Exploring the Associations between Gratitude, Stressful Events, and Emotional Well-Being and Distinguishing Between- and Within-Person Associations of Gratitude and Emotional Well-Being: an Experience Sampling Study

Amelie Schleich

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Psychology Master of Science

Faculty of Behavioural, Management, and Social Sciences (BMS)

Department of Psychology, Health, and Technology (PGT)

University of Twente

1st supervisor: Dr. J. T. Kraiss

2nd supervisor: Dr. P.M. ten Klooster

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Abstract

Aim: In previous research, the importance of gratitude for mental health was consistently shown. In addition, several findings indicate that gratitude might be a protective factor while experiencing a stressful event in the way that it buffers the negative impact of stress on well-being. Although there is a consensus about the importance of distinguishing between-and within-person associations, until now no study clearly examined the association between gratitude and well-being by making this distinction. Therefore, the current study aimed to examine this relationship by clearly distinguishing between-and within-person associations between gratitude and emotional well-being. Additionally, the association between stressful events and well-being as well as the moderating effect of gratitude on this relationship are examined.

Method: Data for this study were collected using the Experience Sampling Method. Participants (N=69) were asked to fill out a baseline questionnaire as well as momentary questionnaires three times a day over two weeks. State gratitude, positive and negative affect, as well as the experience of a stressful event were measured. Linear mixed models and person-mean centering were used to clearly disaggregate between-and within-person associations.

Results: The overall association of state gratitude and emotional well-being was present for positive and negative affect. When distinguishing between-and within-person associations, the association remained significant moderate positive for positive affect between people (β =.33, p<.001) as well as significant strong positive within people (β =.44, p<.001). For negative affect, only a significant within-person association (β =-.27, p<.001) was confirmed. Further, the association between the experience of a stressful event and well-being was significant strong positive for positive affect and significant strong negative for negative affect. The assumed interaction effect of gratitude and stressful events was borderline significant (p=.068) for positive affect but was not confirmed for negative affect.

Conclusion: The study is the first one known showing that the association of gratitude and well-being does not only hold between people but also within people. The within-person association was also shown to be stronger. Furthermore, as the associations were weaker for negative affect this suggests gratitude to be stronger related to promoting positive affect compared to combating negative affect. Moreover, a moderating effect of gratitude on the relation between stressful events and well-being was revealed to be significant for positive affect but not for negative affect suggesting gratitude to buffer the negative impact of stressful events on positive affect without preventing an increase of negative affect. For future studies, a closer look into the way how the association between gratitude and emotional well-being unfolds within individuals should be taken.

Introduction

Just as physical health, mental health has its ups and down throughout one's life, a week, or even throughout a single day. Until a few years ago, the mere absence of psychological complaints led to the conception of a mentally healthy person. However, there is growing evidence for the two-continua model of mental health (Keyes, 2002). This model describes mental well-being and mental illness as related concepts, yet discernible factors on two continua (Bohlmeijer & Westerhof, 2021b). Hence, there is a need to examine not only the absence of psychopathology but also the presence of mental well-being.

The conceptualization of well-being is a complex issue (Ryan & Deci, 2001). Generally, the most prominent conception is that well-being can be distinguished into either eudaimonic or hedonic well-being (Keyes et al., 2002; Ryan & Deci, 2001). The first view of eudaimonic well-being focuses on striving and optimal full functioning of a person (Ryan & Deci, 2001; Ryff, 1989). In later work, this concept was further shaped as being composed of psychological well-being (see Ryff, 1989) and social well-being (see Keyes, 1998). The latter perspective of hedonic well-being refers to well-being as satisfaction with life and the presence of positive emotions (Diener, 1984; Diener et al., 1999). In line with the later work of Keyes (2007), this conception will further be referred to as emotional well-being.

Emotional well-being is the focal point of much research. It has not only been determined as a general key component of quality of life (Diener & Ryan, 2009) but also multiple benefits on an individual level have been identified. Specifically, the experience of emotional well-being has been linked with benefits in health and longevity, work and income, academic performance, and social relations (Diener & Ryan, 2009; Kansky & Diener, 2017). Moreover, several studies showed that a positive ratio, so the experience of more positive than negative affect, is associated with superior mental health (see e.g. Diehl et al., 2011; Fredrickson, 2013b; Sirgy, 2019). Thus, it is important to understand how emotional well-

being can be fostered and protected.

In line with the focus on emotional well-being, there is a consensus in positive psychology about the importance of positive emotions. According to the broaden-and-build theory by Fredrickson (2001), positive emotions have on the one hand the role to broaden one's awareness and to encourage novel thoughts and actions. On the other hand, over time the broadening role supports the building role which entails building useful skills and psychological resources. This shows the importance of experiencing positive emotions throughout the day. It does not only benefit people in the moment, but also long-term benefits for one's own mental health can be achieved, suggesting positive emotion to possibly play a role in protecting one's well-being.

Gratitude

One of the ten key positive emotions identified by Fredrickson (2013a) is gratitude. Like other emotions, gratitude can be conceptualized on a state or trait level. First, trait gratitude is the general tendency of a person to feel grateful throughout the day (McCullough et al., 2002; Wood et al., 2010). Second, some researchers have defined state gratitude as an emotion or affect experienced after receiving help from someone else (McCullough et al., 2002; Wood et al., 2008). However, other conceptualizations of state gratitude are not restricted to receiving help from another person and have defined state gratitude as "the momentary appreciation of what is valuable or meaningful to oneself" (Sansone & Sansone, 2010, p.19). Concerning the relationship between trait and state gratitude, it could be shown that people scoring higher on trait gratitude tend to evaluate daily experiences in more grateful terms as well, so tend to experience more state gratitude throughout the day (McCullough et al., 2002; Wood et al., 2008).

In the last decades, the concept of gratitude has played a vital role in many well-being studies. Specifically, cross-sectional studies showed a positive relation between gratitude and

well-being (Emmons & McCullough, 2003; McCullough et al., 2002; Wood et al., 2010; Wood et al., 2008). A recent review by Portocarrero et al. (2020) demonstrated gratitude to be moderately related to well-being in a way that experiencing gratitude contributes to experiencing positive and negative affect. This relation between gratitude and well-being could be confirmed independently of people's personality as measured by the Big Five (McCullough et al., 2002).

Gratitude, Well-Being, and Stressful Events

Besides establishing a direct association between gratitude and well-being several studies have focused on identifying possible underlying mechanisms explaining this relationship. One variable discussed in this context is stress which is relevant as there is broad consensus about the negative impact of stress on positive affect. For negative affect, the findings are more inconclusive with some studies confirming an association (Civitci, 2015; Kent et al., 2021) and others implying that there is no relationship with stress (Hamama et al., 2013; Watson & Clark, 1994).

Gratitude seems to matter for this association as it was demonstrated that gratitude promotes adaptive coping and personal growth in acute and chronic stressful events (Emmons & Mishra, 2011). To illustrate this further, Wood et al. (2007) confirmed that gratitude correlated positively with productive coping styles, such as social support, and negatively with negative coping styles such as denial. Also, on a biological level particularly state gratitude was found to be a mechanism that protected from cardiovascular reactivity due to stress (Gallagher et al., 2020). In line with this finding, gratitude can lead to reduced stress levels, a new stress appraisal, and support an individual's resistance to mental disorders and stressors in life (Fredrickson, 2004; Fredrickson, 2013a). For instance, in the context of traumatic life events and/or PTSD, it could be shown that gratitude acted as a buffer towards developing PTSD symptoms and supported post-crisis coping (Fredrickson et al., 2003;

Kashdan et al., 2006; Vernon et al., 2009). This suggests that the association between gratitude and well-being is closely related to people's responses to stress in a way that being grateful helps to cope with stressful situations.

The way how gratitude might work as a coping mechanism may be explained by the previously mentioned broaden-and-build theory suggesting that gratitude might serve as a protector when facing stressful situations. According to Fredrickson (2004), the broadening aspect of gratitude appears to become visible in "creatively consider[ing] a wide range of prosocial actions as reflections of their gratitude" (Fredrickson, 2004, p.150). This in turn leads to building resources to show care and loyalty towards others as well as building social bonds (Fredrickson, 2004; Fredrickson, 2013a). This is in line with Emmons and Mishra (2011) who explored possible mechanisms of how gratitude and well-being are related and concluded that one possible mechanism is that gratitude builds social resources not only by strengthening relationships but also by promoting prosocial actions. Furthermore, Wood et al. (2010) describe that gratitude as an affective state might decrease distress by building mental flexibility. In a study with undergraduate students, Gupta and Kumar (2015) revealed gratitude to illustrate the highest predictive value for resilience next to forgiveness and acceptance. Taken together, this implies that gratitude leads to more resilience in life not only by decreasing stress but also by being a protective factor enhancing people's capability to thrive under adverse life experiences.

The way gratitude, well-being, and stress are connected can be summarized using the model of sustainable mental health (see Figure 1) by Bohlmeijer and Westerhof (2021b). The model assumes psychopathology and well-being to be dynamic constructs varying across time and centralizes the ability to adapt as a mechanism to regulate mental health. Further, they include barriers and sources for the adaptation. In an example with gratitude interventions as a possible treatment, they consider gratitude interventions to be one

possibility to build resources that promote adaption through the broadening effect of positive emotions, the positive spiral, positive reframing as well as positive relations. Next to building resources, gratitude may also impact the barriers for adaptation by challenging the negative repetitive thinking of a person and shifting attention towards more positive experiences (Bohlmeijer & Westerhof, 2021a). Gratitude might therefore be relevant from the broaden and build perspective and could serve as a source for adaptation. Hence, it can be assumed that gratitude can enhance the ability to cope with stressful events and thus might represent an important resource for sustainable mental health.

Figure 1

Model of sustainable mental health
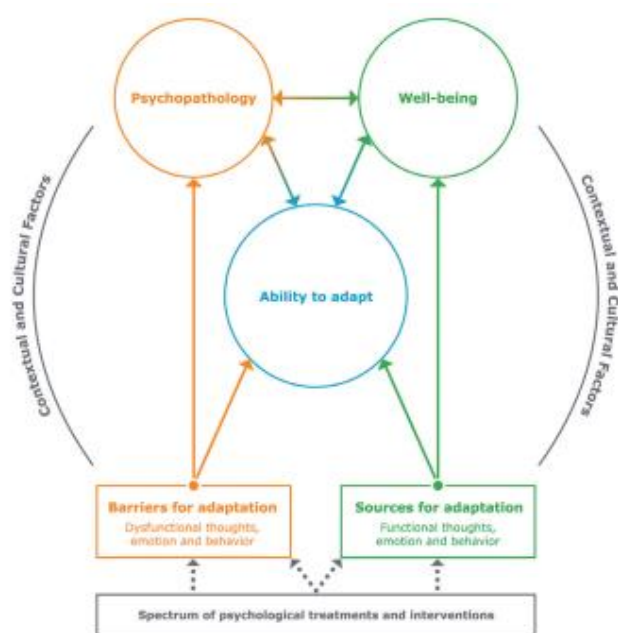
Within and Between Person Associations

The body of literature examining the link between gratitude, well-being, and stress has predominantly been using cross-sectional designs. These studies can only establish so-called between-person associations which, for instance, enable to compare whether people with higher levels of gratitude than others also show higher levels of positive affect. However,

cross-sectional designs can per definition not capture within-person associations. Within-person associations are based on the variability and changes of a state around an individual's mean and help to gain insight into the processes taking place within an individual over time (Hamaker, 2012; Hoffman, 2015; Hoffman & Stawski, 2009). Especially in the field of psychology, theories and models about the association between constructs or the effectiveness of interventions are aimed at gaining insight into processes that happen within and not between individuals (Curran & Bauer, 2011; Hamaker, 2012; Hoffart, 2014).

Many studies thus draw conclusions for within processes based on between-person level analyses even though this generalisation can hardly ever be reached and therefore can be a detrimental error of inference (Curran & Bauer, 2011; Hoffart, 2014). The statistical assumption of *ergodicity* implies that all relevant statistics for a population are identical to corresponding within-person moments (Hamaker, 2012; Molenaar & Campbell, 2009). However, this assumption is rarely met and between- and within-person associations frequently differ not only in magnitude but also in direction (Hoffart, 2014). In line with this, Fisher et al. (2018) argued that the consequences of between-person to within-person generalizations in the psychological field range from biased test and invalid classification systems in clinical research to misleading impressions of variable interactions on a theoretical level. Therefore, there is a necessity to distinguish between these two levels of analyses, using multilevel modelling (Curran & Bauer, 2011) to get a full and more accurate understanding of the relationship between gratitude and well-being.

Experience Sampling Method

Longitudinal studies with repeated measures within one sample, ideally intensive designs with a high number of measurements per participant, can provide suitable data for both levels of association (Curran & Bauer, 2011). One suitable data collection method to fulfil this goal is experience sampling (ESM), also called ecological momentary assessment

(EMA). ESM enables the researcher to give a more detailed analysis of micro-level processes of an experience (Conner & Lehman, 2012) and provides insights into individual characteristics and variations in experience (Csikszentmihalyi & Larson, 2014). The method can not only capture variability, but also improve the understanding of how variables unfold in real-life, and which influence contextual factors in the environment might have (Myin-Germeys et al., 2018). Another advantage is the reduction of retrospective recall bias as the focus lies on recording psychological states at one specific moment (Beal & Weiss, 2003). Compared to other intensive longitudinal designs, ESM studies can be conducted in a rather short period of time by asking participants to complete questionnaires several times a day over a multi-day period resulting in many data points per participant (Kansky & Diener, 2017).

Regarding the association between the variables gratitude, stress, and well-being, several ESM studies have been published. First, a study by Jans-Beken et al. (2019) identified momentary gratitude as a significant predictor of positive affect in daily life independent of the presence of negative affect. However, the authors used time-lagged regression analyses, but did not clearly distinguish between- and within-person associations. Also, this study did not examine the impact of stressful events and the role gratitude plays as a potential adaptive strategy in these situations. A similar study by Simons et al. (2020) has shown that only one aspect of gratitude, namely sense of abundance, was positively associated with positive affect, and negatively associated with negative affect. However, only the affective states were measured on a daily level and trait gratitude was used to predict the changes in affect. This design fails to take individual state experiences of gratitude into account. Finally and most similar to the current study, a diary study by Nezlek et al. (2019) investigated the associations of gratitude, stressful events, and well-being. Their results suggest gratitude and affective states to be related, but they do not suggest a moderating effect of gratitude on the

relationship between stressful events and affective states. However, for other measures of well-being a significant interaction effect of gratitude and stressful events was confirmed which led the authors to conclude that gratitude has a moderating effect on the relationship between daily negative events and well-being. Nonetheless, these studies suggest that gratitude, stress, and well-being might be associated with each other on a daily level, but the kind of analyses used evoke the need to further examine these relations by a clear disaggregation of between-and within-person associations.

Current Study

Until now, most studies that focused on establishing a link between gratitude, well-being, and stressful events employed between-person designs (e.g., Emmons & McCullough, 2003; McCullough et al., 2002; Wood et al., 2010). In doing so, previous studies did suggest that gratitude is linked to well-being and that it might serve as a buffer for the impact of stressful events on well-being (e.g., Bohlmeijer & Westerhof, 2021a; Emmons & Mishra, 2011; Fredrickson, 2004; Wood et al., 2010). Despite the relevance of distinguishing between-and within-person associations, no previous study made this distinction for the association between gratitude and well-being. It cannot be assumed that associations found between people are the same within people (Curran & Bauer, 2011; Hamaker, 2012). For instance, although gratitude might be negatively related to negative affect between persons, this relationship could be the other way around or at least different in magnitude on a within-person level. It could be that people feel more grateful in moments when they feel bad, using gratitude as a coping mechanism. Therefore, this study will focus on further exploring the relationship between gratitude and emotional well-being within individuals using ESM and appropriate statistical analyses that can distinguish between- and within-person associations.

Moreover, as Jans-Beken et al. (2019) suggested in their ESM study that future studies should monitor the occurrence of impactful events, positively and negatively, another

focus lies on how stressful events impact well-being as well as how the relationship between stressful events and well-being might be influenced by the momentary experience of gratitude. Taking everything together, this results in the following research questions.

RQ1: How are gratitude and emotional well-being associated between and within individuals?

RQ2: What is the association between stressful events and emotional well-being?

RQ3: Does state gratitude buffer the impact of stressful events on emotional well-being?

Method

Participants

For this study, a convenience sample of 69 participants was recruited. This seems sufficient considering that the average number of participants for ESM studies lies around 53 (Van Berkel et al., 2017). Convenience sampling, a type of non-probability sampling, seemed fitting due to the rather high burden for participating in ESM studies (Conner & Lehman, 2012; Eisele et al., 2020). Also, with convenience sampling, it was possible to privately contact the participants and therefore increase the likelihood of availability and motivation. The first requirement for participation was to own a smartphone as well as an email address to get contacted about study details. Next, being fluent in German or English was a requirement as the questionnaires were administered in one of these languages. Finally, a requirement to be included in the data analysis was a response rate of at least fifty percent which seems to be common practice for ESM studies (Conner & Lehman, 2012). This means that participants completing less than 50% of the daily questionnaires were not included in the analysis.

Design and procedure

After the approval by the Ethics Committee of Behavioural, Management and Social Sciences of the University of Twente (#211225), the study was set up in the online platform Ethica Data (https://ethicadata.com/). Following a preliminary set-up of the study, a pilot study was conducted to test the study design using the actual Ethica Data smartphone app. The pilot study lasted three days and aimed to test whether the questionnaires were administered and functioned as intended.

For the actual data collection, each potential participant received a study invitation via email and was asked to register in the Ethica application as soon as possible. During the registration process, participants had to actively approve the informed consent (Appendix A) in order to proceed. The study started for all participants on the same date to ease analysis. The time frame for the actual data collection was from the 22nd of November 2021 until the 5th of December 2021. This choice of two weeks of data collection is in line with the suggestion of Conner and Lehman (2012) that studies with several measurements per day should last between three days and three weeks. Furthermore, Van Berkel et al. (2017) concluded that the common practice of studies lasting two weeks with several short measurements per day results in a good response rate.

Within the study, two types of questionnaires were used as typical for ESM studies (Myin-Germeys & Kuppens, 2021). As both types of questionnaires were administered in English and German, participants could choose between the two languages. First, an extensive baseline questionnaire (Appendix B) was completed to assess demographic characteristics and trait-like measures. The baseline questionnaire was triggered one day after registering for the study and had to be filled out once. The day after the sign-up was chosen to avoid any inferences between the timepoint of registration and the trigger time of the questionnaire. Second, daily questionnaires (Appendix C) were used for momentary state

assessments. From the first day of the study, participants were asked to complete three daily questionnaires per day. For the daily questionnaires, a semi-random sampling scheme was used (Myin-Germeys & Kuppens, 2021). This means that the daily questionnaires were triggered at a random time point within multiple pre-defined time intervals. The first questionnaire was triggered at a random point between 10 a.m. and 12 p.m. For the second questionnaire, the trigger point was set between 3 p.m. and 5 p.m. For the last one, the triggering point was set for a random point between 8 p.m. and 10 p.m. The usage of a semi-random sampling scheme has a relatively high ecological validity due to some degree of unpredictability but relatively small consequences for compliance as there is also some degree of predictability (Myin-Germeys & Kuppens, 2021).The complete measurement design is visualized in Figure 2.

Figure 2

Measurement design of the questionnaires including questionnaire type, triggering point, and notification schedule
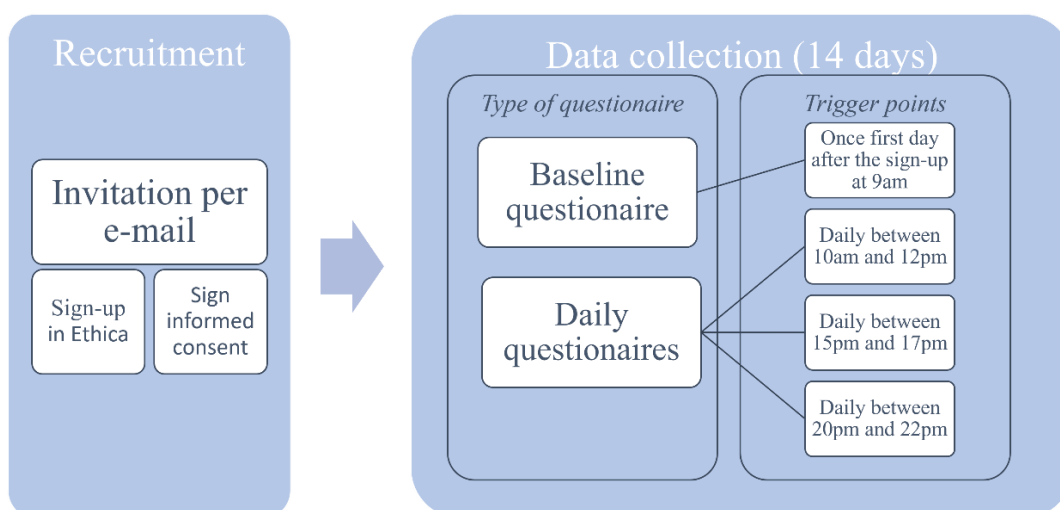
To increase compliance, push notifications were used to remind participants. It was decided to let the daily questionnaires expire two hours after they were triggered, with a reminder appearing after an hour. For the baseline questionnaire, no expiration time was set.

Here, participants received one notification immediately after it was triggered and three reminders, the first after seven hours, the second after six days, and the third after eleven days stating it would be the last chance to fill it out.

Materials

For experience sampling studies, personal mobile phones are considered the best available application tool (Conner & Lehman, 2012). The Ethica Data application was used which is a tool supporting human-subject research with high privacy standards and an easily understandable interface (Ethica, 2021). They support Android and iOS, and offline usage was possible. First, the baseline questionnaire consisted of 43 items with questions about demographics and several validated questionnaires measuring mental health, psychopathology, and trait gratitude. Second, the daily questionnaires used consisted of 16 items to measure momentary positive and negative affect, state gratitude, and stressful events. At the beginning of every daily questionnaire, a piece of short information was added stating "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". This statement aimed to reduce the possible reactivity of some statements so that current feelings are not too much influenced by reading the questions. Another aim was to keep especially the daily questionnaires as short as possible as compliance rates were shown to decline with longer questionnaires (Eisele et al., 2020). In addition, both the baseline and the daily questionnaires also assessed the constructs of self-compassion and positive relations which will not be used in the present study and therefore not described further.

Baseline questionnaire

To measure the overall mental well-being of the participants the short form of the Mental Health Continuum (MHC-SF) was used. The MHC measures emotional, social, and

psychological well-being (Robitschek & Keyes, 2009). The scale consists of 14 items with each item being rated on a scale from 0 (*never*) to 5 (*every day*). Specifically, participants were asked how often during the past month they felt, for instance, 'happy' or 'confident to think or express your own ideas and opinions'. A 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 (α=.89; Lamers et al., 2011). For the present study, Cronbach's alpha was also high with .81.

The General Anxiety Disorder Assessment (GAD-7) was used to measure levels of trait anxiety (Spitzer et al., 2006). Similarly, the Patient Health Questionnaire (PHQ-9) was used to measure levels of trait depression (Kroenke et al., 2001; Spitzer et al., 1999). In both questionnaires, participants needed to indicate how often they have been bothered by several symptoms in the past two weeks. It was possible to rate the frequency on a scale from 0 (*not at all*) to 3 (*nearly every day*). For example, in the GAD-7 the items included symptoms like 'feeling nervous, anxious, or on edge' or for 'trouble relaxing'. In the PHQ-9, symptoms like 'poor appetite or overeating' or 'feeling down, depressed, or hopeless' has been asked for. For both scales, one sum score for the respective instrument was created. The higher the score, the higher a person's trait anxiety or depression.

For the general population, both scales were shown to be valid self-report measures with almost excellent internal consistency for GAD-7 in German (α=.89; Löwe et al., 2008) as well as an excellent one in English (α=.91; Mills et al., 2014). Similar high internal consistency was confirmed for the English version (α=.87; Kocalevent et al., 2013) and the German version (α=.90; Reich et al., 2018) of the PHQ-9. For the present study, the internal consistency was acceptable for both with a Cronbach's alpha of .76 for the GAD-7 and .76 for the PHQ-9.

To measure trait gratitude the Gratitude Questionnaire-Six Item Form (GQ-6) was

used (McCullough et al., 2002). It is a six-item questionnaire with a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Participants were asked to indicate how much they agree with each of the six statements, for instance, 'I have so much in life to be thankful for' or 'I am grateful to a wide variety of people'. For the analysis, the first step was to recode items three and six as these were reversed items. Then, a mean score has been created by averaging the six items. Higher scores on this scale can be interpreted as a higher level of trait gratitude. The GQ-6 is a validated measure in several populations for which a one factor structure could be confirmed, and alpha reliabilities have ranged from .67 to .94 (Emmons et al., 2003; McCullough et al., 2002). For the German version, several studies worked with a five-item version with high reliability (α=.82; Hudecek et al., 2020) For this study, a Cronbach's alpha of .79 was shown which can be interpreted as adequate.

Daily questionnaires

For the daily questionnaires, first, state affect was measured with eight items. To assess positive affect, participants were asked "How 'cheerful', 'enthusiastic', 'satisfied', 'relaxed' do you feel right now?". For negative affect, the same question with the adjectives anxious, insecure, down, and guilty were asked. The emotions or mood states chosen are in line with previous ESM studies (Geschwind et al., 2011; Jans-Beken et al., 2019). A seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*) was used. Two separate mean scores of positive affect and negative affect were calculated by averaging the four corresponding items. A high score for positive affect meant that a person experienced more positive emotions, while a high score for negative affect meant that someone experienced more negative emotions. For the split-half reliability testing, the mean score per person of week one was correlated with the mean score per person of week two (Hektner et al., 2007). The correlations were r=.73, p<.001 for the positive affect scale and r=.83, p<.001 for the negative affect scale suggesting adequate reliability of both measurements over time.

Second, to assess state gratitude the item 'How *grateful* do you feel right now?' was used. On a seven-point Likert scale ranging from 1 (*not at all*) to 7 (*very much*) the momentary state of feeling grateful could be rated so that a higher score indicated higher feelings of state gratitude. In several ESM studies the statement form of "I feel grateful" has been used (e.g., Jans-Beken et al., 2019; Visserman et al., 2018). However, the question form is more typical for ESM studies and can assess dynamic and momentary states better (Myin-Germeys & Kuppens, 2021).

Third, stressful events were measured with one item stating "Think of the most striking event or activity since the last questionnaire. How (un)pleasant was this event or activity?". Participants could rate it between -3 (*very unpleasant*) and +3 (*very pleasant*) with 0 marked as neutral. The item was found in a database of an open science initiative called the ESM item repository and is based on a study protocol developed by Helmich et al. (2020). Some ESM studies asked for rating the most important event (Geschwind et al., 2010; Habets et al., 2022). However, it could be difficult to determine what the important event is and it could be that there was simply no event. Therefore, the item asking about "striking" and in addition about "activities" seemed more suitable.

Data Analysis

All analyses were conducted with IBM SPSS Statistics 27 while Excel for Microsoft 365 was used to create graphs. First, descriptive statistics were calculated to summarize demographic information about the sample as well as the scores for trait gratitude, mental health, depression, and anxiety. In addition, for state gratitude measurements person-mean-centred scores (PMC) were calculated which reflect the variability of each person around their own mean (Curran & Bauer, 2011). For this, first, all daily scores were aggregated per person to get each person's mean (PM). Then, the person-mean was subtracted from participants' daily scores to obtain PMC scores for each time point. This is important to be

able to disaggregate between- and within-person associations (Curran & Bauer, 2011; Hamaker, 2012). Moreover, for stressful events, a dummy variable was created by recoding -3 to -1 to a '1' representing a stressful event happened and 0 to +3 to a '0' meaning that no stressful event has been experienced. Finally, z-scores were created for the variables state gratitude, positive affect, and negative affect which aimed to standardize the variables and obtain standardized regression estimates. For the interpretation of the standardized regression coefficients and the correlation coefficients, the rule by Cohen (1988) was applied. Accordingly, the coefficients were considered weak (<0.3), moderate (0.3-0.5), or strong (>0.50).

Several analyses were carried out to answer the respective research questions. As the data was collected using experience sampling, linear mixed modelling (LMM) was chosen as the main type of analysis (Myin-Germeys & Kuppens, 2021), using the MIXED command in SPSS. This model is useful for repeated measurements where observations are nested within individuals. Moreover, another advantage is that LMM adequately deals with missing data at random (Jahng et al., 2008; Krueger & Tian, 2004). The autoregressive covariance structure (AR1) was chosen which assumes that correlations between measurements exponentially decline over time (Barnett et al., 2010).

For the first research question aiming to examine the association between gratitude and emotional well-being, an LMM was run with positive affect as the dependent variable and state gratitude as an independent variable. In a follow-up model, the PM of state gratitude as well as the PMC of state gratitude were used as fixed covariates and positive affect was used as dependent variable. With this model, it was possible to clearly distinguish between- and within-person associations. Further, two similar models were run with negative affect as dependent variable. Again, first state gratitude was used as predictor and second in another model the PM and PMC of state gratitude were used as fixed covariates. To visualize the

results of the first research question, line plots were created using the Estimated-Marginal (EM)- means to show how state gratitude and positive or negative affect are associated with each other over the course of two weeks as well as per individual. Moreover, observed scores were used to visualize the associations of the three variables for individual cases. For this, participants with a response rate of over 30 measurement points or higher were selected to create clearly readable plots. Furthermore, the three participants selected showed a high person mean (participant 18) and a low person mean (participant 10) for state gratitude, and a low person mean for positive affect (Participant 27) to demonstrate exemplary individual differences.

Second, to test the association between emotional well-being and stressful events, an LMM was used with the dummy of stressful event as a fixed factor and positive affect as dependent variable. The same model was also run with negative affect as dependent variable. Third, to examine how gratitude might influence the relationship between stressful events and emotional well-being, another LMM has been used. For the model, positive affect was used as dependent variable, the dummy of stressful events and state gratitude were used as predictors, and the interaction term between these two predictors was included. The interaction term shows if the relationship between stressful events and affective states is moderated by gratitude. Again, the same model was run with negative affect as dependent variable.

Results

In total, 69 people signed up for the study in Ethica. Respondents that did not reach the requirement of a 50% response rate (*n*=19), as well as one person (*n*=1) with a missing baseline questionnaire, were excluded. For the final sample (*N*=49), the average momentary response rate was 81.25% which is a good response rate compared to the average response rate reported by Van Berkel et al. (2017) of 69.9%. The age span was between 14 and 58

years with a mean age of 25.53 (*SD*=10.84). Also, it was noticeable that most participants

were students and females. Further characteristics of the sample regarding gender,

nationality, employment status, and highest education can be seen in Table 1.

Table 1

Sample characteristics (N= 49)

		N	%
Gender	Female	35	71.4
	Male	14	28.6
Nationality	Dutch	17	34.7
	German	27	55.1
	Other	5	10.2
Employment	Student	22	44.9
Status	Student and working	14	28.6
	Working	9	18.4
	Self-employed	3	6.1
	Other	1	2.0
Highest level	High school	25	51
education	Bachelor	14	28.6
	Master	8	16.3
	Other	2	4.1

The means, standard deviations, and correlations of trait and state measures can be

found in Table 2. The average for the MHC-SF of this sample was relatively low (*M*=3.01,

SD=0.65), compared to a study by Lamers et al. (2011) where a mean of 3.98 (*SD*=0.85) has

been reported for the Dutch general population. For the GAD-7 and PHQ-9, this sample

seemed to score relatively high with sum scores of 7.69 (*SD*=3.6) for GAD-7 and 7.08

(*SD*=4.26) for PHQ-9. Previous studies showed means of 2.95 (*SD*=3.41) for GAD-7 (Löwe

et al., 2008) and 3.3 (*SD*=3.65) for PHQ-9 (Hinz et al., 2016) in the general population. This

suggests that this sample had lower mental health and scored higher on trait anxiety and depression compared to averages reported in previous studies. The mean of the GQ-6 in this study (*M*=5.56, *SD*=0.82) was comparable with a mean reported in a previous study by McCullough et al. (2002) where a mean of 5.92 (*SD*=0.88) was reported for the general population.

Next to means and standard deviations, correlations between the person mean scores per state measure and the mean scores of the trait measures were further inspected (see Table 2). All correlations were significant and in the expected directions. The correlation between trait gratitude measure GQ-6 and the state gratitude measure was significant, positive and moderate in magnitude indicating convergent validity of the state measure (*r* = .30, *p* <.01).

Table 2

Mean, standard deviations, and inter-correlations among trait and state measures

	Mean	SD	1	2	3	4	5	6	7
1 GQ-6	5.56	0.82	-						
2 GAD-7[a]	7.69	3.60	-.35	-					
3 PHQ-9[a]	7.08	4.26	-.37	.62	-				
4 MHC-SF	3.01	0.65	.52	-.24	-.23	-			
5 Positive affect	4.32	0.79	.17	-.47	-.26	.37	-	-	
6 Negative affect	2.29	0.86	-.34	.38	.44	-.35	-.50		
7 State gratitude	4.26	1.23	.30	-.12	-.05	.23	.55	-.14	-

[a] Sum scores have been used

Association state gratitude and emotional well-being

In Figure 3 the EM means for the z-scores of positive and negative affect as well as gratitude are plotted for the 42 measurement points. The graph aims to show fluctuations of the variables over time. It is visible that the variables state gratitude and positive affect appear to clearly covary over time, and that negative affect behaves in the opposite direction. In

Figure 4 the EM-means of positive affect, negative affect, and state gratitude were plotted per participant. It appears that for most participants state gratitude and positive affect were on a similar average level and that negative affect scores were for most participants at a lower average level.

Figure 3

Line plot for estimated marginal means of the z-scores of state gratitude, positive affect, and negative affect per measurement point
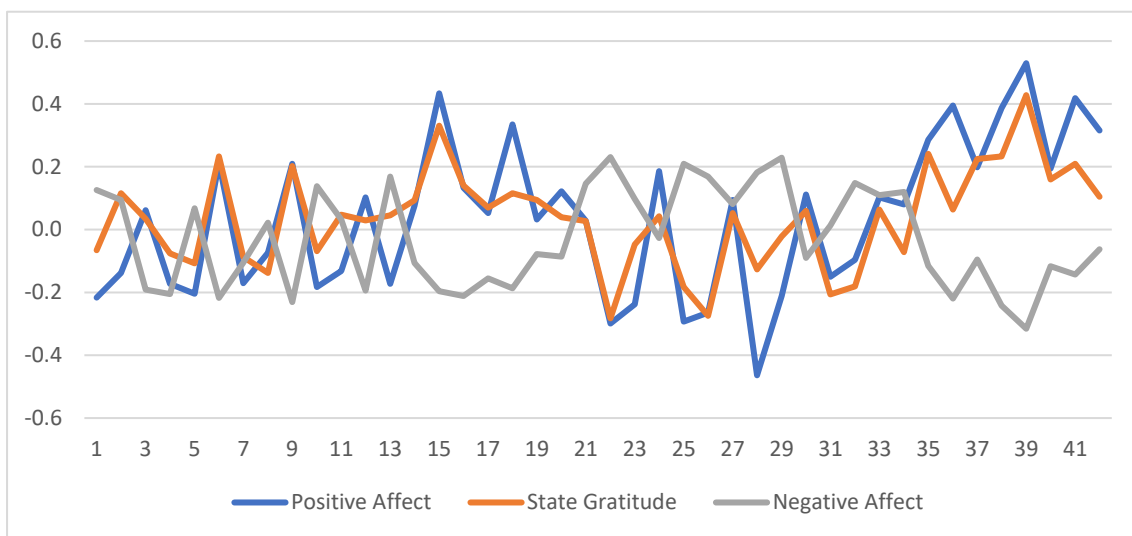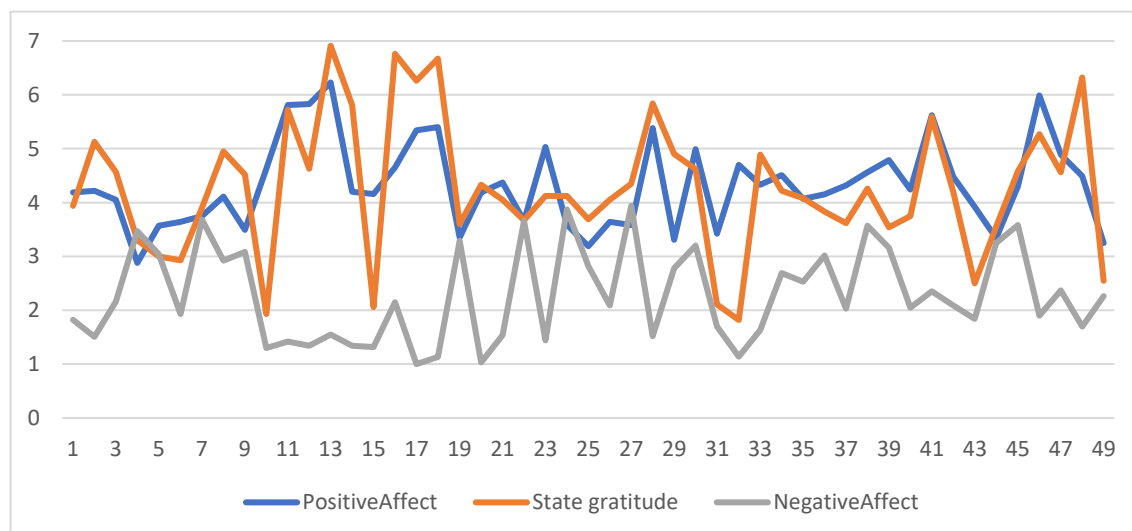

Figure 4

Line plot for estimated marginal means of the observed scores of state gratitude, positive affect, and negative affect per participant

Both figures suggest that gratitude and positive affect covary and therefore are positively related to each other. Also, negative affect and positive affect appear to be negatively related to each other. The relation between negative affect and state gratitude seems also negative, but rather imperfect, especially when looking at Figure 4.

For the blended model that does not distinguish between- and within-person associations, state gratitude was shown to be significantly and strongly related to positive affect (β=.63, p<.001). In the second model distinguishing between-and within-person associations, the person-mean and person mean-centred scores of gratitude also revealed significant associations for both levels of association. For the between-persons association of state gratitude (PM) and positive affect the association was moderate and significant (β =.33, p<.001). The within-persons association of state gratitude (PMC) and positive affect was also significant and stronger (β=.44, p<.001). This can also be seen in the confidence interval as the unstandardized PM estimate (B=0.33) does clearly fall outside the 95% CI of the PMC association (95% CI [0.47,0.54]).

For negative affect, in the blended model state gratitude was shown to be significantly and moderately negatively related (β=-.38, p<.001). Further, in another model for negative affect with person-mean and person-mean-centered scores of state gratitude the between-person association of state gratitude (PM) and negative affect was shown to be weak and not significant (β=-.10, p=.176). The within-person association was shown to be somewhat stronger and significant but still comparatively weak (β =-.27, p<.001). The confidence interval of the within-person association (95% CI [-0.32, -0.25]) again clearly does not contain the unstandardized estimate of the between-persons association (B=-0.12). The findings of all models are summarized in Table 3.

Table 3

Summary of LMM with state gratitude PM and state gratitude PMC as predictors and positive affect and negative affect as dependent variables

| | | | | | | | CI 95% | |
| | | | | | | | Lower | Upper |
	Parameter	*B*	*β*	*df*	*t*	Sig	Bound	Bound
Positive affect	State gratitude	0.50	.63	1623.00	17.28	<.001	0.46	0.53
	State gratitude (PM)	0.33	.33	61.44	4.60	<.001	0.19	0.49
	State gratitude (PMC)	0.50	.44	1609.57	26.57	<.001	0.47	0.54
Negative affect	State gratitude	-0.28	-.38	81.38	-17.19	<.001	-0.32	-0.25
	State gratitude (PM)	-0.12	-.10	76.71	-1.37	.176	-0.32	0.07
	State gratitude (PMC)	-0.29	-.27	1575.53	-17.26	<.001	-0.32	-0.25

df Degrees of freedom *CI* Confidence interval of unstandardized estimates *PM* Person-mean *PMC* Person-mean centered

For the plots of the individual cases, first participant 18 was plotted with a high person mean score for state gratitude (see Figure 5). It is visible that state gratitude and positive affect have a similar pattern while negative affect is rather stable and low. Furthermore, the plot suggests that there is a negative association between positive affect and negative affect as well as state gratitude and negative affect, with negative affect being higher in moments when positive affect or state gratitude are lower.

Second, participant 10 was plotted with a low person mean score for state gratitude (see Figure 6). Here, state gratitude and positive affect do not show such a close and similar pattern, but still behave in similar directions. Although the fluctuations of state gratitude and positive affect seem stronger compared to the previous graph, negative affect still shows a rather stable line. For this individual it seems that positive affect and negative affect are negatively associated with each other. However, for state gratitude the association to positive and negative affect seems imperfect.

Figure 5

Line plot depicting state gratitude, positive affect, and negative affect per measurement point

for participant 18
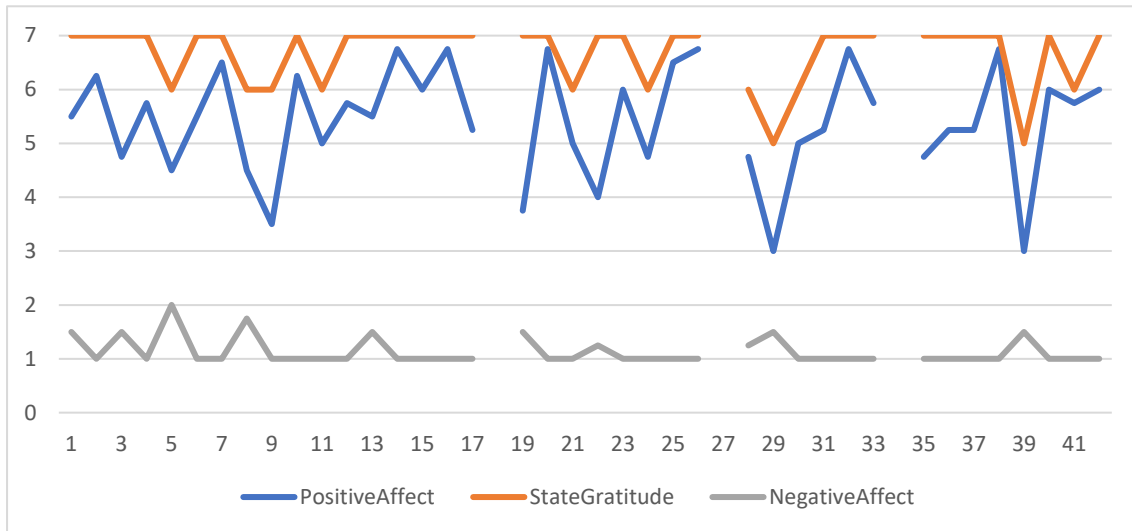
Figure 6

Line plot depicting state gratitude, positive affect, and negative affect per measurement point

for participant 10
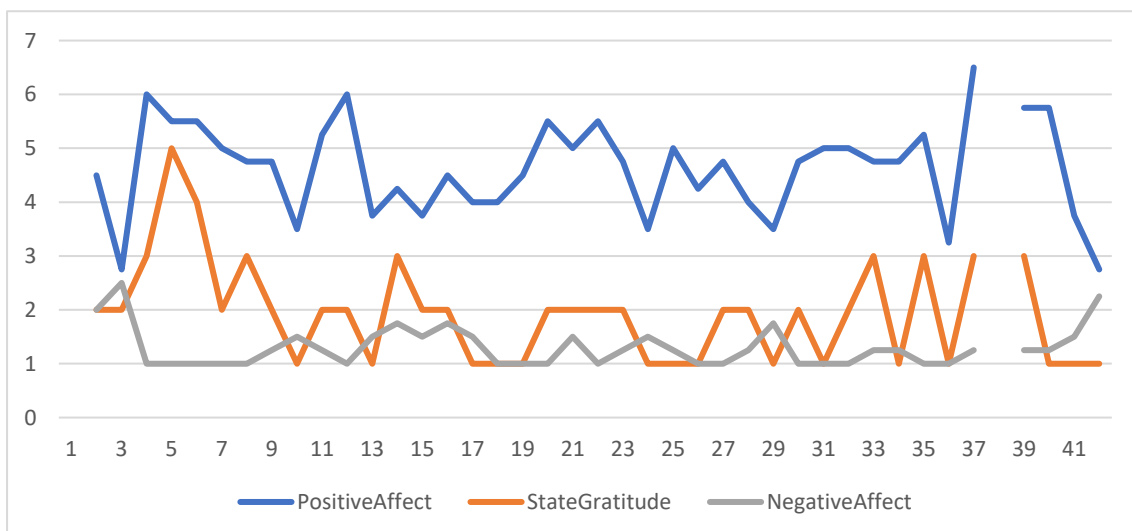
Finally, as the two previous graphs showed a rather stable pattern for negative affect,

participant 27 with a low mean for positive affect was plotted as well (see Figure 7). Here, it

appears that positive and negative affect behave in an opposite manner. When positive affect

is higher, negative affect is lower and vice versa. For this individual very clear and strong fluctuations appear with sometimes even higher scores for negative affect than for positive affect and state gratitude. Therefore, there also appear no clear associations between the three variables over time as the variable as it ranges from positive to negative momentary associations. The three individual cases (Figure 5,6,7) show how different the experiences of the three variables in terms of fluctuations and associations were for each individual over time.

Figure 7

Line plot depicting state gratitude, positive affect, and negative affect per measurement point for participant 27
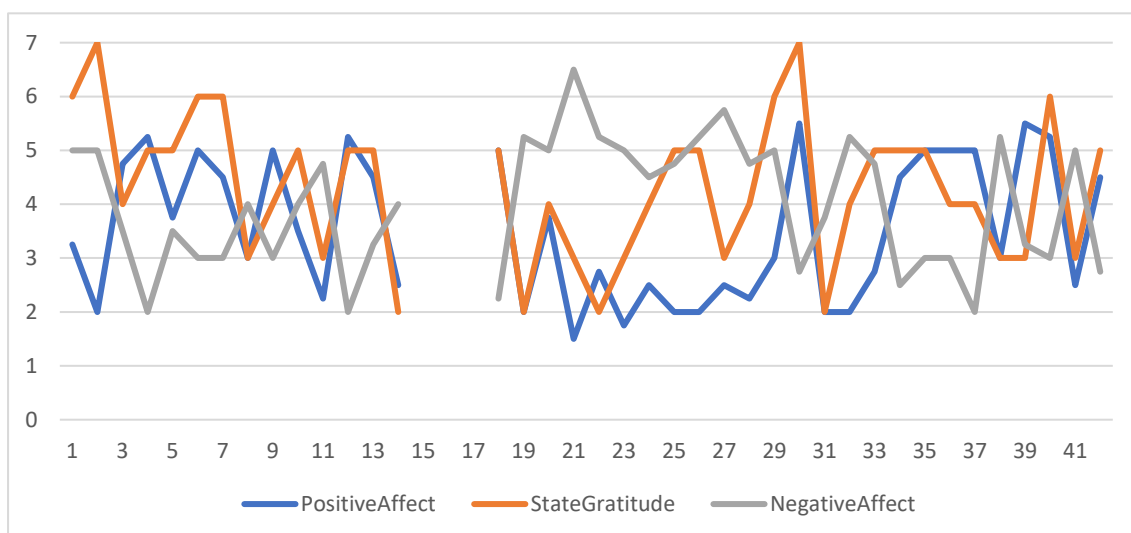
Association stressful events and emotional well-being

The association of stressful events and positive affect was shown to be negative strong and significant ($B=-1.01$, $\beta=-.78$, $p<.001$). This means that the presence of stressful events is associated with lower positive affect. In line with this, the presence of stressful events was positively associated with negative affect. The association was shown to be strong and significant ($B=0.80$, $\beta=.66$, $p<.001$).

Interaction effect of gratitude and stressful events on emotional well-being

The model with positive affect as dependent variable showed similar effects for stressful events and state gratitude as previous models. The interaction effect of state gratitude and stressful events was borderline significant (β=-.09, p=.068). For the model using negative affect as dependent variable, the effects of stressful event and state gratitude revealed a similar pattern as the previous models with significant effects. However, the interaction effect was not significant (β=-.03, p=.426). Table 4 summarizes the findings of both models.

Table 4

Summary of LMM with state gratitude, stressful events and the interaction of state gratitude and stressful events as predictors and positive affect and negative affect as dependent variables

	Parameter	*B*	*β*	*df*	*t*	Sig	95% CI Lower Bound	Upper Bound
Positive affect	Stressful Events	-0.42	-.55	1580.03	-2.88	.004	-0.71	-0.14
	State gratitude	0.46	.58	1611.31	23.54	<.001	0.42	0.50
	Stressful Events*State Gratitude	-0.07	-.09	1575.93	-1.82	.068	-0.14	0.01
Negative affect	Stressful Events	0.71	.49	1431.37	5.66	<.001	0.46	0.96
	State gratitude	-0.23	-.31	1630.73	-13.40	<.001	-0.27	-0.20
	Stressful Events*State Gratitude	-0.03	-.03	1442.13	-.80	.426	-0.09	0.04

df Degrees of freedom *CI* Confidence interval of unstandardized estimates

Discussion

The current study aimed to further explore the association between gratitude and emotional well-being, as well as the association of stressful events and well-being and how this association might be moderated by gratitude. Specifically, for the association between gratitude and well-being, this study focused not merely on between-person associations, but also on within-person associations. It was found that state gratitude and emotional well-being were moderately to strongly related over time. When distinguishing between-and within-person associations, it culd be confirmed that gratitude was significantly positively associated with positive affect on both levels of association. For negative affect, only on the within-person level a significant negative relation between state gratitude and negative affect was shown. Moreover, the results suggest that the presence of a stressful event was associated with decreased levels of positive affect as well as increased negative affect. Finally, the interaction effect of gratitude and stressful events was borderline significant for positive affect. For negative affect no significant interaction effect was shown.

Main findings

According to previous cross-sectional studies (e.g., Emmons & McCullough, 2003; McCullough et al., 2002; Wood et al., 2010), gratitude and well-being are related to each other. In the present study, this relationship could be confirmed in the blended model showing a strong positive effect of state gratitude on positive affect and a moderate negative effect of state gratitude on negative affect. This means that in a daily context higher levels of state gratitude might lead to higher positive affect and lower negative affect. This result is also in line with previous ESM studies where state gratitude was related to positive affect using cross-lagged analyses (Jans-Beken et al., 2019) as well as a sense of abundance as a dimension of gratitude towards both affective states (Simons et al., 2020).

Unique for this study is the clear distinction of between and within-person associations. As known so far, this is the first study exploring how gratitude and well-being are related at both levels of analysis. The significant relation on a between-person level between state gratitude and positive affect is similar to previously mentioned studies solely focusing on between-person associations by using cross-sectional designs (e.g., Emmons & McCullough, 2003; McCullough et al., 2002; Wood et al., 2010). Noteworthy, in the present study, the between-person association between state gratitude and negative affect was not significant. This suggests that people scoring higher on state gratitude on average do not score lower on negative affect. This finding contradicts the results of the meta-analysis by Portocarrero et al. (2020) showing a significant moderate negative association of gratitude on negative affect. However, they also concluded a stronger association being present for positive affect which is confirmed in present results.

In a recent review by Dickens (2017) about the effectiveness of gratitude interventions, she concluded that there are mixed findings of the effect of the interventions on negative affect and that most studies did not reveal a significant effect (see e.g., Fagley, 2018; Froh et al., 2009; Owens & Patterson, 2013). A significant or notable effect of gratitude on negative affect was only present when comparing the effect with negative intervention conditions such as listing hassles or misfortunes and worries, not when the comparison group received a neutral or positive intervention. One of the studies included in the review, argues that participants might not have thought of ongoing relationships or general experiences when being asked for listing things, they were grateful for that day (Owens & Patterson, 2013). This explanation suggests that for the present study specifically the focus on momentary experiences of gratitude might be unrelated to negative affect as participants might have been thinking about something special, they were grateful for in this specific moment rather than including general experiences. This non-significant association between gratitude and

negative affect, might indicate that on a between-person level gratitude plays a more important and consistent role for positive affect than it does for negative affect.

In this study, the distinction of between and within-person associations is unique and therefore specifically for the within-person association, the current results cannot be linked to previous studies. In the present results, a strong positive within-person association for positive affect was found as well as a weak negative one for negative affect. These two associations indicate that when a person feels more grateful in relation to his or her own average, this person tends to experience lower levels of negative affect and higher levels of positive affect. As between- and within-persons associations were disaggregated in the present study, this allows for drawing unambiguous conclusions. For the within-person level solely the variability that occurs around an individual's mean has been examined eliminating all possible between-person variances (Curran & Bauer, 2011; Hamaker, 2012). For now, conclusions are often drawn from between-person associations to within-person associations although the results can only be generalized under the assumption of ergodicity which is hardly ever met (Curran & Bauer, 2011; Hamaker, 2012; Hoffart, 2014). This makes the results of this study highly relevant and contributes to the understanding of the processes happening within individuals (Curran & Bauer, 2011; Hamaker, 2012).

The present findings revealed that associations within people were stronger for positive and negative affect compared to the associations between people. Especially, for positive affect, there seems to be a strong association with gratitude within people. This difference in magnitude underlines the importance of clearly disaggregating both levels of association. The findings indicate that the association of gratitude and well-being also holds within individuals. This is an important new insight especially relevant for the application of gratitude interventions aiming to raise the gratitude level within an individual.

Surprisingly, on a between-and within-person level the strength of the association for

positive and negative affect differed with stronger relations found between gratitude and positive affect. This could be explained following the dual continua model of mental health (Keyes, 2007) that pathology and well-being are two related, yet distinct constructs and therefore might enhance mental health by promoting positive emotions without relieving from negative ones. The results of the present study add also to the ongoing debate of positive and negative affect being independent or bipolar constructs (see e.g., Dejonckheere et al., 2018; Russell & Carroll, 1999; Watson et al., 1999) but this is beyond the purposes of the current study. The stronger relations between gratitude and positive affect on both levels, suggest gratitude to be more strongly associated with positive affect compared to negative affect which might indicate a higher relevance of gratitude for promoting positive feelings.

In line with expectations, the experience of a stressful event had a strong negative association with positive affect and a strong positive one with negative affect. This means that stressful events led to higher levels of negative affect and lower levels of positive affect. While the relation to positive affect is in line with most previous studies, only some studies could find a relation to negative affect (Civitci, 2015; Kent et al., 2021; Zautra et al., 2005). Other studies could not confirm the latter association (Hamama et al., 2013; Watson & Clark, 1994). A possible reason for the strong relationships found in this study also for negative affect might be that the analyses were not controlled for the general perceived stress level. Due to the ongoing Corona pandemic, it could be that the general stress level was already higher than usual which might lead to a different stress appraisal for minor stressors in daily life and therefore stronger effects.

Finally, the interaction effect of gratitude and stressful events was shown to be borderline significant for positive affect, but non-significant for negative affect. This result suggests gratitude to moderate the relationship between stressful events and positive affect. As the interaction effect for positive affect was actually approaching significance this can be

seen as a first indication regarding the protective function of gratitude in a way that gratitude decreases stress and helps to maintain positive affect. When arguing with previous sources and the broaden-and-build theory a possible mechanism for this moderation effect could be that gratitude as a positive emotion broadens awareness and therefore helps an individual to maintain mentally flexible (Fredrickson, 2004; Wood et al., 2010). Furthermore, the present findings are in line with previous studies showing gratitude to support productive and adaptive coping styles (e.g., see Emmons & Mishra, 2011; Wood et al., 2007). Another model supporting the possible moderating mechanism of gratitude was the model of sustainable mental health by Bohlmeijer and Westerhof (2021a). The model suggests the ability to adapt to be central for sustainable mental health with gratitude interventions being one possible way to impact sources and barriers for adaption. Although the model is based on empirical evidence, the authors see it mainly as a theoretical proposition. In stressful situations the ability to adapt is necessary to maintain mental health. As the interaction effect of gratitude and stressful events was borderline significant, the present findings could illustrate some first evidence that momentary experiences of gratitude can actually impact this ability to adapt as it seems that gratitude helps to maintain positive affect during stress.

For the non-significant interaction effect for negative affect, one possible explanation could be that gratitude can buffer the negative impact of stressful events on positive affect, but it cannot prevent the impact on negative affect. This would be in line with the idea of seeing positive and negative affect as two distinct and independent continua. Another explanation could be that previous studies showing that gratitude supports coping with stressful situations focused on stress as a general concept measured with current level of distress or PTSD symptoms (e.g., see Fredrickson et al., 2003; Kashdan et al., 2006; Vernon et al., 2009) rather than the presence of specific stressful events. In line with this explanation about conceptualization, a diary study by Nezlek et al. (2019) revealed a similar outcome of a

non-significant interaction effect for negative affect. They also conceptualized stress in a way that participants rated on a Likert-scale how stressful the past event was. In their results no significant moderating effect of gratitude on the relation between stressful events and positive and negative affect was found. Interestingly, they conceptualized well-being with different concepts and for some measures, including self-esteem, worry, and depressogenic adjustment the interaction of stressful event and gratitude did reveal a significant effect. These findings demonstrate how the definition and selected measures of well-being might lead to different conclusions drawn from analyses. For the current study this suggests that the operationalization of stress as stressful events as binary variable might has influenced the non-significant effect.

Strengths and limitations

One strength of the study is the ecological valid design with a high number of assessments points over 14-days. This enabled the researchers to both capture variations throughout the day and to limit the retrospective bias. Moreover, the semi-random sampling strategy chosen with random assessment moments within fixed intervals is another strength as participants were aware of possible timepoints, but the questionnaire was triggered at random which reduced the anticipation. Further, the clear distinction of between-and within-person associations is a strength. The association of gratitude and well-being has not been examined before on a within-person level and it could be shown that the two levels of association differ especially in magnitude. Many studies conclude within-person associations based on analyses that do not disaggregate. By using person-mean centering the disaggregation was possible in this study which made it unique (Curran & Bauer, 2011).

Next to the strengths of the study, there are also some limitations. First, although the sample was rather heterogenous in age and gender, the educational level was homogenous. Every person participating was highly educated and achieved a high school diploma or

higher. Furthermore, the participants showed higher scores on depression and anxiety and lower scores on mental health compared to previous studies in the general population. A reason for this might be the ongoing insecurity due to the Corona pandemic. The overrepresentation of highly educated people and the rather low mental health of the sample should be kept in mind when generalizing the results.

Second, the concept of gratitude might have been a difficult concept to reflect on. Therefore, it could be that more general levels of gratitude have been assessed only as participants were not able to retrieve and reflect on specific momentary levels of gratitude. One possibility for future studies to reduce this would be to use more cognitive measures instead of only the affective assessment. For example, more implicit items focusing on the number of things to be grateful for or on the extent to which a person was able to appreciate people, events, or situations might be more suitable (Krejtz et al., 2016; Nezlek et al., 2019). These studies were using it more retrospectively to evaluate the day. Future studies could investigate the possibilities of adjusting such cognitive measures to momentary assessment.

Finally, in the present study, the experience of a stressful event has been measured with the question of how (un)pleasant the most striking event or activity was. Although it is reasonable to assume unpleasant and stressful events to be strongly correlated, the present measure might have not captured the exact construct of stressful events which needs to be taken into consideration when interpreting the findings.

Future research

In the current study, between- and within-person associations of gratitude and emotional well-being were distinguished. For future studies, it might be important to investigate the within-person associations closer. The coefficient reported here only represents a group average of individual effects. It would be interesting to understand this average better by investigating what the differences in the individual within-person

associations are. In other words, one could explore in which individuals the association is not present at all or for whom it is stronger. To further elaborate on this, one may consider controlling for possible pre-requisites for this association being present. For example, it could be that people need to experience a generally high baseline level of trait gratitude to be able to experience momentary gratitude and that therefore the within-person association is only present under these circumstances.

Furthermore, in the present study, the moderating effect of gratitude on the relation between stressful events and well-being was investigated. Similar to the previous association, it would also here be interesting to further investigate under which circumstances the interaction effect is present or which individuals benefit from gratitude in stressful situations. In addition, it could be interesting to include perceived stress as a moderator. This would help to understand the extent to which momentary levels of stress are experienced. In line with this idea, it might be valuable for future studies to distinguish between stress as an overwhelming feeling, often referred to as distress, and stress as a status quo supporting productivity, so eustress (Merino et al., 2021). Besides the growing controversy about the concepts of distress and eustress (see e.g., Bienertova-Vasku et al., 2020), the concepts could serve as a starting point for the distinction between productive and overwhelming stress.

In addition, the broaden-and-build theory is based on the assumption that positive emotions increase the likelihood of finding positive meaning in subsequent events (Fredrickson, 2013a). Although Jans-Beken et al. (2019) already examined the predictive value of gratitude on positive affect, it would be interesting to look further into an interplay of how gratitude might buffer the effects of stressful events on mental health using cross-lagged analyses. In the present study, momentary associations were analysed. With cross-lagged panel analysis (Kenny, 1975) it would be possible to estimate the directional effects that gratitude and stressful events might have on mental health at a later time point. As the

interaction effect of gratitude and stress was approaching significance it might be that the experience of gratitude in one moment decreases the likelihood of feeling stressed in the next moment in line with the broaden-and-build theory.

Implications

The present study suggests that the association of gratitude and positive affect does not only hold between people but also within people. For the clinical setting, this finding supports the ongoing implementation and importance placed on gratitude interventions, such as gratitude journaling, diaries or counting blessing (e.g., Bohlmeijer et al., 2022; Bohlmeijer et al., 2021). By clearly distinguishing the two levels of association, the present results implicate that gratitude interventions aiming to increase the gratitude level within a person above his or her mean are actually related to increasing the well-being within this person. Furthermore, it was shown that at a group level the association was within-people even stronger than between-people which might implicate gratitude interventions to be more effective within the individuals than thought until now. Moreover, the significant interaction effect for positive affect implicates that gratitude interventions could be a useful treatment for patients facing stressful events to maintain positive affect. Finally, as the associations were weaker or not present for negative affect this suggests that gratitude interventions are rather suitable for promoting positive feelings instead of combating negative ones which illustrates an important possible limitation of the interventions.

Conclusion

This study is the first one known disentangling between-and within-person associations of gratitude and emotional well-being. The findings show that the association of gratitude and well-being holds not only between people but also within people. Also, the within-person associations were shown to be stronger. This difference in magnitude between

and within people underlines the relevance of clearly disaggregating both levels of association. Furthermore, as the associations were weaker or not present for negative affect this suggests gratitude to be stronger related to promoting positive affect compared to combating negative affect. Moreover, the moderating effect of gratitude on the relation between stressful events and positive was approaching significance. The moderating effect was not confirmed for negative affect. This indicates gratitude might buffer the negative impact of stressful events on positive affect, but it cannot prevent the increase of 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.

German

Liebe Teilnehmer*innen,

wir danken Ihnen für Ihre Teilnahme an dieser Studie. Bevor Sie teilnehmen, ist es wichtig, dass Sie sowohl das Ziel als auch die Anforderungen, die diese Studie an Sie stellt, verstehen. Ziel dieser Studie ist es, herauszufinden, wie die mentale Gesundheit mit verschiedenen Konstrukten der positiven Psychologie zusammenhängt. Um diesen Zusammenhang zu

erforschen, wollen wir die Schwankungen der psychischen Gesundheit im Alltag messen, um ein detaillierteres Bild von der Dynamik der psychischen Gesundheit zu erhalten.

Für diese Studie werden wir Sie bitten, mehrere Fragebögen auf Ihrem Mobiltelefon auszufüllen. Alle Fragebögen werden über die Ethica-App ausgefüllt. Die Studie beginnt mit einem Fragebogen zu Ihren demografischen Daten und Ihrer allgemeinen psychischen Gesundheit. Das Ausfüllen dieses ersten Fragebogens wird etwa 10 Minuten dauern. Danach erhalten Sie über einen Zeitraum von zwei Wochen täglich drei Fragebögen. Diese werden Sie gefragt morgens, nachmittags, und abends auszufüllen. Dabei werden Benachrichtigungen Sie an den nächsten Fragebogen erinnern. Das Ausfüllen eines täglichen Fragebogens dauert etwa 3 Minuten. Es ist wichtig, dass Sie die Fragebögen so schnell wie möglich beantworten. *Bitte stellen Sie sicher, dass Sie die Benachrichtigungen für die Ethica-App auf Ihrem Mobilgerät einschalte*n.

Die Informationen, die wir im Rahmen dieses Forschungsprojekts sammeln, werden vertraulich behandelt. Dies bedeutet, dass nur die Forscher Einblick in Ihre Antworten haben. Alle persönlichen Daten (wie Alter, Geschlecht usw.) werden anonymisiert und werden nicht veröffentlicht und/oder an Dritte weitergegeben. Ihre Teilnahme an dieser Studie ist freiwillig. Es steht Ihnen frei, jederzeit und ohne Angabe von Gründen von dieser Studie zurücktreten.

Kontaktinformationen

Wenn Sie Fragen zu dieser Studie haben, können Sie sich an die Forscherinnen dieses Projekts Amelie Schleich (a.c.schleich@student.utwente.nl) und Allegra Passmann (a.v.passmann@student.utwente.nl) wenden.

Einverständniserklärung

Ich habe die bereitgestellten Informationen gelesen und verstanden und hatte die Möglichkeit, Fragen zu stellen. Ich weiß, dass meine Teilnahme freiwillig ist und dass ich jederzeit ohne Angabe von Gründen und ohne Kosten von der Teilnahme zurücktreten kann.

Appendix B

Baseline questionnaire

English

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

MHC-SF:

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

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

GAD-7

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

1. Feeling nervous, anxious, or on edge

2. Not being able to stop or control worrying
3. Worrying too much about different things
4. Trouble relaxing
5. Being so restless that it is hard to sit still
6. Becoming easily annoyed or irritable
7. Feeling afraid, as if something awful might happen
    a. Not at all
    b. Several days
    c. More than half the days
    d. Nearly every day

PHQ-9

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

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

GQ-6

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.

- I have so much in life to be thankful for.
- If I had to list everything that I felt grateful for, it would be a very long list.
- When I look at the world, I don't see much to be grateful for.*
- I am grateful to a wide variety of people.
- As I get older, I find myself more able to appreciate the people, events, and situations that have been part of my life history.
- 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

German

Demographics:

- Alter: Wie alt sind Sie?
- Nationalität: Welcher Nationalität gehören Sie an? Niederländisch, Deutsch, sonstiges
- Geschlecht: Mit welchem Geschlecht identifizieren Sie sich? Männlich, weiblich, divers
- Tätigkeit: Welcher Tätigkeit gehen Sie nach? Studieren, Angestellt, Selbstständig, Studieren und Arbeiten, Nicht arbeitend, Sonstiges
- Welches ist der höchste Abschluss, den Sie erworben haben? *Falls Sie derzeit immatrikuliert sind, kreuzen Sie den höchsten bereits erworbenen Abschluss an.* Weiterführende Schule (z.B. Haupt- oder Realschule), Weterführende Schule (z.B. Gymnasium, Berufsschule/Berufskolleg), Bachelor, Master oder Diplom, Promotion, Sonstiges
- SONA -ID

MHC-SF

Im letzten Monat, wie oft hatten Sie das Gefühl,

1. dass Sie glücklich waren?
2. dass Sie Interesse am Leben hatten?
3. dass Sie zufrieden waren?
4. dass Sie einen wichtigen gesellschaftlichen Beitrag geleistet haben?
5. dass Sie zu einer Gemeinschaft gehörten (z.B. einer sozialen Gruppe, Ihrer Nachbarschaft oder Ihrer Stadt)?
6. dass unsere Gesellschaft besser für Ihre Bürger wird?
7. dass Menschen von Natur aus gut sind?
8. dass Sie verstehen, wie unsere Gesellschaft funktioniert?
9. dass Sie die meisten Aspekte Ihrer Persönlichkeit wertschätzen?
10. dass Sie Ihre täglichen Aufgaben und Verpflichtungen gut erfüllen konnten?
11. dass Sie warme und vertraute Beziehungen zu anderen haben?
12. dass Sie sich entwickeln oder ein besserer Mensch werden?
13. dass Sie selbstbewusst Ihre eigenen Ideen und Gedanken gedacht und geäußert haben?
14. dass Ihr Leben Richtung und Sinn hat.
    a. Nie
    b. 1-2 mal im Monat
    c. 1 mal in der Woche
    d. 2-3 in der Woche
    e. Fast täglich
    f. täglich

GAD-7

Wie oft fühlten Sie sich im Verlauf der letzten 2 Wochen durch die folgenden Beschwerden beeinträchtigt?

1. Nervosität, Ängstlichkeit oder Anspannung
2. Nicht in der Lage sein, Sorgen zu stoppen oder zu kontrollieren
3. Übermäßige Sorgen bezüglich verschiedener Angelegenheiten
4. Schwierigkeiten zu entspannen
5. Rastlosigkeit, so dass Stillsitzen schwer fällt
6. Schnelle Verärgerung oder Gereiztheit
7. Gefühl der Angst, so als würde etwas Schlimmes passieren
   a. Überhaupt nicht
   b. An einzelnen Tagen
   c. An mehr als der Hälfte der Tage
   d. Beinahe jeden Tag

PHQ-9

Wie oft fühlten Sie sich im Verlauf der letzten 2 Wochen durch die folgenden Beschwerden beeinträchtigt?

1. Wenig Interesse oder Freude an Ihren Tätigkeiten
2. Niedergeschlagenheit, Schwermut oder Hoffnungslosigkeit.
3. Schwierigkeiten ein- oder durchzuschlafen oder vermehrter Schlaf
4. Müdigkeit oder Gefühl, keine Energie zu haben
5. Verminderter Appetit oder übermäßiges Bedürfnis zu essen
6. Schlechte Meinung von sich selbst; Gefühl, ein Versager zu sein oder die Familie enttäuscht zu haben
7. Schwierigkeiten, sich auf etwas zu konzentrieren, z.B. beim Zeitunglesen oder Fernsehen
8. Waren Ihre Bewegungen oder Ihre Sprache so verlangsamt, dass es auch anderen auffallen würde? Oder waren Sie im Gegenteil „zappelig" oder ruhelos und hatten dadurch einen stärkeren Bewegungsdrang als sonst?
9. Gedanken, dass Sie lieber tot wären oder sich Leid zufügen möchten
   a. Überhaupt nicht
   b. An einzelnen Tagen
   c. An mehr als der Hälfte der Tage
   d. Beinahe jeden Tag

GQ-6

Im Folgenden finden Sie sechs Aussagen, die auf Sie in verschiedenem Ausmaß zutreffen können. Geben Sie bitte für jede Aussage an, wie sehr diese auf Sie zutrifft. Bitte antworten Sie offen und ehrlich

- 1. Ich habe so vieles im Leben, wofür ich dankbar sein kann.

- 2. Müsste ich alles aufschreiben, wofür ich je dankbar war, dann würde das eine sehr lange Liste ergeben
- 3. Wenn ich mir die Welt ansehe, dann kann ich nicht viel erkennen, wofür ich dankbar sein könnte.
- 4. Ich empfinde vielen verschiedenen Menschen gegenüber Dankbarkeit.
- 5. Mit zunehmendem Alter kann ich Menschen, Erlebnisse oder Augenblicke besser wertschätzen, die Teil meiner Lebensgeschichte waren.
- 6. Es kann sehr viel Zeit vergehen, bis ich jemandem oder für etwas dankbar bin.
    - 1=Stimme überhaupt nicht zu, 2 = Stimme nicht zu, 3 = Stimme eher nicht zu, 4 = Neutral, 5= Stimme eher zu, 6= Stimme zu, 7= Stimme stark zu
    - Item 3 und 6 sind reversed

Appendix C

Daily questionnaires

English

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)

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)

German

Im Folgenden finden Sie einige Fragen zu Ihren derzeitigen Gefühlen. Bitte versuchen Sie anzugeben, wie Sie sich gefühlt haben, kurz bevor Sie mit der Beantwortung des Fragebogens begonnen haben!

Positive and negative affect

- Wie *fröhlich* fühlen Sie sich im Augenblick?
- Wie *begeistert* fühlen Sie sich im Augenblick?
- Wie *zufrieden* fühlen Sie sich im Augenblick?
- Wie *entspannt* fühlen Sie sich im Augenblick?
- Wie *ängstlich* fühlen Sie sich im Augenblick?
- Wie *unsicher* fühlen Sie sich im Augenblick?
- Wie *niedergeschlagen* fühlen Sie sich im Augenblick?
- Wie *schuldig* fühlen Sie sich im Augenblick?
    - 1(gar nicht) bis 7 (sehr stark)

State gratitude

- Wie dankbar fühlen Sie sich im Augenblick?
    - 1(gar nicht) bis 7 (sehr stark)

Stressful events

- Denken Sie an das auffälligste Ereignis oder die auffälligste Aktivität seit dem letzten Fragebogen. Wie (un)angenehm war dieses Ereignis oder diese Aktivität?
    - -3(sehr unangenehm) bis +3 (sehr angenehm)