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Positive Beliefs about Rumination Are Associated with Ruminative Thinking and Affect in Daily Life: Evidence for a Metacognitive View on Depression

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Background: Self-regulatory executive function theory (Wells and Matthews, 1994; Wells, 2008) stresses the role of metacognitions in the development of emotional disorders. Within this metacognitive model, positive beliefs about ruminative thinking are thought to be a risk factor for engaging in rumination and subsequently for depression. However, most of the existing research relies on retrospective self-report trait measures. **Aims:** The aim of the present study was to examine the theory's predictions with an Ecological Momentary Assessment approach capturing rumination as it occurs in daily life. **Method:** Non-clinical participants ($N = 93$) were equipped with electronic diaries and completed four signal-contingent momentary self-reports per day for 4 weeks. A multilevel mediation model was computed to examine associations between positive beliefs about rumination and ruminative thinking and negative affect in daily life. **Results:** Positive beliefs about rumination were significantly associated with ruminative thinking as it occurs in daily life. We further found evidence for a negative association with positive affect that was completely mediated via ruminative thinking in daily life occurring in response to negative emotions. **Conclusions:** Our results add ecologically valid corroborating evidence for the metacognitive model of emotional disorders within the framework of self-regulatory executive function theory.

Keywords: Rumination, metacognition, emotion, Ecological Momentary Assessment.

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Introduction

Ruminative thinking in its broadest sense refers to repetitive thinking characterized by limited controllability (Martin and Tesser, 1996). In the clinical context, rumination is often conceptualized as repetitive thinking in response to negative affect or negative emotion (Nolen-Hoeksema and Morrow, 1993). Although rumination may also be a functional form of cognitive processing depending, for example, on the mode of processing and the perspective that is taken (Watkins, 2008), most models stress its dysfunctional nature (Thomsen, 2006) and its role in the development and maintenance of disorders: Ruminative thinking is a salient feature not only of depression as evidenced by the notion of depressive rumination (Nolen-Hoeksema, Wisco and Lyubomirsky, 2008), but is also prominent in posttraumatic stress disorder (Ehring, Fuchs and Kläsener, 2009) or – as worry – in generalized anxiety disorder (Roemer, Orsillo and Barlow, 2004). Ehring and Watkins (2008) argue that rumination may even be a transdiagnostic feature of numerous Axis I disorders.

A comprehensive theoretical framework that allows for dedicated modelling the role of cognitive processes in the development of emotional disorders is the self-regulatory executive function theory of emotional disorders (Wells and Matthews, 1994, 1996). This theory conceptualizes cognitive processes at different levels, with a particular focus on the role of metacognitions. Specifically, in the case of depression, the role of beliefs about rumination are stressed: positive beliefs about rumination, that is beliefs that ruminative thinking is functional (for instance to solve a problematic situation), are thought to increase the odds for engaging into ruminative thinking. Given that rumination turns out to be unsuccessful, this has detrimental effects on affect, and negative beliefs about rumination are built up that contribute to the subsequent development of depression (Papageorgiou and Wells, 2003).

Until now a substantial body of evidence has accumulated, corroborating the metacognitive model (Wells, 2008, for an overview), which has then been extended to other emotional disorders, particularly anxiety disorders (e.g. Bennett and Wells, 2010) and posttraumatic stress disorder (Wells et al., 2010). However, most evidence supporting the model and the role of positive and negative beliefs about rumination stems from cross-sectional surveys where key variables were generally assessed with retrospective questionnaires (Papageorgiou and Wells, 2003; Wells and Carter, 2001). Longitudinal trials are scarce; however, some longitudinal data indeed support the notion of metacognitions preceding depression and anxiety (Yılmaz, Gençöz and Wells, 2011). Trials on the effectiveness of metacognitive therapy provide further *ex juvantibus* evidence for the model's validity (van der Heiden, Muris and van der Molen, 2012; Bennett and Wells, 2010; Roelofs et al., 2007; Wells and Papageorgiou, 2004).

While the latter studies provide only indirect evidence for the model, the former studies may be afflicted by substantial biases in terms of the retrospective nature of the self-reports (Schwarz, 2007). Moreover, retrospective self-reports may differ from momentary experience and processes as they unfold in daily life and tap different kind of "experiences" (Conner and Barrett, 2012). Studies that focus on cognitive processes as they occur in daily life are needed to close this gap and to test the predictions of the self-regulatory executive function theory: are trait positive beliefs about rumination related not only to retrospective self-reports about rumination but also to momentary ruminative thinking?

The aim of the present study was to examine ruminative thinking in daily life with an diary-based Ecological Momentary Assessment (EMA) approach (Stone, Shiffman and Atienza,

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2007). Specifically, we examined if trait positive beliefs about rumination (1) were associated with ruminative thinking in daily life and if (2) a potential association with momentary affect was mediated by rumination.

Material and method

In a 4-week EMA study a non-clinical sample was equipped with electronic diaries.[1] Data were obtained on ruminative thinking in response towards negative emotions and momentary affect in daily life. Trait positive beliefs about rumination were assessed via retrospective self-reports at the beginning of the study.

Participants

A non-clinical sample of 93 undergraduate students (non-psychology; 64.5% women; mean age 23.4 years, $SD = 2.9$) at the University of Greifswald, Germany, was studied. The study's protocol was in accordance with the Declaration of Helsinki and informed consent was obtained from all participants.

Procedure

EMA protocol. Participants were equipped with electronic diaries (iPaq 11 series hand-held computers, Hewlett–Packard Corporation, Palo Alto, CA, USA) for 28 consecutive days. The EMA procedure was implemented with mQuest data entry software (cluetec GmbH, Karlsruhe, Germany, see Kubiak and Krog, 2012) and followed a signal-contingent sampling scheme. The participants were prompted acoustically four times per day to complete the questionnaire (random time frames of ± 30 min around 9 am, 1 pm, 5 pm and 9 pm). The participants completed the following EMA measures:

1. Emotions: In each trial, the participants were prompted to complete questions on the experience of emotions since the last trial. Participants were asked to report the possible experience of six emotions in a yes/no manner: anger, fear, sadness, joy, pride and enthusiasm. In cases in which more than one emotion was present, the participants were instructed to check the predominant emotion. To address our hypotheses only responses towards negative emotions (anger, fear, sadness) were of interest and only these episodes were subjected to further analyses. Note that we did not differentiate between the negative emotions (anger, fear, sadness) for the subsequent analyses, as the trait measure of positive beliefs about rumination that we used was not emotion-specific.
2. Rumination: Participants were then asked if they ruminated in response to the emotion ("I cannot forget the situation and keep thinking about it", rated on a 9-point Likert scale from 1 = totally disagree to 9 = totally agree). We examined this one item scale with regard to its psychometrics according to the suggestions made by Nezlek and Gable (2001) and by Shrout and Lane (2012). We found good reliabilities: following Shrout and Lane's (2012)

[1]The data present are a subset of a larger study on processes of ruminative thinking. See Siewert et al. (2011) for further details about the EMA protocol.

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notation, the between-person reliability amounted to $R_{KRN} = 0.89$. The within-person reliability amounted to $R_{CN} = 0.88$.

3. Affect: As a measure of momentary affect we used two bipolar items (content – discontent; well – unwell) adapted from the valence scale of the Mehrdimensionaler Befindlichkeitsfragebogen (MDBF; Multidimensional Mood Questionnaire; Steyer, Schwenkmezger, Notz and Eid, 1997). The version we used was adapted for daily process studies and has been validated previously (Wilhelm and Schoebi, 2007). Reliabilities of the scale were $R_{KRN} = 0.94$ and $R_{CN} = 0.86$ in the present study. A sum score was computed with higher values reflecting more positive affect.

Positive beliefs about rumination. To assess positive beliefs about rumination we used the Positive Beliefs about Rumination Scale (PBRS; Papageorgiou and Wells, 2001; Wells and Papageorgiou, 2003) which the participants completed among other questionnaires in a pre-monitoring session. The PBRS comprises nine items (4-point Likert scale from 1 = do not agree to 4 = agree very much; Cronbach's $\alpha = .86$). Sum scores were computed with higher scores indicating more pronounced positive beliefs in the functionality of ruminative thinking.

Statistical analysis

As our data were of a hierarchical structure, that is measurements (Level 1) nested within individuals (Level 2), we used multilevel analyses (Snijders and Bosker, 1999). Neglecting this multilevel structure would lead to invalid results. There was substantial within and between persons variability that justified the multilevel approach further (ruminative thinking: variance $_{\text{Level 2 -between}} = .53$, SE 0.35 = ; variance $_{\text{Level 1 - within}} = 6.44$, $SE = 0.36$; affect: variance $_{\text{Level 2 -between}} = 0.19$, SE 0.04 = ; variance $_{\text{Level 1 - within}} = 0.76$, $SE = 0.04$).

To investigate our hypotheses, a cross-level mediation model was examined (Krull and MacKinnon, 2001). In Krull and MacKinnon's (2001) terminology a $2 \rightarrow 1 \rightarrow 1$ mediation model was appropriate to test our hypotheses, that is a person level (level 2) effect on a within person (level 1) variable mediated by a within person (level 1) effect. In our study positive beliefs about rumination (Level 2) were modelled to predict average momentary positive affect (Level 1) either directly or indirectly via ruminative thinking (Level 1) in response to a negative emotion (see Figure 1). We used Stata statistical software (version 12.1, Stata Corporation, College Station, TX, USA) and the xtmixed command and ml_mediation package (Ender, 2012; UCLA Academic Technology Services Statistical Consulting Group, 2012) to model random intercept multilevel mediation according to Krull and MacKinnon (2001). The indirect effect was computed by multiplying the a and b paths in the mediation model (see Figure 1). We tested the significance of the indirect, direct, and total effect with an $n = 500$ bootstrap.

Results

The participants complied well with the 4-week protocol: on average 68.4 ($SD = 14.72$), out of a possible 84 signals were answered and completed. To examine whether compliance declined over the course oft he study, we computed a mixed logit regression to predict compliance by time, with the latter variable modelled as an endogenous parameter. The mixed logit regression

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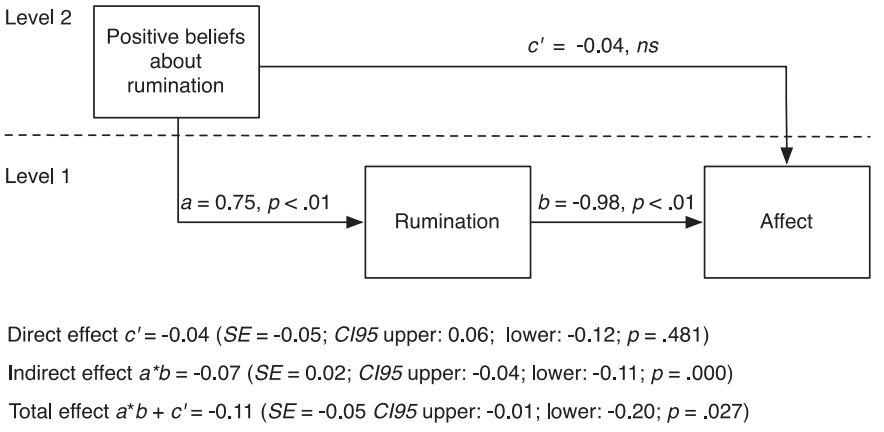

Figure 1. Multilevel mediation model, predicting momentary positive affect.
Notes. Unstandardized coefficients.
CI95 = 95% confidence interval.
Confidence intervals based on an $n = 500$ bootstrap.

model turned out to be non-significant with $b = 0.18$, $SE = 0.25$, $p = .70$. This indicates that protocol compliance did not deteriorate significantly during the course of the 4-week monitoring. Similarly, the degree of rumination did not change significantly over time, $b = -0.02$, $SE = 0.03$, $p = .96$.

The participants experienced on average 3.6 episodes of anger ($SD = 2.6$, range 0 – 11), 2.7 episodes of sadness ($SD = 2.3$, range 0 – 8) and 2.7 episodes of fear ($SD = 2.3$, range 0 – 12). While the rather low rates of fear are surprising the findings on sadness and anger are largely in line with previous evidence from non-clinical populations (Scherer, Wranik, Sangsue, Tran and Scherer, 2004). To rule our competing explanations, we tested if positive beliefs about rumination were associated with the occurrence of negative emotions. Mixed logit regression results showed that there was no significant association, with $b = -.049$ $SE = 0.10$, $p = .626$.

Effect estimates and 95% percentile confidence intervals, based on bootstrapping ($N = 500$) are shown in Figure 1. We found a significant indirect effect, that is the positive beliefs' effect on momentary positive affect was significantly mediated by momentary ruminative thinking. The direct effect of positive beliefs about rumination was non-significant, whereas the total effect was significant.

Discussion

We set out to examine whether positive beliefs about rumination were associated with the occurrence of ruminative thinking in daily life as predicted by the metacognitive model of depression and the self-regulatory executive function theory of emotional disorders (Wells and Matthews, 1994). In line with our predictions we found that trait positive beliefs about rumination are associated with ruminative thinking as it occurs in daily life. Moreover, metacognitions were significantly associated with momentary affect, this effect, however, being almost completely mediated by momentary ruminative thinking as evidenced by the

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total, direct, and indirect effects of the multilevel mediation model. Taken together, our findings add to the evidence supporting the metacognitive model; in line with the model, recent longitudinal evidence on metacognitions (Yılmaz et al., 2011) demonstrate that positive beliefs about rumination are indeed associated with ruminative thinking in daily life. The mediation mechanism that we found further corroborated the model's assumptions in terms of processes underlying the metacognition–negative affect link.

However, the total effect of metacognition is merely modest in terms of its effect size. One explanation may lie in the nature of rumination which, as pointed out by Watkins (2008), is not necessarily only dysfunctional. Different (dys)functional modes of ruminative thinking seem to exist that could be considered an appropriate mode of cognitive processing under specific circumstances: These pertain to different content and perspectives of ruminations (Ayduk and Kross, 2009; Kross, Ayduk and Mischel, 2005; Maria, Reichert, Hummel and Ehring, 2012) or the identification of emotion-specific facets or further moderating factors (Siewert, Kubiak, Jonas and Weber, 2011). For instance, in a recent EMA study, Huffziger, Ebner-Priemer, Koudela, Reinhard and Kuehner (2012) examined the effect of experimentally induced modes of rumination on momentary affect and found that particularly self-focused as opposed to distanced rumination led to a sustained decrease of positive affect. Distanced rumination may even be helpful as shown by Kross et al. (2005). On the same reasoning, positive beliefs about rumination may not only have a dysfunctional basis but could reflect positive experience with ruminative thinking in the past, that is solving problems or even effectively regulating emotions by ruminating. Trait metacognitions as assessed in our study may tap into both types of metacognitions, functional and dysfunctional possibly leading to low effect sizes of the metacognition paths. Future research should try to address this possible issue by differentiating between modes of ruminative thinking and possibly functional and dysfunctional metacognitions.

One prominent limitation of the study is its correlational nature that prevents us from drawing causal inferences pertaining to a directional effect of positive beliefs about rumination on ruminative thinking in daily life. However, from a conceptual perspective a trait like set of metacognitions, as assessed in the current study at baseline, precedes actual behaviour and experiences that could be with caution taken as a hint for a directional relationship. Moreover, we only examined rumination in response to negative affect and our findings may not generalize on ruminative thinking that occurs without a triggering episode of affect. The latter may also play a prominent role within the metacognitive model and warrants further study.

We acknowledge further limitations of our study. First, although we observed good compliance with the sampling protocol and no evidence in terms of reactivity, EMA studies are generally prone to reactivity effects (Barta, Tennen and Litt, 2012.). A further methodological point concerns the sampling frequency, with four scheduled measurements per day implying (modest) recall periods for the diary self-reports and not "true" real-time assessment. We opted deliberately for this sampling frequency as we expected compliance and acceptance to deteriorate considerably were the frequency increased, particularly in light of the long monitoring duration of 4 weeks.

Second, only a non-clinical sample was studied and our findings call for replication in samples of people with depression and other emotional disorders. In addition, we neither assessed depression nor depressive symptomatology in a strict sense. Thus, from a conceptual angle we were only able to test the positive beliefs about rumination –rumination link of the

metacognitive model. An EMA study pertaining to the hypothesized negative beliefs about depression–depression link remains to be conducted.

Conclusions

Our results confirmed our hypotheses and provide evidence of high ecological validity in support of the metacognitive model of depression that had so far been missing, as most studies relied on retrospective, questionnaire-based self-report. From a therapeutic perspective, our results also support the key role of metacognitions as a promising target for interventions, as in metacognitive therapy. Incorporating EMA-based patient reported outcomes in intervention research on metacognitive therapy would be a worthwhile endeavour. Based on the modest effect size of metacognitions that we found we argue that future research should differentiate between functional and dysfunctional modes of ruminative thinking as well as (dys)functional metacognitions.

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