely based on the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991) and modified to specifically target OCD symptoms, as well as items based on the clinical experiences of two authors.

Thus, the structure of the ROCS has two levels: On the first level, mental neutralizing, OCD symptom rumination, and acceptance are conceptualized as three distinct but interconnected forms of responding to OCD symptoms. For clarity, we use the term *scale* in reference to the assessment of these three constructs. On a second level, mental neutralizing is further partitioned into five different aspects (arguing with self, mental reconstruction, mental rituals, replacing the thought with another thought, and thought stopping). We will refer to these aspects as *subscales*.

After the first draft of the ROCS was completed, $n = 12$ individuals diagnosed with DSM-IV-OCD (assessed using the SCID-I) and $n = 12$ CBT therapists experienced in the treatment of individuals with OCD were asked to read through the ROCS, indicate when sections were not easily comprehensible, and suggest adaptations to improve these sections. A few items were found to be phrased ambiguously and subsequently adapted to increase clarity.

2.3. Other measures

2.3.1. Beck Depression Inventory (BDI)

The BDI (Beck, Erbaugh, Ward, Mock, & Mendelsohn, 1961; German version by Hautzinger, Bailer, Worall, & Keller, 1995) is a 21-item questionnaire which measures self-reported depressive symptom severity during the past week. Multiple studies have supported its high reliability and validity (e.g., Beck, Steer, & Garbin, 1988; Hautzinger

¹ The ROCS is free to adapt and reuse under this article's CC BY 4.0 license (<https://creativecommons.org/licenses/by/4.0/>) and we encourage all researchers to use either the English or the German version in their own studies. If you use the ROCS in your research, please contact the corresponding author (KW); we have further information on more recent versions of the questionnaire and are also very interested in possible collaborations.

Table 1
Demographics and Clinical Characteristics per Group.

Variable	OCD (<i>n</i> = 99 ^d)	MDD (<i>n</i> = 74 ^e)	HC (<i>n</i> = 35)
	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Female	64 (64.65)	44 (59.45)	16 (45.71)
Current comorbid depressive disorder	27 ^a (27.55)	— ^b	— ^b
1 or more current comorbid mental disorder	38 ^a (38.38)	21 ^a (28.38)	— ^b
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Age (years)	32.89 ^a (11.36)	47.08 ^b (11.15)	40.49 ^c (11.14)
Obsessive-compulsive symptom severity (OCI-R)	28.63 ^a (12.31)	20.53 ^b (11.49)	8.26 ^c (6.56)
Rumination (RRS brooding)	12.72 ^a (3.27)	13.33 ^a (3.37)	8.11 ^b (2.27)
Cognitive problem solving (RRS reflection)	10.10 ^a (3.27)	12.10 ^b (2.87)	8.89 ^a (3.13)
Depressive symptom severity (BDI)	15.02 ^a (9.49)	24.02 ^b (12.16)	3.31 ^c (3.13)
Anxiety symptom severity (BAI)	15.82 ^a (10.97)	20.17 ^b (12.79)	3.72 ^c (5.04)

Note. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; HC = healthy control group; MDD = major depressive disorder; OCD = obsessive-compulsive disorder; OCI-R = Obsessive-Compulsive Inventory-Revised; RRS = Ruminative Responses Scale.

^a, ^b, ^cDifferent subscripts indicate differences between groups with two-tailed $p < .05$ after Holm correction for family-wise error rate.

^dfor both current comorbid disorders and age, one value was missing.

^efor both rumination and cognitive problem solving, two values were missing.

et al., 1995). In the present study, the internal consistency of the BDI was excellent, Cronbach's $\alpha = .94$.

2.3.2. Beck Anxiety Inventory (BAI)

The BAI (Beck, Brown, Epstein, & Steer, 1988; German version by Margraf & Ehlers, 2007) is a questionnaire which uses 21 items to assess anxiety symptom severity during the past week. It has shown high reliability and validity (Bardhoshi, Duncan, & Erford, 2016; Margraf & Ehlers, 2007). For our sample, the internal consistency of the BAI was excellent, Cronbach's $\alpha = .93$.

2.3.3. Obsessive-Compulsive Inventory-Revised (OCI-R)

The OCI-R (Foa et al., 2002; German version by Gönner, Leonhart, & Ecker, 2008) is a questionnaire measuring obsessive-compulsive symptom severity during the past month. Its 18 items measure the distress associated with obsessive-compulsive symptoms using six subscales: washing, checking, ordering, obsessing, hoarding, and mental neutralizing. The OCI-R has shown high reliability and adequate to high validity (Foa et al., 2002; Gönner et al., 2008). In this study, its internal consistency was high, Cronbach's $\alpha = .88$.

2.3.4. Ruminative Responses Scale (RRS)

The RRS (Nolen-Hoeksema & Morrow, 1991; German version by Kühner & Weber (1999) is a questionnaire which assesses habitual ruminative responses to dysphoric mood. Treynor, Gonzalez, and Nolen-Hoeksema (2003) have proposed three subscales for the RRS: brooding (i.e., measuring maladaptive ruminative responses to distress in general); reflection (i.e., an adaptive, purposeful form of cognitive problem solving); and depression-related rumination (i.e., measuring ruminative responses to specific depressive symptoms). In this study, we present only the results for the brooding and reflection subscales, which include five items each. The two subscales have shown adequate reliability and validity (Huffziger & Kühner, 2012; Treynor et al., 2003). In the present study, the internal consistencies for both subscales were high, Cronbach's $\alpha = .78$ for brooding and $\alpha = .75$ for reflection.

2.4. Analyses

We conducted all analyses using IBM SPSS Statistics, Version 25.0. Some (7.84%) of the participants' responses on items were missing either completely at random or missing at random. Therefore, we calculated (sub)scale scores based on participant means across available items (Newman, 2014). We calculated all ROCS scales and subscales as

mean scores and the other scales used in this study as sum scores. For a preliminary investigation of each scale's structure, we analyzed the items of each scale (mental neutralizing, OCD symptom rumination, and acceptance) separately, using exploratory factor analyses (EFAs) with principal axis factoring. Inter-item correlation matrices corresponding to each EFA can be found as Online Supplemental Tables 1–3. Sampling adequacy (Kaiser-Meyer-Olkin measures were greater than .72) and sphericity (assessed with Bartlett's test) could be assumed for all EFAs. We used parallel analysis (O'Connor, 2000), supplemented by Kaiser's criterion (Kaiser, 1960) and the scree plot (Cattell, 1966) to determine the number of retained factors in each EFA, and interpreted factor loadings as excellent ($\geq .71$), very good ($\geq .63$), good ($\geq .55$), fair ($\geq .45$), or poor ($\geq .32$), based on Comrey & Lee, 1992, p. 243). When more than one factor was extracted, we used direct oblimin rotation because we expected the factors to be correlated. Our decisions on which factor we allocated items to were based on a stepwise procedure using three criteria. First, we allocated all items which had one factor loading at $\geq .45$ (i.e., fair) and no loadings on other factors at $\geq .32$ (i.e., poor) to the factor with their highest loading (Criterion a). Items which could not be allocated using this criterion were interpreted as cross-loading on multiple factors. Because of the limited number of items available and the exploratory nature of our study, we decided not to drop these items but rather to allocate them according to theoretical criteria and the number of items per factor and to interpret them cautiously. Specifically, cross-loading items were allocated to the same factor as the other items from their originally proposed mental neutralizing aspect (Criterion b). Last, for the remaining items we allocated so that each factor represented an approximately similar number of items (Criterion c). We calculated corrected item-total correlation coefficients (CITCs; interpretation based on a cutoff of .3, see Field, 2014) using the mental neutralizing subscales, OCD symptom rumination scale, or acceptance scale as a measure of item discrimination. Additionally, we analyzed item difficulties as described in Reynolds and Livingston (2014).

We explored first indications of convergent and divergent validity by calculating Pearson's correlation coefficients pairwise between the scales (and subscales) of the ROCS and clinical variables, namely depressive, anxiety, and obsessive-compulsive symptom severity, as well as habitual rumination. We interpreted the correlation coefficients in line with Cohen (1988) as small ($r = .10$), medium ($r = .30$), or large ($r = .50$). We restricted the analysis of factor structure, intercorrelations, and correlations with clinical scales to individuals with OCD ($n = 99$) because this is the main target population of the ROCS. Last,

Table 2
Exploratory Factor Analysis of Mental Neutralizing Items in OCD Sample.

Item and original allocation to neutralizing aspects							AS	RR	ET	h^2
	<i>M</i> (<i>SD</i>)	Skewness	Kurtosis	<i>P</i>	CITC	Rotated Factor Loadings				
<i>Arguing with self</i>										
15. list arguments that could counter the thought	2.12 (1.35)	−0.25	−1.01	.53	.74	.84	.22	.03	0.76	
8. argue with myself	1.91 (1.31)	0.12	−1.03	.48	.70	.71	.24	.04	0.57	
2. list arguments that refute the thought	2.18 (1.34)	−0.29	−1.01	.55	.59	.66	.03	−.01	0.43	
<i>Mental reconstruction</i>										
12. mentally reconstruct important situations of the day	1.45 (1.43)	0.53	−1.05	.36	.58	.25	.78	−.04	0.64	
4. mentally reconstruct my actions	2.34 (1.49)	−0.36	−1.27	.59	.61	.18	.75	−.04	0.57	
17. think it through again and again	2.52 (1.31)	−0.67	−0.58	.63	.51	.13	.48	.19	0.33	
<i>Mental rituals</i>										
11. think in a particular order	0.86 (1.32)	1.39	0.54	.21	.60	−.23	.49	.48	0.58	
3. perform a mental ritual	1.61 (1.48)	0.35	−1.32	.40	.54	−.15	.38	.52	0.48	
7. count mentally	0.71 (1.26)	1.63	1.28	.18	.22	−.33	.26	.13	0.20	
<i>Replacing the thought with another thought</i>										
5. think a “good” thought in order to neutralize	1.18 (1.35)	0.68	−0.96	.29	.47	−.07	−.05	.72	0.48	
10. think a positive “counter-thought”	1.56 (1.42)	0.37	−1.24	.39	.53	.20	−.03	.67	0.55	
19. counter it with a certain image	1.82 (1.27)	0.05	−0.94	.45	.58	.62	.17	.20	0.53	
<i>Thought stopping</i>										
14. put effort into not having the thought anymore	1.80 (1.28)	0.16	−1.04	.45	.56	.19	−.01	.55	0.40	
1. suppress the thought	2.38 (1.14)	−0.34	−0.67	.60	.39	.36	−.29	.31	0.35	
18. say “stop” to myself	1.28 (1.17)	0.56	−0.64	.32	.27	.29	−.29	.18	0.22	
% Variance explained						28.72	17.17	11.12		

Note. $N = 95$. Factor loadings $\geq .45$ are boldfaced. Factor loadings of the factors each item is associated with, based on loadings and theoretical considerations, are underlined. AS = arguing-with-self subscale; CITC = corrected item-total correlation; ET = effort-against-thought subscale, h^2 = communality coefficient; P = Item difficulty index; RR = reconstruction-and-rituals subscale.

we investigated whether the ROCS (sub)scales differed between groups (OCD, MDD, and HC) using analyses of variance and pairwise t tests or, when assumptions were violated, Kruskal–Wallis, and Mann–Whitney U tests. For the effect sizes of these tests, we used ω^2 or η^2_H (Tomczak & Tomczak, 2014).

3. Results

3.1. Factor structure and item descriptive statistics

3.1.1. Mental neutralizing items

Table 2 displays the results of an EFA and item descriptive statistics for the ROCS mental neutralizing items in the OCD sample. Four factors had eigenvalues greater than 1.0, but the fourth factor's eigenvalue was only slightly above this cutoff score (1.004) and parallel analysis as well as the scree plot supported a three-factor solution. Therefore, we retained three factors. The final factor solution, based on the criteria described in Section 2.4, is shown in Table 2 by underlined loadings. We labelled the factors *arguing with self* (three items from the originally proposed arguing-with-self aspect as well as Item 19 from replacing the thought with another thought), *reconstruction and rituals* (three items each from mental reconstruction and mental rituals), and *effort against thought* (two items from replacing the thought with another thought as well as three items from thought stopping). Five items showed cross-loadings and were allocated to *reconstruction and rituals* (Items 3, 7, and 11) and *effort against thought* (Items 1 and 18) according to Criteria b and c (see Section 2.4). The internal consistencies of the mental neutralizing subscales were acceptable to high in the OCD sample (total mental neutralizing: Cronbach's $\alpha = .80$, arguing with self: $\alpha = .83$, reconstruction and rituals: $\alpha = .77$, effort against thought: $\alpha = .69$). Only the exclusion of Items 7 or 18 slightly increased their subscales' internal consistencies (to $\alpha = .80$ or $\alpha = .70$, respectively). These items also had low factor loadings and lower communalities than the other items ($h^2 = 0.20$ and $h^2 = 0.22$, respectively).

The mental neutralizing items had moderate difficulties, ranging from $P = .18$ ($M = 0.71$) for Item 7 as the most difficult item to $P = .63$ ($M = 2.52$) for item 17 as the least difficult item. Item 7 also showed the largest skew and kurtosis (1.63 and 1.28, respectively). The

corrected item-total correlations ranged from .22 (Item 7) to .74 (Item 15). Items 7 and 18 showed corrected item-total correlations below the recommended cutoff of .3.

3.1.2. OCD symptom rumination items

Table 3 displays an EFA and item descriptive statistics for the OCD symptom rumination scale. In the EFA, parallel analysis and the scree plot supported retaining one factor, although three factors yielded eigenvalues greater than Kaiser's criterion of 1. Therefore, we chose a one-factor solution for the OCD symptom rumination scale. All items had fair to excellent loadings on this scale, with more than half of them equal to or greater than .63 (i.e., very good or excellent). The OCD symptom rumination scale showed very high internal consistency (Cronbach's $\alpha = .88$) which could not be increased by the exclusion of any item.

Item difficulties were moderate, ranging from $P = .38$ ($M = 1.54$) for Item 28 to $P = .67$ ($M = 2.70$) for Item 26. Almost all items were negatively skewed (ranging from -0.83 to 0.33) and had negative kurtosis values (ranging from -1.15 to 0.03). All items had corrected item-total correlations above the cutoff of .3.

3.1.3. Acceptance items

The results of an EFA as well as item descriptive statistics of the ROCS acceptance items in individuals with OCD are presented in Table 3. A one-factor solution was supported by parallel analysis, along with the fact that only one factor had an eigenvalue greater than 1 and by a clear inflection point in the scree plot. Three of the acceptance items had excellent loadings, while the factor loading on Item 13 ranged between fair and good. The acceptance scale's internal consistency was adequate to high, Cronbach's $\alpha = .78$. The internal consistency would be slightly improved by the exclusion of Item 13 (to $\alpha = .81$) but no other item.

The acceptance items were very difficult with a small range from $P = .21$ ($M = 0.84$) for Item 16 to $P = .29$ ($M = 1.16$) for Item 13. All items had a positive skew (ranging from 0.74 to 1.23) while kurtosis values ranged from -0.34 to 0.81 . Item discrimination indices ranged from .43 to .67, with the lowest discrimination index (for Item 13) still well above the recommended cutoff of .3.

Table 3
Exploratory Factor Analyses for OCD Symptom Rumination- and Acceptance-Items, Respectively, in OCD Sample.

Item						SR	AC	<i>h</i> ²
	<i>M</i> (<i>SD</i>)	Skewness	Kurtosis	<i>P</i>	CITC	Factor Loadings		
<i>OCD symptom rumination</i>								
25. why I cannot deal with these thoughts better	2.25 (1.33)	−0.37	−0.90	.56	.68	.74		0.55
26. why I cannot refrain from repeating thoughts/behaviors	2.70 (1.19)	−0.83	−0.03	.67	.70	.74		0.55
30. why I cannot disengage from these thoughts	2.55 (1.12)	−0.63	−0.09	.64	.67	.71		0.51
23. how angry or sad I feel because of these thoughts/behaviors	2.71 (1.17)	−0.64	−0.58	.68	.66	.70		0.49
20. how hard it is to concentrate because of these thoughts	1.97 (1.30)	−0.20	−1.15	.49	.62	.67		0.44
21. why it is me who experiences these thoughts/behaviors	2.28 (1.26)	−0.34	−0.71	.57	.60	.64		0.41
24. what these thoughts have to do with me as a person	2.01 (1.28)	−0.08	−1.00	.50	.59	.63		0.40
28. whether one of these thoughts is likely to occur again	1.54 (1.33)	0.33	−1.09	.38	.58	.62		0.39
27. how I have contributed to these thoughts/behaviors	1.93 (1.28)	−0.02	−0.94	.48	.51	.55		0.30
29. reasons for these thoughts/behaviors	2.59 (1.06)	−0.68	0.03	.65	.51	.54		0.30
22. why I have to repeat some actions	2.28 (1.29)	−0.46	−0.88	.57	.37	.41		0.17
% Variance explained							46.11	
<i>Acceptance</i>								
9. let the thought pass by and do not engage with it	0.98 (1.03)	0.92	0.49	.25	.67	.80		0.64
16. take the thought as it is without judging it	0.84 (1.08)	1.23	0.81	.21	.64	.79		0.63
6. accept the thought without doing anything	1.06 (1.21)	0.90	−0.21	.27	.62	.71		0.51
13. do nothing	1.16 (1.19)	0.74	−0.34	.29	.43	.48		0.23
% Variance explained							61.45	

Note. *N* = 96. Results for two exploratory factor analyses are presented, with one extracted factor per analysis. Factor loadings ≥ .45 are boldfaced. AC = acceptance scale; CITC = corrected item-total correlation; *h*² = communality coefficient; *P* = Item difficulty index; SR = OCD symptom rumination scale.

3.2. ROCS (sub)scale intercorrelations and correlations with clinical scales

Pearson's correlation coefficients for the ROCS scales and clinical variables in the OCD sample are displayed in Table 4. The total mental neutralizing scale and OCD symptom rumination were correlated to a high degree. Additionally, all mental neutralizing subscales were correlated with OCD symptom rumination to a medium to large degree. Acceptance was not correlated with any of the other ROCS scales or subscales.

Table 4 shows the correlations of the ROCS scales and subscales with other clinical scales. The total ROCS mental neutralizing scale and its reconstruction-and-rituals subscale showed medium to large positive associations with the OCI-R total scale. The ROCS reconstruction-and-rituals subscale also showed positive associations with almost all OCI-R subscales including the OCI-R mental neutralizing subscale. All three ROCS mental neutralizing subscales had medium to large correlations

with the OCI-R obsessing subscale which assesses the distress associated with obsessions (Foa et al., 2002). Correlation coefficients for the ROCS mental neutralizing subscales' associations with RRS reflection, as well as the BDI and BAI, ranged from small to medium. Of the ROCS mental neutralizing subscales, reconstruction and rituals showed the highest correlations with BDI and BAI (however, only the subscale arguing with self was correlated with RRS reflection). The ROCS OCD symptom rumination scale showed strong positive correlations with OCI-R obsessions and RRS brooding. It also showed a medium-sized positive correlation with the BAI and small to medium positive correlations with the RRS reflection and the BDI. The ROCS acceptance scale was negatively associated with the BDI but not correlated with any other variables.

Table 4
ROCS (Sub)Scale Intercorrelations and Correlations with Clinical Variables in OCD Sample.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ROCS																
1. Total mental neutralizing	—															
2. Arguing with self	.74***	—														
3. Reconstruction and rituals	.74***	.25*	—													
4. Effort against thought	.71***	.45***	.21*	—												
5. OCD symptom rumination	.60***	.39***	.45***	.48***	—											
6. Acceptance	−.14	−.11	−.12	−.06	−.02	—										
7. OCI-R total	.39***	.04	.47***	.14	.31**	−.09	—									
8. OCI-R Washing	.06	.02	.15	−.08	−.06	−.08	.41***	—								
9. OCI-R Checking	.26*	.06	.43***	−.01	.12	−.08	.62***	−.01	—							
10. OCI-R Ordering	.14	−.08	.23*	.13	.24*	−.08	.62***	.05	.33***	—						
11. OCI-R Obsessing	.47***	.26**	.43***	.31**	.50***	−.13	.58***	.07	.18	.15	—					
12. OCI-R Hoarding	.24*	−.02	.36***	.13	.18	.12	.52***	.01	.23*	.30**	.28**	—				
13. OCI-R Mental Neutralizing	.15	−.14	.34***	.05	.10	−.004	.63***	.08	.32**	.27**	.29**	.18	—			
14. RRS brooding	.43***	.32**	.35***	.25*	.56***	−.05	.45***	.11	.24*	.41***	.35***	.24*	.18	—		
15. RRS reflection	.22*	.26*	.11	.13	.22*	−.02	.21*	.10	.05	.17	.12	−.01	.25*	.46***	—	
16. BDI	.26*	.17	.26**	.11	.22*	−.20*	.39***	.27**	.25*	.23*	.24*	.18	.11	.50***	.39***	—
17. BAI	.37***	.10	.41***	.25*	.34***	−.12	.59***	.22*	.25*	.33***	.53***	.43***	.28**	.40***	.28**	.54***

Note. *N* = 99. BAI = Beck Anxiety Inventory; BDI = Beck Depression Inventory; ROCS = Rumination on Obsessions and Compulsions Scale; OCD = obsessive-compulsive disorder; OCI-R = Obsessive-Compulsive Inventory-Revised; RRS = Ruminative Responses Scale.
* two-tailed *p* < .05; ** two-tailed *p* < .01; *** two-tailed *p* < .001.

Table 5
Group Comparisons for ROCS Scales.

Scale	OCD (<i>n</i> = 99)	MDD (<i>n</i> = 74)	HC (<i>n</i> = 35)
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
1. Total mental neutralizing	1.79 ^a (0.76)	1.58 ^b (0.66)	0.92 ^c (0.61)
2. Arguing with self	1.98 ^a (1.06)	1.62 ^b (0.87)	1.13 ^c (0.78)
3. Reconstruction and rituals	1.74 ^a (1.04)	1.36 ^b (0.80)	0.51 ^c (0.51)
4. Effort against thought	1.72 ^{ab} (0.95)	1.76 ^a (0.76)	1.18 ^b (0.81)
5. OCD symptom rumination	2.26 ^a (0.83)	1.99 ^a (0.96)	1.87 ^b (1.05)
6. Acceptance	1.00 ^a (0.87)	1.45 ^b (0.78)	1.83 ^c (1.00)

Note. HC = healthy control group; MDD = major depressive disorder; ROCS = Rumination on Obsessions and Compulsions Scale; OCD = obsessive-compulsive disorder.

^{a, b, c} Different subscripts indicate differences between groups with two-tailed $p < .05$ after Holm correction for family-wise error rate.

3.3. Between-groups comparisons

The means, standard deviations, and pairwise comparisons between the OCD, MDD, and HC groups for the ROCS scales are presented in Table 5. Analyses of variance and Kruskal–Wallis tests indicated differences between the three groups for all ROCS scales and the mental neutralizing subscales (total mental neutralizing: $F(2, 205) = 21.12$, $p < .001$, $\omega^2 = .16$; arguing with self: $H(2) = 21.37$, $p < .001$, $\eta^2_H = .09$; reconstruction and rituals: $H(2) = 47.75$, $p < .001$, $\eta^2_H = .22$; effort against thought: $F(2, 205) = 3.95$, $p = .02$, $\omega^2 = .03$; OCD symptom rumination: $H(2) = 63.19$, $p < .001$, $\eta^2_H = .30$; acceptance: $H(2) = 22.83$, $p < .001$, $\eta^2_H = .10$). Pairwise comparisons, using separate family-wise error corrections for each ROCS (sub)scale, showed that individuals with OCD had higher scores on total mental neutralizing, arguing with self, as well as reconstruction and rituals, compared to individuals with MDD and those in the healthy control group. However, we found no differences between individuals with OCD and those with MDD on the effort-against-thought subscale or the OCD symptom rumination scale. On the acceptance scale, individuals with OCD showed lower scores compared to the other two groups, and individuals with MDD had lower scores than those in the HC group.

4. Discussion

We developed a questionnaire to assess three common mental responses to obsessions and/or compulsions (mental neutralizing, OCD symptom rumination, and acceptance) and investigated whether we could establish preliminary indications of psychometric properties of this new assessment instrument. A first EFA suggested that mental neutralizing was best partitioned into three subscales with acceptable to high internal consistencies: arguing with self; reconstruction and rituals; and effort against thought. Thus, we collapsed the five theory-derived aspects of mental neutralizing into three empirically supported scales. With one exception, items from one theoretically derived aspect remained together on the final subscales. More than half (53%) of the mental neutralizing items showed very good or excellent loadings (i.e., $\geq .63$) on their respective subscale, while four (27%) items had less than fair loadings on their subscales (i.e., $< .45$). Five items showed cross-loadings and future studies should investigate whether their allocation to their respective subscales can be replicated. Two items (Items 7 and 18) stood out in particular due to their low loadings, communalities, and corrected item-total correlations, as well as the high difficulty of Item 7. The aspects of mental neutralizing assessed by these items are related to counting rituals and saying “stop” to oneself in order to suppress obsessive thoughts. These aspects have been reported by multiple studies on mental neutralizing (e.g., Freeston et al., 1991; Freeston & Ladouceur, 1997; Ladouceur et al., 2000; Purdon & Clark, 1994a). Because of their theoretical relevance, we retained both items but plan to improve their phrasing in future versions of the ROCS. Only

one item (Item 19) distinctly loaded on a different factor than anticipated. We assume that this is due to the item being ambiguously phrased in German: It could be understood to refer to thought replacement, or alternatively to arguing with self. Because the item had a good to very good loading on the arguing-with-self subscale and promising descriptive statistics, it should be rephrased in a way that clearly reflects the meaning of arguing with oneself.

We found medium to large positive associations of the total mental neutralizing scale and each mental neutralizing subscale with the distress associated with obsessions. Because the mental neutralizing scale was designed to measure mental responses to obsessions, these correlations can be considered first indicators of the scale's and subscales' convergent validity. Further indicators of convergent validity can be seen in the medium to large correlations between both the total mental neutralizing scale and the reconstruction-and-rituals subscale with overall OCD symptom severity. Only the reconstruction-and-rituals subscale was also associated with other aspects of OCD symptom severity (e.g., the distress associated with washing or checking compulsions) and, at the same time, with depressive and anxiety symptom severity to a medium degree. Therefore, it can be argued that reconstruction and rituals shows the strongest signs of convergent validity of the three subscales, and yet a considerable conceptual overlap with depression and anxiety. This conceptual overlap, however, is not surprising given that measures of OCD often show low discriminant validity with regard to depression and anxiety (e.g., Abramowitz & Deacon, 2006; Clark, Antony, Beck, Swinson, & Steer, 2005; Foa et al., 2002; Tellawi, Williams, & Chasson, 2016). Future studies should further investigate the mental neutralizing scale's validity and include existing measures that assess mental neutralizing (e.g., the CIQ; Freeston et al., 1991; or the ROII; Purdon & Clark, 1994b) for an estimation of the ROCS mental neutralizing scale's incremental validity. Last, we found that the total mental neutralizing scale and all of its subscales differed not only between OCD and HC, but (except for effort against thought) also between the OCD and MDD groups. This may be a first indicator of known-groups validity that further studies can be based on.

For the OCD symptom rumination subscale, our EFA showed preliminary support for a single scale with high internal consistency. The items showed moderate difficulties and no discrimination indices below our cutoff. The OCD symptom rumination scale showed a large positive correlation with a measure of habitual rumination but only a small to medium positive correlation with the more adaptive process of reflection; these results may be interpreted cautiously as first indicators of convergent and divergent validity. The scale also showed small to medium positive correlations with depressive and anxiety symptom severity. These correlations may be explained by the fact that both depressive and anxiety symptom severity have shown positive associations with habitual rumination (e.g., Huffziger & Kühner, 2012; Manfredi et al., 2011; Treynor et al., 2003; for a review of the associations of rumination with depression and anxiety, see; Aldao, Nolen-Hoeksema, & Schweizer, 2010). In group comparisons, we found that the OCD symptom rumination scale differed between the OCD and HC groups, but not between the OCD and MDD groups. The similarities between the latter groups are consistent with previous findings which suggest that rumination in OCD and MDD shares common processes (Wahl, Ehring, et al., 2019). It seems that the OCD symptom rumination scale may have not only measured rumination about obsessions and compulsions but also rumination about negative thoughts typical of depression. In order to improve its specificity, a short introduction should be added to the OCD symptom rumination scale which makes the exclusive reference to unwanted intrusive thoughts (such as obsessions) and repetitive behaviors (such as compulsions) clear. Future studies should investigate this scale's psychometric properties further, for instance by comparing individuals diagnosed with OCD and comorbid depressive disorders to those without depressive disorders.

With regard to the acceptance scale, our factor analysis yielded

preliminary support for a one-factor structure, and resulted in a scale with adequate to high internal consistency. The exclusion of one item could slightly increase internal consistency of the scale. However, because the difference in internal consistencies was not very large and the acceptance scale only encompassed four items, we retained this item. All four acceptance items were relatively difficult, but no discrimination index was below our cutoff. The lack of a correlation with any of the other ROCS (sub)scales, and obsessive and anxiety symptom severity, is a first indication that acceptance is conceptually unrelated to any of these other constructs. A negative association of acceptance with the OCI-R might have been a stronger indicator of the acceptance scale's validity than a zero correlation, given that acceptance and the distress caused by obsessions or compulsions can be conceptualized as opposite poles. However, this conceptualization is not consistently supported by previous studies which examined, for example, the associations between experiential avoidance and the OCI-R (Abramowitz, Lackey, & Wheaton, 2009; Blakey, Jacoby, Reuman, & Abramowitz, 2016; Briggs & Price, 2009; Manos et al., 2010; Wetterneck, Steinberg, & Hart, 2014). Therefore, a zero correlation is not necessarily an indication of poor validity of the acceptance subscale. Future studies should examine the associations of the ROCS acceptance scale with other measures of OCD symptom severity and additionally investigate the scale's convergent validity using OCD-independent measures of acceptance. The degree of acceptance differed between the three groups in our study. This suggests that the ROCS acceptance scale may sensitively assess the acceptance of unwanted intrusive thoughts.

We developed the ROCS with the aim of assessing mental responses to obsessive-compulsive symptoms in individuals with OCD. Previous studies have consistently shown that individuals without mental disorders often experience unwanted intrusive thoughts similar to (but experienced as less intense than) obsessions, and that these individuals also engage in mental neutralizing in response to their unwanted intrusive thoughts (e.g., Ladouceur et al., 2000; Rachman & de Silva, 1978; Radomsky et al., 2014). Therefore, research into OCD-related phenomena can benefit from preliminary studies using analogue samples which are then, if promising, followed up with studies in individuals with OCD (Abramowitz et al., 2014). For this reason, the ROCS was deliberately phrased in a way that individuals without clinically relevant OCD symptoms can also complete it. Future studies should investigate whether the ROCS can be used as a reliable and valid measure of the mental responses to unwanted intrusive thoughts in individuals without mental disorders.

Several limitations of this study need to be considered. First, our relatively small sample size may have restricted the power of our analyses, which is why our results should be replicated in further studies using larger samples of individuals with and without diagnoses of OCD. These studies will also show whether our results are generalizable to other samples of individuals with OCD, MDD, and no mental disorders. Second, although the constructs of mental neutralizing and OCD symptom rumination were conceptualized as possibly interconnected, but generally distinct with diverging defining features, they were highly intercorrelated. Whether these correlations reflect conceptual overlap or can be accounted for by the shared phrasing of the question and answer format (i.e. method variance) needs to be addressed in future studies investigating the overall factorial structure of the ROCS with a sample of sufficient size. In this first step, we decided to analyze each scale of the ROCS separately because the relatively small sample size in our study would have limited reliable interpretations of analyses

investigating the questionnaire's broader factor structure (e.g., analyzing the mental neutralizing and the OCD symptom rumination items in one EFA). We consider it critical that future studies with larger sample sizes replicate our results and also investigate the ROCS' broader factor structure. Third, high scores on the OCI-R (above the recommended cutoff value of 17 for distinguishing between individuals with OCD and those with depressive disorders; Gönner et al., 2008) suggest that the MDD group was characterized by unusually high OC symptoms which might not be typical. We did not include an additional measure of OCD symptom severity and thus we cannot completely rule out this possibility. Importantly, individuals in our MDD group did not meet DSM-IV criteria for OCD and had lower OCI-R total scores than the OCD group. Last, although we publish our findings for an international scientific community, the ROCS was constructed in German and our results may not be applicable to an English version of the questionnaire. Our aim in publishing in an international journal is to make the scale public and to facilitate possible future validation studies of an English version which is currently being developed.

To conclude, our study investigated the factor structure and preliminary indications of psychometric properties of the ROCS, an instrument assessing mental neutralizing, OCD symptom rumination, and acceptance. Our findings provide initial evidence for factor structure, item descriptive statistics, the scales' internal consistencies, associations with clinical scales as well as differentiation between groups of individuals with OCD, MDD, and without mental disorders. Although not sufficient for some items, these first indications of reliability and validity of the three constructs are generally promising and justify further elaborations and validation of the questionnaire. While the use of the OCD symptom rumination and acceptance scales can be recommended with little adjustment at this early stage, the mental neutralizing scale requires further revision. The ROCS should be adapted based on results from this study and further psychometric evaluations should follow.

Role of funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The Swiss National Science Foundation (SNSF) is funding the first author's PhD position but was not involved in the research, manuscript preparation, or decision to submit the article for publication.

Contributors

Authors AK and KW designed the study and created the ROCS. Author CH conducted the statistical analyses and wrote the first draft of the manuscript. All authors have contributed to and approved the final manuscript.

Declaration of competing interest

The authors have no competing interests to declare.

Acknowledgments

The authors would like to thank Andrea Hans Meyer for his helpful feedback on the analyses presented in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jocid.2020.100554>.

Appendix

English translation of the ROCS

The ROCS includes an introductory section which describes obsessions, using the terms *upsetting*, *unpleasant thoughts* and gives five examples for these thoughts (e.g., “I could have contaminated myself with something”). Subsequently, the following descriptions and items are presented:

Individuals use a great variety of responses to unpleasant thoughts. Please read through each response and indicate the typical frequency of each response during the past month.

When an upsetting or unpleasant thought intrudes into my mind ...	Never	Rarely	Some-times	Often	Almost Always
1. I try to suppress the thought.	0	1	2	3	4
2. I feel compelled to list all arguments that refute the upsetting thought.	0	1	2	3	4
3. I perform a mental ritual.	0	1	2	3	4
4. I have to mentally reconstruct all my actions repeatedly to make sure that I have not forgotten anything or that nothing terrible has happened.	0	1	2	3	4
5. I have to think a “good” thought again and again in order to neutralize the upsetting thought.	0	1	2	3	4
6. I accept the thought just as it is without doing anything.	0	1	2	3	4
7. I have to count mentally.	0	1	2	3	4
8. I argue with myself until I am convinced that nothing terrible will happen.	0	1	2	3	4
9. I let the thought pass by and do not engage with it.	0	1	2	3	4
10. I cannot get rid of the thought until I have thought a positive “counter-thought.”	0	1	2	3	4
11. I feel compelled to think in a particular order.	0	1	2	3	4
12. the upsetting thought bothers me until I have mentally reconstructed all important situations of the day.	0	1	2	3	4
13. I do nothing to get rid of the thought.	0	1	2	3	4
14. I put an extreme amount of effort into not having the thought anymore.	0	1	2	3	4
15. I feel compelled to list any arguments that could counter the upsetting thought.	0	1	2	3	4
16. I take the thought just as it is, without judging it.	0	1	2	3	4
17. I have to think it through again and again.	0	1	2	3	4
18. I say “stop” to myself in order to keep myself from thinking the thought again.	0	1	2	3	4
19. The thought keeps intruding into my mind until I can counter it with a certain image.	0	1	2	3	4

Time and time again, I think about ...	Never	Rarely	Some-times	Often	Almost Always
20. How hard it is to concentrate because of my unwanted thoughts.	0	1	2	3	4
21. Why <u>it is me</u> who experiences upsetting thoughts or repetitive behaviors.	0	1	2	3	4
22. Why I have to repeat some actions over and over again.	0	1	2	3	4
23. How angry or sad I feel because of my upsetting thoughts or behaviors.	0	1	2	3	4
24. What the upsetting thoughts have to do with me as a person.	0	1	2	3	4
25. Why I cannot deal with the unpleasant thoughts in a better way.	0	1	2	3	4
26. Why I cannot refrain from repeating thoughts or behaviors.	0	1	2	3	4
27. In what way I have contributed to upsetting thoughts or behaviors.	0	1	2	3	4
28. Whether an upsetting thought is likely to occur again.	0	1	2	3	4
29. The reasons for my upsetting thoughts and repetitive behaviors.	0	1	2	3	4
30. Why I cannot disengage from my upsetting thoughts.	0	1	2	3	4

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Appendix C (Manuscript 3)

Effects of abstract versus concrete rumination about anger on affect

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Submitted to the *Journal of Behavior Therapy and Experimental Psychiatry*

Effects of abstract versus concrete rumination about anger on affect

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Abstract

Background and Objectives

The processing-mode theory of rumination proposes that an abstract mode of rumination results in more maladaptive consequences than a concrete ruminative mode. The theory is supported by evidence mostly from the area of depression. Little is known of the relative consequences of abstract versus concrete rumination about anger for affect. We therefore investigated the differential effects of abstract versus concrete rumination about anger on individuals' current affective state. We hypothesized that abstract rumination would increase current anger and negative affect, and decrease positive affect, to a greater extent than concrete rumination.

Methods

In a within-subject design, $N = 120$ participants were instructed to focus on a past social event that resulted in them experiencing intense anger and then to ruminate about the event in an abstract and a concrete mode, in randomly assigned order. Current anger, negative affect, and positive affect were assessed before and after each rumination phase.

Results

Anger and negative affect increased and positive affect decreased from pre- to post-rumination. Contrary to expectations, these patterns were observed irrespective of the ruminative mode induced.

Limitations

Anger was not elicited directly and only short-term (i.e., not intermediate or long-term) effects of ruminative modes were investigated.

Conclusions

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

This initial study's findings do not support the hypothesis that abstract and concrete rumination about anger have different consequences for current anger and affect.

Replications and more extensive designs are warranted in future studies.

Keywords Rumination (cognitive process); Ruminative mode; Processing mode; Anger; Affect

Effects of abstract versus concrete rumination about anger on affect

1 Introduction

Rumination is a repetitive thought process associated with a wide range of adverse consequences (e.g., Ehring & Watkins, 2008; Nolen-Hoeksema et al., 2008). The processing-mode theory of rumination distinguishes an abstract from a concrete mode of rumination (Watkins et al., 2008). Abstract rumination is characterized by predominantly analytical, decontextualized, and evaluative thinking (Watkins et al., 2008). A concrete ruminative mode, on the other hand, is more experiential, situation specific, and less evaluative. This theory emerged from research on depression, in which rumination is typically defined as “a mode of responding to distress that involves repetitively and passively focusing on symptoms of distress and on the possible causes and consequences of these symptoms” (Nolen-Hoeksema et al., 2008, p. 400). To illustrate the two ruminative modes, after arguing with a colleague, ruminating in an abstract mode may include thoughts such as “Why can’t I handle these things differently?” or “Why does this [always] happen to me?” (Van Lier et al., 2015, p. 35). In contrast, more concrete rumination could include thoughts such as “What exactly did I say first?” or “What happened exactly?” (Van Lier et al., 2015, p. 35). For the purposes of this paper, we use the terms *abstract* and *concrete* to refer to the two modes of rumination described by the processing-mode theory. The processing-mode theory predicts that abstract rumination has adaptive consequences, and concrete rumination more maladaptive consequences, for affect¹ and cognitive processes (Watkins et al., 2008).

¹ For the purposes of this paper, we define affect broadly as «an umbrella term for states that involve relatively quick good-bad discriminations» (Gross, 2014, p. 5), including states described as emotions or moods, and more specifically including anger.

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

Multiple studies have demonstrated differential effects of abstract versus concrete rumination on various cognitive processes relevant to depression, in line with the processing-mode theory (Watkins, 2008; Watkins & Roberts, 2020). For instance, experiments that have manipulated the mode of rumination about oneself and one's depressive symptoms in depressed individuals have demonstrated that overgeneral memory decreased from pre- to post-rumination for the concrete ruminative mode but did not change over time for the abstract ruminative mode (Watkins & Teasdale, 2001, 2004). Other experiments have shown that depressed individuals' endorsement of self-judgments of worthlessness and incompetence increased following abstract but not concrete rumination (Rimes & Watkins, 2005). In individuals with a high fear of negative evaluation, these self-judgments were maintained following abstract rumination but decreased following concrete rumination (Vassilopoulos & Watkins, 2009).

Results from the depression literature on the effects of ruminative modes on affect are somewhat mixed. For example, in accord with the processing-mode theory's predictions, Galfin and Watkins (2012) demonstrated that the extent to which individuals engaged in abstract rumination about their concerns was positively associated with their psychological distress related to rumination. Moreover, experimental studies have demonstrated that abstract rumination about oneself and one's symptoms increased depressed mood (Rimes & Watkins, 2005) compared to concrete rumination. Additionally, Kambara et al. (2019) recently demonstrated that ruminating on a recent failure experience in an abstract way maintained negative affect, whereas concrete rumination decreased it (however, note there were no effects on positive affect). Similarly, other experiments have shown that whereas abstract rumination on positive memories maintained affect, concrete rumination on positive memories decreased sadness (Werner-Seidler & Moulds, 2012) and

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

increased positive affect (Nelis et al., 2015; however, note that in a second experiment in their paper, positive affect also increased following abstract rumination). On the other hand, some experiments have demonstrated that effects on affect are comparable for rumination about oneself and one's symptoms in an abstract and a concrete mode (e.g., on sadness, Sanders & Lam, 2010; on negative affect, Watkins & Moulds, 2005; on despondency and happiness, Watkins & Teasdale, 2001). Additionally, some studies have shown differential effects of ruminative modes on affect only under specific conditions, for example, in a sample of individuals diagnosed with depression but not for those without such a diagnosis (Rimes & Watkins, 2005), or subsequent to a failure experience after rumination, but not following the rumination induction itself (Watkins et al., 2008).

Rumination is considered a transdiagnostic factor relevant to many affective or behavioral experiences and mental disorders (e.g., Ehring & Watkins, 2008). Multiple studies have investigated the processing-mode theory in various conditions other than depression or despondency, such as social anxiety (Van Lier et al., 2015; Vassilopoulos & Watkins, 2009; Wong & Moulds, 2012), schizophrenia (Ricarte, Del Rey, et al., 2018; Ricarte, Ros, et al., 2018), and alcohol dependence (Grynberg et al., 2016; for an overview of different conditions see also Watkins & Roberts, 2020), as well as in the context of symptoms such as intrusive memories (Santa Maria et al., 2012; Schaich et al., 2013; Stavropoulos & Berle, 2020). Most of these studies have reported comparable effects of abstract and concrete rumination on affect (e.g., negative affect in Santa Maria et al., 2012; Schaich et al., 2013; anxious and depressed mood in Vassilopoulos & Watkins, 2009).

There is also some evidence that rumination plays a role in the processing of anger. For instance, experimental studies have shown that ruminating about anger increases or maintains anger, compared to reappraisal or distraction (Aboulaflia-

Brakha et al., 2016; Lievaart et al., 2017; Peuters et al., 2019; Ray et al., 2008; Takebe et al., 2017). To our knowledge, no study has yet investigated the differential effects of abstract and concrete rumination (as described by the processing-mode theory) about anger on affect. Accordingly, the aim of this initial study was to investigate the differential effects of abstract and concrete rumination about anger on participants' levels of self-reported current anger, negative affect, and positive affect. On the basis of the processing-mode theory, we hypothesized that abstract rumination would result in a greater increase in anger (Hypothesis 1) and negative affect (Hypothesis 2), and a greater decrease in positive affect (Hypothesis 3), relative to concrete rumination.

2 Method

2.1 Participants and design

$N = 120$ ($n = 102$ women) students and individuals from the community participated in the experiment in exchange for either course credit or gift vouchers. The experiment had a $2 \times 2 \times 2$ mixed-subject design, with ruminative mode (abstract vs. concrete rumination about anger) and time (pre- vs. post-rumination) as within-subject factors and order of ruminative modes (i.e., abstract vs. concrete ruminative mode first) as a between-subject factor. The main analyses use a 2 (ruminative mode) $\times 2$ (time) within-subject design. Rumination about anger was operationalized as rumination about memories of anger-eliciting events, and we use the shorter phrase "rumination about anger" hereafter. The study was approved by the Ethics Committee of the department of Psychology at the University of Basel.

2.2 Measures

State anger was assessed with the State-Trait Anger Expression Inventory–State version (STAXI-State; Spielberger, 1988; German version by Schwenkmezger et al., 1992), and current negative and positive affect were assessed with the Positive

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

and Negative Affect Schedule (PANAS; Watson et al., 1988; German version by Krohne et al., 1996). To mask the study's aim, we added the 10 state items from the State-Trait Anxiety Inventory (Spielberger et al., 1970; German version by Laux et al., 1981) to the STAXI-State.

The STAXI-Trait subscale was used to assess participants' general experience, expression, and control over anger; the Beck Depression Inventory–II (BDI-II; Beck et al., 1996; German version by Hautzinger et al., 2006) assessed depressive symptoms; the Perseverative Thinking Questionnaire (PTQ; Ehring et al., 2011) assessed the general tendency to engage in repetitive thinking; and the Rumination subscale of the Anger-Related Reactions and Goals Inventory (ARGI; Kubiak et al., 2011; German version by Weber & Titzmann, 2003) assessed anger-related rumination. The trait measures' internal consistencies in our study were good to excellent with Cronbach's $\alpha = .85$ for the STAXI-Trait, $\alpha = .93$ for the BDI-II, $\alpha = .94$ for the PTQ, and $\alpha = .90$ for the ARGI Rumination subscale.

One-item measures were adapted from Fabiansson et al. (2012) to assess participants' current anger ("How angry do you feel right now when you are thinking back to the event?") and happiness ("How happy do you feel right now when you are thinking back to the event?") after focusing on the anger event. These ratings were used as indicators of the consequences of focusing on the anger event. Additionally, participants were asked to rate the intensity of their recall when focusing on the anger event ("Please think back to the event you recalled just now.... How intense is the memory [of this event] at the moment?"), following Fabiansson et al. (2012). This rating was included as a manipulation check to verify that participants' memory recall was sufficiently intense, as well as to investigate whether intensity ratings were comparable in the two ruminative mode conditions. All three items were rated on a scale of 0 (*not at all*) to 10 (*extremely*).

We also administered a number of additional manipulation checks.

Participants rated their degree of self-focus during rumination on a scale of 0 (*not at all focused on self*) to 10 (*very focused on self*), based on Wong and Moulds (2012). Additionally, two sum scores were adapted from Fabiansson et al. (2012) to assess the degree of abstractness and concreteness of rumination during the ruminative mode inductions, with three items per sum score. For abstractness, the items were “To what extent did you think... (a) about the meaning of the event (e.g., on how you can explain your feelings)?; (b) about the consequences of the event?; (c) about the reasons for the event (e.g., on why things developed this way)?; for concreteness, the items were “To what extent did you focus on... (a) the concrete experience during the event (e.g., on your feelings back then)?; (b) your feelings relating to the other person?; (c) your sensations and feelings during the event in general?”. All six items were rated on 7-point Likert scales of 1 (*not at all*) to 7 (*extremely so*). Internal consistencies were lower in Phase 1 of the experiment and acceptable in Phase 2, with Cronbach’s $\alpha = .62$ (Phase 1) and $\alpha = .79$ (Phase 2) for abstractness and $\alpha = .69$ (Phase 1) and $\alpha = .82$ (Phase 2) for concreteness (Phases are defined in Section 2.4).

2.3 Tasks

2.3.1 Identification and focus on an anger-provoking social event

At the beginning of the experiment, participants were asked to recall a social event within the past 12 months that resulted in them feeling intense anger. If needed, participants received up to two prompts reminding them of the criteria and providing examples.² At two time points during the experiment, participants were asked to focus on the event they had previously identified in detail and to focus on it

² Subsequent analyses showed that $n = 116$ participants had identified an event without needing a prompt. Only $n = 4$ participants received the first prompt, and no participants required a second prompt.

for 20 s (“Please take a moment to bring a clear memory of the event you identified before to mind”; we refer to this as “recall”).

2.3.2. Ruminative mode inductions

The inductions of abstract and concrete ruminative modes were based on inductions from previous studies (Rimes & Watkins, 2005; Watkins & Moulds, 2005). Specifically, participants were instructed to concentrate on 18 consecutively presented statements. The instructions were adapted from Wong and Moulds (2012) and Fabiansson et al. (2012). In the abstract ruminative mode condition, participants were asked to focus on the causes, meanings, and consequences of the anger event (“As you read the items, use your imagination and concentration to think about the causes, meanings, and consequences of the [event]. Spend a few minutes concentrating on each item, attempting to make sense of and understand the issues raised by [the event]”; Wong & Moulds, 2012, pp. 1066–1067). In the concrete ruminative mode condition, participants were asked to focus on the concrete experience of the anger event (“As you read the items, use your imagination and concentration to focus your mind on each experience... [Spend a few minutes concentrating on your experience,] attempting to find a phrase, image or set of words that best describes the quality of what you sense”; Wong & Moulds, 2012, p. 1067).

Sixteen ruminative mode induction statements were adapted from Nolen-Hoeksema and Morrow (1993; German translation by Huffziger & Kühner, 2009), with two additional statements adapted from Fabiansson et al. (2012). In the abstract ruminative mode condition, each statement was preceded by the instruction “Think about...” and asked participants to think about a different aspect of the anger event in an abstract way (e.g., “Think about the meaning of the event”). In the concrete ruminative mode condition, each statement was preceded by the instruction “Focus your attention on your experience of...” and asked participants to focus their attention

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

on a different aspect of the anger event in a concrete way (e.g., “Focus your attention on your experience of how exactly the event unfolded”). The two ruminative mode conditions were designed to be identical in self-focus (e.g., focus on motivation, or how passive or active one feels). Participants were allowed to navigate back and forth between the introductory text and the statements at their own pace for 8 min. Thus, they could take as much time as they needed to read through and concentrate on the aspects mentioned by each statement.

2.4 Procedure

Participants were tested in groups of up to four in the same room for practical reasons, with dividers placed between seats to allow them to focus on the tasks without interruptions. All parts of the experiment were conducted on a computer. At the start of the experiment, participants were informed that the study was investigating the interplay of memory, imagination, and affect. Participants provided written informed consent and were then randomly assigned to the order of ruminative modes using block randomization. Participants identified an anger event and completed baseline (T0) measures: the STAXI-State and PANAS (Figure 1). They were asked to focus on the anger event (“recall” in Figure 1) and then to provide ratings of anger, happiness, and intensity (T1). Participants then spent 8 min ruminating in either an abstract or concrete mode and then completed the STAXI-State and PANAS followed by the manipulation checks (T2; we refer to T0–T2 as Phase 1 of the experiment). Next, participants watched a 3-min film clip intended to reduce any possible carry-over effects from Phase 1 to Phase 2. The film clip showed two people visiting different sights in Europe. Subsequently, Phase 2 (T3–T5) started: Participants again completed the STAXI-State and PANAS (T3) and then ruminated on the anger event for a second time, in either an abstract or concrete mode. Next, participants rated their levels of anger, happiness, and intensity (T4) and

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

then completed the second ruminative mode induction. Finally, participants completed the STAXI-State, PANAS, and manipulation checks and provided details for participant characteristics (e.g., age, gender, STAXI-Trait; T5).

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

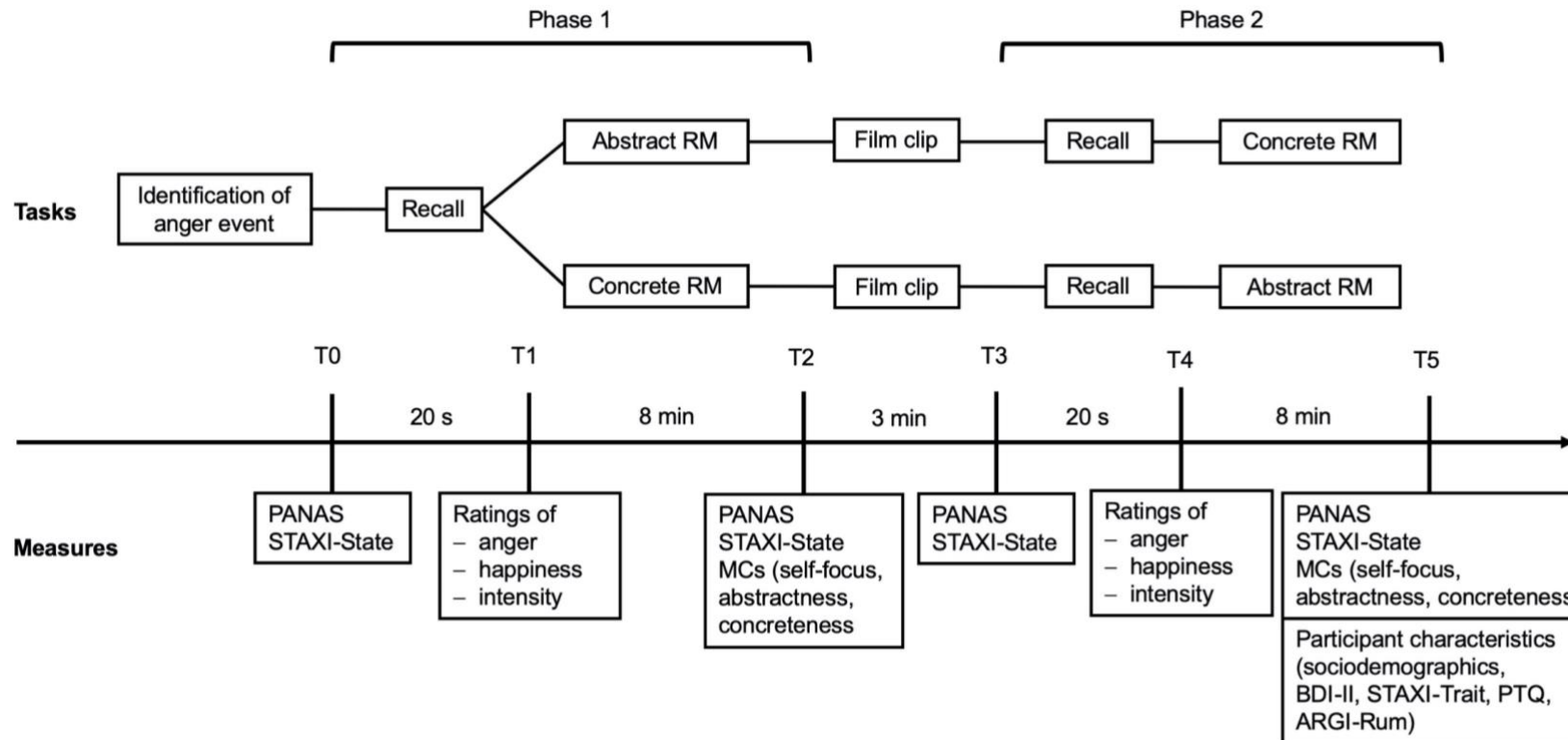


Figure 1. Experimental procedure. ARGI-Rum = Rumination subscale of the Anger-Related Reactions and Goals Inventory; BDI-II = Beck Depression Inventory–II; MCs = manipulation checks; PANAS = Positive and Negative Affect Schedule; PTQ = Perseverative Thinking Questionnaire; RM = ruminative mode; STAXI = State-Trait Anger Expression Inventory.

2.5 Analyses

The calculation of the sample size necessary to detect an expected small-to-medium effect size was based on a study that yielded small ($\eta_p^2 = 0.01$) and small-to-medium ($\eta_p^2 = 0.03$) effects of ruminative modes on sadness and happiness, respectively (Ricarte, Ros, et al., 2018). A G*Power (Version 3.1.9.3; Faul et al., 2007) power calculation for a one-sample *t* test against 0 was used because it is identical to that of a two-way repeated-measures analysis of variance (ANOVA) in which both within-subject factors contain exactly two levels. For an effect size of Cohen's $d = 0.26$ (judged approximately equivalent to the average effect size reported by Ricarte, Ros, et al., 2018), 80% power, and $\alpha = .05$, the resulting sample size was calculated as $N = 119$. Thus, the study was sufficiently powered to detect small-to-medium-sized effects.

Possible order effects (i.e., abstract vs. concrete ruminative mode first) for participant characteristics as well as anger, happiness, and intensity ratings were investigated using independent-samples *t* tests. Additionally, mixed ANOVAs were used to investigate whether Order \times Ruminative Mode \times Time or Order \times Time interaction effects emerged for the manipulation checks, STAXI-State, or PANAS NA or PA (Negative Affect and Positive Affect subscales, respectively). None of the analyses for order effects resulted in significant results, with the exception of PANAS PA, for which a three-way interaction effect of Order \times Ruminative Mode \times Time emerged. Thus, the analyses for PANAS PA (Hypothesis 3) were conducted separately for Phases 1 and 2.

To examine ratings of current anger and happiness immediately after focusing on the anger event, a repeated-measures ANOVA was used to check for possible interaction effects of the anger versus happiness measures with study phases (Phase 1 vs. Phase 2). Because an interaction effect emerged, differences between

current anger and happiness ratings were investigated separately for each study phase, using paired-samples *t* tests. With regard to self-focus, potential differences between ruminative modes were analyzed using paired-samples *t* tests. Regarding abstractness vs. concreteness manipulation checks (outcome), a two-way repeated-measures ANOVA with the focus of the manipulation check (abstractness vs. concreteness) and allocated ruminative mode (abstract vs. concrete) as within-subject factors was used. We expected a significant interaction effect between rated and allocated ruminative mode. This would mean that we successfully induced two different ruminative modes.

For the main analyses, the main effect of time and the interaction effect of Ruminative Mode \times Time (Hypotheses 1–3) on each outcome variable (STAXI-State, PANAS NA, and PANAS PA) were examined using two-way repeated-measures ANOVAs. The assumption of normality for all analyses was checked visually, using histograms and q-q plots. For all independent-samples *t* tests, bootstrap was used to confirm results when normality could not be assumed, and Welch's approximate *t* test was used when variance homogeneity was violated. Residuals for STAXI-State and PANAS NA were not normally distributed and thus these outcome variables were log transformed. Cohen's *d* is reported for independent-samples *t* tests, and corrected Cohen's *d* (Field, 2018) is presented for paired-samples *t* tests (interpretation based on Cohen, 1988). For *F* tests, η_p^2 is reported (interpretation based on Richardson, 2011). The significance level was set at $\alpha = .05$ for all tests.

3 Results

3.1 Participant characteristics and manipulation checks

Table 1 displays participants' characteristics; anger, happiness, and intensity ratings; and manipulation checks. Participant characteristics and anger, happiness, and intensity ratings did not differ between participants who were allocated first to the

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

abstract, then to the concrete rumination compared to the concrete first, then abstract order. Participants' average level of anger was $M = 6.11$ ($SD = 2.60$) for Phase 1 and $M = 4.90$ ($SD = 2.56$) for Phase 2, representing moderate levels of anger. Happiness ratings were $M = 2.33$ ($SD = 2.31$) for Phase 1 and $M = 2.83$ ($SD = 2.36$) for Phase 2, representing low happiness levels. Last, ratings of the intensity of the anger memory at recall can be interpreted as moderate with $M = 6.18$ ($SD = 2.30$) for Phase 1 and $M = 5.47$ ($SD = 2.25$) for Phase 2. Participants reported higher ratings of current anger than happiness in both phases of the experiment, with large effect sizes. Self-focus during the ruminative mode inductions did not differ significantly between the two ruminative modes. Importantly, there was a medium-to-large interaction effect of the focus of manipulation checks (abstractness vs. concreteness) with allocated ruminative mode (abstract vs. concrete rumination) on abstractness or concreteness sum scores (this interaction effect is labeled "MC \times RumMode" in Table 1). Our results indicate that after abstract versus concrete ruminative mode inductions, participants' abstractness versus concreteness levels differed in the expected direction; thus, we successfully induced two different ruminative modes.

Table 1

Descriptives, Cronbach's α , and Test Statistics for Participant Characteristics and Manipulation Checks

Variable	<i>M (SD)</i>		Effect	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>
	Order: AC	Order: CA					
Age	28.03 (11.98)	25.65 (9.84)	Order	1.19	117	.24	-0.22
Trait anger (STAXI-Trait)	18.19 (5.21)	19.10 (5.45)	Order	-0.92	117	.35	0.17
Depressive symptom severity (BDI-II)	11.92 (9.72)	10.08 (8.90)	Order	1.07	117	.29	-0.20
Repetitive negative thinking (PTQ)	25.19 (13.11)	26.32 (12.30)	Order	-0.48	117	.63	0.09
Anger-related rumination (ARGI-Rum)	8.81 (3.05)	9.07 (3.17)	Order	-0.44	117	.66	0.08
T1 ratings			AH	10.29	119	< .001	-1.33
anger	6.27 (2.62)	5.95 (2.60)	Order	0.67	118	.51	-0.12
happiness	2.25 (2.41)	2.42 (2.23)	Order	-0.39	118	.69	0.07
intensity	6.22 (2.57)	6.15 (2.02)	Order	0.16	118	.87	-0.03
T4 ratings			AH	5.52	118	< .001	-0.72
anger	5.00 (2.53)	4.80 (2.61)	Order	0.42	117	.67	-0.08
happiness	2.53 (2.42)	3.13 (2.28)	Order	-1.41	117	.16	0.26
intensity	5.58 (2.47)	5.37 (2.02)	Order	0.51	111.90	.61	-0.09
Manipulation checks	After AR	After CR					
focus on self	6.60 (2.33)	6.76 (2.22)	RumMode	-0.73	118	.47	0.09
abstractness	15.24 (3.65)	14.35 (3.64)		<i>F</i>	<i>df</i>	<i>p</i>	η_p^2
concreteness	15.03 (3.38)	15.62 (3.81)	MC × RumMode	12.08	1, 118	.001	.09

Note. $N = 120$. Data for participant characteristics, T4 ratings, and abstractness vs. concreteness manipulation checks (MCs) were missing for one participant. AH = anger vs. happiness rating; AR = abstract rumination; ARGI-Rum = Rumination subscale of the Anger-Related Reactions and Goals Inventory; BDI-II = Beck Depression Inventory-II; CR = concrete rumination; d = Cohen's d for order effects and corrected Cohen's d for effects of AH and ruminative mode (RumMode); Order: AC = order of ruminative modes:

ABSTRACT VERSUS CONCRETE RUMINATION ABOUT ANGER

abstract, then concrete; Order: CA = order of ruminative modes: concrete, then abstract; PTQ = Perseverative Thinking Questionnaire; STAXI = State-Trait Anger Expression Inventory.

Table 2

Effects of Ruminative Modes and Time on Anger, Negative Affect, and Positive Affect

Variable	Abstract RumMode	Concrete RumMode	Effect	Test statistic			
	<i>M (SD)</i>	<i>M (SD)</i>		<i>F</i>	<i>df</i>	<i>p</i>	η_p^2
Anger (STAXI-State) ^a							
Pre-rumination (Phases 1 & 2)	16.14 (6.53)	16.61 (7.16)	Time	16.53	1, 118	< .001	.12
Post-rumination (Phases 1 & 2)	17.34 (7.08)	17.69 (7.15)	RumMode × Time	< 0.001	1, 118	.998	< .001
Negative affect (PANAS NA) ^a							
Pre-rumination (Phases 1 & 2)	17.83 (7.16)	17.34 (6.60)	Time	8.72	1, 118	.004	.07
Post-rumination (Phases 1 & 2)	18.35 (7.22)	18.43 (6.56)	RumMode × Time	1.15	1, 118	.29	.01
Positive affect (PANAS PA)							
Pre-rumination (Phase 1)	27.38 (5.96)	28.15 (6.97)	Time	39.66	1, 118	< .001	.25
Post-rumination (Phase 1)	25.12 (7.04)	25.33 (6.88)	RumMode × Time	0.46	1, 118	.50	.004
Pre-rumination (Phase 2)	28.83 (7.76)	28.81 (8.35)	Time	110.68	1, 117	< .001	.49
Post-rumination (Phase 2)	22.47 (7.32)	23.44 (7.11)	RumMode × Time	0.79	1, 117	.37	.01

Note. *N* = 120 for Phase 1, *n* = 119 for Phase 2 or combined Phases 1 & 2. PANAS PA = Positive Affect subscale of the Positive and Negative Affect Schedule; PANAS NA = Negative Affect subscale of the Positive and Negative Affect Schedule; post-rumination = T2 or T5; pre-rumination = T0 or T3; RumMode = ruminative mode; STAXI = State-Trait Anger Expression Inventory.

^aValues were log transformed prior to hypothesis tests but not for means and standard deviations.

3.2 Effects on anger, negative affect, and positive affect

Table 2 displays untransformed means and standard deviations and results for the main analyses using log-transformed variables for the STAXI-State and PANAS NA. A main effect of time on anger indicated higher post-rumination than pre-rumination levels of anger, with a medium effect size. There was no significant Ruminative Mode \times Time interaction, indicating that anger increased irrespective of ruminative mode (see Figure 2). Similarly, a main effect of time on negative affect reflected higher post-rumination than pre-rumination levels with a medium-to-large effect size. The interaction of Ruminative Mode \times Time was not significant. For positive affect, we analyzed the two study phases separately because of order effects. For both study phases, a main effect of time indicated lower post-rumination than pre-rumination levels of positive affect with very large effect sizes. Again, no Ruminative Mode \times Time interaction effects emerged.

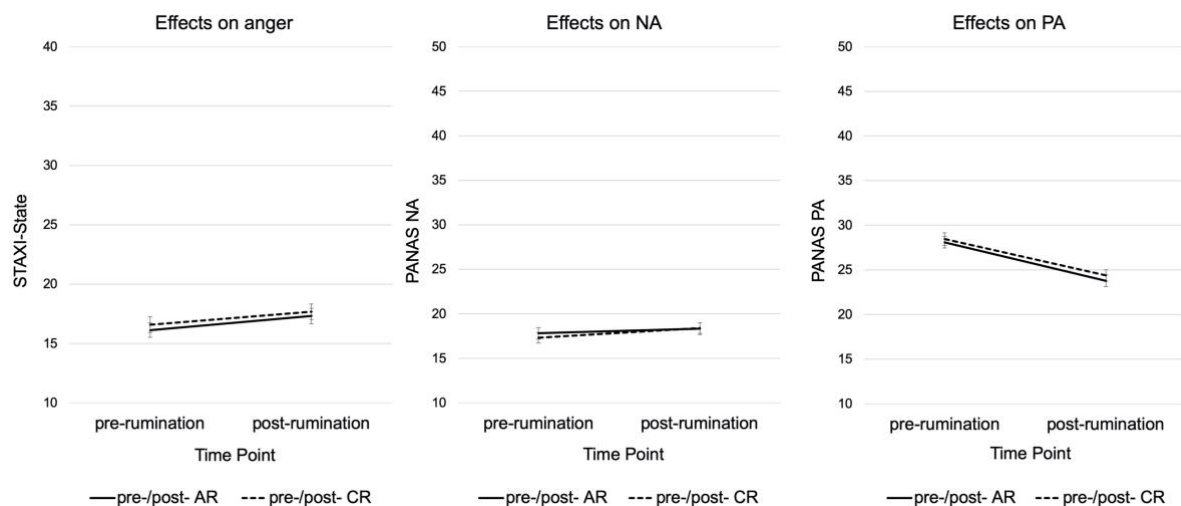


Figure 2. Anger, negative affect, and positive affect before and after rumination, separated by ruminative modes. Error bars display standard errors. STAXI-State scores can range between 10 and 40 and PANAS NA and PA scores can range between 10 and 50. AR = abstract rumination; CR = concrete rumination; PANAS PA = Positive Affect subscale of the Positive and Negative Affect Schedule; PANAS NA

= Negative Affect subscale of the Positive and Negative Affect Schedule; STAXI = State-Trait Anger Expression Inventory.

4 Discussion

The study investigated the immediate effects of abstract versus concrete rumination about anger on participants' levels of current anger, negative affect, and positive affect. Both ruminative modes resulted in medium-to-large increases in current anger and negative affect, and a large decrease in positive affect. Contrary to expectations, there were no differences between the two ruminative modes in these changes over time. Thus, our hypotheses were not supported.

Our results are inconsistent with the processing-mode theory (Watkins et al., 2008), which would predict a larger increase in anger and negative affect, and a greater decrease in positive affect, following abstract relative to concrete rumination. However, our results are not completely surprising given that the short-term effects of ruminative modes on affect have not been consistently found in previous studies (e.g., Sanders & Lam, 2010; Watkins & Moulds, 2005; Watkins & Teasdale, 2001). One possible explanation for the lack of a differential effect is the degree of activated anger in our study, which was moderate. It is possible that the effects of ruminative modes might materialize only when anger is much more intense. In the area of depression, Rimes and Watkins (2005) have provided some evidence for the possible impact of affect intensity. Specifically, they demonstrated comparable effects of abstract and concrete rumination on depressed mood over time for nondepressed individuals, but differential effects for depressed individuals, who generally have higher negative affect. Future studies could usefully compare the effects of abstract and concrete rumination by including individuals high in trait anger or employ different methods to activate stronger anger with an ongoing relevance for participants, for example, by directly activating anger in an interpersonal situation

(e.g., Pfeiler et al., 2017). This might presumably also possess higher ecological validity than recalling an event that elicited anger in the past (Lobbestael et al., 2008). Furthermore, such experimental forms of eliciting anger also offer opportunities to assess behavioral outcomes (e.g., participants' tendencies to approach or avoid the person who provoked the anger), thus extending the evidence beyond effects on self-reported affect. It should also be noted that we investigated only the immediate and not intermediate or long-term effects of ruminative modes. Researchers have proposed that ruminative modes have different effects in the short term compared to the long term (e.g., Hart-Smith & Moulds, 2019). Future studies should include intermediate or long-term assessments when investigating the effects of abstract versus concrete rumination on anger.

The lack of a significant interaction between ruminative mode and time is unlikely to be accounted for by an unsuccessful ruminative mode manipulation or by differences in self-focus: the manipulation checks demonstrated that participants ruminated in the instructed modes, and there were no differences between ruminative modes in self-focus. Additionally, the lack of an interaction is unlikely to be due to insufficient power, because the present study was sufficiently powered to detect the expected effect size for effects of Ruminative Mode \times Time on anger, negative affect, and positive affect. While our findings are preliminary, should they be replicated in future studies, the question of whether ruminative modes have different consequences for anger than for depression will warrant discussion.

Several limitations of the present study should be considered. First, participants' anger levels were moderate and we investigated only short-term effects. As described above, future studies should consider activating higher levels of anger and investigating longer term effects of rumination about anger. Second, because our results are based on a sample of students and individuals from the community, it is

unclear whether they can be generalized to other populations. Third, we did not include a measure that allowed us to estimate whether demand effects might have influenced the results—although we note that we employed instructions and manipulations used in previous rumination studies. Fourth, the absence of a no-instruction control condition means that we cannot ascertain whether the observed time effects were merely due to recalling a past anger-eliciting event or to ruminating about it. The inclusion of an appropriate control in future studies will clarify this. Last, our Phase 1 manipulation check scales' internal consistencies were below what may be considered acceptable values. Despite this limitation, our analysis using these scales yielded a medium-to-large effect and supported successful ruminative mode inductions. Future studies should assess possible demand effects, and researchers may consider replacing or modifying the manipulation check scales used in our study.

In conclusion, this study represents an initial investigation of the differential effects of abstract versus concrete rumination (as described by the processing-mode theory) about anger on current anger, negative affect, and positive affect. Our results suggest that these two ruminative modes do not have distinct consequences for anger. Future studies should investigate the differential effects of abstract versus concrete rumination about anger in a more extensive study design, which may include stronger and more ecologically valid anger inductions and longer term assessments of the effects of ruminative modes—with the goal of extending the applicability of this laboratory research to everyday life situations.

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