

**Exploring the Moderating Effect of Gratitude on the Association between Stressful
Events and Negative Affect, taking into account Depression and Well-being: an
Experience Sampling Study**

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Master Thesis

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Abstract

Background: An increasing body of evidence suggests that gratitude buffers the negative impact of stressful life events. Recognising adaptation as a dynamic process, it becomes particularly interesting to explore the potential to employ gratitude in specific situations, as opposed to possessing high levels of trait gratitude. This study will comprehensively evaluate the moderating effect of gratitude across state, mood, and trait levels on the association between stressful events and negative affect and assess whether the moderating effect is maintained for individuals with various levels of mental well-being and depression.

Method: This study comprised a secondary analysis and used the Experience Sampling Method (ESM) to assess gratitude in daily life. In this study state, mood, and trait levels of gratitude were distinguished. 132 participants completed a baseline questionnaire and three momentary questionnaires for 14 days. The data was analysed using linear mixed models (LMM).

Results: The results showed a significant negative interaction effect for stressful events and state gratitude ($b = -0.60, p = .048$), a positive significant moderation effect for trait gratitude ($b = .128, p < .001$), and a non-significant interaction effect for mood gratitude ($b = -.033, p = .627$) on negative affect. Distinguishing levels of mental well-being and depression showed positive interaction effects for trait gratitude in all groups. Furthermore, negative interaction effects were shown for state gratitude in the low well-being and for state and mood gratitude in the low depression group. Other interaction effects were insignificant.

Conclusion: The findings highlight the significant role of state gratitude in buffering negative affect during stressful events, suggesting its potential value in gratitude interventions. Furthermore, this study provides some evidence for the potential of gratitude in populations with low levels of depression and populations with low mental well-being.

Introduction

There is a substantial increase in adults with mental health disorders, such as depression and anxiety, particularly among young adults and students. Growing societal concerns and stage salient developmental tasks may be contributing factors (Duprey et al., 2018). This suggests the importance of identifying potential mechanisms for reducing psychopathology in the aftermath of stressful events. In this regard and to promote mental well-being, increased attention has been paid to gratitude (Emmons & McCullough, 2003). Gratitude has been defined as an ‘orientation towards noticing and appreciating the positive in life’ (Wood et al., 2010). Following this definition, Watkins (2014) argues that a grateful person has an appreciation for all of life as a gift. They identify three subordinate facets of a grateful predisposition. The first facet entails a strong *sense of abundance*, meaning that grateful people should feel that life has treated them well. The second facet involves *appreciation of simple pleasures*. The final facet, *social appreciation*, encompasses grateful people’s recognition of the importance of appreciating others’ contributions to their lives.

The Buffering Effect of Gratitude

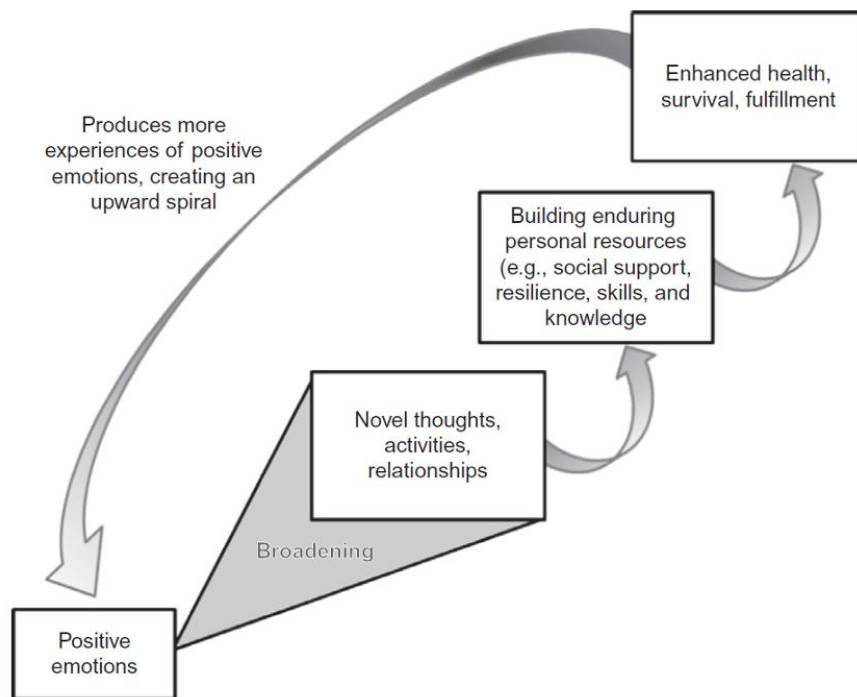
There is growing evidence suggesting that gratitude buffers the negative impact of stressful life events. First of all, gratitude interventions lead to increased positive affect and decreased negative affect (Emmons & McCullough, 2003). Furthermore, gratitude is associated with more adaptive and less maladaptive coping (Wood et al., 2007; Lin, 2016). McCanlies et al. (2018) found a negative association between gratitude and depression indicating that the buffering effect of gratitude is also found in the clinical population. Additionally, gratitude lowers depression in chronic illness populations (Sirois & Wood, 2017), is beneficial in recovery from physical illness (Millstein et al., 2016) and counteracts high blood pressure and cholesterol resulting from negative emotions (Fredrickson et al., 2000). Moreover, gratitude has been shown to improve mental well-being. Expressing daily gratitude increased eudaimonic and hedonic daily well-being in veterans (Kashdan et al., 2006) and higher levels of trait gratitude more often led to post-traumatic growth after trauma due to a school shooting (Vieselmeyer et al., 2017). These findings suggest that gratitude serves as a protective factor in response to stress or adverse events and has the potential to increase well-being.

The broaden-and-build theory, shown in Figure 1, explains the working mechanism of the buffering effect of gratitude (Fredrickson, 2004). Fredrickson suggests that frequently

experiencing positive emotions broadens a person's perception, which results in focusing on 'good things' instead of threats and danger. The latter narrows a person's perception. Subsequently, the broadened perceptions encourage people to engage in cognitive and behavioural activities that build useful resources for future stressful events. Through broaden-and-build processes, grateful people develop positive coping responses (Fredrickson, 2004).

Figure 1

The Broaden-and-build theory of Fredrickson (2004)



The broaden-and-build theory of Fredrickson (2004) explains that positive emotions broaden perceptions and actions, consequently building enduring personal resources, and therefore enhancing well-being.

State, Mood, and Trait Gratitude

Rosenberg (1998) proposed a framework for the organization of affective processes in which affective experiences, such as gratitude, are structured into emotional states, moods, and traits. Affective states are highly dependent on specific events and are of short duration, whereas traits are more stable and therefore less subject to change. Moods as an intermediate level of affect fluctuate throughout and across days and are attributable to individual differences and events. The most used differentiation in research about gratitude is between gratitude as a state and gratitude as a trait (McCullough et al., 2001; Wood et al., 2008). State

gratitude is understood as a momentary emotional response to the experience of receiving a benefit and trait gratitude as ‘a generalized tendency to recognize and respond with grateful emotion to the roles of benevolence in the positive experiences and outcomes that one obtains’ (Emmons & McCullough, 2003).

Wood et al. (2008) acknowledged that states involve temporary affective states and longer-duration moods, but did not differentiate between state and mood. McCullough et al. (2004) were the first who investigated gratitude as mood and found that day-to-day fluctuations in gratitude are strongly related to events in people’s daily lives and daily gratitude casts a grateful affective tone over people’s day. Consistent with this, Bohlmeijer et al. (2022) found a gradual increase in mood gratitude during a 6-week gratitude intervention aimed at improving mental well-being. Therefore, they propose that mood gratitude is in particular a relevant working mechanism in the effect of gratitude interventions on well-being. Although gratitude as mood seems to be important, it is understudied.

The majority of previously described studies operationalized gratitude as a static trait by assessing it cross-sectionally (Lin, 2016; McCanlies et al., 2018; Millstein et al., 2016; Sirois & Wood, 2017), while only some studies assessed state gratitude (Kashdan et al., 2006; Vieselmeyer et al., 2017). The subject of mood as an affective level is often not even considered, because emotion and mood levels of affect are insufficiently distinguished and used interchangeably in the literature (Watkins, 2014). Reiterating Rosenberg’s (1988) framework for the organization of affective processes, Watkins (2014) emphasizes that grateful moods are more enduring than grateful emotions, are more in the background of awareness, and facilitate the experience of grateful emotions. As there is growing consensus that adaptation is a dynamic process, it might be specifically interesting to examine the ability to utilize gratitude more dynamically instead of possessing high levels of trait gratitude (Kalisch et al., 2019; Ong & Leger, 2022). Gratitude must be assessed on state, mood, and trait levels to determine if more dynamic levels of gratitude have a stronger buffering effect on negative affect than trait gratitude.

Experience Sampling Method

To assess dynamic levels of gratitude, the Experience Sampling Method (ESM) is suitable. ESM tracks experiences in the real world and in real-time, using self-reports to capture these momentary experiences as well as their context (Conner & Lehman, 2012; Myin-Germeys & Kuppens, 2022). As self-reports are examined multiple times a day, it

enables distinguishing between state, mood, and trait gratitude to assess what level best buffers the negative impact of stressful events. Another advantage of ESM is it accurately represents typical conditions under which effects occur in real situations, improving the ecological validity. Moreover, questionnaires are filled out shortly after an event, reducing recall bias and enhancing reliability (Myin-Germeys & Kuppens, 2022). These advantages are absent in methods that presently predominate the behavioural science literature, such as global self-reports and observations in laboratories (Conner & Lehman, 2012).

Current Study

Previous ESM studies assessed the relationship between gratitude and various constructs such as spirituality (Olson et al., 2019) and aggression (Dewall et al., 2012). Simons et al. (2020) found associations in the expected directions between the subdimension *Sense of Abundance* and positive and negative affect. Although they assessed affect with ESM, they only assessed gratitude once with a baseline questionnaire. In a longitudinal research study, McCullough et al. (2004) found a strong association between mood gratitude and the number of discrete interpersonal events in daily life that elicited gratitude. Moreover, increased mood gratitude experienced in response to discrete interpersonal events increased state gratitude. This study contributed to the literature as it assessed how daily gratitude unfolds in daily life. To date, no single research has addressed how state, mood, and trait gratitude are related to stressful events and negative affect.

The current study aims to assess the moderating effect of state, mood, and trait gratitude on the relationship between stressful events and negative affect. As adaptation is assumed to be a dynamic process, it is hypothesized that state gratitude accounts best for the buffering effect on negative affect, followed by mood gratitude and lastly trait gratitude. Furthermore, this study aims to assess if the moderating effect is maintained in cases of different levels of depression and mental health. The existing literature is inconsistent about the association between gratitude and different levels of mental well-being. The previously mentioned study of Bohlmeijer et al. (2022) in which a positive effect of mood gratitude was found, only included individuals with low to moderate levels of well-being. They suggest that gratitude interventions might not be effective for individuals with already high levels of mental well-being due to a ceiling effect. Consistent with this, a meta-analysis by Komase et al. (2021) reported inconsistent results. Contrarily, another meta-analysis reported increased levels of mental well-being after gratitude interventions (Diniz et al., 2023). Studies assessing the association between gratitude and depression consistently indicate a negative association

between clinical and subjective depression and gratitude (Diniz et al., 2023; Iodice et al., 2021; Komase et al., 2021; McCanlies et al., 2018). Therefore, this study explores whether the buffering effect of gratitude is maintained for individuals with various levels of mental well-being and depression. It is hypothesized that this buffering effect is maintained for individuals with low mental well-being and either level of depression.

Method

This study involves a secondary analysis. The data for this study was originally collected as part of a broad ESM study at the University of Twente investigating the association between positive psychology constructs and mental well-being. The primary study was approved by the Ethics Committee of Behavioural, Management and Social Sciences of the University of Twente (#211225).

Participants

A convenience sample of 132 participants was recruited for this study. A post hoc power analysis for linear multiple regression, examining the interaction effect showed that 132 participants would provide greater than 80% power to detect a medium effect (power = .99, $\alpha = .05$, effect size = .15). This number seems moreover sufficient, as a mean of 53 participants was found among previous ESM studies (Van Berkel et al., 2017). Due to the intensity of data collection causing a high participant burden, high attrition was expected. Therefore, the number of initial participants would be significantly reduced after excluding participants with low compliance rates. Convenience sampling provides the possibility to motivate the participants to partake and provide data to ensure compliance and is therefore a suitable method (Conner & Lehman, 2012; Eisele et al., 2022). The criteria for participation were a minimum age of 18 years, sufficiency in English or German language, and the possession of a smartphone.

Design and Procedure

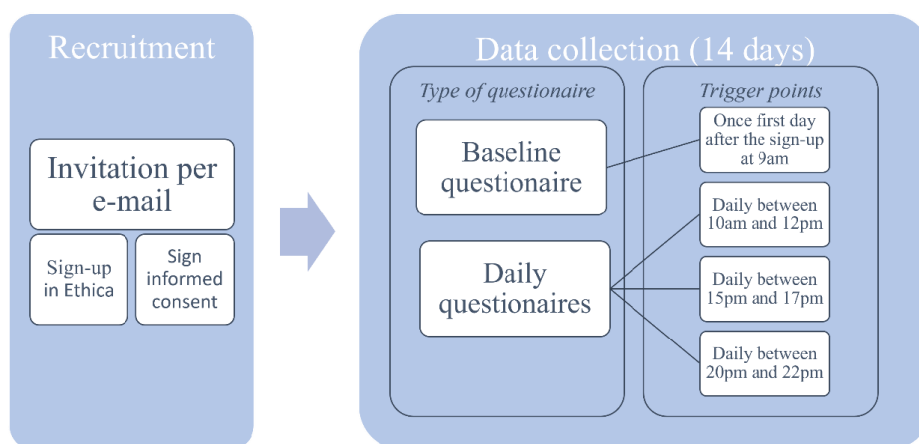
The Ethica Data platform (<http://ethicadata.com/>) and the corresponding smartphone application were used for data collection. For registration, each participant received an invitation via email in which they were asked to register for an account on Ethica, download the Ethica Data application, and give informed consent (Appendix A). Participants chose whether they administered the questionnaires in English or German. The study was carried out in two waves. The first wave spanned from the 22nd of November until the 5th of December 2021 and the second wave spanned from the 11th of April until the 24th of April

2022. The duration of the study is an important consideration in ESM studies, because sufficient data needs to be collected without being overly burdensome to the participants (Conner & Lehman, 2012). A study duration of two weeks for data collection is in line with other ESM studies, generally lasting between three days and three weeks (Conner & Lehman, 2012; Van Berkel et al., 2017).

The study consisted of a baseline survey and momentary questionnaires. The baseline questionnaire (Appendix B) was administered one day after registering for the study. It contained demographic questions and questionnaires to assess the psychological traits of interest. To assess momentary gratitude, stressful events, and negative affect, the momentary questionnaires (Appendix C) were administered three times during 14 days. A semi-random sampling scheme was used in which the momentary questionnaires were triggered at a random time point within three pre-defined time intervals between 10 a.m. and 10 p.m. (Myin-Germeys & Kuppens, 2022). This approach limits participant burden, as notifications are triggered during wake hours, while the interval aspect limits predictability. The recruitment and measurement scheme is graphically displayed in Figure 2. Push notifications were sent to notify participants about questionnaires. A reminder was sent one hour after the momentary questionnaire was triggered and expired after two hours. Three reminders were sent for the baseline questionnaire.

Figure 2

Recruitment and Data collection schemes, including Type of questionnaire and Trigger points



Materials

The questionnaires were administered on the mobile phones of the participants, using the Ethica Data application. This is a tool suitable for human-subject research with an easily understandable interface and with high privacy standards (Ethica, n.d.). In the initial study, the questionnaires administered a range of additional psychological constructs. This section will specifically outline the materials utilised in the present study.

Baseline Questionnaire

The baseline questionnaire comprised 43 items, containing demographical questions and validated questionnaires measuring mental health, gratitude, and depression. The Mental Health Continuum-Short Form (MHC-SF) was administered to assess the overall mental well-being of the participants (Lamers et al., 2011). The scale comprises fourteen items, representing various feelings of well-being, with each item being rated on a frequency scale from 0 (*never*) to 5 (*every day*), during the last month. Participants were for instance asked how often they felt 'satisfied with life' or whether their 'life has a sense of direction or meaning to it'. The mean total score was calculated, with a higher mean indicating an overall higher level of mental well-being. The MHC-SF has shown convergent validity and high internal consistency for the total scale ($\alpha = .89$; Lamers et al., 2011). The present study also showed good internal consistency ($\alpha = .82$).

The Patient Health Questionnaire (PHQ-9) was used to assess levels of trait depression (Kroenke et al., 2001; Spitzer et al., 1999). Using nine items, participants were asked how often they had been bothered in the past two weeks by symptoms of depression, such as 'little interest or pleasure in doing things', and 'trouble falling or staying asleep, or sleeping too much'. Responses were given on a frequency scale from 0 (*not at all*) to 3 (*nearly every day*). The sum score of the items was calculated, with a higher score indicating more severe depression. The English version of the PHQ-9 showed high internal consistency ($\alpha = .87$; Kocalevent et al., 2013), as well as the German version ($\alpha = .90$; Reich et al., 2018). For the present study, the internal consistency was adequate with a Cronbach's alpha of .76.

To measure trait gratitude the Gratitude Questionnaire-Six Item Form (GQ-6) was used (McCullough et al., 2002). The GQ-6 comprises six items and responses are given on a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). An example of an item is: 'If I had to list everything that I felt grateful for, it would be a very long list'. A mean score was calculated, with higher scores indicating higher levels of trait gratitude. The

construct validity was shown to be good with other studies indicating a one-factor structure and acceptable to good internal consistency ($\alpha = .67$, Emmon & McCullough, 2003; $\alpha = .94$, McCullough et al., 2002). The internal consistency of the GQ-6 for this study was adequate ($\alpha = .79$).

Daily Questionnaires

The daily questionnaires contained ten items, consisting of momentary positive and negative affect, state gratitude, and stressful events. The daily questionnaires were aimed to be kept short, as compliance rates are shown to decrease with extensive questionnaires (Eisele et al., 2022). Participants were instructed to answer the items about feelings they felt right before starting the questionnaire.

State negative affect was measured with four items. The question “How *anxious* do you feel?” was asked. The same question was asked three more times in which *anxious* was replaced by *insecure, down, and guilty*. The emotions or mood states chosen are in line with previous ESM studies (Geschwind et al., 2011; Jans-Beken et al., 2020). Responses were given on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*). A mean score of negative affect was calculated by averaging the four items, with a high score indicating the experience of negative emotions to a higher extent. To assess the internal consistency of negative affect, split-half reliability testing was applied. The person mean (PM) scores of the first and second weeks were compared. This indicated a high correlation, showing good reliability for negative affect ($r = .853, p < .001$).

To assess state gratitude, the question ‘How *grateful* do you feel right now?’ was used. Responses were given on a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*), with higher scores indicative of higher feelings of state gratitude. This item captures the dynamic phenomena of state gratitude, and the broad response scale provides the possibility to indicate within-person variability (Myin-Germeys & Kuppens, 2022). Other ESM studies were less capable of indicating this variability, as they examined a more static statement (“I feel grateful”) (Jans-Beken et al., 2020; Visserman et al., 2018). The split-half method was applied to indicate the internal consistency of the state measure of gratitude. The PM scores of the first week were compared to the PM scores of the second week. This showed a high correlation, indicating good reliability ($r = .855, p < .001$). The correlation between the PM gratitude score and the GQ-6, administered at baseline, was low positive ($r = .361, p < .001$). This indicates low convergent validity according to the rule of Cohen (1988).

Stressful events were examined with a single item, stating “Think of the most striking event or activity since the last questionnaire. How (un)pleasant was this event or activity?”. Participants were asked to rate it on a scale between -3 (*very unpleasant*) and +3 (*very pleasant*) with 0 marked as neutral. The item was borrowed from the ESM item repository, an open science initiative, and was originally constructed in a recent study (Helmich et al., 2020).

Data Analysis

The analyses were conducted with IBM SPSS Statistics 28. Before the data was analysed, both participants with response rates lower than 33.3% in the ESM questionnaire and participants who did not complete the baseline questionnaire were excluded. This cut-off point is commonly used in ESM research to ensure data validity (Yang et al., 2016). To answer the research questions, measures from the momentary questionnaires for negative affect, stressful events, and state, mood, and trait gratitude were constructed. An average score of the four negative affect questions was computed to assess momentary negative affect. For stressful events, a dummy variable was created by recoding -3 to -1 to a ‘1’ representing a stressful event was experienced, and 0 to +3 to a ‘0’ meaning that no stressful event had been experienced.

The different levels of gratitude were distinguished via several preprocessing steps. First, the person mean (PM) of the gratitude item was computed, indicating trait gratitude. Second, the PM was subtracted from the participant’s momentary scores to obtain person mean-centred (PMC) scores. PMCs reflect the variability of each person around their mean and therefore indicate state gratitude (Curran & Bauer, 2011). To indicate mood gratitude, PM scores for each day were computed. The PM scores were subtracted from the daily PM scores, resulting in PMC scores per day.

To answer the research questions, linear mixed models (LMMs) were applied. LMMs are useful for repeated measurements where observations are nested within individuals (Myin-Germeys & Kuppens, 2022). Moreover, another advantage is that LMMs adequately deal with missing data at random (Jahng et al., 2008; Krueger & Tian, 2004). The autoregressive covariance structure (AR1) was applied, which assumes that correlations between measurements exponentially decline over time (Barnett et al., 2010). Random error models of intercepts were added to the models, as this resulted in the best fit based on the Akaike information criterion (AIC).

The first research question aimed to assess the moderating effect of state, mood, and trait gratitude on the association between momentary stressful events and state negative affect. For state gratitude, an LMM was performed with negative affect as the dependent variable (DV) and the dummy variable of stressful events and state gratitude as predictors. To assess the moderating effect of gratitude on the relationship between stressful events and negative affect, the interaction term between stressful events and gratitude was included. A significant interaction effect is indicative of the moderating effect of state gratitude. Subsequently, two more models were performed in which state gratitude was replaced by mood gratitude and trait gratitude as predictors.

The second research question aimed to assess if the moderating effect of gratitude is altered by different levels of depression and well-being. Dummy variables indicating high and low mental well-being and depression were constructed based on the median of the MHC-SF (median = 4.21) and the PHQ-9 (median = 7.00). This resulted in four groups, respectively: high mental well-being, low mental well-being, high depression, and low depression. With the select cases option in SPSS, LMMs for each group separately were performed with the dummy variable for stressful events and the three levels of gratitude as predictors. In every LMM negative affect was the DV. Again, significant interaction effects were indicative of the moderating effect of gratitude.

Results

After excluding participants according to the exclusion criteria, 108 participants remained as the final sample. A post hoc power analysis for linear multiple regression, investigating interaction effects, indicated that with 108 participants, the study achieved greater than 80% power to detect a medium effect (power = .99, $\alpha = .05$, effect size = .15). The average response rate was 75.93%, which is similar to reported average response rates of 69.9% in previous ESM studies (Van Berkel et al., 2017). In the current study, ages ranged from 14 to 60 years with a mean age of 28.13 ($SD = 12.25$). The majority of the participants were female (74.1%) and German (75.0%), with high school as the highest completed education (49.1%). Characteristics of the sample are provided in Table 1. Descriptive statistics and bivariate correlations of the measures in the study are shown in Table 2.

Table 1

Characteristics of the participants (N = 108)

	<i>N</i>	<i>%</i>
Gender		
Female	80	74.1
Male	26	24.1
Nationality		
German	81	75.0
Dutch	17	15.7
Other	8	7.4
Occupation		
Working	40	37.0
Studying	36	33.3
Studying and working	25	23.1
Other	5	4.7
Education		
High school	53	49.1
Bachelor	30	27.8
Master	11	10.2
Middle school	10	9.3
Other	2	1.9

Table 2

Ranges, Means, Standard deviations, and bivariate correlations of Measures (N = 108)

Variable	Range	Mean	St. dev.	1	2	3	4
1. Stressful event	-3 – 3	0.68	1.48	-			
2. Negative affect PM	1 – 7	2.20	1.20	-.333*	-		
3. Gratitude PM	1 – 7	4.23	1.55	.369*	-.182	-	

The Moderating Effect of different levels of Gratitude on Stress and Negative Affect

					(.060)		
4. Mental wellbeing (mean)	0 – 5	2.92	0.67	.238*	-.267*	.261*	-
5. Depression (sum)	0 – 27	7.04	4.38	-.149	.419*	-.044	-.294*
				(.125)		(.654)	

Note. Correlations indicated with an asterisk (*) are significant at the .01 level. For insignificant correlations, the level of significance is provided in brackets.

The Moderating Effect of State, Mood, and Trait Gratitude on the Association between Stressful Events and Negative Affect

To gain insight into how the different levels of gratitude, stressful events, and negative affect interact, these constructs are displayed for three participants with varying degrees of trait gratitude (Figure 3 for low gratitude, Figure 4 for moderate gratitude, and Figure 5 for high gratitude). The graphical representation reveals substantial variability in the patterns among participants and across different time points within each participant. This dynamic nature of the data aligns with the theory suggesting that gratitude is inherently dynamic, emphasizing the need to assess gratitude as a state (Kalisch et al., 2019; Ong & Leger, 2022). Examining the graphs for all three participants, it is evident that moments of stressful events coincide with relatively lower levels of gratitude. However, it is noteworthy that decreases in state gratitude also occur without apparent stressful events. This nuanced observation adds complexity to our understanding of the relationship between gratitude and stress, indicating that the association is not solely contingent on explicit stressors. Interestingly, this observed negative association between stressful life events and gratitude contrasts with findings from previous cross-sectional research (Duprey et al., 2018).

Figure 3

Line plot showing Variability of the levels of Gratitude, Stressful Events, and Negative Affect for a participant with Low Trait Gratitude (ID 130)

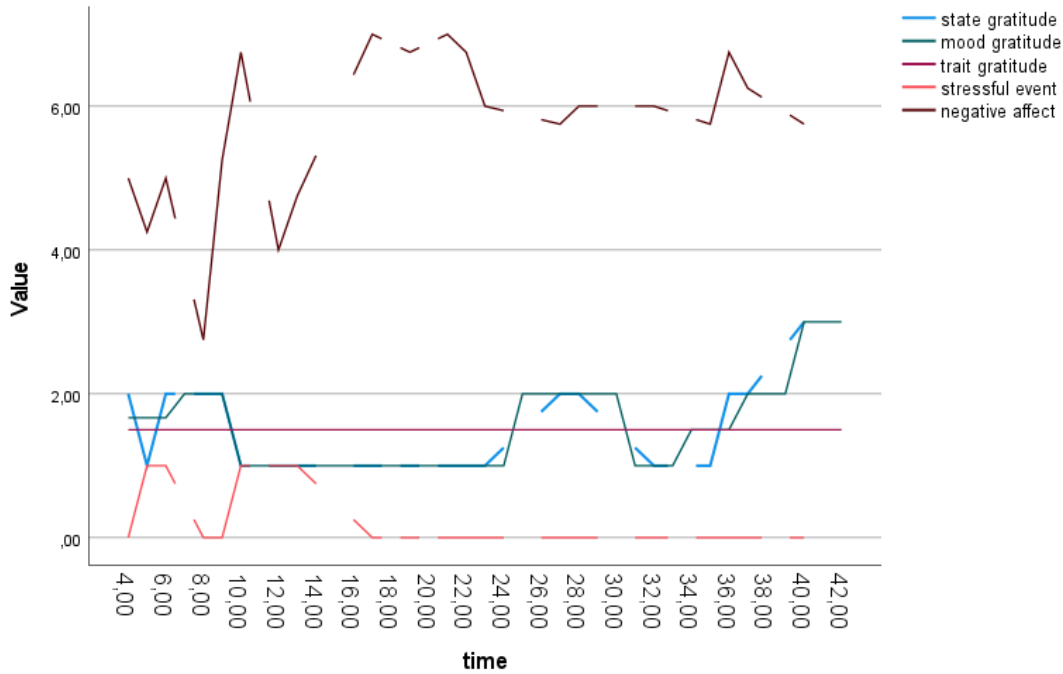


Figure 4

Line plot showing Variability of the levels of Gratitude, Stressful Events, and Negative Affect for a participant with Moderate Trait Gratitude (ID 47)

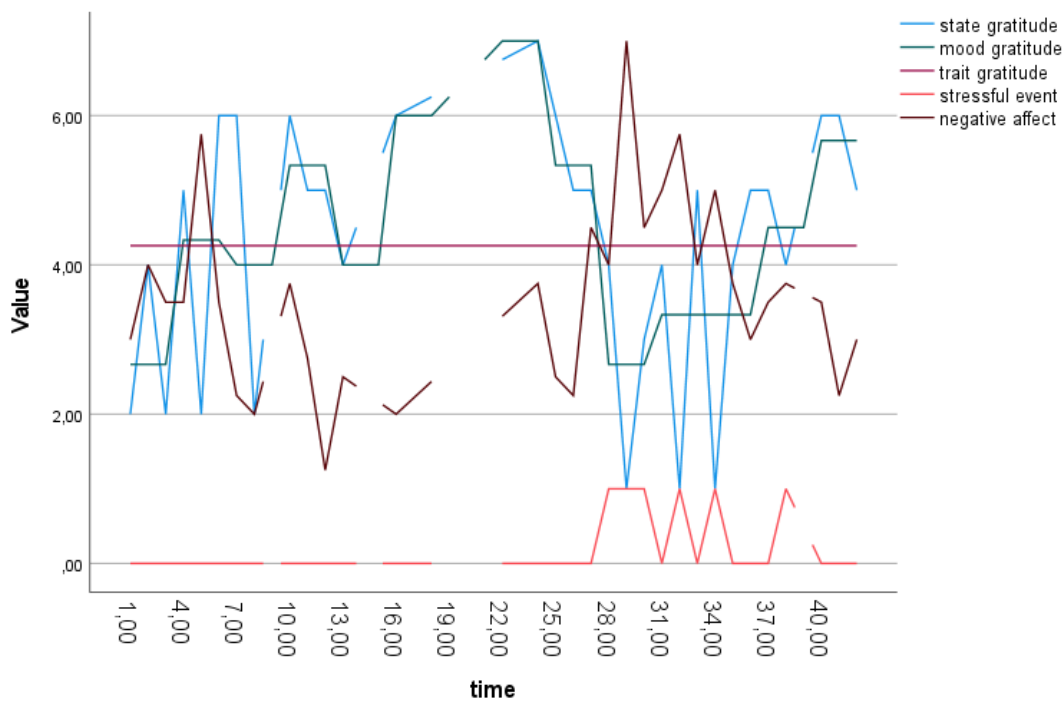
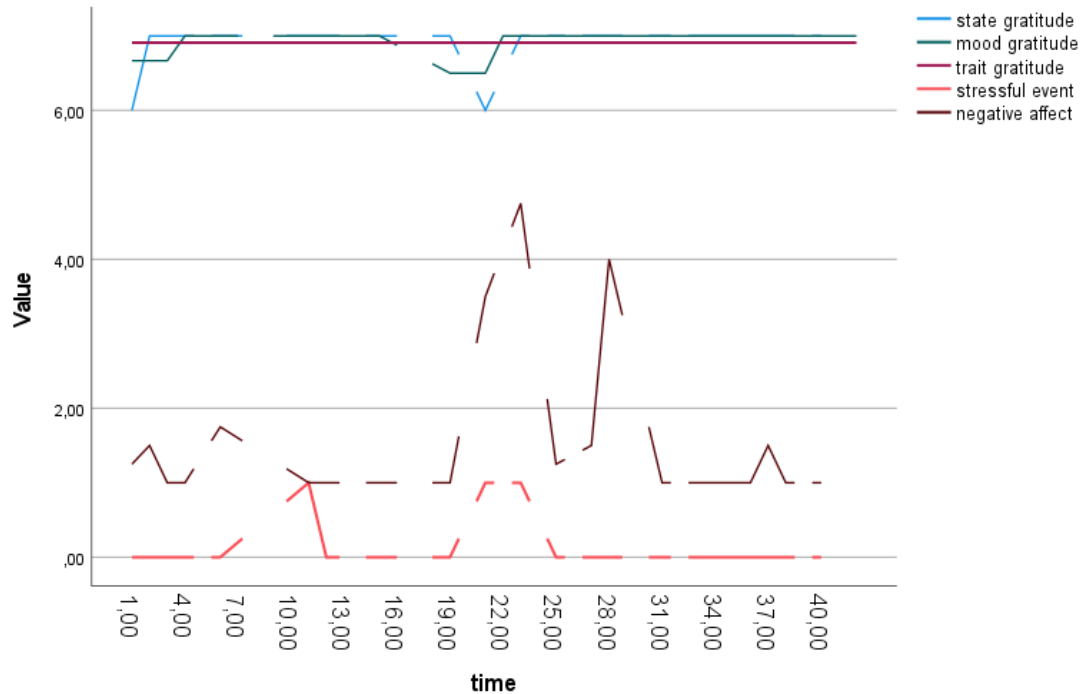


Figure 5

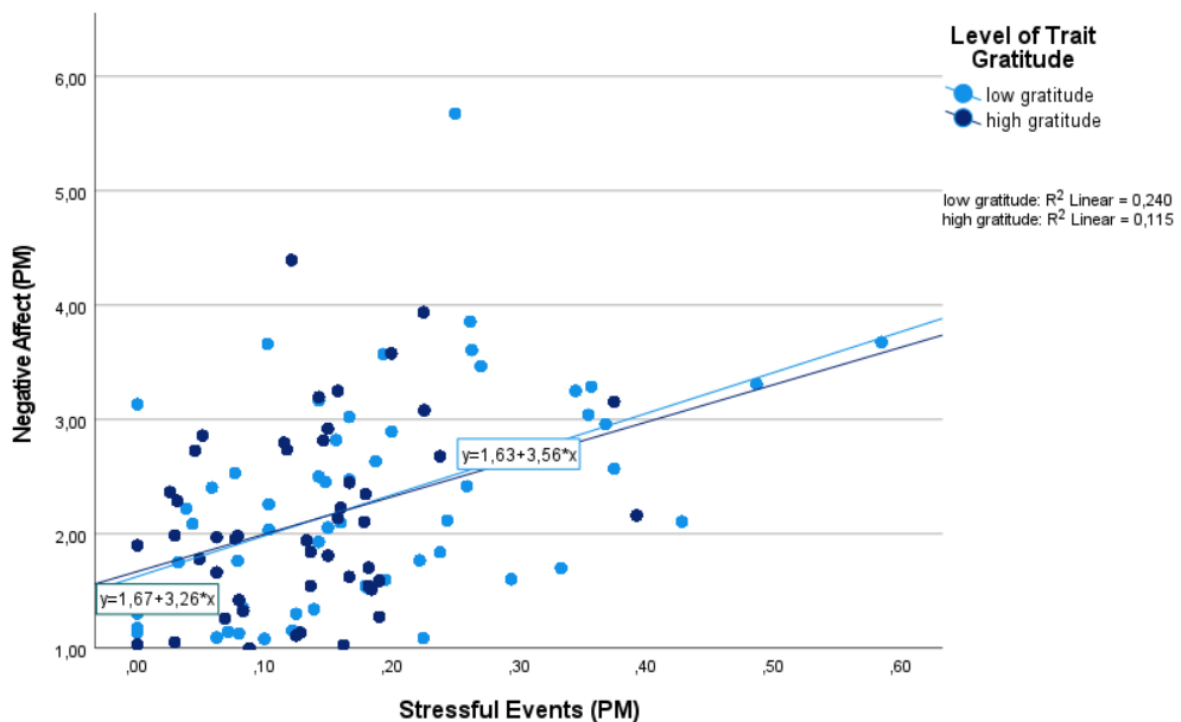
Line plot showing Variability of the levels of Gratitude, Stressful Events, and Negative Affect for a participant with High Trait Gratitude (ID 19)



Furthermore, the scatterplot in Figure 6 displays the correlation between stressful events and negative affect for individuals with low levels of trait gratitude, differentiated from individuals with high levels of trait gratitude. This figure shows that stressful events and negative affect are low to moderate positively associated ($r = .49$ for low gratitude and $r = .34$ for high gratitude) and the differences between high and low gratitude are negligible. This suggests that possessing higher levels of trait gratitude is not indicative of better adaptation during stress.

Figure 6

Scatterplot of the Association between Stressful events PM and Negative affect (PM) differentiating Individuals scoring High on Trait Gratitude from Individuals scoring Low on Trait Gratitude



Results of the Linear Mixed Models

The linear mixed model (LMM), with negative affect as the DV and the interaction effect between stressful events and state gratitude as the IV, shows a significant negative moderating effect ($b = -.060, p = .048$). This shows a moderating effect of state gratitude in which an increase in the interaction between stressful events and state gratitude is associated with lower levels of negative affect. A second LMM, in which the interaction effect between stressful events and trait gratitude (IV) on negative affect (DV) was assessed, showed a positive significant moderation ($b = .128, p < .001$). This shows a moderating effect of trait gratitude, in which an increase in the interaction between stressful events and trait gratitude is associated with higher levels of negative affect. The LMM with an interaction between mood gratitude and stressful events (IV) on negative affect (DV) shows an insignificant effect ($b = -.033, p = .627$). Therefore, this research suggests that mood gratitude does not moderate the relationship between stressful events and negative affect.

Table 3

Interaction Effects of Different Levels of Gratitude and Stressful Events on Negative Affect

Parameter	<i>b</i>	<i>df</i>	<i>t</i>	<i>p</i>	95% CI	
					LB	UB
Stressful event * state gratitude	-.060	2849.42	-1.977	.048*	-.119	.000
Stressful event * trait gratitude	.128	3086.91	3.623	<.001*	.059	.197
Stressful event * mood gratitude	-.033	67.45	-.488	.627	-.170	.103

Note. Results indicated with an asterisk (*) are significant at the .05 level.

Distinguishing the Moderating Effect of Gratitude for Different Levels of Mental Well-being and Depression

To explore the association between stressful events and negative affect across high and low levels of mental well-being and depression, scatterplots were created. Figure 7 displays this association distinguishing individuals with high and low well-being. Furthermore, in Figure 8 this association is displayed, distinguishing individuals with high and low depression. It seems that the positive association between stressful events and negative affect is stronger for participants with lower well-being than for people with higher well-being. Concerning depression, people with higher depression seem to experience more negative affect, compared to people with lower depression. However, the strength of the association between stressful events and negative affect is similar for people with high and low depression.

Figure 7

Scatterplot of the Association between Stressful events (PM) and Negative affect (PM) differentiating Individuals with Low Well-being from Individuals with High Well-being

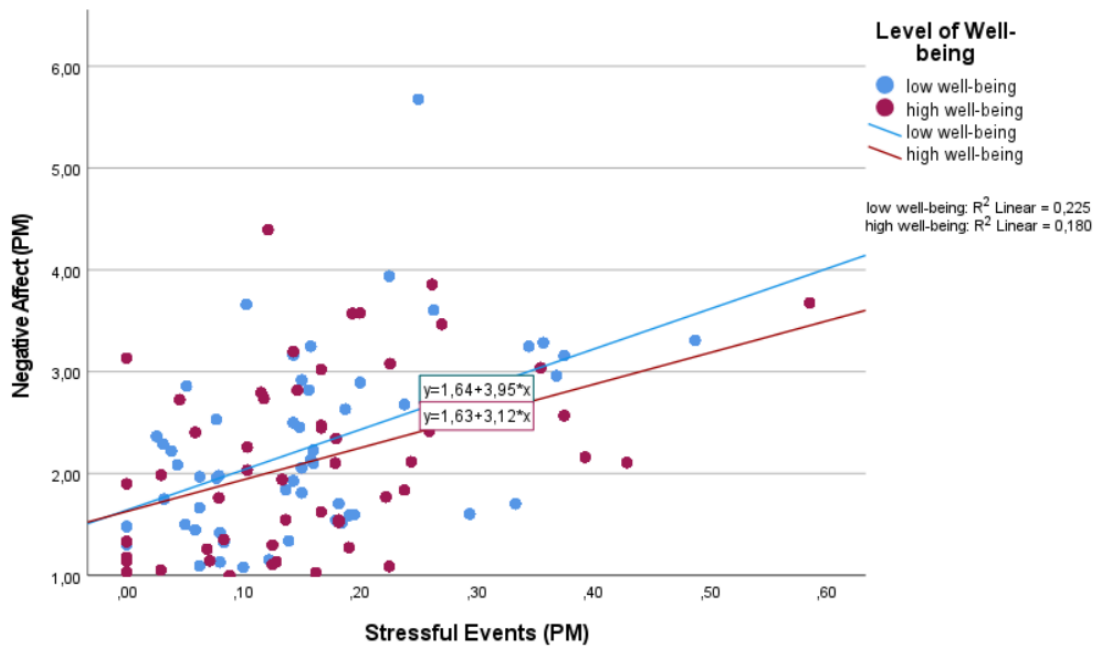
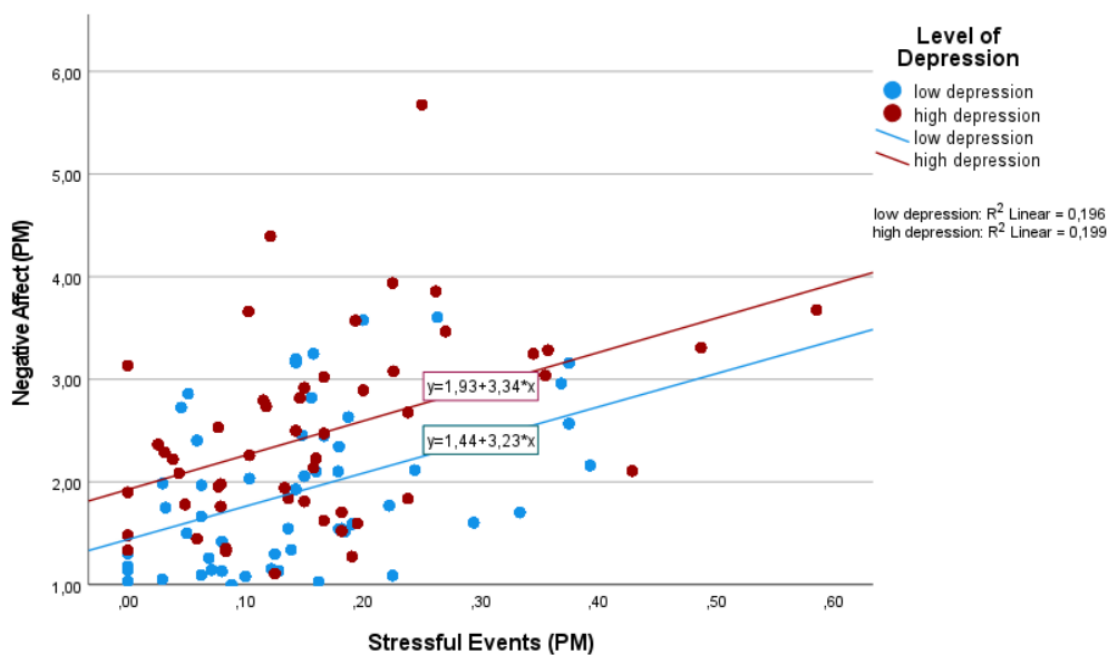


Figure 8

Scatterplot of the Association between Stressful events (PM) and Negative affect (PM) differentiating Individuals with Low Depression from Individuals with High Depression



Results of the Linear Mixed Models

The LMMs for participants with high mental well-being showed a significant positive moderating effect of trait gratitude ($b = .104, p = .020$) and insignificant moderating effects for state ($b = -.027, p = .504$), and mood ($b = -.060, p = .311$) gratitude. This shows that for people with high mental well-being, an increased interaction between stressful events and trait gratitude is associated with increased negative affect. For individuals with low mental well-being, LMMs show a significant negative moderating effect of state gratitude ($b = -.100, p = .027$), a significant positive moderating effect of trait gratitude ($b = .176, p = .002$), and an insignificant moderating effect of mood gratitude ($b = -.078, p = .208$). This indicates that for people with low mental well-being, an increased interaction between stressful events and state gratitude is associated with reduced negative affect. Moreover, for people with low mental well-being, an increased interaction between stressful events and trait gratitude is associated with increased negative affect.

Table 4

Interaction Effects of Different Levels of Gratitude and Stressful Events on Negative Affect Distinguishing High and Low Mental Well-being

	Parameter	<i>b</i>	<i>df</i>	<i>t</i>	<i>p</i>	95% CI	
						LB	UB
High mental well-being (<i>N</i> = 53)	Stressful event *	-.027	1378.13	-.668	.504	-.107	.052
	state gratitude						
	Stressful event *	.104	1446.99	2.322	.020*	.016	.191
	trait gratitude						
	Stressful event *	-.060	1546.22	-1.013	.311	-.176	.056
	mood gratitude						
Low mental well-being (<i>N</i> = 53)	Stressful event *	-.100	1448.59	-2.211	.027*	-.188	-.011
	state gratitude						
	Stressful event *	.176	1575.30	3.049	.002*	.063	.289
	trait gratitude						
	Stressful event *	-.078	1575.30	-1.260	.208	-.200	.044
	mood gratitude						

Note. Results indicated with an asterisk (*) are significant at the .05 level.

The Moderating Effect of different levels of Gratitude on Stress and Negative Affect

The LMMs differentiating high from low depression indicate the following results. For people with high depression, a significant positive moderating effect ($b = .173, p = .005$) was found for trait gratitude, and insignificant moderating effects were found for state ($b = -.003, p = .946$) and mood ($b = .070, p = .277$) gratitude. This indicates that for people with high depression, increased interaction between stressful events and trait gratitude increases negative affect. For individuals with low depression, significant negative moderating effects were found for state ($b = -.134, p < .001$) and mood gratitude ($b = -.208, p < .001$), and a significant positive moderating effect was found for trait gratitude ($b = .100, p = .014$). These results show that for people with low depression, increased interaction between stressful events and state gratitude, as well as mood gratitude, decreases negative affect. Contrarily, the association with trait gratitude increases negative affect.

Table 5

Interaction Effects of Different Levels of Gratitude and Stressful Events on Negative Affect Distinguishing High and Low Depression

		95% CI					
	Parameter	<i>b</i>	<i>df</i>	<i>t</i>	<i>p</i>	LB	UB
High depression (<i>N</i> = 52)	Stressful event * state gratitude	-.003	1317.67	.068	.946	-.085	.091
	Stressful event * trait gratitude	.173	1521.4	2.787	.005*	.051	.294
	Stressful event * mood gratitude	.070	1470.94	1.088	.277	-.056	.197
Low depression (<i>N</i> = 55)	Stressful event * state gratitude	-.134	1562.96	-3.349	<.001*	-.212	-.055
	Stressful event * trait gratitude	.100	1909.99	2.488	.014*	.020	.179
	Stressful event * mood gratitude	-.208	1683.42	-3.731	<.001*	-.317	-.099

Note. Results indicated with an asterisk (*) are significant at the .05 level.

Discussion

The current study aimed to explore the moderating effect of state, mood, and trait levels of gratitude with the use of experience sampling data. Specifically, this study assessed to what extent experiencing gratitude at the moment (state), on a day (mood), or in general (trait) served as a buffer for experiencing negative affect during stressful events. Moreover, this study aimed to assess if the moderating effect of gratitude varied among people with high and low levels of mental well-being and depression.

Main findings

Following the theory that adaptation is a dynamic process, it was expected that gratitude as a state would have a stronger buffering effect on negative affect than trait gratitude (Kalisch et al., 2019; Ong & Leger, 2022). However, previous studies reported inconsistent results about the association between state gratitude and affect. A positive association between state gratitude and positive affect was recently confirmed in an ESM study by Jans-Beken (2018). However, other studies could not confirm this association (Hamama et al., 2013; Watson & Clark, 1994). Additionally, preliminary evidence pointed towards mood gratitude as the most influential factor in gratitude interventions to improve mental well-being (Bohlmeijer et al., 2022; Kashdan et al., 2006). The current study indicates that state gratitude negatively moderates the association between stressful events and negative affect, and therefore serves as a buffer for negative affect after stressful events.

Contrary to expectation, a positive moderating effect was found for trait gratitude, indicating that possessing higher levels of trait gratitude during stressful events is associated with higher levels of negative affect. Indicative of this is the lineplot in Figure 5, showing a strong increase in negative affect during a stressful event, despite a high level of trait gratitude. Furthermore, Figure 3 indicates how a stressful event was associated with a relatively low level of negative affect, despite a low level of trait gratitude. Conversely, the scatterplot in Figure 6 suggests that people with low trait gratitude are slightly more amenable to negative affect during stressful events than people with high trait gratitude. However, this contrast could be caused by two outliers reflecting higher negative affect during stressful events for two individuals with low trait gratitude. Removing these outliers results in similar associations between the two groups. Previous studies provided some evidence for the stress-buffering effect of specifically state gratitude, and not trait gratitude on cardiovascular stress responses (Gallagher et al., 2020; Leavy et al., 2023). Gallagher et al., (2020) explain that the buffering potential of positive emotions, such as gratitude, is shown close to or during times

of stress. In addition, a study assessing the effect of gratitude on health-related quality of life (HRQoL) showed that state gratitude predicted significantly higher weekly HRQoL, while trait gratitude did not (McGuire et al., 2020). The finding that state gratitude specifically buffers negative affect, is in line with the theory about coping as a dynamic process, suggesting that adaptation is highly dependent on situations and across time (Kalisch et al., 2019; Ong & Leger, 2022). This implies that only dynamic levels of gratitude, would buffer the association between stressful events and negative affect and trait gratitude would not have this effect. Both state and mood gratitude are considered dynamic, as they are both conceptualised as covering a short period, respectively one moment and one day.

Building on this point, the theory of self-discrepancy by Higgins et al. (1986) suggests that grateful individuals might be more vulnerable to discrepancies between their positive expectations and the actual negative experiences during stressful events. This discrepancy could lead to increased negative affect during stressful events, as they might struggle to reconcile their positive mindset with the challenges they are facing. This could indicate that possessing high levels of trait gratitude is counter-effective in specific stressful moments, which is in line with the positive moderating effect found in this study. The difference with state gratitude lies in the speculation that gratitude only shows its buffering effect in close proximity to the stressful event. The present study adds the speculation that trait gratitude worsens coping with stress, however this should be tested more extensively. Moreover, contrary to expectations, gratitude as mood did not show a moderating effect. These results provide some evidence that state gratitude is particularly beneficial in buffering negative affect during stressful events. However, the remainder of the initial hypothesis proposing a positive moderating effect of mood could not be confirmed, and the moderating effect of trait gratitude should be rejected based on the current findings. The value of differentiation is underscored by the variations in moderation, observed across different levels of gratitude.

Regarding the second research question, the existing literature shows inconsistencies concerning the moderating effect of gratitude on varying levels of mental well-being and depression (Diniz et al., 2023; Iodice et al., 2021; Jans-Beken et al., 2020; Komase et al., 2021; McCanlies et al., 2018). To gain deeper insight into the underlying mechanisms of this moderating effect, distinctions were made between individuals with low and high mental well-being and low and high depression. The increased negative affect found for trait gratitude in the whole sample persisted across all four subgroups. Furthermore, the buffering effect of state gratitude was only present for the subgroup with low mental well-being and the

subgroup with low depression. As no significant moderating effect of mood gratitude was found in the whole sample, it was surprising that a buffering effect of mood gratitude emerged for the subgroup experiencing low depression. These findings cast a new perspective on the literature, suggesting that possessing state gratitude appears particularly beneficial for individuals with low depression and individuals with low mental well-being. Furthermore, the efficacy of mood gratitude seems specifically confined to individuals with low depression.

Moreover, the current study suggests that both state and mood gratitude did not buffer negative affect in individuals with high mental well-being, as well as those with high levels of depression. The finding that gratitude was beneficial for individuals with low depression, and not for individuals with high depression, is consistent with a preceding study that assessed the effect of a gratitude intervention (Chen & Ishak, 2022). The authors hypothesized that the persistence of moderate to severe depression may be influenced by specific genetic factors, making it less amenable to change. Furthermore, mild depression could be linked to non-genetic causes, and consequently, be alleviated through the cultivation of gratitude. Regarding the absence of a buffering effect of both state and mood gratitude on negative affect for individuals with high well-being, Bohlmeijer et al. (2021) suggested that the impact of gratitude interventions in healthy populations is limited, due to a ceiling effect. In conclusion, the distinction between subgroups underscores the characteristics-dependent nature of gratitude's influence.

Strengths and limitations

A particular strength of this study is that it is the first to use ESM data to differentiate between state, mood, and trait gratitude. This approach proves particularly advantageous as it enables the reliable capture of moment-to-moment fluctuations in daily life, mitigating retrospective bias and providing a highly nuanced understanding of gratitude's moderating effect. Furthermore, the study uniquely assesses how this moderating effect varies among individuals with different levels of mental well-being and depression. Enhancing our understanding of the effect of gratitude can potentially lead to clinical improvements, for instance, if interventions are tailored to the most appropriate groups.

However, several limitations necessitate consideration. Foremost among these is the potential compromise in reliability and validity resulting from measuring gratitude with a single item in the momentary questionnaires. The inherent complexity of gratitude, encompassing various subdimensions, cannot be adequately captured in a single question

(Allen et al., 2022). This is evident in the low correlation between trait gratitude, derived from the average gratitude score in the momentary questionnaires, and the average score on the GQ-6 administered at baseline. This indicates limited overlap. The use of a single-item measure precludes an assessment of reliability by hindering control over the consistency of the measure. Furthermore, it inadequately reflects the comprehensive construct of gratitude, impacting its validity. Additionally, the lack of an explicit explanation of gratitude to the participants may have led to a different understanding of the concept among participants, affecting the validity of the measurements. It is recommended to employ a multiple-item questionnaire that allows for a more robust assessment of psychometric quality, potentially providing more certainty in interpreting the results.

The second limitation pertains to the study's restricted generalizability due to the relatively homogeneous sample resulting from convenience sampling, predominantly reflecting German, highly educated, young adult women (Jager et al., 2017). Additionally, the sample size, especially in the subgroup analyses, poses a vulnerability to type II errors (Faber & Fonseca, 2014). In the subgroup analyses, the differentiation was based on median scores from baseline questionnaires, rather than established literature or diagnosis according to the Diagnostic Statistical Manual for Mental Disorders (DSM-5). For instance, a score of 10 on the PHQ-9 was deemed an appropriate cut-off for depression (Kroenke et al., 2001), although this study used a cut-off score of 7. This implies that the findings cannot be generalised to people with diagnosed depression. It should be further investigated to what extent the findings apply to people with diagnosed depression and people with verifiable limited mental health.

Implications

The findings of the current study imply the importance of enhancing the utilization of gratitude in specific moments. Therefore, focusing on improving state gratitude should be the central focus in gratitude interventions. For this purpose, ecological momentary interventions (EMIs) could be deployed, which are treatments that are provided to people during their everyday lives and in natural settings (Balaskas et al., 2021). For instance, a feasible approach would be to deliver gratitude exercises through personal mobile phones, allowing users to access them whenever necessary. Adding the possibilities of technology, sensors could be incorporated to detect elevated stress levels, aiming to deliver gratitude exercises during stressful moments. These interventions that provide tailored support at the exact time of need are Just-In-Time Adaptive Interventions (JITAI) (Wang & Miller, 2020). Implementing such

interventions ensures tailored assistance precisely when it is needed, enhancing the effectiveness of gratitude interventions.

It is reasonable to propose that individuals may face challenges in participating in interventions during periods of heightened stress. A comprehensive meta-analysis on the efficacy of Just-In-Time Adaptive Interventions (JITAI) demonstrates that delivering tailored feedback based on specific risky states significantly contributes to positive outcomes in JITAI (Wang & Miller, 2020). Elaborating on this, it seems that the use of passive detection of behaviours and the delivery of interventions only when needed reduces the burden on the user. This, in turn, increases the engagement of the user in the longer term, and therefore, increases the benefits from the intervention (Nahum-Shani et al., 2018). JITAI may hold particular promise for mental health interventions because challenges with fatigue and concentration are common symptoms across mood and anxiety disorders (Ben-Zeev et al., 2013). These symptoms make it particularly difficult to remain engaged in interventions. Therefore, this patient group may find JITAI more manageable in the long term. Moreover, exploratory research suggests that prompts requiring low-effort self-regulatory activities are generally more effective in increasing engagement compared to those requiring high-effort activities (Carpenter et al., 2020). To enhance engagement, it is recommended to utilize passive detection of behaviours, deliver interventions only when needed, and utilize prompts for low-effort self-regulatory strategies.

The discovery that the beneficial effect of state gratitude is particularly pronounced among individuals with low well-being and low depression suggests that gratitude interventions should specifically target these groups. More precisely, there potentially is considerable value in enhancing both state and mood gratitude in individuals with low depression and enhancing state gratitude particularly in those with low mental well-being. Conversely, trait gratitude did not show to effectively buffer against negative affect following stressful events. Consequently, directing interventions toward increasing trait gratitude may not buffer the negative impact of stressful life events on affect.

The study sample predominantly consisted of young adults and students. The notable increase in psychopathology due to stage-salient stressors among these groups underscores the significance of identifying methods to enhance their mental well-being. Focusing interventions on this group is especially valuable, given that individuals in this life stage are more open to change due to ongoing neurobiological development (Duprey et al., 2018). To

improve the future design of gratitude interventions, it is suggested to replicate similar ESM studies in larger and more diverse samples. Furthermore, it is recommended to use multiple items covering the three subdimensions of gratitude to ensure a robust conceptualization of gratitude.

Conclusions

This study highlights the significant role of state gratitude in buffering negative affect during stressful events. Furthermore, it suggests that trait gratitude potentially increases negative affect during stressful events. Differentiating high and low levels of mental well-being and depression showed that state gratitude effectively buffers negative affect in individuals with low well-being and individuals with low depression. Furthermore, mood gratitude specifically seems to buffer negative affect in the low depression group. This provides support for specifically delivering interventions improving state gratitude to individuals with low mental well-being and individuals with low depression. Moreover, this study implies potential value in delivering gratitude interventions focussed on improving mood gratitude to groups with low depression. Despite the valuable and novel insights of the current study, the limitations underscore the need for similar ESM studies with a comprehensive conceptualisation of gratitude with a more heterogeneous sample.

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The Moderating Effect of different levels of Gratitude on Stress and Negative Affect

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Appendix A

Informed Consent (English)

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
- SONA- ID

Mental Health Continuum Short Form:

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

GAD-7 for anxiety

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

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

The Moderating Effect of different levels of Gratitude on Stress and Negative Affect

- a. Not at all
- b. Several days
- c. More than half the days
- d. Nearly every day

Scoring Sum Scores PHQ-9

- 0-4 no depression
- 5-9 mild depression
- 10-14 moderate depression
- 15-19 moderately severe depression
- 20-27 severe depression

Psychological Well-being scale items from the positive relations with others subscale

Below are three statements that may apply to you to varying degrees. For each statement, please indicate how much it applies to you. Please answer openly and honestly.

1. "Maintaining close relationships has been difficult and frustrating for me."
 2. "People would describe me as a giving person, willing to share my time with others."
 3. "I have not experienced many warm and trusting relationships with others."
- Strongly disagree
 - Disagree
 - Somewhat disagree
 - neutral
 - Somewhat agree
 - Agree
 - Strongly agree

Trait gratitude GQ-6 (McCullough et al., 2002)

Below are six statements that may apply to you to varying degrees. For each statement, please indicate how much it applies to you. Please answer openly and honestly.

- 1. I have so much in life to be thankful for.
- 2. If I had to list everything that I felt grateful for, it would be a very long list.
- 3. When I look at the world, I don't see much to be grateful for.*
- 4. I am grateful to a wide variety of people.
- 5. As I get older I find myself more able to appreciate the people, events, and situations that have been part of my life history.
- 6. Long amounts of time can go by before I feel grateful to something or someone.*
 - 1 = strongly disagree 2 = Disagree 3 = Somewhat disagree 4 = neutral 5 = Somewhat agree 6 = Agree 7 = Strongly agree
- *Item 3 and 6 are reversed

Self-compassion

Please read each statement carefully before answering. Indicate how often you behave in the stated manner.

1. When I fail at something important to me I become consumed by feelings of inadequacy.
2. I try to be understanding and patient towards those aspects of my personality I don't like.
3. When something painful happens I try to take a balanced view of the situation.
4. When I'm feeling down, I tend to feel like most other people are probably happier than I am.
5. I try to see my failings as part of the human condition.
6. When I'm going through a very hard time, I give myself the caring and tenderness I need.
7. When something upsets me I try to keep my emotions in balance.
8. When I fail at something that's important to me, I tend to feel alone in my failure
9. When I'm feeling down I tend to obsess and fixate on everything that's wrong
10. When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people.
11. I'm disapproving and judgmental about my own flaws and inadequacies
12. I'm intolerant and impatient towards those aspects of my personality I don't like.
 - a. Almost never
 - b. Rarely
 - c. Sometimes
 - d. Often
 - e. Almost always

Appendix C

Daily Questionnaires

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!

Positive and negative affect

- How *cheerful* do you feel right now?
- How *enthusiastic* do you feel right now?
- How *satisfied* do you feel right now?
- How *relaxed* do you feel right now?
- How *anxious* do you feel right now?
- How *insecure* do you feel right now?
- How *down* do you feel right now?
- How *guilty* do you feel right now?
 - 1 (not at all) to 7 (very much)

Gratitude

- How *grateful* do you feel right now?
 - 1 (not at all) to 7 (very much)

Positive relations

- Who did you spend time with since the last time you answered a questionnaire for this study? (online or offline) If more answers apply, only choose the longest contact.
 - Family Member
 - Friend
 - Romantic Partner
 - Co-Worker/Fellow Student
 - Other
 - I did not spend time with anyone

Unless the last answer was given:

- How pleasant did you experience the contact you had?

The Moderating Effect of different levels of Gratitude on Stress and Negative Affect

- 1 (not at all) to 7 (very much)
- How positive did you experience the contact you had?
 - 1 (not at all) to 7 (very much)

Stressful event

Think of the most striking event or activity since the last questionnaire. How (un)pleasant was this event or activity?

- -3 (very unpleasant) to +3 (very pleasant)

Self-compassion

1. I currently feel self-critical
2. I feel kind towards myself

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