

To Ruminare or not to Ruminare?

**An ESM Study on the Individual Association between Daily Rumination and Negative
Affect and their Relationship with Depression, Anxiety, and Well-being**

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Master's thesis

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Date: 25 January 2024

UNIVERSITY OF TWENTE.

Acknowledgements

This thesis was written to complete my Master's degree in Psychology with a specialisation in Positive Clinical Psychology and Technology at the University of Twente. During this last period of my degree, my professional development was challenged once more and I was lucky enough to have been supported by numerous people. Herewith, I would like to thank them. First, I am extremely grateful for my first supervisor, Dr Jannis Kraiss. Without the moments of constructive feedback and his expertise and knowledge on the subject, I would not have been able to carry out this thesis as it is now. Thanks should also go to two groups of people without whom I literally could not have conducted this research. Namely, the previous researchers who collected the data of this study, and the participants who committed themselves to participate in a study that is more demanding than the average. With the help of their contribution, I was able to pursue my thesis. Finally, I would also like to express my gratitude to my partner, family, fellow students and friends. To whom I could always turn, not only for emotional support but also for advice, inspiration and suggestions. Overall, I am incredibly grateful to have all these people around me, who have supported me in any way they could during this final step towards graduating as a psychologist.

Abstract

Rumination is mostly portrayed as maladaptive, however, some studies have hinted towards possible adaptiveness. Previous studies mainly used cross-sectional methodology and group models, which conceal individual variability. In contrast, this study employed Experience Sampling Methodology, which allowed for analysing the association between rumination and negative affect on both group- and individual level. Additionally, the individual within-person associations were correlated with trait levels of depression, anxiety, and well-being.

Participants ($n = 70$) were recruited with convenience sampling. State variables rumination and negative affect were completed four times daily for 14 days according to a semi-random schedule. The Person Mean and Person Mean-Centred scores of rumination were calculated. Linear Mixed Models with random slopes were used to determine the association between rumination and negative affect. Results showed a positive between-person association between state rumination and negative affect ($b = .31, 95, p > .001$), and a range of variability between the individual associations $[-0.20, 0.69]$. The associations were significantly correlated with trait depression ($r = .40, p < .001$) and anxiety ($r = .26, p = .029$), but not with well-being ($r = -.13, p = .27$). The group- and individual level analyses confirmed that individuals with more positive within-person associations between rumination and negative affect, reported higher levels of trait depression and anxiety. Exploration of unexpected individuals indicated a low compliance rate or possible depressive or anxious symptoms. As far as is known, previous studies were unable to identify individuals with unexpected results in correlation analyses based on the association between daily rumination and negative affect. These findings highlight the necessity of individualised mental health interventions, and future research could provide a more nuanced understanding of rumination's possible adaptiveness. Recommendations focused on mechanisms, such as qualitative research or moderating variables.

Keywords: rumination, negative affect, mental health, Experience Sampling Methodology, Linear Mixed Models

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Introduction

According to data from the World Health Organization (2022b), one in eight individuals worldwide suffers from mental illnesses, with anxiety and depressive disorders being particularly prevalent (Dattani et al., 2021; Mahmud et al., 2022; World Health Organization, 2022a). These disorders substantially impact educational and occupational achievements, contributing to productivity loss, absence, and underperformance (Linder et al., 2019; Penninx et al., 2021). In addition, the high prevalence contributes to the pressure on Dutch mental health care, which can be seen when looking at the, sometimes enormous, waiting lists (Faber, 2023; Maas, 2023). Maladaptive emotion regulation strategies play a pivotal role in depression and anxiety (Aldao et al., 2010; Beck, 1975; Berking & Wupperman, 2012). Emotion regulation refers to individuals' behavioural and cognitive strategies to control, experience and express their emotions (Barańczuk, 2019; Naragon-Gainey et al., 2017). These strategies can be adaptive, maladaptive, and deployed consciously or unconsciously (Slovák et al., 2022). External factors such as context, culture, and emotion influence the adaptiveness of emotion regulation (Calkins, 1994; Troy et al., 2013). Distraction, problem-solving, suppression, acceptance, reassurance seeking, avoidance, reappraisal, and rumination are all prominent examples of emotion regulation strategies (Aldao et al., 2010; Kraiss et al., 2020; Rector et al., 2011; Slovák et al., 2022). Deficits in emotion regulation are relevant to the development, maintenance, and recurrence of depression and anxiety (Berking & Wupperman, 2012). Therefore, focusing on the pivotal role of emotion regulation during treatment can influence decreases in depressive and anxious symptoms by improving skills and reducing dysregulation and deficits (Dryman & Heimberg, 2018; Young et al., 2019).

In exploring the domain of emotion regulation, rumination emerges as a crucial predictor and forms an important risk factor for anxiety and depression. Meta-analyses have shown rumination to be a predictor and strong risk factor for depression and anxiety (Aldao et al., 2010; Hong & Cheung, 2014). Rumination is defined as a repetitive and perseverative process of thinking about and focusing on emotions, feelings, concerns, and situations (Barańczuk, 2019; Nolen-Hoeksema et al., 2008). It encompasses two subtypes: brooding and reflection (Treyner et al., 2003). Brooding involves passively dwelling on negative consequences, while reflection entails critically analysing the causes of one's emotions and thoughts (Iqbal & Dar, 2015; Treyner et al., 2003). Rumination relates to worrying, but it differs in its temporal focus, with worrying being more future-focused and rumination past-focused (Kim & Newman, 2023). As an important transdiagnostic factor for depression and

anxiety (McLaughlin & Nolen-Hoeksema, 2011), increased rumination was found in individuals who had both mood and anxiety disorders compared with groups with one of the disorders and healthy control groups (Spinhoven et al., 2015). A meta-analysis observed a weak, but significant negative association between rumination and well-being (Kraiss et al., 2020). These studies highlight rumination as a multifaceted and transdiagnostic mental health factor.

Within the realm of emotion regulation research, the relationship between affect and rumination has been extensively explored. A meta-analysis by Mor and Wingquist (2002) concluded rumination to be more strongly related to higher negative affect than other self-focused attention strategies. Moreover, positive associations between rumination and negative affect are consistently found in more recent studies (Kim & Newman, 2023; Nolen-Hoeksema et al., 2008; Páez et al., 2013). Rumination is not only associated with increased negative affect but also with decreased positive affect (Brans et al., 2013; Hoorelbeke et al., 2016). However, a recent study observed no differences between high and low ruminators and their association with positive affect (Lask et al., 2021). Several studies have also revealed relationships among rumination, negative affect, well-being, depression, and anxiety. Negative affectivity is linked to both depression and anxiety (Iqbal & Dar, 2015; Renner et al., 2016). Rumination was observed to decrease positive affect and increase negative affect, depression, and anxiety (McLaughlin et al., 2007). One study showed rumination to be significantly associated with affective experiences for participants diagnosed with Major Depressive Disorder (MDD) and/or Generalised Anxiety Disorder (GAD), but not significantly associated with participants without these diagnoses (Kircanski et al., 2017). Iqbal and Dar (2015) concluded that ruminative thinking mediates the association between negative affect and depression. With this information in mind, the intricate interplay with rumination reveals a mainly positive correlation with negative affect and a predominantly negative correlation with mental health.

In addition to the maladaptive aspect of rumination, certain studies have highlighted potential positive aspects. Defined as a repetitive thinking style of feelings, rumination can increase positive affect after experiencing a positive emotion (Páez et al., 2013). Shrimpton et al. (2017) demonstrated ruminating to be associated with positive and constructive daydreaming (Shrimpton et al., 2017). Moreover, emotional events can be tolerated better by ruminating (Watkins & Teasdale, 2001), suggesting rumination's potential to support adapting to negative emotions. This aligns with the relationship between adaptive rumination and problem-solving strategies (Sütterlin et al., 2012). Furthermore, rumination can be employed

as a coping style to re-evaluate, focus on past events, and rearrange meanings or beliefs (Platte et al., 2022). This is in line with a study by Nolen-Hoeksema et al. (2008), which described that ruminating gives individuals feelings of gaining insight into their feelings and thoughts. This might explain why rumination can improve an individual's ability to imagine future events (Lavender & Watkins, 2004). Ruminating has also been indicated as a strategy to decrease anxiety when a person is worrying, and this study suggested investigating this on an individual level (McLaughlin et al., 2007). Burwell and Shirk (2007) focused on the subtypes of rumination and showed that reflection is associated with adaptive coping to depressive symptoms, whereas brooding is associated with maladaptive coping. Reflective rumination has been found to help understand feelings in individuals with high well-being (Barber et al., 2010). This suggests a dual nature of rumination, wherein alongside its maladaptive manifestations, empirical evidence demonstrates its potential for adaptive functions.

Until now, the correlation between rumination and mental health has predominantly been studied using cross-sectional methodologies and group analyses. The limitation of this methodology is that it shows average results across all participants in the data, which is likely to mask variability in individual associations (Gabriel et al., 2018). ESM studies have emerged as a valuable alternative with increasing popularity. ESM studies are intensive longitudinal studies with multiple assessment points per day per participant (Myin-Germeys & Kuppens, 2021). Therefore, ESM obtains data from participants anytime, anywhere, in their natural, personal habitat (Larson & Csikszentmihalyi, 1983), and allows for calculating both between-person and within-person information (Jarvinen et al., 2022). Myin-Germeys and Kuppens (2021) indicate that between-person and within-person information illustrate individual differences, whereas within-person information also illustrates how an individual and their experiences change over time or context. However, even within-person information is usually examined using group models and calculating and testing the statistical significance of one results in an average within-person association. This conceals individual variability and can lead to erroneous conclusions about the actual individual associations. However, the intensive longitudinal nature of ESM data also allows for specific analyses focused on the individual level, without employing group models (Lafit, 2022).

Several ESM studies have already been conducted that studied rumination and negative affect on group levels (Eisele et al., 2021; Schmitter et al., 2021; Schneider et al., 2016). Connolly and Alloy (2017), for example, investigated rumination as a reaction to stress and a predictor of depressive symptoms. Their study consisted of four measurements per day

for a week. However, this study did not find an independent relationship between rumination and depressive symptoms, which might indicate that not every participant who ruminated could be related to depressive symptoms. Another ESM study found rumination to be related to increased sadness and decreased happiness (Baik & Newman, 2023). Baik and Newman (2023) of eight daily measurements for 8 days to participants with MDD and/or GAD and participants without psychopathology. This study found that individuals with MDD and GAD reported higher rates of rumination than those without psychopathology. Brans et al. (2013) conducted an ESM study in which participants received ten daily measurements for seven days, and they found a positive association between rumination and negative affect and a negative association between rumination and positive affect. Hoorelbeke et al. (2016) studied the application of rumination in daily life, by gathering ESM data over 7 days and non-clinical participants completed eight surveys per day. They found rumination to be related to future increased negative affect and decreased positive affect.

Due to the changeability of rumination in terms of maladaptiveness, there are reasons to wonder if there are relevant differences between individuals in their (within-person) strength and the direction of the association between individuals. Previous studies have focused on rumination, negative affect, and mental health using cross-sectional methodologies and group analyses. As mentioned, some ESM studies also focused on these topics; however, they still used group models by analysing average between- or within-person levels and not individual person-specific levels. Therefore, this study will use ESM data to focus on the individual association between rumination and negative affect. Furthermore, it will be studied how the strengths of the individual associations subsequently correlate to trait levels of depression, anxiety, and well-being. In the long term, this can help understand the individual mechanisms and can aid the opportunity for individualised interventions and treatment for depressive and anxiety disorders. Considering all the information above, the following two research questions have been formulated:

1. *What is the extent of variability in the individual association between state rumination and state negative affect?*

Since the literature does not show a complete uniformity in the correlation that rumination has on negative affect, it is important to study the variability at an individual level. *H1*: It is expected that on average the individuals will have a positive association between rumination and negative affect. *H2*: A substantial variability within the associations is expected. *H3*: It is expected that some individuals will show a negative association between rumination and negative affect.

2. *To what extent are the individual associations correlated with trait depression, anxiety, and well-being and are there individual associations that are not in the expected direction?*

H4: For both trait depression and trait anxiety, a positive correlation between the individual associations and the trait variables is expected. *H5*: A negative correlation between the individual associations and trait well-being is expected. *H6*: For all three correlation measures, it is expected from the individuals outside of the confidence interval, that one or more individuals will be categorized as unexpected.

Method

Participants

This study concerns secondary analyses using previously collected data (Schwabe, 2022; Wallner, 2022). A convenience sampling method was used to recruit participants. Convenience sampling is a type of non-random sampling where accessible participants are available and allows for motivated participants, which is fitting for ESM studies since it requires a high frequency of data collection (Van Berkel & Kostakos, 2021). The sampling was conducted using personal contacts and SONA, a test-subject pool from the University of Twente for mandatory research participation that provides SONA credits to participating students.

Participants were required to be at least 18 years old, possess a sufficient level of English and own a smartphone. The targeted sample size was based on an observed average of 53 participants in previous ESM studies (Van Berkel et al., 2017). The earlier discussed ESM study by Brans et al. (2013), found a significant effect ($B = .18, p < .001$) between rumination and negative affect, with 46 participants. According to the literature, the total of 114 participants that were recruited in the current study, seemed agreeable, considering the possibility of high drop-out rates and, or low response rates in ESM studies (Dejonckheere & Erbas, 2022). Additionally, this number would provide around 99.61% power to detect a moderate correlation on the between-person level ($r = 0.4$; two-sided $\alpha = .05$).

Design and Procedure

The Ethics Committee of Behavioural, Management and Social Sciences of the University of Twente approved the study (request number: 220285). After this approval, a two-day pilot test was performed to ensure that the technology and questionnaires worked properly. Ethica was the application used to collect data during this study (Ethica, 2022). Participants were asked to download Ethica on their mobile phones, to register for the study

by entering an assigned study code after successful pilot testing and they provided active informed consent, see Appendix A. Data collection started on April 13, 2022, and ended on April 27, 2022, and thus lasted for 14 days. The length and number of measurements per day were based on earlier ESM research. While avoiding an excessive amount of data points, this duration permitted the analysis of daily emotions and behaviours (Conner & Lehman, 2012; Larson & Csíkszentmihályi, 2014; Van Berkel et al., 2017) and resulted in a balance between capturing daily data and minimising participant burden. Previous ESM studies with more items or higher sample frequencies have been linked to decreased compliance (Eisele et al., 2020).

On the first day of data collection at 9 a.m., participants were asked to complete the baseline questionnaires, which took about 20 minutes to complete. The baseline questionnaires, containing 3 questionnaires with a total of 30 items, were available to fill in during the entire duration of the study and three reminders were sent after 8, 24, and 72 hours. The daily questionnaires were triggered in the application four times a day using a semi-structured sampling scheme. This form of sampling scheme leads to a higher ecological validity compared to fixed sampling schemes (Dejonckheere & Erbas, 2022). Furthermore, this form of sampling scheme increases the compliance rates and authenticity of reported feelings and thoughts in comparison to fixed intervals, because participants are less likely to anticipate or organise their actions around the questionnaires (Dejonckheere & Erbas, 2022). Random prompts were given out over the day within four predetermined time intervals: between 10 and 11 a.m., 1:30 p.m. and 2:30 p.m., 5 and 6 p.m., and 8:30 and 9:30 p.m. The daily questionnaires contained six items and were estimated to be answered within 3 minutes. If unanswered, participants received reminders after 1 hour and the questionnaires expired after 2 hours. For both baseline and daily questionnaires, multiple questionnaires were administered for a larger project. Only measures relevant to the current study are described.

Materials

State questionnaires

Six items were completed four times per day to measure the daily negative affect and rumination that the participants experienced at these moments, see Appendix B. The ESM Item Repository was used to select the six items (Kirtley et al., 2018). The following four items measured negative affect: “*How anxious do you feel right now?*”, “*How irritable do you feel right now?*”, “*How down do you feel right now?*” and “*How sad do you feel right now?*”. The items could be answered using a seven-point Likert scale, ranging from 1 (not at all) to 7

(very much), and a higher score on the items indicated a higher experience of negative affect. The average of the four items was used to create a single-state negative affect score. Using a split-half-correlation of the person-mean (PM) between the results of the items of the first week and those of the second week, a high, significant correlation was found in this study: $r(68) = .82, p = .001$.

Second, two items measured the amount of rumination they experienced at that moment, these were: “*In the last hour, I have been thinking about my problems.*” and “*In the last hour, I had repetitive thoughts about my problems.*”. A seven-point Likert scale, ranging from 1 (not at all) to 7 (very much) could be used to answer the items, a higher score indicated a higher ruminating experience. These two items were also collected from the ESM Item Repository (Kirtley et al., 2018), and comparable items have been used in several studies (Hoebeke et al., 2022; Huffziger et al., 2013; Moberly & Watkins, 2008a; Rosenkranz et al., 2020). The two items were composited into an average state rumination score. In this study, state rumination showed a high, significant split-half correlation between the PM results of the first week and those of the second week: $r(68) = .82, p = .001$.

Baseline questionnaires

To gather demographic information, a questionnaire with questions regarding age, gender, nationality, educational background, and occupation was included. Furthermore, three questionnaires were administered to measure trait depression, trait anxiety, and trait well-being. The baseline questionnaires are provided in Appendix C.

To measure trait depression, the Patient Health Questionnaire-9 (PHQ-9) was employed. This questionnaire contained nine items about problems participants experienced over the last two weeks. These could be answered using a four-point Likert scale, ranging from 0 (never) to 3 (nearly every day). A higher score indicated higher levels of depressive symptoms. The PHQ-9 has a high internal consistency ($\alpha = .87$), and research suggests that it is a valid instrument with established reliability (Costantini et al., 2021; Janssen et al., 2016; Teymoori et al., 2020). The results of the PHQ in the current study showed a high internal consistency ($\alpha = .89$).

Trait anxiety was measured using the General Anxiety Disorder-7 (GAD-7). This questionnaire contained seven items about the frequency of being bothered by certain issues. These questions could be answered with a four-point Likert scale, which ranges from 0 (never) to 3 (every day). A higher score indicated higher levels of anxiety symptoms. The GAD-7 is an established reliable instrument with high internal consistency ($\alpha = .92$), and

good criterion validity (Donker et al., 2011; Homans, 2012; Rutter & Brown, 2016). The internal consistency in this study was high ($\alpha = .88$).

The Mental Health Continuum Short Form (MHC-SF) was applied to measure trait well-being. This questionnaire contained fourteen items and measured well-being with questions about their experiences over the last month. The questions are answered with a six-point Likert scale. This scale ranges from 0 (never) to 5 (every day) and a higher score indicates a higher level of well-being. The MHC-SF shows a high internal consistency ($\alpha = .91$) (Luijten et al., 2019). Together with a moderate to high convergent validity, the MHC-SF is a valid and reliable questionnaire (Franken et al., 2018; Luijten et al., 2019; Yeo & Suárez, 2022). In this study, the internal consistency was also high ($\alpha = .93$).

Data analysis

The analyses were performed using both SPSS version 28 and R version 4.3.1. Moreover, in R, the packages ggplot2, haven, and dplyr were installed. Studies indicate that to make reliable analyses with ESM data, a compliance rate of at least 33% is required for participants to be included (Biron & Van Veldhoven, 2012; Viechtbauer, 2022). After adding this criterion, 44 participants were removed, resulting in 70 participants being left for analysis. This resulted in a power of 94.94% to detect a two-sided significant and moderate effect size ($r = .4$). On average, the remaining participants filled in 67.42% of the data ($SD = 16.80\%$, range = 33.93 - 98.21%). 68.53% of all state questions from all measurements and participants were answered, indicating 30.47% missing data points from all state questions.

For the state and trait questionnaires, mean scores and standard deviations were computed. The person-mean (PM) and person-mean centred (PMC) (Enders & Tofighi, 2007; Hoffman & Walters, 2022) were calculated for the state rumination variable. The PMC of state rumination was used to analyse the association between rumination and negative affect, as the PMC can show pure within-person associations by obtaining a time-specific deviation from the PM (Gottfredson, 2019).

The first research question focuses on the variability in individual associations and was examined using Linear Mixed Models (LMMs). LMMs can examine repeated measures and both within- and between-person associations (Landerman et al., 2011). Moreover, LMMs are more fitting for ESM data as they consider missing data, random errors, and the nested data structure (Magezi, 2015; Schunk & Perales, 2017). By using the Covariance Type First-order Autoregressive AR(1) the time dynamics within participants of repeated measured variables could be modelled (Bringmann et al., 2013). With time as a repeated variable,

identity number of the participants as subject, state negative affect as the dependent variable, and PMC state rumination as a covariate, the analysis was run.

Visualising the association between the scores of state negative affect and the PMC scores of state rumination was made possible by using a random slopes model, which provided insight into how individuals differ from each other (Viechtbauer, 2022). For further clarity, three categories of association strength were distinguished: negative association, negligible positive association, and positive association. This distinction was made since most participants were expected to show positive associations. This made it important to distinguish the variety in the strength of positive associations. The cut-off point for a negative association was $<.0$, for negligible positive it was $>0.0-<0.2$, and for positive it was >0.2 (Mukaka, 2012). Finally, the individual associations between state rumination and state negative affect were extracted from the calculated random slopes and defined as a new variable for further analyses.

The second research question was answered by calculating Pearson correlations between the extracted individual associations between rumination and negative affect, and trait depression, anxiety, and well-being. The strength and direction of the correlation between the associations and trait measures were examined.

Moreover, using three scatterplots, the correlations per participant were made visible, where each scatterplot shows the correlations between one of the traits and the individual associations. To determine unexpected correlations the scatterplots were divided into four quadrants. These quadrants were determined by the medians of the variables, meaning that the vertical lines were determined by the median of the trait variables and the horizontal lines by the median of the individual associations from the first research question. Two of the quadrants were defined as expected and two as unexpected. As most studies showed a positive correlation between rumination, negative affect, depression, and anxiety, it was expected that for the scatterplots considering trait depression and trait anxiety, most of the correlations would be located in the bottom-left and upper-right quadrants. Therefore, these two quadrants were defined as expected quadrants. Subsequently, for the scatterplot considering variable trait well-being, it was expected that most of the correlations would be located in the upper-left and bottom-right quadrants, which were then the expected quadrants.

Furthermore, per scatterplot an ellipse was calculated using the package `ggplot2` in R. This ellipse was based on a 95% confidence interval assuming a multivariate normal distribution (Greenacre, 2016). Consequently, participants in the unexpected quadrants close to the intersection of the medians could not be fully labelled as unexpected. Since they were

found not to deviate sufficiently compared with expected individuals, and the focus was more on participants lying in the outer corners of the unexpected quadrants. Unexpected individuals on the border or outside the ellipse were further examined by visualising their data.

Results

The overall age of the 70 participants was relatively young with an average age of $M = 22.93$ years ($SD = 7.46$ years, range = 18-65 years). Moreover, the majority of participants identified as female (61.43%) with a German nationality (68.57%), and who were studying at the time of data collecting (87.14%). In Table 1, further demographic information of the participants can be found.

Table 1

Demographic information of the participants, including the age, gender, nationality, occupation, and education of the individuals.

Variable	n=70	%
Gender		
Female	43	61.4
Male	26	37.1
Non-binary	1	1.4
Nationality		
Dutch	12	17.1
German	48	68.6
Other	10	14.3
Occupation		
Not working	2	2.9
Studying	42	60.0
Studying and working	19	27.1
Working	6	8.6
Other ^a	1	1.4
Education		
Bachelor	4	5.7
High school	62	88.6
Master	3	4.3
HBO associate degree	1	1.4

^a The participant did not specify the other occupation.

The results of the mean scores and standard deviations of the state and trait questionnaires can be found in Table 2. The participants scored relatively low average scores with some variability in both state rumination and state negative affect. Compared to a study with a non-clinical sample of German students, the participants of this study showed a somewhat higher score and variability on both the PHQ-9 and GAD-7 (Zhou et al., 2020). A score between 5 and 9 on the PHQ-9 and GAD-7 indicates mild symptoms (Jordan et al., 2017; Kroenke et al., 2001). This participant sample showed a lower score than a previous non-clinical sample of Dutch participants on the MHC-SF (Lamers et al., 2011). A score of 2.29-2.85 for females and 2.21-2.78 for males can be interpreted as low well-being (Lamers et al., 2011). In general, it appears that participants in this study exhibited a relatively infrequent occurrence of rumination and negative affect in their daily experiences. Simultaneously, there are indications of mild depressive and anxious symptoms, as well as a diminished sense of well-being.

Table 2

Descriptive statistics of state- and trait questionnaires compared with related studies.

Measure	Current study		Comparative study	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
State rumination	2.75	1.57	-	-
State negative affect	2.15	1.13	-	-
Trait depression (PHQ-9)	8.35	5.91	6.77 ^a	4.84 ^a
Trait anxiety (GAD-7)	8.97	4.86	6.23 ^a	4.27 ^a
Trait well-being (MHC-SF)	2.65	.91	3.98 ^b	.85 ^b

Note. Data are from Zhou et al. (2020)^a and Lamers et al. (2011)^b.

Variability in the associations between state rumination and state negative affect

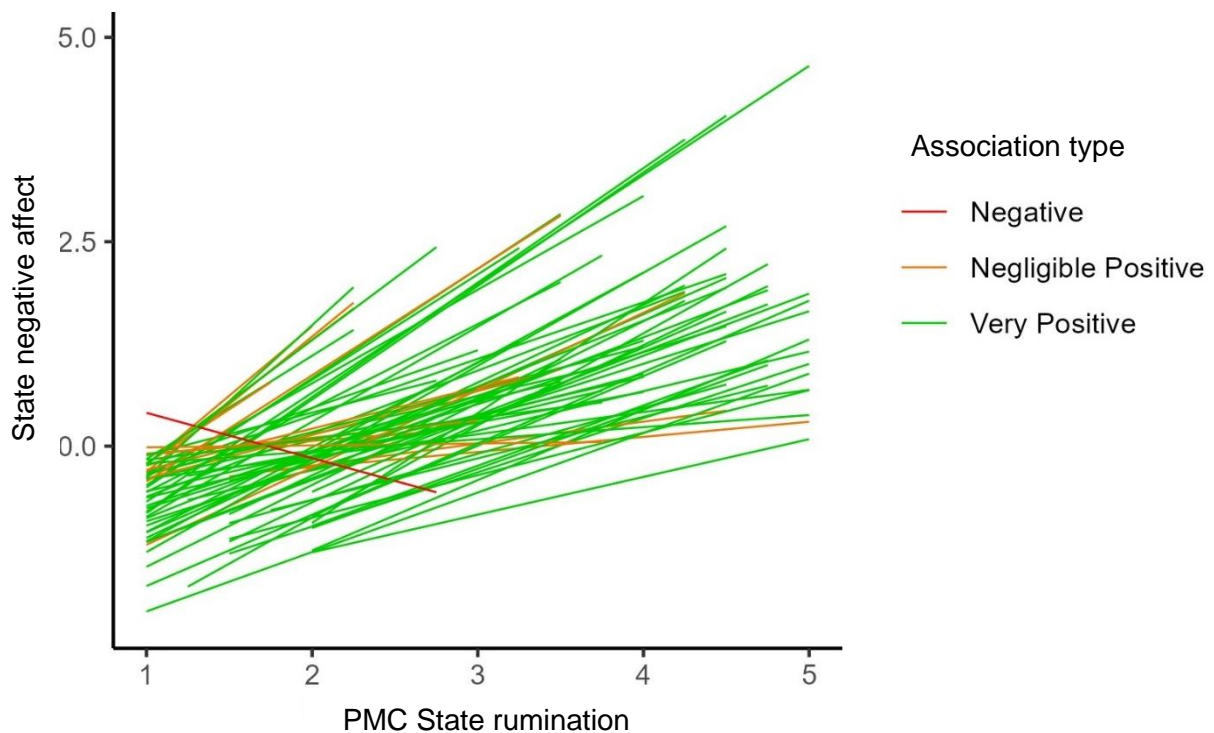
The analysis, conducted using a linear mixed model, demonstrated a significant positive association between the person-mean centred state rumination and state negative affect ($b = .31$, 95% CI = [.28; .33], $p > .001$). This indicates that, with an increase of one in rumination, the average increase of negative affect was .31 and suggests that for most of the participants, there was indeed a positive association between the variables.

To further examine the individual associations, Figure 1 was created. In the figure, three different levels of association are distinguished. The first category included negative associations ($n = 1$), the second category included negligible positive associations ($n = 13$),

and the last category included positive associations ($n = 56$). While the majority of participants showed a positive association between rumination and negative affect, these findings revealed the variation in the strength of the associations. The lowest individual association was $-.20$ and the highest individual association was $.69$.

Figure 1

Individual associations between PMC state rumination and state negative affect are visualised with random slopes.



Correlation between individual associations and trait variables

The correlation between the individual associations and trait depression showed a positive significant moderate correlation ($r = .40, p < .001$). Second, the correlation between individual associations and trait anxiety also showed a positive correlation of small strength ($r = .26, p = .029$). Finally, the correlation between individual associations and trait well-being showed a small, not significant negative correlation ($r = -.13, p = .27$). Table 3, is a brief overview of the correlation analyses.

Table 3

Pearson's R correlations between the individual associations of rumination and negative affect and the trait variables.

		PHQ-9 (Trait depression)	GAD-7 (Trait anxiety)	MHC-SF well-being)
Association between rumination and negative affect	<i>r</i>	.40	.26	-.13
	<i>p</i>	<.001***	.029*	.27

*** Correlation is significant at the .001 level (two-tailed).

* Correlation is significant at the .05 level (two-tailed).

Three scatterplots were visualised with the association between PMC state rumination and state negative affect on the x-axis and the trait variables for depression, anxiety, and well-being on the y-axis. On both the x- and y-axes the median was used to draw a line and divide the scatterplot into four quadrants. The median association between rumination and negative affect was .32. Furthermore, for all scatterplots, an ellipse was calculated based on a 95% confidence interval. Table 4 provides an overview of the number of participants in the quadrants per scatterplot.

Table 4

Overview of the participant distribution between the expected and unexpected quadrants, and how many are both in the unexpected quadrant outside of the confidence interval.

Trait variable		<i>N</i>
Depression (PHQ-9)	Expected quadrant	41
	Unexpected quadrant	29
	Unexpected and outside* the 95% CI	1
Anxiety (GAD-7)	Expected quadrant	38
	Unexpected quadrant	32
	Unexpected and outside the 95% CI	2
Well-being (MHC-SF)	Expected quadrant	40
	Unexpected quadrant	30
	Unexpected and outside the 95% CI	3

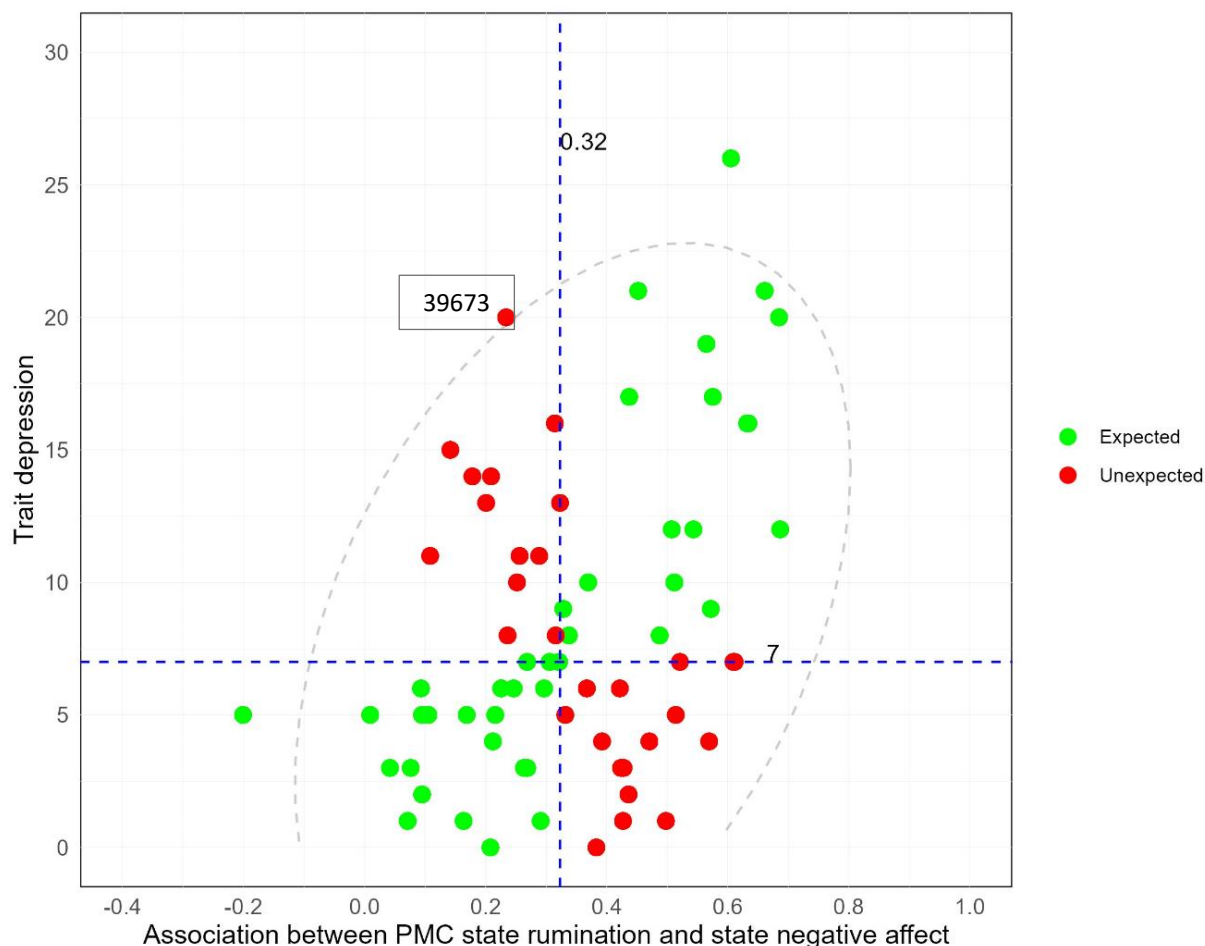
Note. Participants located on the edge of the ellipse are also included.

For all three scatterplots, a small majority of participants were found in the expected quadrants and slightly less than half of the participants were found in the unexpected quadrants. In Table 4, the number of participants who were around or outside the border of the 95% confidence interval can also be found.

In Figure 2, the scatterplot for trait depression with a median of 7 can be seen. A weak positive correlation with a strong association and a linear shape was shown. Even though there were numerous participants in the unexpected quadrants, most of them were found within the boundary of the ellipse, which means they did not stand out significantly compared with the participants in the expected quadrants. In addition, only one participant lay near the edge of the ellipse. only five participants were outside the confidence in

Figure 2

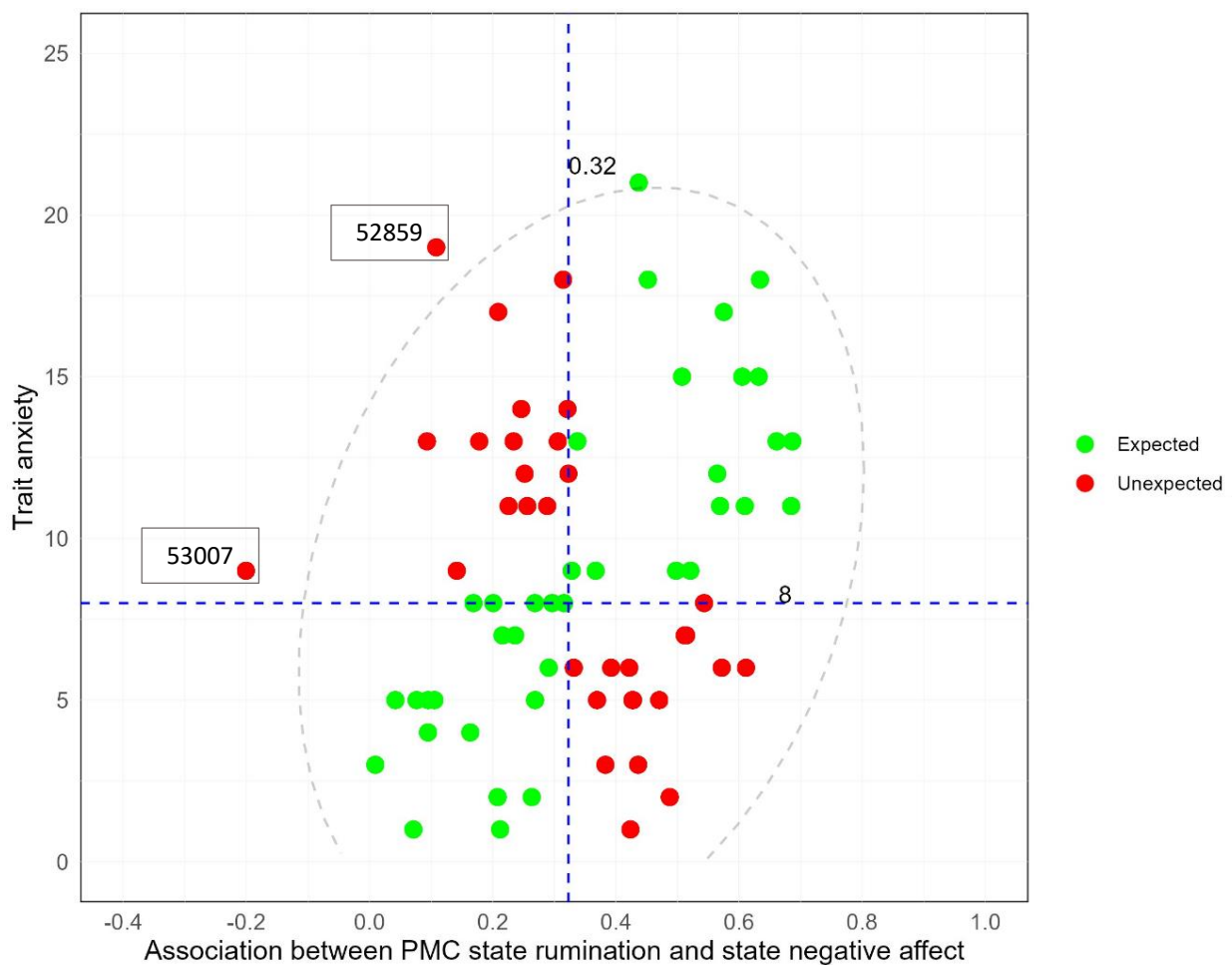
Scatterplot of the association between PMC state rumination and state negative affect, and trait depression with four quadrants and an ellipse based on a 95% confidence interval.



For trait-variable anxiety, the scatterplot also showed a positive correlation with a somewhat linear shape. However, this one showed a weaker correlation as the dots were more broadly scattered, see Figure 3. This counted for both the participants in the expected and the unexpected quadrants. The median of trait anxiety was 8. There were many participants in the unexpected quadrants, but there were only two who fell outside the 95% confidence interval ellipse.

Figure 3

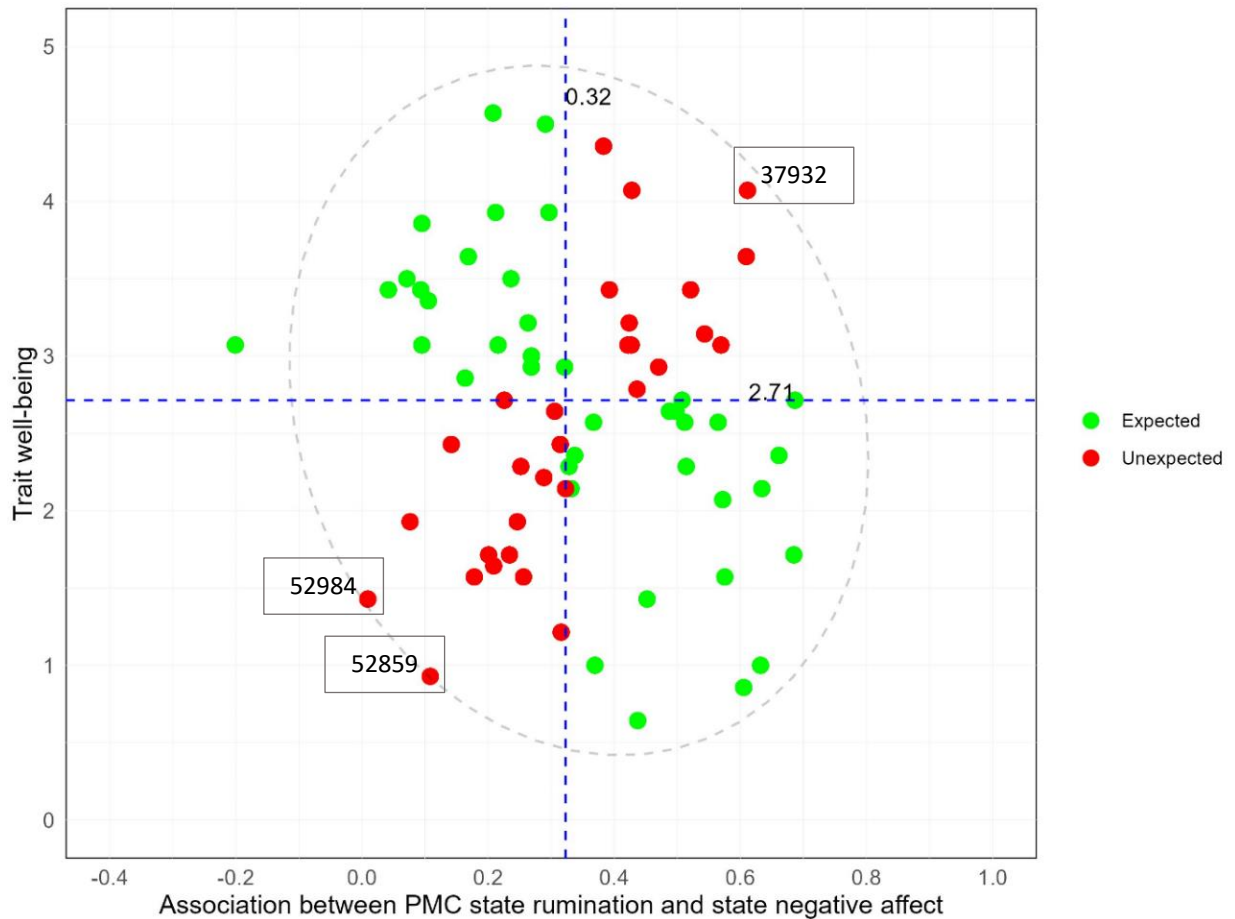
Scatterplot of the association between PMC state rumination and state negative affect, and trait anxiety with four quadrants and an ellipse based on a 95% confidence interval.



In Figure 4, the scatterplot for trait well-being can be found and this trait has a median of 2.71. The scatterplot showed a weak, negative correlation with a strong association and a somewhat linear shape. Three participants from the unexpected quadrants were located around the ellipse border.

Figure 4

Scatterplot of the association between PMC state rumination and state negative affect, and trait well-being with four quadrants and an ellipse based on a 95% confidence interval.



As previously mentioned, Table 4 shows the participants on the border or outside of the ellipse. One participant (ID: 52859) was outside the ellipse for both trait anxiety and trait well-being. Table 5 presents the total scores of the trait questionnaires and the mean scores of the state questionnaires of the five participants whose individual association fell outside of the ellipse. Moreover, the trait variable in which the participant was outside the 95% confidence interval ellipse was marked.

The observed scores of state negative affect and rumination of participants who were on the boundary or outside the ellipses are additionally visualised in Figure 5. Participant 37932 showed moderate depressive and anxious symptoms. The line graph showed that the participant answered 30 of the 56 response moments, which is slightly more than half. This complicates the interpretation of results from this individual, and it can only be stated that at

the times when answers were filled in, it seems that negative affect and rumination were fairly similar, except for the first measurement moment.

Table 5

Total scores of the trait variables and their indication, together with the mean score and standard deviation of the state variables per individual.

Variable \ ID	37932	39673	52859	52984	53007
Trait depression	7.00 (Moderate)	20.00 (Severe)*	11.00 (Moderate)	5.00 (Mild)	5.00 (Mild)
Trait anxiety	6.00 (Moderate)	13.00 (Moderate severe)	19.00 (Severe)*	3.00 (Mild)	9.00 (Moderate)*
Trait well-being	4.07 (Average)*	1.71 (Below average)	.93 (Low)*	1.43 (Below average)*	3.07 (Average)
State negative affect	2.74 (.99)	1.80 (.74)	2.42 (.98)	1.63 (.58)	1.73 (.50)
State rumination	2.58 (1.18)	1.57 (1.35)	4.58 (2.14)	1.83 (.93)	2.03 (.84)

*The individual was on the edge or outside the ellipse for this variable.

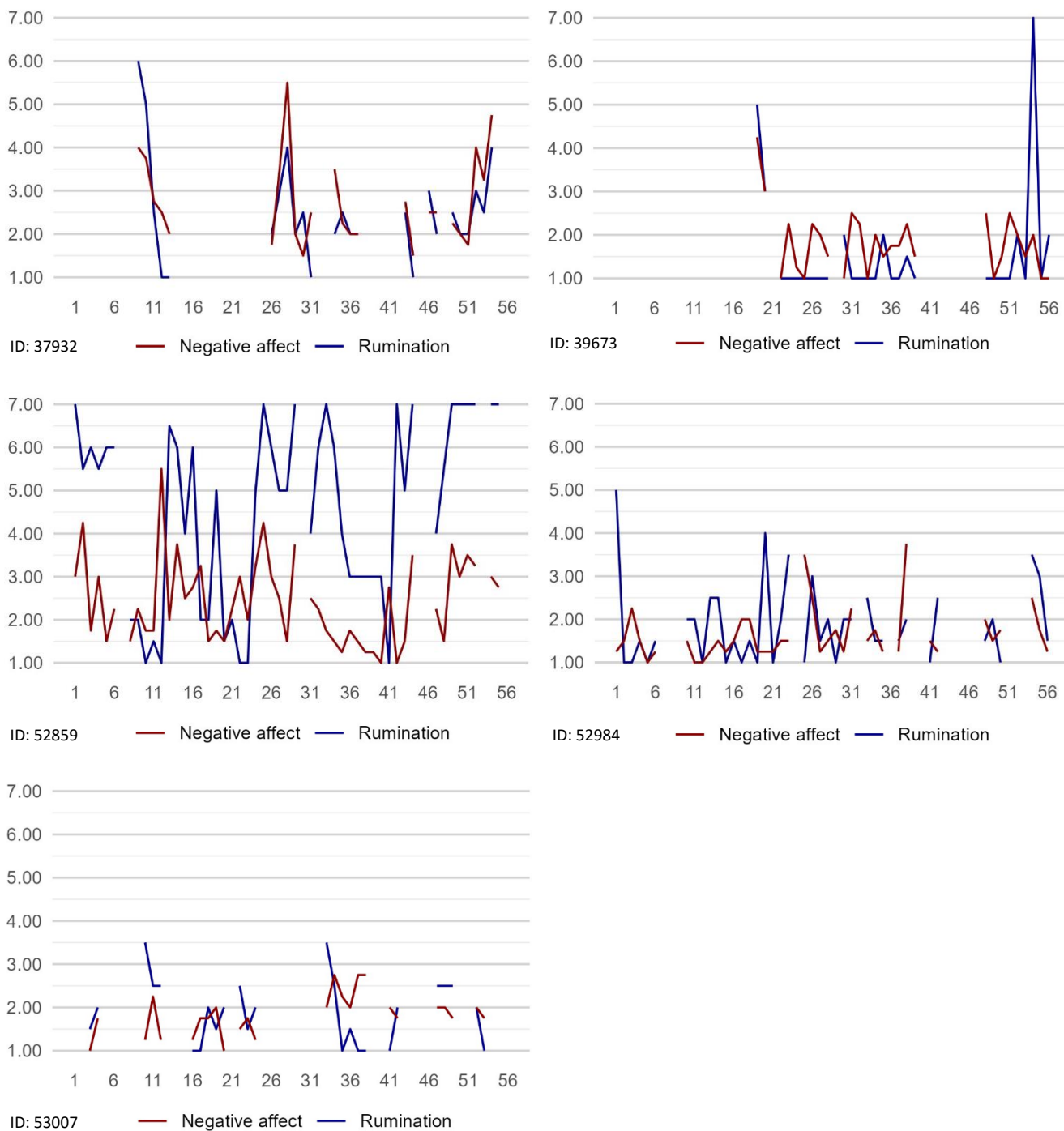
The baseline questionnaires of participant 39673 revealed severe depressive and moderately severe symptoms of anxiety and a below-average feeling of well-being. Again, slightly more than half, 29 out of 56, of the response moments were completed, and a low variability was found in the line graph. Compared with participant 37932, this participant seemed to show less similarity between the scores of negative affect and rumination. However, little can be concluded about this because of the poor response rate. Participant 52859 reported low feelings of well-being, symptoms of moderate depression, and severe anxiety. In the graph, it can be seen that this participant answered almost all response moments and high variability in rumination could be seen across measurement times.

Moreover, negative affect and rumination seemed to fluctuate somewhat independently in the graph. Below-average feelings of well-being were reported by participant 52984 and the low variability for the state items is noteworthy. Rumination and negative affect scores seemed to be mostly equivalent to each other. Finally, participant 53007 showed moderate anxiety symptoms and a small range of rumination and negative affect. Interestingly, participant 53007 was also the only participant with a negative association between state rumination and negative affect.

However, slightly more than half of the measurement times were answered, which decreased the reliability of these observations.

Figure 5

Line graphs of the observed rumination and negative affect scores varying over time for the salient individuals.



Discussion

This study aimed to investigate the variability of individual associations between daily rumination and negative affect. Moreover, correlations between individual associations and depression, anxiety, and well-being were investigated. Previous studies used mostly group analyses and cross-sectional methodologies to examine rumination, negative affect, and mental health (Iqbal & Dar, 2015; Kircanski et al., 2017; Lask et al., 2021; McLaughlin et al., 2007). Although some studies using ESM explored these topics, they still mainly used group models and explored levels that were either between- or within-person rather than person-specific (Baik & Newman, 2023; Connolly & Alloy, 2017; Hoorelbeke et al., 2016), which results in generalised conclusions that might not apply to all individuals. The approach of this study contributes to a more nuanced understanding of individual differences in links between daily mechanisms that consider rumination, paving the way for personalised interventions and treatments for depressive and anxiety disorders.

Variability in the associations between state rumination and state negative affect

The results of the current study found on average a significant association between state rumination and state negative affect, which approves the first hypothesis: *It is expected that on average individuals will have a positive association between rumination and negative affect.* This result is also in line with ESM studies by Baik and Newman (2023) and Kircanski et al. (2017). Baik and Newman (2023) demonstrated that rumination increases sadness, and Kircanski et al. (2017) observed that higher levels of rumination are associated with higher levels of negative affect. Individual associations between state rumination and state negative affect were also positive for most participants; however, the individual associations also demonstrated a range of variability. Despite most participants showing a positive association, there is still a discernible group of individuals who are not that unambiguous in their association. Therefore, these results confirm the second hypothesis: *A substantial variability within the associations is expected,* the third hypothesis, *It is expected that some individuals will show a negative association between rumination and negative affect,* can be partly approved, because there is merely one negative association. These results seem consistent with previously mentioned studies suggesting potential benefits of rumination for some people, such as problem-solving, adaptive coping, and gaining insights (Nolen-Hoeksema et al., 2008; Platte et al., 2022; Sütterlin et al., 2012; Watkins & Teasdale, 2001). Hence, the individuals who showed a negligible positive association or a negative association might not fit into the previous studies employing group models, which typically portray ruminating to be uniformly negatively related to negative affect.

The significant positive association between state rumination and state negative affect can be interpreted as follows: if an individual ruminated more than usual, more negative affect was experienced. However, this does not fully justify the observed individual variability when examining the associations on a person-specific level. This variability ranges from a negative association between state rumination and negative affect for some people to a strong negative association. A possible explanation for this might be the dual structure of rumination. Ruminating can be divided into two subtypes: brooding and reflecting. Brooding is defined as dwelling passively and engaging in negative comparison, while reflective rumination is defined as an active and purposeful focus on problem-solving (Treynor et al., 2003; Whitmer & Gotlib, 2011). Because brooding is mostly interpreted as more maladaptive than reflecting, this indicates a possible explanation for the variability between individuals (Treynor et al., 2003). Individuals employing brooding might explain the association with negative affect, whereas reflective ruminating might explain a weaker positive, or even a negative, association with negative affect.

Another explanation for the variability could be because of a moderating variable. An individual with higher rumination showing lower levels of negative affect than another individual might indicate a difference in a situation or an event to ruminate about between the individuals. Previous studies found life stressors and unpleasant daily events to be moderated by rumination (Connolly & Alloy, 2017; Genet & Siemer, 2012), meaning that rumination can change the magnitude of the effect a stressor has on negative affect, and depression and anxiety symptoms (Michl et al., 2013; Moberly & Watkins, 2008b). Moreover, Rood et al. (2009) found the action of seeking distraction as a possible moderator of the effect ruminating can have on affect. Ganor et al. (2023) explained the moderating effect of distraction as a way for high ruminators to change their direction away from the negative and, therefore, help improve their affective state.

In addition, the variability between individuals might be mediated by a skill or personality trait. If an individual experiences such a stressful or unpleasant event, each person's unique set of traits and skills may influence their affective state. Previous studies have found that individuals with high neuroticism engage more frequently in rumination (Du Pont et al., 2019; A. Liu et al., 2023). Subsequently, high neuroticism together with high levels of rumination relates to negative affect, and depressive and anxiety symptoms (Hervás & Vázquez, 2011; Merino et al., 2016). Furthermore, the skills of resilience and thought suppression were found to be associated with rumination, where resilience moderates the effect rumination has on depressive symptoms and successful thought suppression results in

lower rumination levels (Ryckman & Lambert, 2015; D. Liu et al., 2023; Van Seggelen-Damen et al., 2023). McGreevy et al. (2015) even concluded that the effect of distraction on rumination can be moderated by thought-suppressing tendencies. Finally, the role positive affect has in the association between rumination and negative affect might be an alternative explanation. Because the results of this study indicate that rumination is not related to negative affect, depression, anxiety, and well-being in the same way for all individuals and thus may provide clues to the positive effects of rumination, it is interesting to see what the individual associations between rumination and positive affect look like. Previous studies have indicated that rumination is related to decreased positive affect (Brans et al., 2013; Hoorelbeke et al., 2016). Moreover, studies have found positive and negative affect to co-occur and have a dynamic trajectory with each other (Dejonckheere et al., 2021; Larsen et al., 2017). Therefore, positive affect might have a role in either rumination or negative affect, or both in these calculated associations. With this information in mind, there seem to be various possible indicators that may further explain the range of variability between the individual associations of state rumination and state negative affect.

An unexpected result was the observation that only one participant showed a negative association between state rumination and state negative affect. As hypothesised, more participants were expected to show a negative association, by using rumination as a problem-solving coping mechanism, for example, and therefore experiencing lower levels of negative affect. This was expected based on studies indicating possible adaptive mechanisms of ruminating, such as reflective ruminating (Treynor et al., 2003; Whitmer & Gotlib, 2011). However, these surprising results might indicate that adaptive rumination is more complex and not directly associated with lower levels of negative affect. Long-term effects of rumination can be an explanation, as previous longitudinal studies have mentioned that reflective ruminating was moderately related to decreased depressive symptoms (Hasegawa et al., 2013; Junkins & Haeffel, 2017).

Correlation between individual associations and trait variables

Moreover, this study aimed to correlate the individual associations between rumination and negative affect, with the trait variables depression, anxiety, and well-being. To the best of our knowledge, no study has yet examined these variables in conjunction with these analyses. In support of previous studies, this study found a positive correlation between the association of rumination and negative affect, and trait depression and trait anxiety (Kircanski et al., 2017; McLaughlin et al., 2007; Spinhoven et al., 2015). These results confirm the fourth hypothesis: *For both trait depression and trait anxiety, a positive correlation between the*

individual associations and the trait variables is expected. The correlation between the individual associations and trait well-being was negative but insignificant. This insignificance results in rejecting the fifth hypothesis: *A negative correlation between the individual associations and trait well-being is expected.* However, a meta-analysis by Kraiss et al. (2020) found a significant relationship between rumination and well-being with similar strength ($r = -0.19, p < .001$) compared to the results of this study. Moreover, it is important to mention that, compared to depression and anxiety, the relationship between well-being, rumination, and negative affect seems less studied.

The creation of three scatterplots between the individual associations and the trait variables showed a clear view of the participants and their correlation with the variables. A near-equal deviation of participants in the quadrants was observed. Since many of the unexpected participants were clustered around the intersection of the medians, these were not necessarily unexpected compared with the expected participants who were also around the intersection. This necessitated a more nuanced analysis. By creating an ellipse with a confidence interval, these salient individuals were visualised more clearly. In other words, only participants that were in the unexpected quadrants and further into the far corner were then indicated to show salient relationships with rumination, negative affect, and the traits. This criterion provided one participant with unexpected results in their correlation with depression, two participants for the anxiety correlation, and three participants for the well-being correlation. Before this study, the variables were not examined in this way; therefore, it is difficult to compare these results.

Interestingly, the correlation between individual associations and anxiety was weaker than that between depression. Showing that individuals with a higher association between rumination and negative affect were on average experiencing more depressive than anxiety symptoms. These results do not completely align with those of previous studies. Kircanski et al. (2015) and Ruscio et al. (2015) both concluded that rumination is equally correlated with MDD and GAD. However, some studies indicated that worrying was more related to GAD than rumination (Dar & Iqbal, 2014), and as worrying relates to ruminating (Kim & Newman, 2023), this might explain the weaker correlation.

Furthermore, because a confidence interval of 95% was used to create the ellipse, always 5% of the participants with substantial deviating associations would be on the outside. The results show that in every 5%, one or more of the individuals were in one of the unexpected quadrants. So, according to these results the last hypothesis: *For all three correlation measures, it is expected from the individuals outside of the confidence interval,*

that one or more individuals will be categorized as unexpected, can be approved. Based on an examination of the individual observed scores, it was determined that two participants reported severe anxious or depressive symptoms, while the other three either had mild symptoms or below-average feelings of well-being. Previous studies found participants with depressive and anxiety symptoms to be associated with reduced adherence and increased non-responsiveness in ESM studies (Jones et al., 2021; Silvia et al., 2013), which is consistent with the low response rate for three out of the five participants. This may serve as a possible explanation for the conspicuous scores of these individuals. Moreover, some of the unexpected participants showed substantial temporal variability in their rumination and negative affect state scores. In other words, a higher score on one of these did not necessarily indicate a higher score on the other. Together with the earlier mentioned issue about the presence of possible mediating or moderating variables that are either associated with rumination, negative affect, or both, this might serve as an explanation as to why the results for these individuals deviated. With this information in mind, there are alternative reasons for the salient results, in addition to the hypothesised explanation that these individuals adaptively employed rumination.

Implications

Overall, this study suggests that there is evidence of substantial individual deviation in how rumination and negative feelings are intertwined and that this is related to trait feelings of depression, anxiety, and well-being. Although it remains unclear what the role of rumination is in the variability, this does seem to be an important rationale for follow-up research. Since rumination is mostly negatively associated with depression and anxiety in studies using group models (Aldao et al., 2010; Hong & Cheung, 2014; McLaughlin & Nolen-Hoeksema, 2011), and it is often named in conjunction with MDD and GAD treatment (Mennin et al., 2018; Papola et al., 2023; Renna et al., 2018; Rogiers et al., 2021), it seems appropriate to continue researching rumination by employing individual-level analyses. To explore what specifically enables rumination to be adaptive and how this can be carried through into the development of individual mental health treatments. The goal is to design more effective treatments, shorten waitlists in mental health care, and reduce pressure on mental health care employees.

Limitations and strengths

Within this study, several limitations should be acknowledged. First, the demographic information of this study's sample. This study mostly contained young, highly educated females as participants. Hence, the sample is not diverse enough to represent the general

population. This limits the ability to translate the results found to the general mental health target group. Moreover, this limitation is possibly related to the convenience sampling method, as this method is known for its inconsistencies in participants that make it more challenging to generalise and build upon (Jager et al., 2017).

Second, there seems to be a lack of collected demographic information from the participants. Hence, from the results, it appears that some participants may suffer from MDD or GAD. However, this has not been asked and is therefore merely an assumption. Furthermore, it is unknown whether the participants are currently undergoing therapy or any treatment whatsoever. These two aspects of information could help to interpret the collected data more accurately, for example, by knowing if there is a possibility that participants already received tools during therapy to cope differently or if a mental health diagnosis might serve as a disability to adhere to a study. Several studies have expanded their demographic questions to include similar questions on mental health, with the aim of inclusiveness and a better focus on the individual, among other things (Fassett et al., 2022; Hughes et al., 2016).

Lastly, as mentioned before, this study did not distinguish between the two subtypes of rumination: brooding and reflecting. Resulting in analysing rumination as a whole, while reflecting seems more adaptive than brooding (Treyner et al., 2003). This complicates the process of investigating whether rumination can be adaptive and, if it turns out to be adaptive, how it can be explained.

Nonetheless, this study also has strengths. First, this study achieved a sufficient compliance rate for an ESM study. With a compliance rate of 67.42% on the state questionnaires, this can be interpreted as an average rate compared to similar studies, which is related to higher reliability (Wen et al., 2017; Van Berkel et al., 2020). Second, as indicated several times, numerous research studies have been conducted on rumination and negative affect using group models. However, when a study wants to say something about the individual, ESM with individual analyses is more appropriate (Gabriel et al., 2018; Myin-Germeys & Kuppens, 2021). This study made a start, by examining the individual association between rumination and negative affect and their correlation with depression, anxiety, and well-being. This allowed us to examine how individuals differ from each other. This leads to the final strength, as the results of the current study provide an interesting draft for follow-up studies. Adequate studies could ultimately influence the development of effective and individualised mental health care.

Future recommendations

The current study has provided helpful, new insights and simultaneously provides certain recommendations for future studies. The first and perhaps most obvious recommendation is to focus on a more representative participant sample when repeating the study. Next to a more representative sample of participants, a homogeneous convenience sampling method can also be employed. When a future study has a more representative participant sample, the results can also be better generalised to the general population and, in addition, better integrated into mental health care. When a future study uses a homogeneous convenience sample, instead of a conventional convenience sample, the study can be repeated with a specific sociodemographic subgroup (Jager et al., 2017). Homogeneous convenience sampling results in clearer generalisability than conventional convenience sampling, because the likelihood of biased sociodemographic sampling is decreased by purposefully reducing the sampling frame with sociodemographic heterogeneity (Jager et al., 2017).

Second, it is recommended that future studies obtain more information from participants, information about possible mental health diagnoses, ill-being, or attending therapy that appears fitting (Connell et al., 2014; Fassett et al., 2022; Fernandez et al., 2016; Gold et al., 2016; Hughes et al., 2016). Since individualised treatment with high effectiveness seems like a good and appropriate goal for studies with individual-level analyses, it seems important to know more about participants' mental health as it enables the possibility to analyse individuals with different mental health backgrounds. In addition, multiple groups of participants could also be considered, such as a group with and without psychopathology. This would allow the possible adaptive effect of rumination to be examined in even more detail with an eye for individual differences (Jager et al., 2017).

Third, since it remains unclear from this study where the large variability in the associations between rumination and negative affect originates, it is recommended that future studies investigate whether possible moderating variables are involved in this association. It might be interesting to conduct this based on an ESM study that is more qualitatively oriented, for example, by having participants keep a diary. This enables space for participants to explain the progress of the day and subsequently offers opportunities to analyse variables that seem to play a role in moments of rumination and negative affect. Eisma et al. (2021), for example, employed a qualitative study in which they had baseline questionnaires and a diary, both measuring rumination, worry, and affect. The diary was filled in twice daily for ten consecutive days and the diary results brought new variables, such as grief, into the study.

Finally, a future ESM study is recommended in which a clear distinction is made between the two types of rumination. Since the current study suggested individual variability in the association between rumination and negative affect, addressing the possibility that either reflecting or brooding is involved may provide a more comprehensive analysis. Future ESM studies might implement this recommendation by creating more specific state questions that distinguish between reflective rumination, for example, “How often in the last hour have you found yourself dwelling on the same negative thoughts?”, and brooding rumination, for example, “To what extent are your current thoughts focused on finding solutions?”. In doing so, it also seems important to continue exploring how negative affect and other well-being variables relate to this distinction. In conclusion, one might even consider applying all four recommendations to one follow-up study.

Conclusion

The current ESM study challenged the adaptiveness of the emotion-regulation strategy of rumination and its relation to the mental health of individuals. The results found a significant positive association between rumination and negative affect at the group level, while the variability contained a wide range at the individual level. As far as known, this is the first study to correlate the individual associations of rumination and negative affect with trait depression, anxiety, and well-being. The group-level correlations were as expected, and a few salient individuals showed unexpected relationships with depression, anxiety and well-being. Considering the individual variability in the results, this indicates that a one-size-fits-all approach in emotion-regulation treatment for depression and anxiety might not work effectively for everyone. This, together with the limitations of this study, highlights the importance of future research. Recommendations focused on improved sampling, extended demographic information, qualitative methodologies aimed at moderating variables, and the distinction between the subscales of rumination, aiming to continue working towards effective and individualised treatment of mental health.

References

- Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30*(2), 217–237. <https://doi.org/10.1016/j.cpr.2009.11.004>
- Baik, S. Y., & Newman, M. G. (2023). The transdiagnostic use of worry and rumination to avoid negative emotional contrasts following negative events: A momentary assessment study. *Journal of Anxiety Disorders, 95*, 102679. <https://doi.org/10.1016/j.janxdis.2023.102679>
- Barańczuk, U. (2019). The five factor model of personality and emotion regulation: A meta-analysis. *Personality and Individual Differences, 139*, 217–227. <https://doi.org/10.1016/j.paid.2018.11.025>
- Barber, L. K., Bagnsby, P. G., & Munz, D. C. (2010). Affect regulation strategies for promoting (or preventing) flourishing emotional health. *Personality and Individual Differences, 49*(6), 663–666. <https://doi.org/10.1016/j.paid.2010.06.002>
- Beck, A. T. (1975). *Cognitive Therapy and the Emotional Disorders*. <http://ci.nii.ac.jp/ncid/BA62049443>
- Berking, M., & Wupperman, P. (2012). Emotion regulation and mental health. *Current Opinion in Psychiatry, 25*(2), 128–134. <https://doi.org/10.1097/yco.0b013e3283503669>
- Biron, M., & Van Veldhoven, M. (2012). Emotional labour in service work: Psychological flexibility and emotion regulation. *Human Relations, 65*(10), 1259–1282. <https://doi.org/10.1177/0018726712447832>
- Brans, K., Koval, P., Verduyn, P., Lim, Y. W., & Kuppens, P. (2013). The regulation of negative and positive affect in daily life. *Emotion, 13*(5), 926–939. <https://doi.org/10.1037/a0032400>
- Bringmann, L. F., Vissers, N., Wichers, M., Geschwind, N., Kuppens, P., Peeters, F., Borsboom, D., & Tuerlinckx, F. (2013). A Network Approach to Psychopathology: New Insights into Clinical Longitudinal Data. *PLOS ONE, 8*(4), e60188. <https://doi.org/10.1371/journal.pone.0060188>
- Burwell, R. A., & Shirk, S. R. (2007). Subtypes of rumination in adolescence: associations between brooding, reflection, depressive symptoms, and coping. *Journal of Clinical Child and Adolescent Psychology, 36*(1), 56–65. <https://doi.org/10.1080/15374410709336568>
- Calkins, S. D. (1994). Origins and Outcomes of Individual Differences in Emotion

- Regulation. *Monographs of the Society for Research in Child Development*, 59(2/3), 53. <https://doi.org/10.2307/1166138>
- Connell, J., O’Cathain, A., & Brazier, J. (2014). Measuring quality of life in mental health: Are we asking the right questions? *Social Science & Medicine*, 120, 12–20. <https://doi.org/10.1016/j.socscimed.2014.08.026>
- Conner, T. S., & Lehman, B. J. (2012). Getting started: Launching a study in daily life. *Handbook of Research Methods for Studying Daily Life*, 89–107. <https://psycnet.apa.org/record/2012-05165-005>
- Connolly, S. L., & Alloy, L. B. (2017). Rumination interacts with life stress to predict depressive symptoms: An ecological momentary assessment study. *Behaviour Research and Therapy*, 97, 86–95. <https://doi.org/10.1016/j.brat.2017.07.006>
- Costantini, L., Pasquarella, C., Odone, A., Colucci, M. E., Costanza, A., Serafini, G., Aguglia, A., Murri, M. B., Brakoulias, V., Amore, M., Ghaemi, S. N., & Amerio, A. (2021). Screening for depression in primary care with Patient Health Questionnaire-9 (PHQ-9): A systematic review. *Journal of Affective Disorders*, 279, 473–483. <https://doi.org/10.1016/j.jad.2020.09.131>
- Dar, K. A., & Iqbal, N. (2014). Worry and rumination in generalized anxiety disorder and obsessive compulsive disorder. *The Journal of Psychology*, 149(8), 866–880. <https://doi.org/10.1080/00223980.2014.986430>
- Dattani, S., Ritchie, H., & Roser, M. (2021, August 20). *Mental Health*. Our World in Data. Retrieved June 1, 2023, from <https://ourworldindata.org/mental-health>
- Dejonckheere, E., & Erbas, Y. (2022). Designing an Experience Sampling Study. In I. Myin-Germeys & P. Kuppens, *The open handbook of Experience Sampling Methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies* (2nd ed., pp. 33–70). Center for Research on Experience Sampling and Ambulatory Methods Leuven.
- Dejonckheere, E., Mestdagh, M., Verdonck, S., Lafit, G., Ceulemans, E., Bastian, B., & Kalokerinos, E. K. (2021). The relation between positive and negative affect becomes stimore negative in response to personally relevant events. *Emotion*, 21(2), 326–336. <https://doi.org/10.1037/emo0000697>
- Donker, T., Van Straten, A., Marks, I., & Cuijpers, P. (2011). Quick and easy self-rating of Generalized Anxiety Disorder: Validity of the Dutch web-based GAD-7, GAD-2 and GAD-SI. *Psychiatry Research-neuroimaging*, 188(1), 58–64. <https://doi.org/10.1016/j.psychres.2011.01.016>

- Dryman, M. T., & Heimberg, R. G. (2018). Emotion regulation in social anxiety and depression: a systematic review of expressive suppression and cognitive reappraisal. *Clinical Psychology Review, 65*, 17–42. <https://doi.org/10.1016/j.cpr.2018.07.004>
- Du Pont, A., Rhee, S. H., Corley, R. P., Hewitt, J. K., & Friedman, N. P. (2019). Are rumination and neuroticism genetically or environmentally distinct risk factors for psychopathology? *Journal of Abnormal Psychology, 128*(5), 385–396. <https://doi.org/10.1037/abn0000430>
- Enders, C. K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: A new look at an old issue. *Psychological Methods, 12*(2), 121–138. <https://doi.org/10.1037/1082-989x.12.2.121>
- Eisele, G., Lafit, G., Vachon, H., Kuppens, P., Houben, M., Myin-Germeys, I., & Viechtbauer, W. (2021). Affective structure, measurement invariance, and reliability across different experience sampling protocols. *Journal of Research in Personality, 92*, 104094. <https://doi.org/10.1016/j.jrp.2021.104094>
- Eisma, M. C., Franzen, M., Paauw, M., Bleeker, A., & Rot, M. a. H. (2021). Rumination, worry and negative and positive affect in prolonged grief: A daily diary study. *Clinical Psychology & Psychotherapy, 29*(1), 299–312. <https://doi.org/10.1002/cpp.2635>
- Ethica*. (2022). [Mobile Application]. Ethica Data. <https://play.google.com/store/apps/details?id=com.ethica.logger>
- Faber, J. F. (2023). “Ik ben van de afdeling life skills.” *Skipr, 16*(4), 58–61. <https://doi.org/10.1007/s12654-023-1464-4>
- Fassett, K., Wolcott, M. D., Harpe, S. E., & McLaughlin, J. E. (2022). Considerations for writing and including demographic variables in education research. *Currents in Pharmacy Teaching and Learning, 14*(8), 1068–1078. <https://doi.org/10.1016/j.cptl.2022.07.022>
- Fernandez, T., Godwin, A., Doyle, J., Verdín, D., Boone, H., Kirn, A., Benson, L., & Potvin, G. (2016). More Comprehensive and Inclusive Approaches to Demographic Data Collection. *ASEE Annual Conference & Exposition, 6*. <https://doi.org/10.18260/p.25751>
- Franken, K., Lamers, S., Klooster, P. M. T., Bohlmeijer, E. T., & Westerhof, G. J. (2018). Validation of the Mental Health Continuum-Short Form and the dual continua model of well-being and psychopathology in an adult mental health setting. *Journal of Clinical Psychology, 74*(12), 2187–2202. <https://doi.org/10.1002/jclp.22659>
- Gabriel, A. S., Podsakoff, N. P., Beal, D. J., Scott, B. A., Sonnentag, S., Trougakos, J. P., &

- Butts, M. M. (2018). Experience Sampling Methods: A Discussion of Critical Trends and Considerations for Scholarly Advancement. *Organizational Research Methods*, 22(4), 969–1006. <https://doi.org/10.1177/1094428118802626>
- Ganor, T., Mor, N., & Huppert, J. D. (2023). Effects of rumination and distraction on inhibition. *Journal of Behavior Therapy and Experimental Psychiatry*, 78, 101780. <https://doi.org/10.1016/j.jbtep.2022.101780>
- Genet, J. J., & Siemer, M. (2012). Rumination moderates the effects of daily events on negative mood: Results from a diary study. *Emotion*, 12(6), 1329–1339. <https://doi.org/10.1037/a0028070>
- Gold, K. J., Andrew, L. B., Goldman, E. B., & Schwenk, T. L. (2016). “I would never want to have a mental health diagnosis on my record”: A survey of female physicians on mental health diagnosis, treatment, and reporting. *General Hospital Psychiatry*, 43, 51–57. <https://doi.org/10.1016/j.genhosppsych.2016.09.004>
- Gottfredson, N. C. (2019). A straightforward approach for coping with unreliability of person means when parsing within-person and between-person effects in longitudinal studies. *Addictive Behaviors*, 94, 156–161. <https://doi.org/10.1016/j.addbeh.2018.09.031>
- Greenacre, M. (2016). Data reporting and visualization in ecology. *Polar Biology*, 39(11), 2189–2205. <https://doi.org/10.1007/s00300-016-2047-2>
- Hasegawa, A., Koda, M., Hattori, Y., Kondo, T., & Kawaguchi, J. (2013). Longitudinal predictions of the brooding and reflection subscales of the Japanese Ruminative Responses scale for Depression. *Psychological Reports*, 113(2), 566–585. <https://doi.org/10.2466/02.15.pr0.113x24z5>
- Hervás, G., & Vázquez, C. (2011). What else do you feel when you feel sad? Emotional overproduction, neuroticism and rumination. *Emotion*, 11(4), 881–895. <https://doi.org/10.1037/a0021770>
- Hoebcke, Y., Blanchard, M. A., Contreras, A., & Heeren, A. (2022). An experience sampling measure of the key features of rumination. *PubMed*, 19(5), 288–297. <https://doi.org/10.36131/cnforitieditore20220504>
- Hoffman, L., & Walters, R. W. (2022). Catching up on multilevel modeling. *Annual Review of Psychology*, 73(1), 659–689. <https://doi.org/10.1146/annurev-psych-020821-103525>
- Homans, W. A. (2012). *The validity of the PHQ-9 and the GAD-7 for screening depressive and anxiety disorders in sick-listed workers* [Master’s thesis]. University of Utrecht.
- Hong, R. Y., & Cheung, M. W. (2014). The structure of cognitive vulnerabilities to

- depression and anxiety. *Clinical Psychological Science*, 3(6), 892–912.
<https://doi.org/10.1177/2167702614553789>
- Hoorelbeke, K., Koster, E. H. W., Demeyer, I., Loeys, T., & Vanderhasselt, M. (2016). Effects of cognitive control training on the dynamics of (mal)adaptive emotion regulation in daily life. *Emotion*, 16(7), 945–956. <https://doi.org/10.1037/emo0000169>
- Huffziger, S., Ebner-Priemer, U. W., Eisenbach, C., Koudela, S., Reinhard, I., Zamoscik, V., Kirsch, P., & Kuehner, C. (2013). Induced ruminative and mindful attention in everyday life: An experimental ambulatory assessment study. *Journal of Behavior Therapy and Experimental Psychiatry*, 44(3), 322–328.
<https://doi.org/10.1016/j.jbtep.2013.01.007>
- Hughes, J. L., Camden, A. A., & Yangchen, T. (2016). Rethinking and Updating Demographic Questions: Guidance to improve descriptions of research samples. *Psi Chi Journal of Psychological Research*, 21(3), 138–151.
<https://doi.org/10.24839/2164-8204.jn21.3.138>
- Iqbal, N., & Dar, K. A. (2015). Negative affectivity, depression, and anxiety: Does rumination mediate the links? *Journal of Affective Disorders*, 181, 18–23.
<https://doi.org/10.1016/j.jad.2015.04.002>
- Jager, J., Putnick, D. L., & Bornstein, M. H. (2017). II. More than Just Convenient: The Scientific Merits of Homogeneous Convenience Samples. *Monographs of the Society for Research in Child Development*, 82(2), 13–30. <https://doi.org/10.1111/mono.12296>
- Janssen, E. P. C. J., Köhler, S., Stehouwer, C. D. A., Schaper, N. C., Dagnelie, P. C., Sep, S. J. S., Henry, R. M., Kallen, C., Verhey, F. R., & Schram, M. T. (2016). The Patient Health Questionnaire-9 as a Screening Tool for Depression in Individuals with Type 2 Diabetes Mellitus: The Maastricht Study. *Journal of the American Geriatrics Society*, 64(11), e201–e206. <https://doi.org/10.1111/jgs.14388>
- Jarvinen, J., Ketonen, E., Hietajärvi, L., & Salmela-Aro, K. (2022). From high peaks to deep valleys: Using a situation- and person-oriented approach to assess within- and between-student variation in momentary engagement and disengagement. *Learning and Instruction*, 82, 101685. <https://doi.org/10.1016/j.learninstruc.2022.101685>
- Jones, S., Moore, R. C., Pinkham, A. E., Depp, C. A., Granholm, E., & Harvey, P. D. (2021). A cross-diagnostic study of adherence to ecological momentary assessment: Comparisons across study length and daily survey frequency find that early adherence is a potent predictor of study-long adherence. *Personalized Medicine in Psychiatry*, 29–30, 100085. <https://doi.org/10.1016/j.pmip.2021.100085>

- Jordan, P., Shedden-Mora, M. C., & Löwe, B. (2017). Psychometric analysis of the Generalized Anxiety Disorder scale (GAD-7) in primary care using modern item response theory. *PLOS ONE*, *12*(8), e0182162. <https://doi.org/10.1371/journal.pone.0182162>
- Junkins, M. B., & Haeffel, G. J. (2017). Rumination: Reflection can amplify the depressogenic effects of brooding. *International Journal of Cognitive Therapy*, *10*(1), 34–46. https://doi.org/10.1521/ijct_2016_09_19
- Kim, H., & Newman, M. G. (2023). Worry and rumination enhance a positive emotional contrast based on the framework of the Contrast Avoidance Model. *Journal of Anxiety Disorders*, *94*, 102671. <https://doi.org/10.1016/j.janxdis.2023.102671>
- Kircanski, K., Thompson, R. J., Sorenson, J. E., Sherdell, L., & Gotlib, I. H. (2015). Rumination and worry in daily life. *Clinical Psychological Science*, *3*(6), 926–939. <https://doi.org/10.1177/2167702614566603>
- Kircanski, K., Thompson, R. J., Sorenson, J. E., Sherdell, L., & Gotlib, I. H. (2017). The everyday dynamics of rumination and worry: precipitant events and affective consequences. *Cognition & Emotion*, *32*(7), 1424–1436. <https://doi.org/10.1080/02699931.2017.1278679>
- Kirtley, O. J., Hiekkaranta, A. P., Kunkels, Y. K., Eisele, G., Lüken, M., Verhoeven, D., Van Nierop, M., & Myin-Germeys, I. (2018). The Experience Sampling Method (ESM) Item Repository. *Item Repository*. <https://doi.org/10.17605/osf.io/kg376>
- Kraiss, J. T., Klooster, P. M. T., Moskowitz, J. T., & Bohlmeijer, E. T. (2020). The relationship between emotion regulation and well-being in patients with mental disorders: A meta-analysis. *Comprehensive Psychiatry*, *102*, 152189. <https://doi.org/10.1016/j.comppsy.2020.152189>
- Kroenke, K., Spitzer, R. L., & Williams, J. B. W. (2001). The PHQ-9. *Journal of General Internal Medicine*, *16*(9), 606–613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>
- Lafit, G. (2022). Non-normal, higher-level, and VAR(1) models for the analysis of ESM data. In I. Myin-Germeys & P. Kuppens, *The open handbook of Experience Sampling Methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies* (2nd ed., pp. 185–217). Center for Research on Experience Sampling and Ambulatory Methods Leuven.
- Lamers, S., Westerhof, G. J., Bohlmeijer, E. T., Klooster, P. M. T., & Keyes, C. L. (2011).

- Evaluating the psychometric properties of the mental health Continuum-Short Form (MHC-SF). *Journal of Clinical Psychology*, *67*(1), 99–110.
<https://doi.org/10.1002/jclp.20741>
- Landerman, L. R., Mustillo, S., & Land, K. C. (2011). Modeling repeated measures of dichotomous data: Testing whether the within-person trajectory of change varies across levels of between-person factors. *Social Science Research*, *40*(5), 1456–1464.
<https://doi.org/10.1016/j.ssresearch.2011.05.006>
- Larsen, J. T., Hershfield, H. E., Stastny, B. J., & Hester, N. (2017). On the relationship between positive and negative affect: Their correlation and their co-occurrence. *Emotion*, *17*(2), 323–336. <https://doi.org/10.1037/emo0000231>
- Larson, R. W., & Csikszentmihályi, M. (2014). The experience sampling method. *Flow and the Foundations of Positive Psychology: The Collected Works of Mihaly Csikszentmihalyi*, 21–34. https://doi.org/10.1007/978-94-017-9088-8_2
- Larson, R. W., & Csikszentmihályi, M. (1983). The Experience Sampling Method. *New Directions for Methodology of Social & Behavioural Science*, *15*, 41–56.
- Lask, L. S., Moyal, N., & Henik, A. (2021). Rumination, emotional intensity and emotional clarity. *Consciousness and Cognition*, *96*, 103242.
<https://doi.org/10.1016/j.concog.2021.103242>
- Lavender, A., & Watkins, E. R. (2004). Rumination and future thinking in depression. *British Journal of Clinical Psychology*, *43*(2), 129–142.
<https://doi.org/10.1348/014466504323088015>
- Linder, A., Gerdtham, U. G., Trygg, N., Fritzell, S., & Saha, S. (2019). Inequalities in the economic consequences of depression and anxiety in Europe: a systematic scoping review. *European Journal of Public Health*, *30*(4), 767–777.
<https://doi.org/10.1093/eurpub/ckz127>
- Liu, A., Yu, Y., & Sun, S. (2023). How is the Big Five related to college students' anxiety: The role of rumination and resilience. *Personality and Individual Differences*, *200*, 111901. <https://doi.org/10.1016/j.paid.2022.111901>
- Liu, D., Wang, Y., Xie, P., Deng, H., Qiu, L., Liu, W., Huang, D., Xia, B., Liu, S., & Zhang, X. Y. (2023). Rumination and depression in Chinese adolescents with mood disorders. *The Journal of Clinical Psychiatry*, *84*(5). <https://doi.org/10.4088/jcp.22m14682>
- Luijten, C. C., Kuppens, S., Van De Bongardt, D., & Nieboer, A. P. (2019). Evaluating the

- psychometric properties of the mental health continuum-short form (MHC-SF) in Dutch adolescents. *Health and Quality of Life Outcomes*, 17(1).
<https://doi.org/10.1186/s12955-019-1221-y>
- Maas, J. (2023). “We zien hier de hele samenleving voorbijkomen.” *Zorg + Welzijn*, 29(3), 22–27. <https://doi.org/10.1007/s41185-023-2002-3>
- Magezi, D. A. (2015). Linear mixed-effects models for within-participant psychology experiments: an introductory tutorial and free, graphical user interface. *Frontiers in Psychology*, 6. <https://doi.org/10.3389/fpsyg.2015.00002>
- Mahmud, M., Mohsin, M., Dewan, M. N., & Muyeed, A. (2022). The Global Prevalence of Depression, Anxiety, Stress, and Insomnia Among General Population During COVID-19 Pandemic: A Systematic Review and Meta-analysis. *Trends in Psychology*, 31(1), 143–170. <https://doi.org/10.1007/s43076-021-00116-9>
- McGreevy, C. A., Bonanno, G. A., & D’Andrea, W. (2015). Variation in the physiological costs and benefits of rumination and distraction: The moderating effect of habitual thought suppression. *Personality and Individual Differences*, 85, 93–97.
<https://doi.org/10.1016/j.paid.2015.04.033>
- McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy*, 38(1), 23–38.
<https://doi.org/10.1016/j.beth.2006.03.003>
- McLaughlin, K. A., & Nolen-Hoeksema, S. (2011). Rumination as a transdiagnostic factor in depression and anxiety. *Behaviour Research and Therapy*, 49(3), 186–193.
<https://doi.org/10.1016/j.brat.2010.12.006>
- Mennin, D. S., Fresco, D. M., O’Toole, M. S., & Heimberg, R. G. (2018). A randomized controlled trial of emotion regulation therapy for generalized anxiety disorder with and without co-occurring depression. *Journal of Consulting and Clinical Psychology*, 86(3), 268–281. <https://doi.org/10.1037/ccp0000289>
- Merino, H., Senra, C., & Ferreiro, F. (2016). Are Worry and Rumination Specific Pathways Linking Neuroticism and Symptoms of Anxiety and Depression in Patients with Generalized Anxiety Disorder, Major Depressive Disorder and Mixed Anxiety-Depressive Disorder? *PLOS ONE*, 11(5), e0156169.
<https://doi.org/10.1371/journal.pone.0156169>
- Michl, L. C., McLaughlin, K. A., Shepherd, K., & Nolen-Hoeksema, S. (2013). Rumination

- as a mechanism linking stressful life events to symptoms of depression and anxiety: Longitudinal evidence in early adolescents and adults. *Journal of Abnormal Psychology*, 122(2), 339–352. <https://doi.org/10.1037/a0031994>
- Moberly, N. J., & Watkins, E.R. (2008a). Ruminative self-focus and negative affect: An experience sampling study. *Journal of Abnormal Psychology*, 117(2), 314–323. <https://doi.org/10.1037/0021-843x.117.2.314>
- Moberly, N. J., & Watkins, E. R. (2008b). Ruminative self-focus, negative life events, and negative affect. *Behaviour Research and Therapy*, 46(9), 1034–1039. <https://doi.org/10.1016/j.brat.2008.06.004>
- Mor, N., & Winquist, J. R. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin*, 128(4), 638–662. <https://doi.org/10.1037/0033-2909.128.4.638>
- Mukaka, M. (2012). Statistics corner: A guide to appropriate use of correlation coefficient in medical research. *PubMed*. <https://pubmed.ncbi.nlm.nih.gov/23638278>
- Myin-Germeys, I., & Kuppens, P. (2021). *The Open Handbook of Experience Sampling Methodology: A Step-by-step Guide to Designing, Conducting, and Analyzing ESM Studies*.
- Naragon-Gainey, K., McMahon, T. P., & Chacko, T. (2017). The structure of common emotion regulation strategies: A meta-analytic examination. *Psychological Bulletin*,
- Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. *Perspectives on Psychological Science*, 3(5), 400–424. <https://doi.org/10.1111/j.1745-6924.2008.00088.x>
- Páez, D., Martínez-Sánchez, F., Mendiburo-Seguel, A., Bobowik, M., & Sevillano, V. (2013). Affect regulation strategies and perceived emotional adjustment for negative and positive affect: A study on anger, sadness and joy. *The Journal of Positive Psychology*, 8(3), 249–262. <https://doi.org/10.1080/17439760.2013.786751>
- Papola, D., Miguel, C., Mazzaglia, M., Franco, P., Tedeschi, F., Romero, S., Patel, A., Ostuzzi, G., Gastaldon, C., Karyotaki, E., Harrer, M., Purgato, M., Sijbrandij, M., Patel, V., Furukawa, T. A., Cuijpers, P., & Barbui, C. (2023). Psychotherapies for generalized anxiety disorder in adults. *JAMA Psychiatry*. <https://doi.org/10.1001/jamapsychiatry.2023.3971>
- Penninx, B. W. J. H., Eikelenboom, M., Giltay, E. J., Van Hemert, A. M., Riese, H., Schoevers, R. A., & Beekman, A. (2021). Cohort profile of the longitudinal Netherlands Study of Depression and Anxiety (NESDA) on etiology, course and

- consequences of depressive and anxiety disorders. *Journal of Affective Disorders*, 287, 69–77. <https://doi.org/10.1016/j.jad.2021.03.026>
- Platte, S., Wiesmann, U., Tedeschi, R. G., & Kehl, D. (2022). Coping and rumination as predictors of posttraumatic growth and depreciation. *Chinese Journal of Traumatology*, 25(5), 264–271. <https://doi.org/10.1016/j.cjtee.2022.02.001>
- Rector, N. A., Kamkar, K., Cassin, S. E., Ayearst, L. E., & Laposa, J. M. (2011). Assessing excessive reassurance seeking in the anxiety disorders. *Journal of Anxiety Disorders*, 25(7), 911–917. <https://doi.org/10.1016/j.janxdis.2011.05.003>
- Renna, M. E., Quintero, J. M., Soffer, A., Pino, M., Ader, L., Fresco, D. M., & Mennin, D. S. (2018). A pilot study of emotion regulation therapy for generalized anxiety and Depression: findings from a diverse sample of young adults. *Behavior Therapy*, 49(3), 403–418. <https://doi.org/10.1016/j.beth.2017.09.001>
- Renner, K., Hock, M., Bergner-Köther, R., & Laux, L. (2016). Differentiating anxiety and depression: the State-Trait Anxiety-Depression Inventory. *Cognition & Emotion*, 32(7), 1409–1423. <https://doi.org/10.1080/02699931.2016.1266306>
- Rogiers, R., Baeken, C., Van Den Abbeele, D., Watkins, E., Remue, J., Colman, R., De Raedt, R., & Lemmens, G. (2021). Group Intervention ‘Drop it!’ Decreases Repetitive Negative Thinking in Major Depressive Disorder and/or Generalized Anxiety Disorder: A Randomised Controlled Study. *Cognitive Therapy and Research*, 46(1), 182–196. <https://doi.org/10.1007/s10608-021-10240-6>
- Rood, L., Roelofs, J., Bögels, S. M., Nolen-Hoeksema, S., & Schouten, E. (2009). The influence of emotion-focused rumination and distraction on depressive symptoms in non-clinical youth: A meta-analytic review. *Clinical Psychology Review*, 29(7), 607–616. <https://doi.org/10.1016/j.cpr.2009.07.001>
- Rosenkranz, T., Takano, K., Watkins, E., & Ehring, T. (2020). Assessing repetitive negative thinking in daily life: Development of an ecological momentary assessment paradigm. *PLOS ONE*, 15(4), e0231783. <https://doi.org/10.1371/journal.pone.0231783>
- Ruscio, A. M., Gentes, E. L., Jones, J. D., Hallion, L. S., Coleman, E. S., & Swendsen, J. (2015). Rumination predicts heightened responding to stressful life events in major depressive disorder and generalized anxiety disorder. *Journal of Abnormal Psychology*, 124(1), 17–26. <https://doi.org/10.1037/abn0000025>
- Rutter, L. A., & Brown, T. A. (2016). Psychometric Properties of the Generalized Anxiety

- Disorder Scale-7 (GAD-7) in Outpatients with Anxiety and Mood Disorders. *Journal of Psychopathology and Behavioral Assessment*, 39(1), 140–146.
<https://doi.org/10.1007/s10862-016-9571-9>
- Ryckman, N., & Lambert, A. J. (2015). Unsuccessful suppression is associated with increased neuroticism, intrusive thoughts, and rumination. *Personality and Individual Differences*, 73, 88–91. <https://doi.org/10.1016/j.paid.2014.09.029>
- Schmitter, M., Van Roekel, E., Heininga, V. E., & Oldehinkel, A. J. (2021). Personalized lifestyle advice alters affective reactivity to negative events in anhedonic young adults. *Journal of Affective Disorders*, 291, 118–125.
<https://doi.org/10.1016/j.jad.2021.04.036>
- Schneider, B., Krajcik, J., Lavonen, J., Salmela-Aro, K., Broda, M., Spicer, J., Bruner, J., Moeller, J., Linnansaari, J., Juuti, K., & Viljaranta, J. (2016). Investigating optimal learning moments in U.S. and Finnish science classes. *Journal of Research in Science Teaching*, 53(3), 400–421. <https://doi.org/10.1002/tea.21306>
- Schunck, R., & Perales, F. (2017). Within- and Between-cluster Effects in Generalized Linear Mixed Models: A Discussion of Approaches and the Xthybrid command. *Stata Journal*, 17(1), 89–115. <https://doi.org/10.1177/1536867x1701700106>
- Schwabe, J. (2022). *The Relationship between Cognitive Reappraisal and Mental Health in the Context of Resilience : An Experience Sampling Study*. [Bachelor's Thesis]. University of Twente.
- Shrimpton, D., McGann, D., & Riby, L. M. (2017). Daydream believer: Rumination, self-reflection and the temporal focus of mind wandering content. *Europe's Journal of Psychology*, 13(4), 794–809. <https://doi.org/10.5964/ejop.v13i4.1425>
- Silvia, P. J., Kwapil, T. R., Eddington, K. M., & Brown, L. H. (2013). Missed beeps and missing data. *Social Science Computer Review*, 31(4), 471–481.
<https://doi.org/10.1177/0894439313479902>
- Slovák, P., Antle, A. N., Theofanopoulou, N., Roquet, C. D., Gross, J. J., & Isbister, K. (2022). Designing for Emotion Regulation Interventions: An Agenda for HCI Theory and Research. *ACM Transactions on Computer-Human Interaction*, 30(1), 1–51.
<https://doi.org/10.1145/3569898>
- Spinhoven, P., Drost, J., Van Hemert, A. M., & Penninx, B. W. (2015). Common rather than unique aspects of repetitive negative thinking are related to depressive and anxiety disorders and symptoms. *Journal of Anxiety Disorders*, 33, 45–52.
<https://doi.org/10.1016/j.janxdis.2015.05.001>

- Sütterlin, S., Paap, M. C. S., Babic, S., Kübler, A., & Vögele, C. (2012). Rumination and Age: Some Things Get Better. *Journal of Aging Research*, 2012, 1–10.
<https://doi.org/10.1155/2012/267327>
- Teymoori, A., Real, R., Gorbunova, A., Haghish, E., Andelic, N., Wilson, L., Asendorf, T., Menon, D., & Von Steinbüchel, N. (2020). Measurement invariance of assessments of depression (PHQ-9) and anxiety (GAD-7) across sex, strata and linguistic backgrounds in a European-wide sample of patients after Traumatic Brain Injury. *Journal of Affective Disorders*, 262, 278–285.
<https://doi.org/10.1016/j.jad.2019.10.035>
- Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination Reconsidered: A Psychometric Analysis. *Cognitive Therapy and Research*, 27(3), 247–259.
<https://doi.org/10.1023/a:1023910315561>
- Troy, A. S., Shallcross, A. J., & Mauss, I. B. (2013). A Person-by-Situation approach to emotion Regulation. *Psychological Science*, 24(12), 2505–2514.
<https://doi.org/10.1177/0956797613496434>
- Vachon, H., Viechtbauer, W., Rintala, A., & Myin-Germeys, I. (2019). Compliance and retention with the Experience Sampling Method over the Continuum of Severe Mental Disorders: Meta-Analysis and Recommendations. *Journal of Medical Internet Research*, 21(12), e14475. <https://doi.org/10.2196/14475>
- Van Berkel, N., Ferreira, D., & Kostakos, V. (2017). The Experience Sampling Method on Mobile Devices. *ACM Computing Surveys*, 50(6), 1–40.
<https://doi.org/10.1145/3123988>
- Van Berkel, N., Gonçalves, J., Hosio, S., Sarsenbayeva, Z., Velloso, E., & Kostakos, V. (2020). Overcoming compliance bias in self-report studies: A cross-study analysis. *International Journal of Human-Computer Studies*, 134, 1–12.
<https://doi.org/10.1016/j.ijhcs.2019.10.003>
- Van Berkel, N., & Kostakos, V. (2021). Recommendations for conducting longitudinal experience sampling studies. In *Human-computer interaction series* (pp. 59–78).
https://doi.org/10.1007/978-3-030-67322-2_4
- Van Seggelen-Damen, I. C. M., Peeters, S., & Jacobs, N. (2023). Being mindful and resilient: The role of self-reflection, rumination, and well-being. *Psychology of Consciousness*, 10(2), 193–203. <https://doi.org/10.1037/cns0000338>
- Viechtbauer, W. (2022). Structuring, Checking and Preparing the Data. In I. Myin-Germeys

- & P. Kuppens, *The open handbook of Experience Sampling Methodology: A step-by-step guide to designing, conducting, and analyzing ESM studies* (2nd ed., pp. 137–152). Center for Research on Experience Sampling and Ambulatory Methods Leuven.
- Wallner, J. (2022). *Emotion Regulation : The Role of Rumination in the Experience of Negative Affect : An Experience Sampling Study*. [Bachelor's Thesis]. University of Twente.
- Watkins, E., & Teasdale, J. D. (2001). Rumination and overgeneral memory in depression: Effects of self-focus and analytic thinking. *Journal of Abnormal Psychology, 110*(2), 353–357. <https://doi.org/10.1037/0021-843x.110.2.333>
- Wen, C., Schneider, S., Stone, A. A., & Spruijt-Metz, D. (2017). Compliance with Mobile Ecological Momentary Assessment Protocols in Children and Adolescents: A Systematic Review and Meta-Analysis. *Journal of Medical Internet Research, 19*(4), e132. <https://doi.org/10.2196/jmir.6641>
- Whitmer, A. J., & Gotlib, I. H. (2011). Brooding and reflection reconsidered: a factor analytic examination of rumination in currently depressed, formerly depressed, and never depressed individuals. *Cognitive Therapy and Research, 35*(2), 99–107. <https://doi.org/10.1007/s10608-011-9361-3>
- World Health Organization (WHO). (2022a). *World mental health report: transforming mental health for all - executive summary* [Online]. World Health Organization. <https://apps.who.int/iris/rest/bitstreams/1433507/retrieve>
- World Health Organization (WHO). (2022b). *Mental disorders* [Online]. World Health Organization. <https://www.who.int/news-room/fact-sheets/detail/mental-disorders>
- Yeo, Z. Z., & Suárez, L. (2022). Validation of the mental health continuum-short form: The bifactor model of emotional, social, and psychological well-being. *PLOS ONE, 17*(5), e0268232. <https://doi.org/10.1371/journal.pone.0268232>
- Young, K. S., Sandman, C. F., & Craske, M. G. (2019). Positive and negative emotion regulation in Adolescence: Links to anxiety and depression. *Brain Sciences, 9*(4), 76. <https://doi.org/10.3390/brainsci9040076>
- Zhou, Y., Xu, J., & Rief, W. (2020). Are comparisons of mental disorders between Chinese and German students possible? An examination of measurement invariance for the PHQ-15, PHQ-9 and GAD-7. *BMC Psychiatry, 20*(1). <https://doi.org/10.1186/s12888-020-02859-8>

Appendix A

Consent form

Dear participant,

Thank you for your participation in this study. Before you participate, it is important that you understand the goal of this research and what the study will ask from you. The purpose of this study is to find out how mental health is related to emotion regulation. To explore this relationship, we want to measure fluctuations in emotions in daily life.

For this study, we will ask you to fill in several questionnaires on your mobile phone. All questionnaires will be completed in the Ethica app. The study will start with a questionnaire concerning your demographics and general mental health. This initial questionnaire will take about 10 minutes to complete. Afterwards, you will receive four questionnaires per day for a period of two weeks. Notifications will remind you about the next questionnaire. One daily questionnaire takes approximately 3 minutes to complete. It is important that you answer the questionnaires as soon as possible. *Please make sure that you turn on the notifications for the Ethica app on your mobile device.*

The information that we collect from this research project will be kept confidential. This means that only the researchers have insight into your answers. All personal data (such as age, gender etc.) will be anonymized and will not be published and/or given to a third party. Your participation in this study is voluntary. You are free to withdraw from this study at any time and without giving a reason.

Contact information

If you have any questions regarding this study, you can contact the researchers of this research project Jasmin Wallner (j.wallner@student.utwente.nl), Paula Oberle (p.v.oberle@student.utwente.nl), Natalie Koop (n.koop@student.utwente.nl), Caroline Dauer (v.c.dauer@student.utwente.nl), Kia Lemmen (k.r.lemmen@student.utwente.nl) and Jenny Schwabe (j.schwabe@student.utwente.nl).

Consent

I have read and understood the information provided and had the opportunity to ask 38 questions. I understand that my participation is voluntary and that I am able to withdraw at any time, without a reason or cost. I hereby voluntarily agree to take part in this study.

Appendix B

State questionnaires

Positive and negative affect

Below you can find several questions about your current feelings. Please try to indicate how you felt right before you started to answer the questionnaire!

- How *anxious* do you feel right now?
- How *irritable* do you feel right now?
- How *down* do you feel right now?
- How *sad* do you feel right now?
 - 1 (not at all) to 7 (very much)

Rumination

In the last hour, I have been thinking about my problems

In the last hour, I had repetitive thoughts about my problems

- 1 (not at all) to 7 (very much)

Appendix C

Trait questionnaires

Demographics

- Age: How old are you?
- Gender: What gender do you identify as? Male, female, other
- Nationality: What is your nationality? Dutch German Other
- Occupation: What is your current occupation? Student, Working, Self-employed, studying and working, not working, other
- Highest degree obtained: Middle school (such as MBO, MTS, MEAO or Haupt- oder Realschule), High school (such as HAVO, VWO, HBS or Gymnasium/ Berufsschule/ Berufskolleg), High school, Bachelor, Master, PhD, Other

Mental well-being (MHC-SF)

During the past month, how often did you feel...

1. Happy
2. Interested in life
3. Satisfied with life
4. That you had something important to contribute to society
5. That you belonged to a community
6. That our society is a good place or is becoming a better place, for all people
7. That people are basically good
8. That the way our society works makes sense to you
9. That you liked most parts of your personality
10. Good at managing the responsibilities of your daily life
11. That you had warm and trusting relationships with others
12. That you had experiences that challenged you to grow and become a better person
13. Confident to think or express your own ideas and opinions
14. That your life has a sense of direction or meaning to it
 - a. Never
 - b. Once or twice
 - c. About once a week
 - d. About 2 or 3 times a week
 - e. Almost every day
 - f. Every day

Anxiety (GAD-7)

Over the last two weeks, how often have you been bothered by the following problems?

1. Feeling nervous, anxious, or on edge
2. Not being able to stop or control worrying
3. Worrying too much about different things
4. Trouble relaxing

5. Being so restless that it is hard to sit still
6. Becoming easily annoyed or irritable
7. Feeling afraid, as if something awful might happen
 - a. Not at all
 - b. Several days
 - c. More than half the days
 - d. Nearly every day

Depression (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems?

1. Little interest or pleasure in doing things
2. Feeling down, depressed, or hopeless
3. Trouble falling or staying asleep, or sleeping too much
4. Feeling tired or having little energy
5. Poor appetite or overeating
6. Feeling bad about yourself or that you are a failure or have let yourself or your family down
7. Trouble concentrating on things, such as reading the newspaper or watching television
8. Moving or speaking so slowly that other people could have noticed. Or the opposite being so fidgety or restless that you have been moving around a lot more than usual
9. Thoughts that you would be better off dead, or of hurting yourself
 - a. Not at all
 - b. Several days
 - c. More than half the days
 - d. Nearly every day