

Social Context as a Predictor of Rumination: An Experience Sampling Study

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Abstract

Background: Previous studies showed that rumination is associated with various aversive mental health outcomes. It is a symptom in mental disorders such as depression, anxiety disorders, or eating disorders. One factor that might be associated with rumination is the social context. It may act as a distraction from or prevent the onset of rumination.

Objective: This study aimed to investigate the relationship between social context and rumination. First, it was studied how the presence of another person is associated with rumination. Second, the relationships between different categories of social context (alone, family member, friend, romantic partner, co-worker/fellow student, unknown people) and rumination were examined. **Method:** In this experience sampling study, participants were recruited via convenience sampling. The sample ($N = 70$; mean age = 22.92 years, $SD = 7.52$; 61.4% female), received state questionnaires assessing their level of rumination and social context at four time points per day for 14 days. Linear mixed models were utilized to analyze the data. **Results:** The analyses indicated that rumination was significantly positively associated with being alone ($p < .001$). Further, as opposed to being alone, rumination was significantly lower when being with a friend ($p < .001$), romantic partner ($p < .001$), and a family member ($p = .005$). **Conclusion:** This study was the first to examine the social context in relation to rumination in daily life using the experience sampling method. The insights highlight the need to include rumination in the treatment of mental health issues such as depression and anxiety, and future ESM studies should build on them to advance knowledge about rumination and to develop new directions for treatment.

Keywords: rumination, social context, experience sampling study, linear mixed model

Social Context as Predictor of Rumination: An Experience Sampling Study

Mental health can be a challenge for many people as the prevalence of mental disorders worldwide, reported by the World Health Organization, is approximately 12.5% (World Health Organization: WHO, 2022). Rumination, an important transdiagnostic factor in mental illnesses, has several aversive consequences: it worsens symptoms of mental health disorders, reduces the efficacy of psychological interventions by hindering therapy, and perpetuates physiological reactions to stress (Watkins & Roberts, 2020). It takes place in solitude when people repetitively have negative thoughts (Nolen-Hoeksema, 1991), but the social context could also affect the extent to which a person ruminates internally depending on whether they are alone or with another person. Comparing oneself with others could lead to increased self-consciousness which could then lead to more rumination about one's social performance for instance. On the other hand, the presence of someone could also provide the feeling of social and/or emotional support and the possibility to talk with someone could reduce rumination. Yet, it remains unclear how different social contexts affect momentary levels of rumination. Therefore, this study aims to assess how the presence of other people in general and changes in the social context influence levels of rumination over time.

Rumination

The first definition of rumination by Nolen-Hoeksema (1991), it is defined as behavior or thoughts that direct a person's attentiveness to their depressive symptoms and to the causes and consequences of these symptoms. According to the American Psychological Association (APA), rumination is a type of obsessive thinking characterized by excessive and repetitive thoughts that disrupt other mental processes (*APA Dictionary of Psychology*, n.d.). Since rumination and worry are partly overlapping constructs, it is important to differentiate them. Worry has been defined as negative thoughts that are hard to control and center around a problem to find ways to solve it (Borkovec et al., 1983). The two concepts

are both related to psychological illnesses, but nevertheless each contain distinctive features (Stade & Ruscio, 2022). Rumination and worry can be both seen as styles of repetitive negative thinking.

Recently, more research on rumination has emerged in the field of psychology. In a meta-analysis, Kraiss et al. (2020) found that among various emotion regulation strategies, rumination was negatively correlated with well-being. This means that in people diagnosed with psychological disorders, higher levels of rumination are associated with lower well-being. In this study, these disorders predominantly comprise mood disorders, especially depression, on which the literature has been largely focused. More confirmation for the association between rumination and mental health conditions comes from Nolen–Hoeksema et al. (1999). In their study, they observed that depressive symptoms were associated with more rumination over time. Inversely, ruminative responses to distress were predictive of the onset and the chronicity of major depressive episodes (Nolen–Hoeksema, 2000). Apart from mood disorders, there is also emerging evidence for an association between anxiety disorders and rumination (Olatunji et al., 2013). In their meta-analysis, Olatunji et al. (2013) review correlational studies and conclude that people with mood or anxiety disorders display higher levels of rumination. With regards to these disorders, rumination has been identified as a transdiagnostic factor that is responsible for some of the overlap between anxiety and depression (McLaughlin & Nolen–Hoeksema, 2011). Another group of mental health disorders that is being studied in relation to rumination are eating disorders. In their meta-analysis, Smith et al. (2018) identified rumination as an important process in eating disorder psychopathology. Moreover, rumination is not only associated with mental but also with physical health (Sansone & Sansone, 2012). According to Sansone and Sansone (2012), rumination is related to a worsening of bodily symptoms and less favorable clinical results in general.

Whereas rumination was mainly studied cross-sectionally, at one point in time, until now, emerging experience sampling studies aim to capture the concept longitudinally. In order to achieve this, the experience sampling method (ESM) was implemented for data collection in previous studies. This method collects data with short self-report questionnaires and can be used to assess several variables that concern peoples' behavior, feelings, thoughts, and context throughout their daily lives (Csikszentmihalyi, 2014). Compared to cross-sectional designs, which do not take the momentary context of people into account, the ESM is able to assess context variables and changes therein. Moberly and Watkins (2008) investigated the relationship between rumination and acute stressors in an experience sampling study. They demonstrate that rumination is related to aversive consequences in a variety of situations, for example stressful or negative events. These events give rise to ruminative thinking and this in turn induces a heightened negative affect. Similarly, one experience sampling study by Ruscio et al. (2015) found that rumination was a predictor of a range of aversive consequences after a stressful event.

Rumination and Social Context

The lack of a social context, more specifically loneliness, was found to intensify rumination in young adults aging 18-24 years (Yun et al., 2022). They observed that the content of rumination is often focused on social relationships and interactions. A common way to cope with these thoughts is to find a distraction, as for example the company of another person. Therefore, the social context could affect the levels of rumination within a person. According to the APA, the social context refers to the specific circumstances or broader environment that provide a social framework for individual or interpersonal behavior (*APA Dictionary of Psychology*, n.d.). This context often affects to some extent the behaviors and emotions that take place within it. Consequently, this study aims to investigate the relation between rumination and different social contexts, namely whether

someone is present or not and the specific people that accompany the participant at a given time point.

Preceding the study of Yun et al. (2022), Borawski (2019) found that people tend to engage in higher levels of rumination when feeling lonely. This increase in rumination when people feel lonely in turn decreased the overall well-being of participants (Borawski, 2019). On the other hand, perceived social support was found to be a protective factor against the engagement in frequent rumination in an experience sampling study by Puterman et al. (2010). The possibility to share one's thoughts and feelings with a companion can prevent the onset of rumination or provide help when rumination is occurring. Puterman et al. (2010) further state that without a person to share one's thoughts and feelings, there might be a greater inclination to get stuck in a repetitive cycle of thinking without making progress in coping with stressful events.

The Current Study

While there are (experience sampling) studies that investigate loneliness, social support and rumination (Borawski, 2019; Puterman et al., 2010), there is no study that utilizes the ESM to investigate the association between social context and rumination. Consequently, obtaining further knowledge and understanding of the context in which rumination occurs could contribute to gaining new insights into the development and maintenance of mental health disorders. This in turn could be valuable for diagnostics and treatment. While previous research studied rumination cross-sectionally, this study investigates the association between social context and rumination using intensive longitudinal data that is able to gather the momentary social context a person is in. The current study aims to answer the following research questions:

- (1) How is the presence of other people related to rumination?
- (2) How is the type of social context (alone, family member, friend, romantic partner, co-worker/fellow student, unknown people) associated with rumination?

Based on the literature discussed above, the following hypotheses can be determined: With regards to the first research question, it can be assumed that the presence of others is negatively associated with rumination. Second, the associations between the different categories of social context and rumination will be explored. While the second research question is more explorative, it can be anticipated that the levels of rumination will be lower in the company of close confidants (i.e. family, romantic partner, or friends) compared to strangers or acquaintances. A higher decrease in rumination in the presence of these persons can be expected, because interacting with less well-known persons or even strangers could induce more self-consciousness, less engagement, and less social support among other things. Further, they could be less distracting, compared to interacting with close confidants, because the nature of contact is more superficial and quicker.

Method

Participants

The convenience sampling method was used to recruit participants. This is a non-probability or non-random sampling method, and the researchers recruit participants that are easy to access, available in a certain timeframe, and motivated to participate in the study (Etikan et al., 2016). Convenience sampling is favored due to its affordability, relative time efficiency compared to other sampling methods, and comprehensibility (Stratton, 2021). In addition to the researcher's personal contacts, participants were obtained via the University of Twente's research participation system SONA. To meet the specified inclusion criteria, participants that were recruited had to be at least 18 years of age, have adequate proficiency in the English language, and possess a smartphone. Van Berkel et al. (2017) state that on average 53 participants were included in previous ESM studies. Hence the study at hand aimed to obtain a sample of at least the same size.

Design and Procedure

This study is part of a larger study and multiple research projects used the same data. Hence, various psychological constructs were measured, of which a complete overview can be found on the website of the OSF repository (<https://osf.io/gvebm/>). A pilot test was conducted after the study obtained approval of by the Ethics Committee of Behavioural, Management, and Social Sciences of the University of Twente (request nr: 220285). This test was run via the online platform Ethica Data (<https://ethicadata.com/>) with a duration of three days to ensure technical functionality. From the 13th until the 27th of April 2022 the actual data collection took place via the Ethica Data platform. This total duration of 14 days is appropriate for ESM studies that entail multiple assessments per day (Conner & Lehmann, 2012). Participants accessed the study by downloading the Ethica Data app on their smartphones. They received an email with a link and a code to begin the questionnaires. After registration, they were informed about data confidentiality, their right to stop participating anytime, and provided with an informed consent form (Appendix A). No compensation was given to participants, except for students at the University of Twente, who received research participation points.

The study consisted of two questionnaires, one baseline questionnaire (Appendix B) that was administered once and state questionnaires (Appendix C) that had to be completed four times per day for 14 successive days. The baseline questionnaire was triggered at 9 am on the first day of the study and participants that did not fill it out yet were reminded to do so after eight, 24, and 72 hours. Completion of this questionnaire took approximately 15 minutes and comprised questions about demographic information in addition the assessment of different trait measures of psychological constructs. The daily questionnaires assessed the momentary states of participants, and their completion took approximately three minutes. Participants received four daily notifications prompting questionnaire completion through signal-contingent sampling. These questionnaires were administered at semi-random times within

pre-defined slots from 10-11 am, 1.30-2.30 pm, 5-6 pm, and 8.30-9.30 pm. By randomly prompting questionnaires within a fixed time interval, this method ensures high ecological validity because of their unpredictability (Myin-Germeys & Kuppens, 2021). Since participants are unable to anticipate the questionnaires, these randomized time intervals contribute to the accurate and authentic reporting of emotions, feelings, and thoughts (Thomas & Azmitia, 2015). Participants were reminded to fill in the questionnaires if they have not done so, to decrease attrition. But contrary to the baseline questionnaire, which did not expire throughout the study, the state questionnaires became inaccessible after 60 minutes.

Measures

Baseline Questionnaire

For the rumination questionnaire at baseline, the Cognitive Emotion Regulation Questionnaire (CERQ) was used. This questionnaire measures the cognitive strategies that people apply after experiencing negative events or situations (Jermann et al., 2006). The CERQ consists of 36 items that can be divided into nine subscales: self-blame, other-blame, rumination, catastrophizing, putting into perspective, positive refocusing, positive reappraisal, acceptance, planning (Garnefski & Kraaij, 2006). Participants answer the items on a five-point Likert scale with categories ranging from 1 (“almost never”) to 5 (“almost always”). The current study used the subscale for rumination with a total of four items. Examples of these items are: “I often think about how I feel about what I have experienced” and “I am preoccupied with what I think and feel about what I have experienced”. The obtained scores ranged from four to 20 and a higher score indicates higher levels of rumination. The Cronbach’s Alpha that was calculated for the items of the current study showed acceptable internal consistency ($\alpha = .733$).

State questionnaires

To measure rumination, the items “In the last hour, I have been thinking about my problems” and “In the last hour, I had repetitive thoughts about my problems” were

administered. The answer options ranged from 1 (“not at all”) to 7 (“very much”) on a Likert scale. A mean score variable for the items that measures rumination was calculated to be used in the following analyses. Participants could reach a maximum mean score of 7 indicating high levels of rumination. For these two items, the split-half reliability, calculated with the Spearman-Brown formula, was excellent with a coefficient of .91. An ESM study by Hartley et al. (2013), that investigated worry and rumination in patients with psychosis, included similar items in their measures. In the current study, the validity of the questionnaire, calculated using the correlation between the scores on the rumination questionnaire at baseline and the rumination scores from the daily questionnaires, was weak ($r(68) = .17, p = .157$).

Social context was measured with the question “Who are you with right now?” and participants were presented with the following answer options: “family member, friend, romantic partner, co-worker/fellow student, unknown people/others, I am alone”. The ESM study of Brown et al. (2011) investigated the association between depression and the social context of participants. They used similar items to assess the type of social context. Additionally, another ESM study that examined the impact of the social context on adolescents’ feelings of loneliness included similar questions to measure the social context (Van Roekel et al., 2014).

Data analysis

All the steps of this statistical analysis were carried out using the Statistical Package of Social Sciences (SPSS) version 29. Since the data, that was obtained in daily life with the ESM, consists of multiple measurements per individual, models that consider the multilevel structure of the data needed to be used. Linear mixed models (LMM) are suitable for the analysis of multilevel ESM data, since they account for random errors, missing data at random, and the nested structure of the data (Magezi, 2015; Palmier-Claus et al., 2019). For the LMM analyses, a first-order autoregressive covariance structure was applied with the

assumption that scores that are closer in time are more strongly correlated (Fidell & Tabachnick, 2003). The values for the Akaike's Information Criterion (AIC) and the Schwarz's Bayesian Criterion (BIC) were lower for the model with a random intercept instead of a random slope and intercept. Therefore, a model with a random slope was chosen for this analysis. From the originally 107 participants, those with a response rate lower than 33% were excluded for the following analyses.

To answer the first research question of how the presence of other people is related to rumination, a binary variable was created for social context to indicate whether there were other people present or not at the time the questionnaire was administered irrespective of who those people were (0 = alone, 1 = with someone). A LMM with rumination as the dependent variable and the binary social context variable as fixed effect was carried out.

The second research question concerning how the type of social context is associated with rumination was answered by creating dummy variables for social context with 'alone' as the reference category. In general, the value 0 indicated that the participant was alone and the value 1 specifies that there was someone present. Another LMM with rumination as dependent variable and the dummy variables for type of social context as fixed effects was executed.

Results

Sample Characteristics and Descriptive Statistics

The final sample comprised 70 participants. On average, the response rate on the ESM questionnaires relevant for this study was 68.34%, which approximately corresponds with the average response rate of other ESM studies (Van Berkel, 2017). The age of participants in the final sample ranged from 18 to 65 years and with the mean age being 22.92 years ($SD = 7.52$). The sample characteristics, such as gender, nationality, occupation, and education, are depicted in Table 1.

At baseline, rumination, measured with a subscale of the Cognitive Emotion Regulation Questionnaire (CERQ), reached an average value of 7.29 ($SD = 1.57$). The sample's mean score on the two rumination items from the daily questionnaires was 2.75 ($SD = 1.57$). For the majority of the study duration, participants were alone (32.1%) followed by being with a family member (11.8%), with their romantic partner (10.7%), with a friend (8.7%), with a co-worker or fellow student (3.7%), and lastly with unknown people (2.5%).

Table 1

Sociodemographic Characteristics of Participants at Baseline (N = 70)

| Baseline Characteristics | | N | % |
|--------------------------|----------------------|----|------|
| Gender | Female | 43 | 61.4 |
| | Male | 26 | 37.1 |
| | Other | 1 | 1.4 |
| Nationality | Dutch | 12 | 17.1 |
| | German | 48 | 68.6 |
| | Other | 10 | 14.3 |
| Occupation | Not working | 2 | 2.9 |
| | Student | 42 | 60 |
| | Studying and working | 19 | 27.1 |
| | Working | 6 | 8.6 |
| | Other | 1 | 1.4 |
| Education | Bachelor | 4 | 5.7 |
| | Highschool | 62 | 88.6 |
| | Master | 3 | 4.3 |
| | Other | 1 | 1.4 |

Linear Mixed Models

Rumination and the Presence of Others

With regards to the first research question, the effect of the presence of other persons on rumination was significant, as depicted in Table 2. This indicates that rumination was on average significantly higher when participants in this sample were alone compared to being with someone, irrespective of whom ($b = - 0.32, p < .001$). Figure 1 illustrates the mean scores of rumination per participant when they were alone or with someone.

Table 2

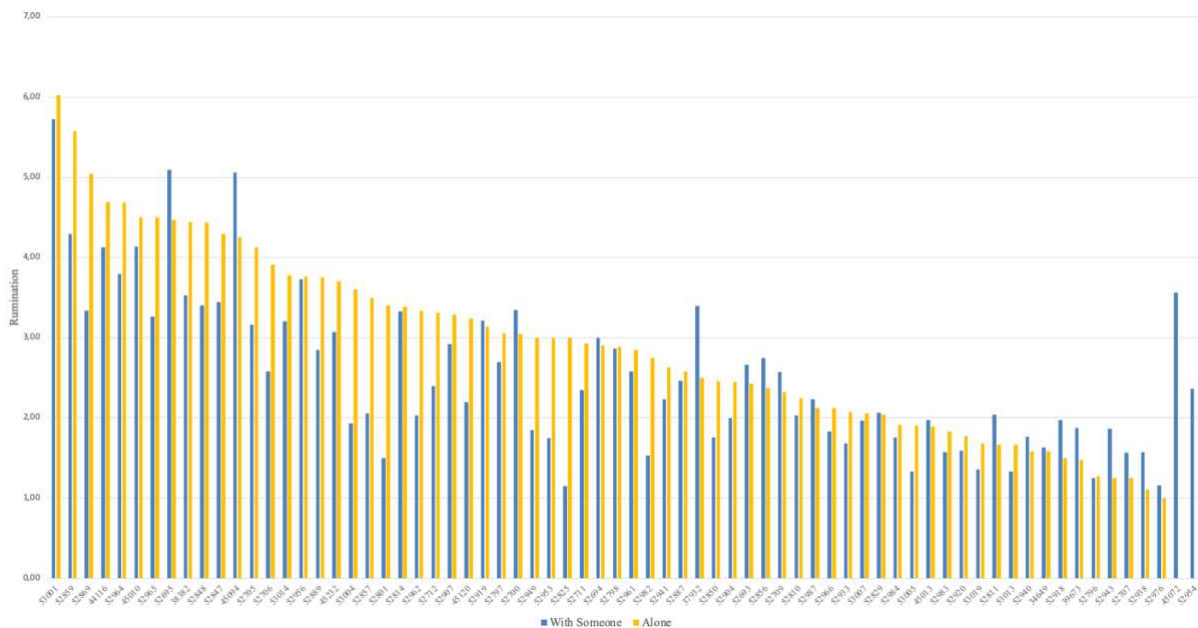
Scores of the LMM with Rumination and Binary Social Context

| Parameter | Estimate | SE | df | t | p | 95% CI | |
|--------------|----------|-----|---------|--------|-------|--------|--------|
| | | | | | | LL | UL |
| Intercept | 2.92 | .12 | 76.32 | 24.21 | <.001 | 2.68 | 3.17 |
| With Someone | - 0.32 | .05 | 2463.26 | - 6.24 | <.001 | - 0.43 | - 0.22 |

Note: SE = Standard Error; CI = Confidence Interval; LL= Lower Limit; UL: Upper Limit

Figure 1

Mean Rumination Scores of Participants When with Someone or When Alone (N = 70)



Rumination and Type of Social Context

To answer the second research question, a LMM was carried out to test the association between the different categories of social context and rumination. Being alone served as the reference category for the calculation. Hence the categories of social context, alone, family member, friend, romantic partner, co-worker/fellow student, unknown people, were each compared to being alone, see Table 3. The results indicated that compared to being with a family member, levels of rumination are significantly higher when the participant was alone, ($b = -0.22, p = .005$). When a co-worker or fellow student was present, rumination was lower as opposed to when the participants were alone ($b = -0.15, p = .2$). In comparison to being alone, rumination was significantly lower when being with a friend, ($b = -0.45, p < .001$). Further, when participants were with a romantic partner, rumination was lower compared to being alone, ($b = -0.38, p < .001$). Lastly, the levels of rumination were lower when participants were accompanied by unknown people or others compared to being alone, ($b = -0.01, p = .96$). Taken together, the largest reduction in levels of rumination, compared to being alone, was when participants were with a friend.

Table 3

Scores of the LMM with Rumination and the Dummy Variables for Social Context

| Parameter | Estimate | SE | df | t | p | 95% CI | |
|-------------------|----------|-----|---------|-------|-------|--------|-------|
| | | | | | | LL | UL |
| Intercept | 2.92 | .12 | 77.03 | 24.57 | <.001 | 2.68 | 3.16 |
| Family Member | -0.22 | .08 | 2573.53 | -2.84 | .005 | -0.36 | -0.07 |
| Co-Worker/Student | -0.15 | .12 | 2527.99 | -1.3 | .2 | -0.38 | 0.08 |
| Friend | -0.45 | .08 | 2473.48 | -5.81 | <.001 | -0.61 | -0.3 |
| Romantic Partner | -0.38 | .09 | 2524.67 | -4.37 | <.001 | -0.55 | -0.21 |
| Unknown People | -0.01 | .13 | 2457.13 | -0.05 | .96 | -0.27 | 0.25 |

Note: SE = Standard Error; CI = Confidence Interval; LL= Lower Limit; UL: Upper Limit

Visualization of the Associations for Individual Participants

The following line graphs visualize the mean rumination scores for participants with low, medium, and high levels of rumination to illustrate the association between rumination and the social context at these different levels. The participant with 52976 as their ID had generally the lowest levels of rumination with a mean rumination score of 1.11. Figure 3 shows the line graph depicting the fluctuations in their rumination scores over the course of the study. The dots on the line indicate the presence of another person. This participant was accompanied by another person at 29 of all in all 56 points of measurement, indicating a relatively high frequency of social contact. Medium levels of rumination were attained by participant 53004 with a mean rumination score of 3.02. The fluctuations in their rumination levels are visualized below in Figure 4 and the dots indicate the presence of another person at this measurement point. For the duration of the study, this participant was with someone seven times. Finally, participant 53001 scored the highest mean rumination levels with a score of 5.98. Their rumination scores and social context are illustrated in Figure 5. There was another person present at nine measurement occasions. Mean rumination values of zero in the line graphs are indicative of missing data.

Figure 3

Rumination and Social Context of Participant 52976

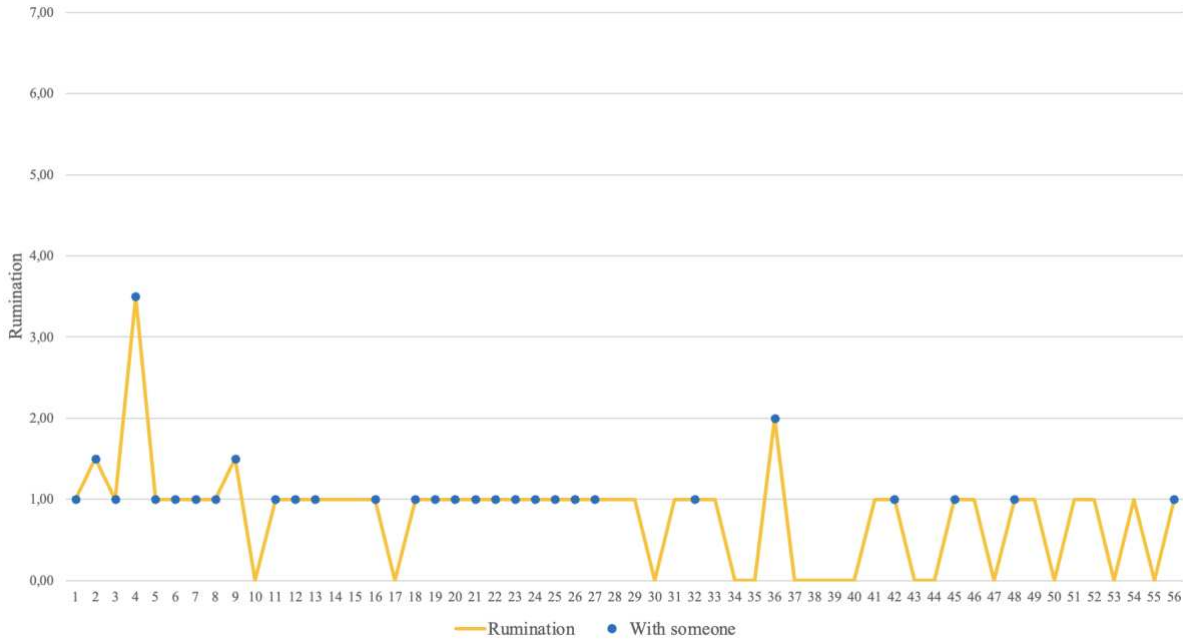


Figure 4

Rumination and Social Context of Participant 53004

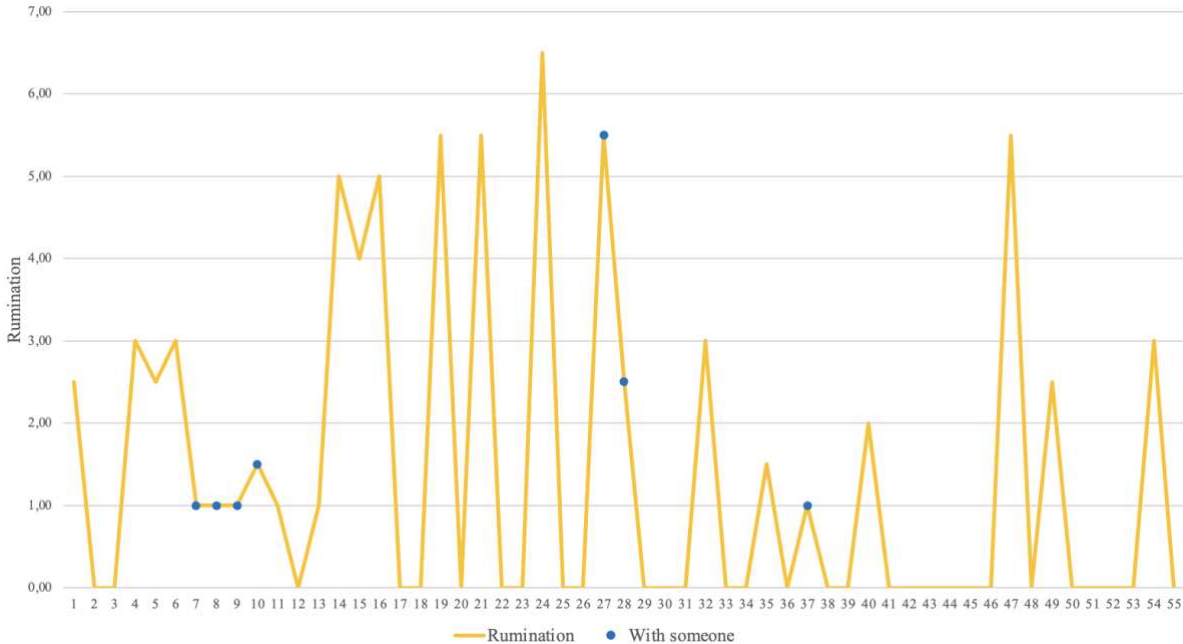
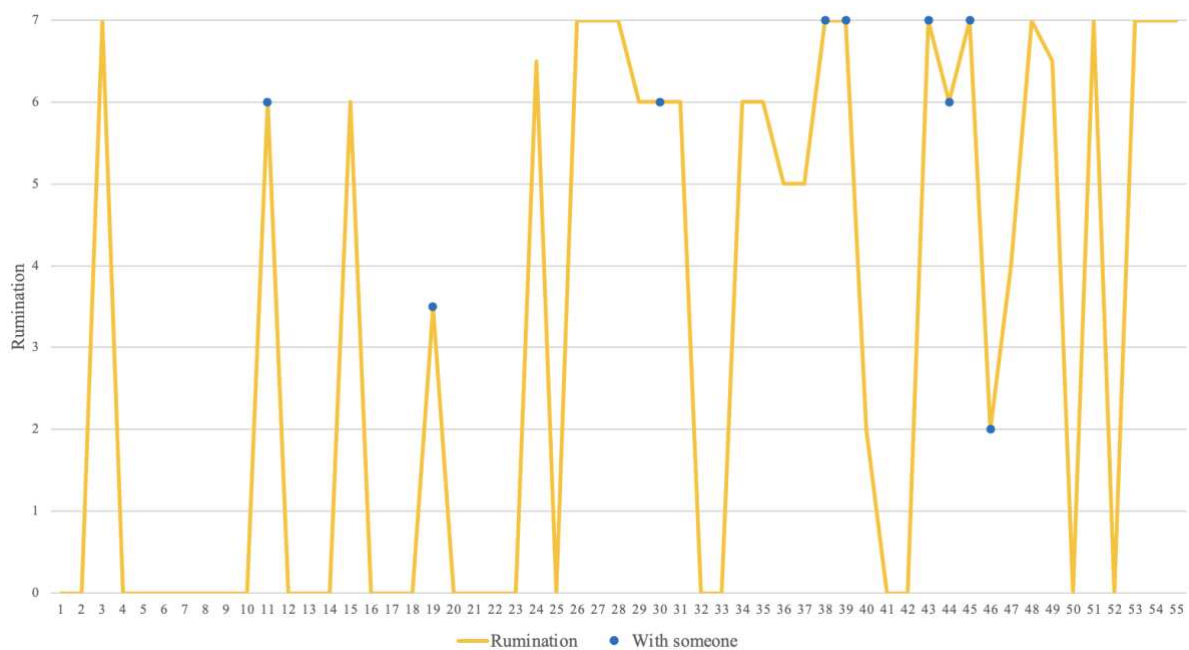


Figure 5*Rumination and Social Context of Participant 53001*

Discussion

The current study aimed to investigate the associations between social context and rumination in daily life with the experience sampling method. In short, results showed that rumination was significantly higher when the participants were alone compared to when they were with someone. Further, levels of rumination reduced significantly when participants were accompanied by a friend, romantic partner, or family member compared to being alone.

Social Context and Rumination

The results indicated that the presence of another person was associated with rumination. Specifically, people engaged in less rumination when they were with someone and on the other hand, levels of rumination were higher when people were alone. These findings are in line with the established hypothesis and consistent with previous literature. According to preceding studies, people engage in more rumination when they are alone and

contrary to that, the presence of another person reduces rumination (Borawski, 2019; Puterman et al., 2010). Often, people seek the company of others as a distraction from these recurrent negative thoughts (Yun et al., 2022). By supporting these findings, this study contributes to the accumulation of evidence that is in favor of the existing knowledge concerning the association between rumination and social context described above. To the existing literature, this study adds the differentiation between persons that shared diverse relations to the participants and how these distinct social contexts are associated with rumination. This will be discussed in the paragraph below. Another addition to the literature is the ESM that was used to study this relationship. For this reason, the unique momentary changes in social context and rumination could be monitored over the course of one day for 14 consecutive days. Advancing knowledge about rumination and the context in which it occurs, contributes to the acquisition of new insights into the role of rumination for the development and maintenance of mental illnesses, such as mood disorders, anxiety disorders, and eating disorders (Nolen-Hoeksema et al, 1999; Olatunji et al., 2013; Smith et al., 2018). For the study at hand, these insights are that the presence another person reduces rumination and that therefore increasing the frequency of social contact could be a protective factor against rumination or reduce rumination that occurs as a symptom of mental health disorders.

Type of Social Context and Rumination

Concerning the associations between the different categories of social context and rumination, it was hypothesized that levels of rumination are lower in the company of close confidants compared to strangers or acquaintances. The analyses revealed that the largest significant reduction in levels of rumination occurred when participants were accompanied by a friend compared to being alone. Until the current study, no study has examined the association between friends and rumination without considering the concept of co-rumination. Rose (2002) defined co-rumination as excessively discussing personal issues in

a dyadic relationship. It is represented by routinely debating over problems, bringing up the same issue repeatedly, encouraging one another to discuss and speculate about problems, and concentrating on negative emotions. Since co-rumination was not examined in the current study due to the operationalization of rumination, no conclusions in this regard can be drawn. Here, the social support provided by the company of friends reduced rumination. A possible reason for these contradicting findings could be that the interaction with friends served as a distraction from rumination. Compared to social contact with strangers, interacting with friends could be more engaging, provide emotional support and reduce negative feelings, such as self-consciousness. Another significant reduction in rumination occurred in the presence of the romantic partner of participants. Previous research, investigating the role of rumination within relationships and more specifically the association between relationship satisfaction and rumination had a different focus and proposed that rumination within a relationship is related to relationship dissatisfaction (Elphinston et al., 2013). First, the present study did not take relationship (dis)satisfaction into account and second results suggest that participants showed reduced levels of rumination in the presence of their romantic partner. Similarly to the association between rumination and friends, the decreased levels of rumination in the presence of a romantic partner could be due to the distraction as well as the social and emotional support they provide in addition to empathy and understanding. Last, levels of rumination significantly decreased when participants in this study were with a family member. Research exists stating that the early family context predicts the development of rumination in adolescence (Hilt et al., 2012). Especially over-controlling parenting and negative-submissive expressivity were associated with the development of rumination later in life. Since the current study did not investigate the development of rumination in the family context, no conclusions can be drawn in this direction. Rather, this might be explained by family members serving as a distraction from rumination or as a protective factor that reduces

rumination. No previous study examined the associations between different social contexts and rumination and previous research rather contradicts the findings from the current study, as discussed above.

All of these relations, friend, romantic partner, and family member can be categorized as close confidants. In particular, this means that rumination was reduced when participants were not alone, but with a person that maintains a close relationship with them. Further, the relationships with co-worker/fellow student and unknown people/others as categories of social context were not significant. These two were the least frequent categories of social context in the study at hand: participants were with a co-worker/fellow student 3.7% and with unknown people/others 2.5% of the time. These low frequencies could be a possible explanation for these insignificant results. Since participants in this study were mainly students, it is likely that they spend a certain amount of time in lectures every week. From this fact would follow, that they would have chosen 'fellow student' as a category of social context more often. A possible explanation for why they did not do this could be that they spend their time at university within their peer groups and hence chose the category 'friend' instead. Therefore, they were provided with the previously mentioned benefits of friendships that in turn decrease rumination.

Strengths and Limitations

One limitation of this study is the homogeneity of the sample with regards to age and nationality. The majority of participants were 18–24 years old (88.4%) and German (68.6%), with minimal representation of other age groups and nationalities. This likely originates from the convenience sampling method that was used for recruitment. Convenience sampling brings about several disadvantages (Etikan et al., 2016; Stratton, 2021): due to sampling bias, the sample is unrepresentative of the general population thus limiting generalizability of the results (Jager et al., 2017). Second, the validity of the two questions that were used to assess rumination was low. Last, the data that was obtained in

the current study remains purely observational and therefore no causal inferences can be drawn.

In contrast, by using signal-contingent sampling within the ESM, this study avoids behavior change of participants that could be caused by the repeated assessments of non-random sampling (Scollon et al., 2003). Measuring each participant 56 times captures momentary fluctuations in the variables of interest (Scollon et al., 2003). Additionally, the data are obtained in real-life situations of participants, which increases the ecological validity (Myin-Germeys et al., 2018; Van Berkel et al., 2017) and allows for a higher generalizability of the results (Scollon et al., 2003). Last, the ESM reduces memory bias by leaving participants with a short amount of time to answer the questionnaires once they are triggered. In general, the use of the ESM allowed for the assessment of the momentary social context of participants.

Implications and Future Directions

Findings from this study can be valuable for future research as well as for the treatment of mental disorders. They show the unique fluctuations of rumination over the day and how these are associated with the momentary social context that participants are in. Because rumination is known to be a factor in depression, anxiety disorders, eating disorders, and physical health (Nolen-Hoeksema et al, 1999; Olatunji et al., 2013; Sansone & Sansone, 2012; Smith et al., 2018), gaining further knowledge about the context in which it is more or less likely to occur could be important for the treatment of these disorders, help in the reduction of these thoughts when they occur or prevent their occurrence altogether.

Future studies that test the association between rumination and social context within a non-healthy sample could detect different nuances of rumination, compared to the healthy sample of students that was tested in the current study. Since levels of rumination in this sample were moderate, as indicated by participants in the daily state questionnaires, it can be expected that rumination scores within a non-healthy sample would be higher. Because

rumination is a transdiagnostic factor in emotional disorders (Ehring & Watkins, 2008; McLaughlin & Nolen-Hoeksema, 2011), gaining insights into its occurrence in a sample whose participants are diagnosed with a mental health disorder would be of great importance for the clinical field. Enhanced knowledge concerning rumination would lead to more targeted treatment, thus increasing the efficiency thereof and improve clinical outcomes (Watkins & Roberts, 2020). The suggested treatment approaches for rumination, mindfulness-based and cognitive behavioral therapy, that are known to effectively reduce rumination, could be further tailored to clients' needs with additional knowledge (Querstret & Cropley, 2013). Because knowing about the situations in which rumination is more or less likely to occur could enable therapists to make more specific suggestions or teach different skills for each kind of situation. For example, if a depressive client frequently engages in rumination, the therapist could then recommend seeking social support from close confidants to reduce these recurrent negative thoughts.

The questionnaire that was used to measure momentary rumination only consisted of two questions and had poor validity. Future studies should therefore apply a questionnaire with better validity. Furthermore, the data obtained during the current study remains purely observational and therefore no causal inferences can be drawn. In order to be able to establish causality, future studies could ask people to seek social contact and then measure how this changes levels of rumination of participants.

Conclusion

This study was the first to investigate how the social context is associated with rumination using the ESM. The results support the findings from previous cross-sectional studies pointing to higher levels of rumination when participants are on their own and less frequent rumination when one is accompanied by someone with whom they share a close relationship. Especially the presence of a friend, romantic partner, or family member is negatively associated with rumination compared to being alone. These insights underlie the

importance of a focus on including the social context as a factor in the treatment of various mental health issues such as depression and anxiety disorders among others. Following ESM studies should build on the results of this study and aim to not only advance knowledge about rumination, but also develop new directions for treatment.

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Appendix A

Informed consent

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 well being is related to several positive psychology constructs. To explore this relationship, we want to measure fluctuations in mental health in daily life to gather a more detailed picture of the dynamics of mental health.

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 three daily questionnaires per day for a period of two weeks. Notifications will remind you about the next questionnaire. The questionnaires will be provided in the morning, afternoon, and evening. 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 project Amelie Schleich (a.c.schleich@student.utwente.nl) and Allegra Passmann (a.v.passmann@student.utwente.nl)

Consent

I have read and understood the information provided and had the opportunity to ask 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 – Baseline Questionnaire

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

Focus on thought/rumination

1. I often think about how I feel about what I have experienced.
2. I am preoccupied with what I think and feel about what I have experienced.
3. I want to understand why I feel the way I do about what I have experienced.
4. I dwell upon the feelings the situation has evoked in me.

Appendix C – Daily Questionnaires**Social context**

Who are you with right now?

- Family member, friend, romantic partner, co-worker/fellow-student, unknown people/others, I am alone

Rumination

1. In the last hour, I have been thinking about my problems.
2. In the last hour, I had repetitive thoughts about my problems.