Understanding the Association between Gratitude and Loneliness in Daily Life: An Experience Sampling Study

Master Thesis

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Abstract

With the emergence of positive psychology, gratitude has been increasingly in the focus of attention, therefore several studies have examined both gratitude and loneliness. However, literature investigating the relationship between these constructs in terms of momentary states is scarce. This study employed experience sampling methodology to assess the association between gratitude and loneliness in the daily context, taking into consideration trait levels of both constructs. Participants (N = 34) indicated their experience of gratitude and loneliness three times a day for one week with subsequent trait level questionnaires at the end. Trait gratitude predicted more frequent experience of state gratitude and less frequent experience of state loneliness, while the opposite was the case for trait loneliness. Furthermore, this study found a negative within-person association between state gratitude and loneliness, indicating that loneliness is associated with less gratitude at a specific moment and vice versa. The association between momentary gratitude and loneliness varied based on trait levels. Highly grateful individuals did not show a significant within-person association between state gratitude and loneliness, while there was a small association within lonely individuals. Those with low trait levels of both constructs showed a moderate association. Yet, the effect of state gratitude was not carried over to the next measurement on the same day. These results indicate that highly grateful individuals experience gratitude regardless of loneliness, while for others, increased loneliness is associated with less gratitude and vice versa, with a weaker effect in lonely individuals.

Understanding the Association between Gratitude and Loneliness in Daily Life: An Experience Sampling Study

With the advent of positive psychology, much attention has been placed on gratitude, highlighting its beneficial role for mental well-being (Gulliford & Morgan, 2018). Gratitude interventions were found to have a range of positive effects, for instance, increases in happiness, life satisfaction, positive affect, as well as a decrease in depressive mood (Dickens, 2017). Moreover, a direct relationship between gratitude and loneliness has been found (Ni et al., 2015) and O'Connell et al. (2016) established the mediating role of loneliness in the relationship between gratitude and physical health. Additionally, another study showed that increased levels of gratefulness on a specific day led to fewer feelings of loneliness and fewer health issues (Bartlett & Arpin, 2019).

Hence, there is an association between gratitude and loneliness. Yet, literature sparsely distinguishes between the state and trait levels of gratitude and loneliness, respectively. Generally, psychological constructs, such as gratitude, can exhibit significant variation on the intrapersonal level. Therefore, they can vary across different situations and contexts (McGuire et al., 2020). These within-person fluctuations in the daily context are not captured with traditional, cross-sectional designs, which often utilise self-report questionnaires with one measurement only. While this allows capturing how people generally reflect on themselves, it can be subject to false recollection or biased perception of past events (Montag et al., 2016). An approach to overcome these limitations is the use of experience sampling methodology (ESM). Here, instead of administering a questionnaire at a single time-point, participants complete a brief questionnaire several times a day for several consecutive days (Myin-Germeys et al., 2018). This methodology allows to investigate the fluctuating, moment-to-moment human experiences of psychological constructs and to gain a more in-depth understanding. It allows distinguishing within-person and between-person effects, which is crucial to fully understand how the constructs work in real life. Therefore, this study aims to explore the association between gratitude and loneliness in the daily context, distinguishing between trait- and state levels of the constructs, using ESM.

Gratitude

Many scholars define gratitude as merely the result of interpersonal exchange, however, others add that gratitude also consists of a broader, more general sense of being grateful for all kinds of different things, which includes relationships with important others in one’s life (Lambert et al., 2009).

Gratitude can be seen as a trait, emotion, and mood, in line with the hierarchy of affective processes by Rosenberg (1998). Considering it as a trait, it is a stable disposition that causes individuals to be more prone to the affective experience of gratitude (Emmons & Mishra, 2011), and that can vary between individuals (McCullough et al., 2002). According to Watkins et al. (2004), individuals with a grateful disposition are characterized by a specific appreciation of small pleasures, a sense of abundance, and a general appreciation of others. They also encode life events in a more positive fashion (Watkins et al., 2004).

In contrast, as a state, emotions can be seen as both temporary affects and longer-lasting moods (Wood et al., 2008); hence, both emotion and mood. Gratitude as an emotion refers to specific, brief, and acute states, which are most strongly elicited and experienced when one is the recipient of a benefit by another person. This, in turn, motivates to engage in reciprocal behaviour to increase the chances of receiving more benefits in the future (McCullough et al., 2001). Considered as a mood, gratitude is a more constant state, lasting longer than an emotion, while still being less constant than affective traits. Some individuals may be more prone to experience gratitude over the day, but this varies across days and is closely related to situational factors (McCullough et al., 2004). Generally, moods are less consciously available than emotions, but they are hypothesized to exert a larger influence on our conscious experience due to their longer duration and pervasiveness (Rosenberg, 1998). Specifically, the beneficial effects of gratitude (e.g. better coping with stress), are more likely to be caused by gratitude as a mood (McCullough et al., 2004).

Being a combination of emotion and mood, state gratitude is “a discrete experience that occurs when one perceives themselves as the recipient of a positive outcome, triggering a subsequent desire to reciprocate or otherwise engage in prosocial behaviour” (McGuire et al., 2020, p. 2250). It is based on situational factors, as well as individual differences and can fluctuate within a person, while it also differs between individuals (Wood et al., 2008).

Traditionally, gratitude has mostly been examined as a trait, where it was found to have a range of positive effects, such as increases in well-being, positive affect, happiness, and life satisfaction (Dickens, 2017; Gulliford & Morgan, 2018). In practice, however, the differences between the different levels of affective states seem to be crucial. A study has shown that while trait gratitude does not have a significant effect, state gratitude does buffer against cardiovascular reactions of stress, therefore, being a protective health factor (Gallagher et al., 2020). Furthermore, it was found that state gratitude predicted organisational citizen behaviour (Spence et al., 2014), and led to increased satisfaction and cheerfulness and that this relationship is reciprocal (Jans-Beken et al., 2019). Thus,

emphasising the difference between state and trait gratitude; each can have distinct effects and should be examined separately. Curran and Bauer (2010) argue how within-person and between-person effects must be disentangled since they often refer to fundamentally different questions and associations. Failing to disaggregate different levels of psychological constructs this way can lead to false interferences, often referred to as ecological fallacy. For instance, drawing conclusions from trends observed between groups might not represent intraindividual trends. Perhaps higher trait levels of gratitude generally lead to frequent experience of state gratitude in general, while this effect is not necessarily apparent in single individuals, who might experience a lot of fluctuation or constant low levels of state gratitude in general. Results should not be generalised without considering intraindividual trends.

Underscoring the distinctiveness, the social-cognitive model (Wood et al., 2008) explains that there is no direct relationship between trait and state gratitude, but that this relationship is fully mediated by benefit appraisals. Trait gratitude is strongly associated with benefit appraisals, and these in turn are linked to state gratitude. Higher trait gratitude leads to more frequent experiences of benefit appraisals, which causes more state gratitude. Specifically, benefit appraisals refer to the costs required from the benefactor, the perception of a genuinely helpful motive, and the identification of the benefit as valuable. This model explains how benefit appraisals are the specific mechanism linking individuals with high levels of trait gratitude to experience state gratitude more frequently.

Loneliness

While gratitude is a positive psychological construct, loneliness refers to the corresponding distressing feeling when one perceives a lack of quantity or quality in one's social relationships (Hawkley et al., 2008). Yet, lower quality in social relationships was found to be more pertinent to feelings of loneliness than the mere lack of quantity (Pinquart & Sorensen, 2001). While some researchers define loneliness as a one-dimensional construct, others describe it as multidimensional. Two popular dimensions of loneliness are emotional loneliness and social loneliness, which both share an underlying discrepancy between the desired and actual level of social relationships (Buecker et al., 2020). Emotional loneliness describes the perceived absence of a significant other in one's life, while social loneliness describes the absence of a social network (Weiss, 1973). Here, the former refers more strongly to the lack of quality and the latter refers to the lack of quantity when one feels lonely. Moreover, while subjective social isolation can be seen as similar to loneliness, objective social isolation is distinct (Hawkley & Cacioppo, 2010).

Similar to gratitude, loneliness can be conceptualised at a trait and a state level.

Considering loneliness as a more stable disposition, a meta-analysis has shown that of the Big Five personalities only neuroticism is positively associated with loneliness, while the other personality traits are negatively correlated with loneliness (Buecker et al., 2020). The authors suggest that lonely persons are on average more introverted and neurotic, while at the same time they tend to score lower on agreeableness and conscientiousness. More specifically, another meta-analysis has shown loneliness to exhibit trait-like characteristics, as some individuals, despite life circumstances, feel lonelier than others. Yet, loneliness does not seem to be a perfectly stable trait (Mund et al., 2019).

States of loneliness may be dependent on external triggers, like the social context and the time of the day (van Roekel et al., 2018). Most studies examining state loneliness conceptualise it as the amount of loneliness one perceives in a specific moment (e.g. Tam & Chan, 2019; van Roekel et al., 2018). State loneliness might be influenced by different types of responses to the environment and context of a situation, namely, affective, behavioural, and cognitive responses (van Winkel et al., 2017).

Generally, feelings of loneliness motivate individuals to connect or reconnect with others (Hawkley & Cacioppo, 2010). Still, if loneliness persists, it can have detrimental consequences, such as increased incidence of diseases (Caspi et al., 2006; Hawkley et al., 2006), and higher mortality (Perissinotto et al., 2012; Rico-Uribe et al., 2018). Moreover, loneliness was found to exert a significant effect on depression (Erzen & Çikrikci, 2018), and lead to decreased mental health (Beutel et al., 2017) and sleep quality (Matthews et al., 2017).

Most research examining loneliness has focused on trait loneliness, highlighting general tendencies instead of momentary experiences (van Winkel et al., 2017). Individuals with high trait loneliness were found to anticipate social interactions more negatively, expect rejection and be less responsive to positive stimuli (Cacioppo & Hawkley, 2009; Hawkley & Cacioppo, 2010). Moreover, they often behave according to their negative expectations, thus, initiating a self-fulfilling prophecy, where external factors are perceived as the cause of social distance (Newall et al., 2009).

Yet, some studies examined state loneliness. An experience sampling study using lagged analyses has shown that state loneliness leads individuals to evaluate social situations more negatively and withdraw from them (van Winkel et al., 2017). Further, it was found that state loneliness is associated with negative affect and emotional hypervigilance (Meng et al., 2020), depends on the social context (van Roekel et al., 2014), and that increased Facebook use can be predicted by state loneliness, but that the strength of this association varies across individuals (Reissmann et al., 2018).

Gratitude and Loneliness

Previous studies found a relationship between gratitude and loneliness (Bartlett & Arpin, 2019; Caputo, 2015; Ni et al., 2015; O'Connell et al., 2016). However, these mostly focused on the trait levels of the respective construct. Bartlett and Arpin (2019) examined daily fluctuations in both gratitude and loneliness in older adults and found that on days with high state gratitude, individuals felt less lonely. Thus, a negative within-person association, which similarly indicates that higher loneliness was associated with less gratitude. They further found evidence that a gratitude intervention can increase this association compared to a control group.

There are several mechanisms which could explain a negative between-person association, while it remains unclear to what degree this could be applicable on the within-person level. Individuals with high trait gratitude were more likely to experience a positive memory bias; hence, pleasant events come more easily to mind and have a larger positive emotional impact, increasing subjective well-being (Watkins et al., 2004). High levels of gratitude also increase the forming and maintenance of relationships (Algoe et al., 2008), and increase the perception that one has close others easily available (O'Connell et al., 2018). It could be hypothesized that this, in turn, helps individuals high in trait gratitude to be less strongly affected by momentary states of loneliness.

Furthermore, grateful individuals were found to display higher levels of well-being, spirituality or religiousness, and prosociality than less grateful individuals (McCullough et al., 2002). Considering the relationship with loneliness, the latter deems to be particularly important, as lonely individuals perceive a lack of quantity or quality in their social ties (Hawkley et al., 2008). Similarly, state gratitude is defined by prosocial behaviour (McGuire et al., 2020), hence, it might negatively affect loneliness on the within-person level, reducing it momentarily. A previous ESM study found that trait gratitude, and a sense of abundance more specifically, were associated with momentary positive affect (Simons et al., 2020). Additionally, grateful individuals showed higher levels of positive emotions (McCullough et al., 2002), which, considering the broaden-and-build theory (Fredrickson, 2001), lead an individual to have a broader focus of attention and to build enduring social resources, potentially mitigating state loneliness.

More specifically, while positive emotions can be transient on a state level, they do have persisting effects. Being exposed to them repeatedly leads an individual to enter a positive spiral with a broader thought-action repertoire and more psychological resources, including social resources (Garland et al., 2010). Yet, it is not specifically clear whether state

gratitude and state loneliness progress with opposing tendencies in the daily context of individuals or whether they develop analogous to each other. Moreover, it is unclear whether there are differences between individuals with different respective trait levels of gratitude and loneliness. In a similar vein, it could be interesting to investigate whether the repeated experience of state gratitude is associated with higher, lasting trait levels of gratitude (Garland et al., 2010), and whether gratitude also has a lasting effect on loneliness. So, whether high gratitude associates with less loneliness later. Hence, considering these different mechanisms, it needs to be investigated how gratitude and loneliness progress in the daily context, and whether the relationship differs according to individuals' trait levels.

The Present Study

Taking this information into consideration, many studies have investigated either gratitude, loneliness or the relationship between these two constructs. While, for instance, the broaden-and-build theory could be a relevant theory to explain this association, there is a lack of understanding of how state gratitude and state loneliness develop in the daily context. It would be particularly valuable to study fluctuations in state levels to investigate whether state gratitude and state loneliness develop in opposed directions. Moreover, the respective trait levels should be considered. It could be expected that high trait levels of gratitude correlate to a higher frequency of state gratitude and that correspondingly there is less experience of state loneliness. In contrast, it could be expected that those higher in trait loneliness would display an opposing tendency, experiencing more states of loneliness and fewer states of gratitude. Lastly, it would be interesting to find out whether state gratitude correlates negatively with state loneliness at the next measurement, so whether there is a carry-over effect. The goal of this study is therefore to explore gratitude and loneliness and their respective daily fluctuations in order to get a more thorough understanding of both constructs and their association. From that, the following research questions can be drawn:

1. Exploring the within-person association between state gratitude and state loneliness in daily context: How are these constructs associated?
    a. Is the within-person association different based on high or low trait levels of gratitude?
    b. Is the within-person association different based on high or low trait levels of loneliness?
    c. Is there an association between previous state gratitude and state loneliness at the next measurement?

Methods

Design

The current study is a post-hoc analysis of the data collected by Adam (2020) and Wallisch-Prinz (2020). Data were collected using experience sampling methodology to assess participants' state levels of gratitude and loneliness, respectively. In addition, a questionnaire was used to assess demographic information, as well as trait levels of gratitude and loneliness. The study was part of a larger study that included additional psychological constructs which are not described here.

Participants

In total, 59 students took part in the study. Incomplete data, caused either by technical difficulties with the state measurements or by not completing the final questionnaire were removed (n = 25), as well as n = 1 participant after visual inspection of the responses. Hence, N = 34 participants were included and completed the study. The sample consisted exclusively of university students. To be included, participants had to be at least 18 years of age, be proficient in the English language, and required a smartphone running either Android OS or iOS to complete the study. The average age of participants was 20.65 (SD = 3.15) years. The sample consisted of 85% women (n = 29), 9% men (n = 4), as well as 3% transgender (n = 1) and 3% diverse (n = 1). Participants were German (50%), Dutch (38%), Indian (3%), Bulgarian (3%), Vietnamese (3%) and Indonesian (3%).

Materials

This study was built and implemented using The Incredible Intervention Machine (TiiM), which is a tool developed by the BMS Lab of the University of Twente (The BMS Lab, n.d.). TiiM was also used to assess the demographic characteristics of the participants, namely age, gender, and nationality at the beginning of the study. Moreover, for this study, the Multi-Component Gratitude Measure (Morgan et al., 2017) and the UCLA Loneliness Scale Version 3 (Russell, 1996) were used.

TiiM can be run on Android OS and iOS, and allows to create modules of questions to be provided to participants at fixed times and for fixed time frames. The programme also incorporates reminders, so that participants are informed when there are new questions available. For the current study, TiiM was set to provide questions to the participants three times a day (between 8 am and 10 am, between 12 pm and 2 pm, and between 7 pm and 9 pm) for a period of seven days. The aim was to capture data in different contexts of the students' daily life. The duration was set to one week to include both working days and the

weekend, again in order to capture a broad range of contexts in the life of the participants. The modules were pilot tested with two participants and adjusted accordingly to ease the usability of the questions and the surface of the survey. Due to technical issues with the reminder feature, the first four participants were instructed to set manual reminders at the respective times. However, these participants did have a low response rate and hence, adjustments were made. For the following participants, manual reminders were sent manually via the BMS Lab Dashboard, which resulted in higher response rates. Therefore, participants were no longer instructed to set manual reminders themselves. Using these signal-contingent triggers was intended to reduce the burden of participants (Berkel et al., 2017). To maximise response rates, responses were checked 30 minutes before the end of the respective time frames, and additional reminders were sent to those who did not respond yet.

State Measures

To avoid habituation, the order of the state questionnaires were randomised at each time point. State gratitude was measured with the single item "I am grateful right now", which was chosen to minimise the effort needed by the participants and hence, increase adherence and response rates. A similar approach has been taken before (DeWall et al., 2012; Emmons & McCullough, 2003; Jans-Beken et al., 2019; Visserman et al., 2018). Participants answered the item on a 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7), which indicated the degree to which they felt grateful in that moment, a higher score corresponds to higher levels of gratitude. This item was strongly correlated to the trait gratitude questionnaire ($r = .67$, $p < .01$), so it can be considered a valid measure of gratitude.

State Loneliness was measured with the single item "I feel lonely right now", which was used in previous research (Tam & Chan, 2019; van Roekel et al., 2018) and answered on a 7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7). The higher the score, the more loneliness is indicated. This item was strongly related to the trait loneliness scale ($r = .66$, $p < .01$) suggesting it is a valid measure of loneliness.

Trait Measures

To assess trait levels of gratitude, the Multi-Component Gratitude Measure (MCGM) was used (Morgan et al., 2017). The MCGM conceptualises trait gratitude as a moral virtue and incorporates an emotional, attitudinal and behavioural domain of gratitude. The MCGM consists of 29 items, each being answered on a 7-point Likert scale, with answers ranging from "strongly disagree" (1) to "strongly agree" (7). Most items (13) belong to behavioural gratitude, followed by ten items used to measure attitudinal gratitude and six items to measure emotional gratitude. Exemplary items are "I recognise how many things I have to be

grateful for", "I believe gratitude is an important value to have", and "There are many things that I am grateful for" for behavioural, attitudinal and emotional domains of gratitude, respectively. Several items needed to be reversed. The total score representing the level of gratitude consists of the sum of all items and ranges from 29 to 203. The former indicating low levels of gratitude and the latter representing the highest level of gratitude. Each of the three components displayed good reliability before, indicated by a Cronbach's Alpha above .70 and good construct validity, shown by strong correlations with other measures of gratitude (Morgan et al., 2017). In this study, Cronbach's alpha was good (α = .87).

To assess trait loneliness, the third version of the UCLA Loneliness Scale (Russell, 1996) was used. Using 20 items, this questionnaire estimates how often a person experiences feelings of loneliness. Each item has to be answered using a 4-point Likert scale from "never" (1) to "always" (4). Several items need to be reversed before scoring, for example, "How often do you feel outgoing and friendly?". All items were added to receive a total score, ranging from 20 to 80, representing the level of loneliness. The higher the score, the higher the level of loneliness. The UCLA was found to have high internal consistency as well as test-retest reliability. Moreover, confirmatory factor analysis has shown that the scale measures a unipolar construct and has good convergent validity (Russell, 1996). In this study, Cronbach's Alpha was excellent (α = .94).

Procedure

This study received ethical approval from the Behavioural, Management and Social Sciences Department (BMS) of the University of Twente (request number 191272). Data were collected in November 2019, using convenience sampling (Etikan, 2016). Participants were recruited via *SONA* Systems, the Test Subject Pool of the University of Twente, as well as via distribution of a direct, anonymous link to access the survey. The direct link was shared by the researchers through messaging apps and social media among their networks. Students of the University of Twente who accessed the study via *SONA* were compensated with 2.5 virtual credits, which are needed for the completion of the bachelor's degree. The remaining participants were not compensated for their participation.

The study had a total duration of nine days, where the first day was used for informational purposes only to ensure understanding and consent of the participants. Upon entering the study link, participants had to register at TiiM with a valid email address and a password, as well as entering their age, gender, nationality, and confirm that they are currently students. Next, they received instructions to install the TiiM application on their mobile device. Here, they could find the respective link for their OS and were informed that

no further steps were necessary and that more information will automatically be provided in the app the next day.

On the second day of the study, more information about the background of the study and its setup was shown in the app. Participants were also informed about their right to withdraw from the study at any time and whom they can contact if there were any questions. Lastly, active consent was necessary to continue the study. During the following seven days, participants were required to answer six questions three times a day. No question could be skipped, each one had to be answered before continuing to the next question. On the last day of the study, participants had to fill out the trait questionnaires.

Data Analysis

All analyses were done with IBM SPSS Statistics 26, and Excel for Microsoft 365 was used to create graphs. First, descriptive statistics were calculated to illustrate demographic information of participants and for the respective trait scores of gratitude and loneliness. Next, data on the respective states were aggregated to receive a mean score for state gratitude and state loneliness. Moreover, state data were aggregated per participant (person-mean, PM) and a series of Pearson correlations were run to examine the relationships between person mean state and trait levels of gratitude and loneliness, respectively. Correlations were considered weak (> .10), moderate (> .30) or strong (> .50) in line with the criteria by Cohen (1988). For further analyses, the respective trait levels were categorized into three categories: high, average, and low. Trait levels were considered average between the 25^{th} and 75^{th} percentile, with high and low scores indicated by deviation above and below the respective percentiles. To answer the respective research questions, only high and low levels of the trait levels were used for analysis.

As the time series data in this ESM study required special considerations regarding data analysis, first-order autoregressive linear mixed models (LLM) were used for further analyses. LMM can account for the hierarchical ESM data and account for missing data. Moreover, random subject effects, so the effect of individual participants on their own measurements can be accounted for (Jahng et al., 2008).

To answer the research question, an LMM was used to investigate whether state gratitude predicts state loneliness. For the first sub-question, an LMM was run with state loneliness as dependent variable, and state gratitude and the category of trait gratitude (high/low) as predictors. Moreover, it was investigated whether there was an interaction effect between state gratitude and the category of trait gratitude in the association with state loneliness. Next, the data file was split, and two separate analyses were run. First, including

only those participants in the high trait gratitude group, an LMM was used to assess whether state gratitude predicts state loneliness. Second, another LMM was run to assess the association between state gratitude and state loneliness, including only participants in the low trait gratitude group. Moreover, spaghetti plots were created. First, two depicting the development of state gratitude and state loneliness across all measurements for the high trait gratitude group, and two displaying the development of state gratitude and state loneliness in the low trait gratitude group.

For the second sub-question, an LMM was run using state loneliness as dependent variable and state gratitude and the category of trait loneliness as the predictor variables. Here, it was explored whether there was an interaction effect between the category of trait loneliness and state gratitude in the relationship with state loneliness. Next, the data set was split. First, only participants in the high trait loneliness group were included. Then, an LMM was run with state loneliness as dependent, and state gratitude as independent variable. In the next step, the same LMM was run, including only those participants in the low trait loneliness category. In addition, spaghetti plots were created to illustrate the development of state gratitude and state loneliness in each trait level category across all measurements.

To see whether state gratitude at the previous measurement leads to less state loneliness at the next measurement point, another LMM was run. Here, state gratitude scores were shifted to the following measurement point, so that each state gratitude score was located at timepoint t+1. Then, the first measurement point of each day was deleted, since state gratitude from the previous day was disregarded due to the longer period (including a full night) between measurements. An LMM using the delayed state gratitude as predictor and the regular measurement of state loneliness as dependent variable was run.

Results

The average score of trait gratitude was 144.94 (*SD* = 16.91). Compared to the sample used by Morgan et al. (2017), these scores can be considered rather high. In their original study, the mean score was 108 (*SD* = 17.67). Moreover, the mean score of trait loneliness was 45.37 (*SD* = 10.82). This approximately resembles the student sample used to validate the measure (Russell, 1996, *M* = 40.08, *SD* = 9.50), and reflects a rather balanced level of trait loneliness. The respective scores per participant can be seen in Figure 1. Based on the 25th percentile, *n* = 9 participants were categorized as ‘high’, *n* = 17 were categorized as ‘average’, and *n* = 9 were categorized as ‘low’ in trait gratitude and trait loneliness.

Figure 1

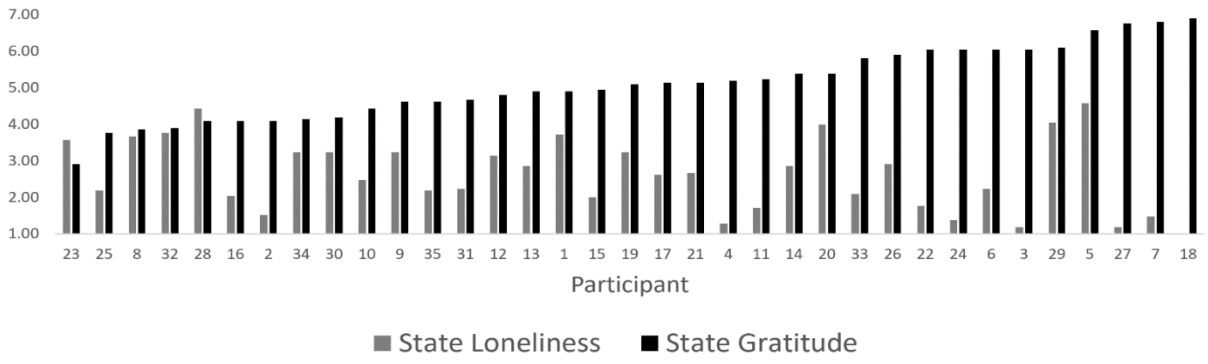
Trait Levels of Loneliness and Gratitude per Participant in Percentage

Note. 100% refers to the maximum score obtainable on the respective questionnaire. Data are ordered ascendingly according to the score on the MCGM.

Considering state levels in this sample (Figure 2), the mean score of state gratitude was 5.10 (*SD* = .97) and 2.62 (*SD* = .98) for state loneliness. Hence, state levels of gratitude were generally higher (around 68%) than state levels of loneliness, which was considerably lower (around 27%). Separated by trait category, the mean of state gratitude and loneliness differed. In the high trait gratitude group, it was 5.75 (*SD* = 1.41) for state gratitude and 2.62 (*SD* = 1.84) for state loneliness. In the low trait gratitude group, the mean was 4.28 (*SD* = 1.31) and 3.13 (*SD* = 1.42), respectively. Moreover, in the high trait lonely category, the means were 4.52 (*SD* = 1.50) and 3.59 (*SD* = 1.49), and in the low trait lonely group 5.70 (*SD* = 1.26) and 1.94 (*SD* = 1.30) for state gratitude and state loneliness.

Figure 2

Mean State Levels of Loneliness and Gratitude per Participant



Note. 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7), which indicated the degree to which they felt grateful or lonely in that moment, a higher score corresponds to higher levels of the construct. Data are ordered ascendingly according to the mean score in state gratitude.

The correlational analyses showed a strong and statistically significant positive relationship between the state person-mean and the trait levels of gratitude ($r = .67$, $p < .01$) and loneliness ($r = .66$, $p < .01$), respectively. Moreover, there was a moderate negative relationship between trait gratitude and trait loneliness ($r = -.48$, $p < .01$), trait gratitude and state loneliness (PM) ($r = -.39$, $p < .01$), and trait loneliness and state gratitude (PM) ($r = -.43$, $p < .01$). State levels (PM) of gratitude and loneliness were also correlated moderately negative ($r = -.37$, $p < .01$). Thus, gratitude and loneliness were negatively correlated, across all levels of the respective constructs.

State Gratitude and State Loneliness

To answer the first research question, an LMM was run with state loneliness as dependent variable and state gratefulness as predictor. There was a moderate negative association between state gratefulness and state loneliness (Table 1). In practice, many participants displayed an opposing pattern of state gratitude and state loneliness; when state gratitude was high, state loneliness was low and vice versa. Phases in which gratitude was high and state loneliness was low prevailed. Still, as suggested by the moderate nature of this association, there were instances where the two states equalled. An example can be seen in Figure 3. The participant experienced mostly high levels of gratitude and rather low levels of loneliness. In moments in which loneliness rose, however, gratitude decreased. Moreover, there were also a few instances where state gratitude and state loneliness moved in the same direction which can be seen in Figure 8. Here, participant 1, who was high in trait gratitude first showed opposing tendencies in the relationship between both state measures, with gratitude generally remaining around higher levels. Towards the last six measurements, however, both constructs developed rather similarly. While this pattern was displayed rarely in such clear terms, a few participants also showed simultaneous movements of state gratitude and state loneliness at fewer measurements and in less extreme fluctuations.

Table 1

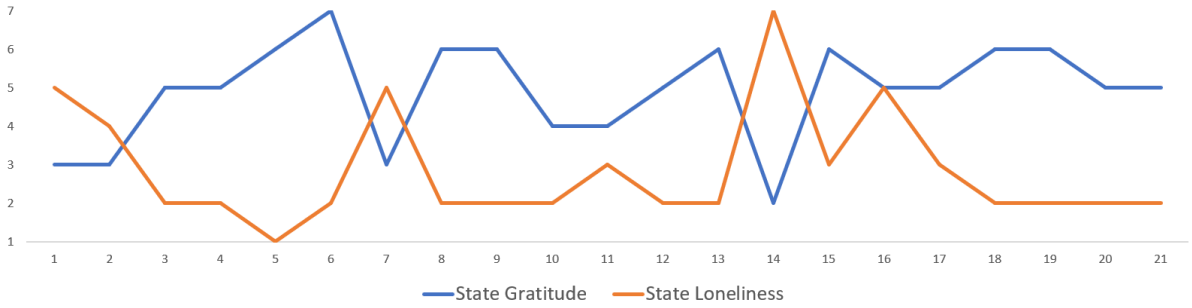
Parameter Estimates of State Gratitude and Lagged State Gratitude on State Loneliness

Parameter	β[a]	Std. Error	*t*	df	*p*	95% CI		*F*
State Gratitude	-.38	.03	-10.66	716.23	<.001*	-.45	-.31	113.61
State Gratitude t+1	-.06	.05	-1.23	471.05	.218	-.15	.03	1.52

[a] β = standardized beta coefficient.
* $p < .05$

Figure 3

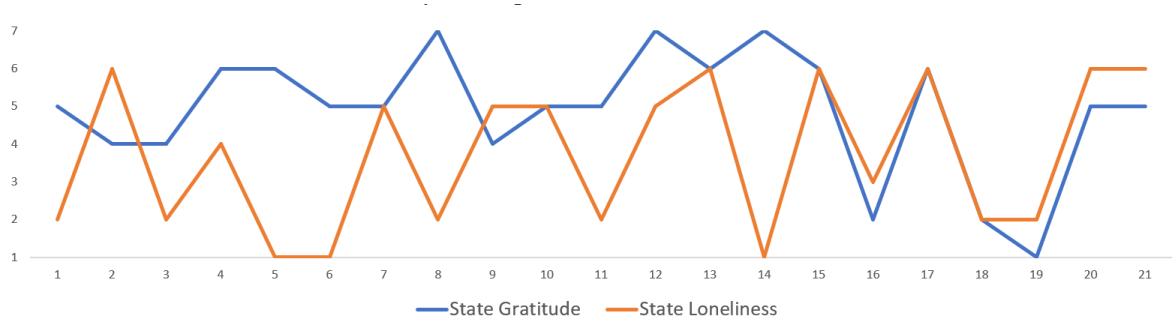
State Gratitude and State Loneliness of Participant 13 across One Week



Note. Participant 13 was in the average category of trait loneliness and the low category of trait gratitude.

Figure 4

State Gratitude and State Loneliness of Participant 1 across One Week



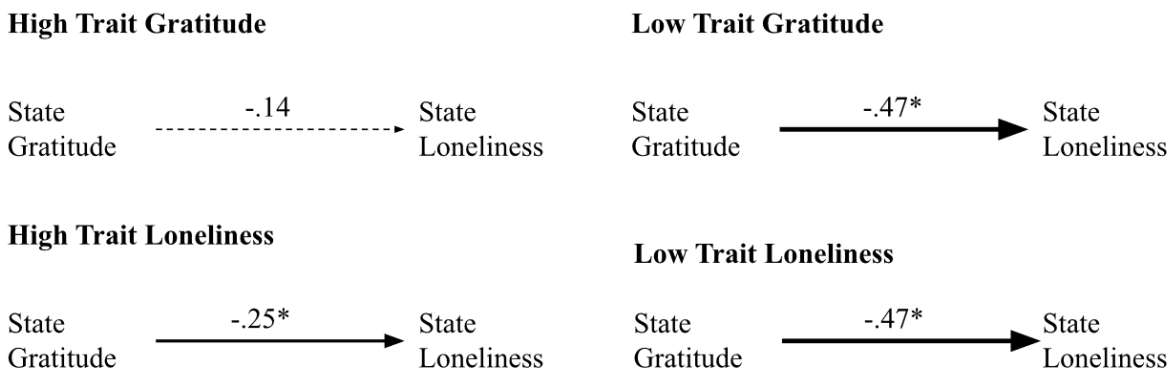
Note. Participant 1 was in the average category of trait loneliness and the high category of trait gratitude.

The association between state gratitude and state loneliness differed between the trait levels of gratitude and loneliness, which can be seen in Figure 5. Considering research question 1a, the LMM showed that there was a significant interaction effect between the category of trait gratitude (high/low) and state gratitude in association with state loneliness, β = .32, *SE* = .11, p = .004, 95% CI [.10, .53]. Hence, separate analyses were run for each category. For the high trait gratitude group, there was no significant association between state gratitude and state loneliness, β = -.14, *SE* = .09, p = .092, 95% CI [-.32, .02]. In contrast, for the low trait gratitude group, there was a moderate negative association between state gratitude and state loneliness, β = -.47, *SE* = .07, p < .001, 95% CI [-.60, -.34]. Hence, state gratitude predicted levels of state loneliness only in the low trait gratitude group.

As visible in Figure 6, the low trait gratitude group was more concentrated in the mid-levels of state gratitude. Still, a maximum level of gratitude was achieved three times, each by a different participant. Generally, fluctuations were less extreme. Compared to the high trait gratitude group, the lowest level of state gratitude was slightly more frequent. This group was also rather clustered around low to mid-levels of state loneliness. Considering the

Figure 5

Differences in the Association between State Gratitude and State Loneliness per Trait Category



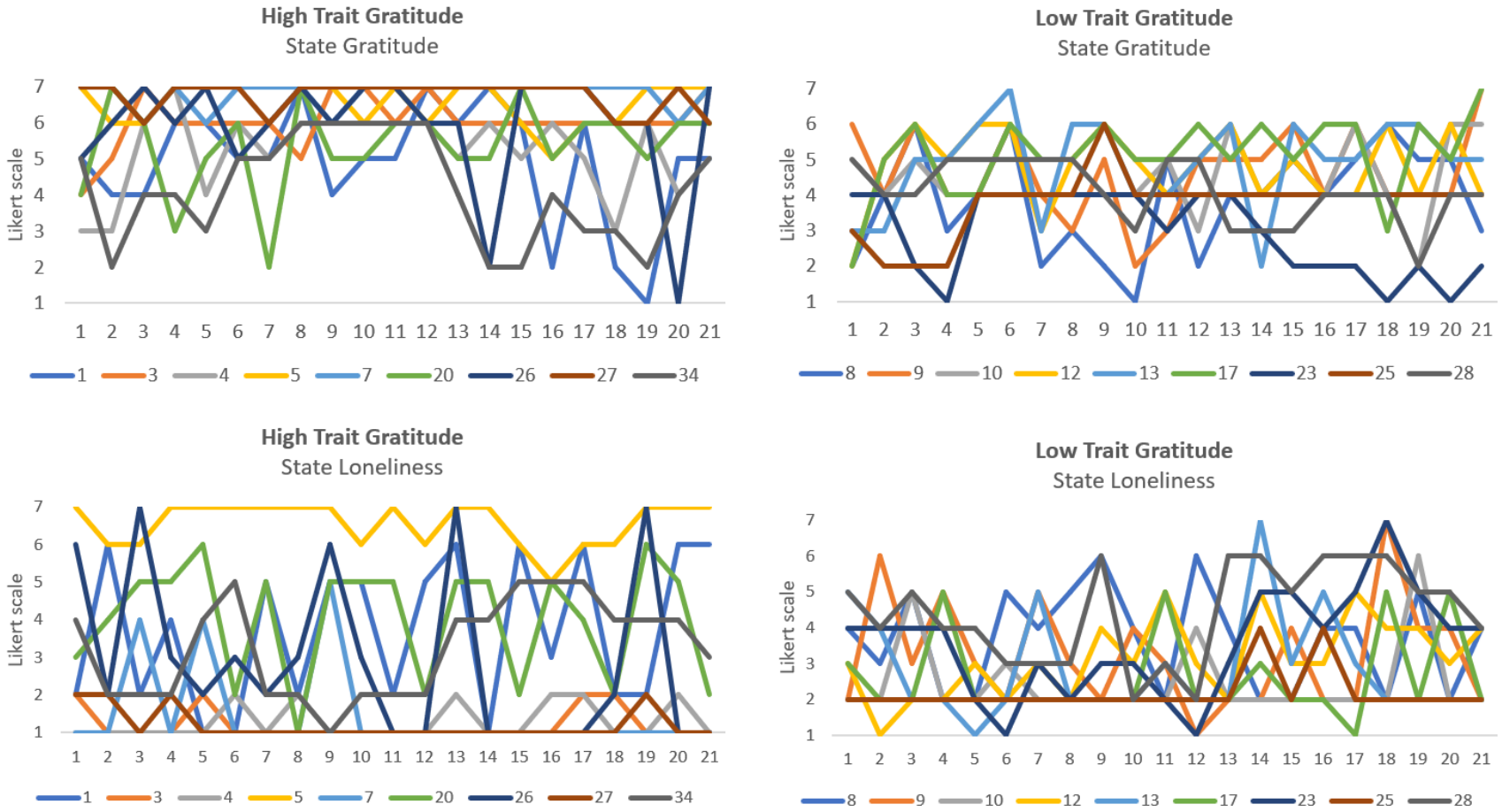
Note. The number refers to the standardized beta coefficient.
* $p < .05$.

relationship between gratitude and loneliness, opposing tendencies can be identified. For example, participant 9, 13, 17, 23 and 28 showed opposing tendencies. However, this is not all the case for participant 25, where there seemed to be no connection between fluctuations in both constructs.

The high trait gratitude group was very concentrated around high state levels of gratitude. While there were also low scores of state gratitude present, these were more fluctuating in nature; scores were not clustered in the low range of state gratitude. Moreover, in the middle of the week, there were almost no low scores of state gratitude. In contrast, there was a lot of fluctuation in state loneliness. While scores were loosely clustered around mid-range levels of state loneliness, this did not represent a clear tendency. Specifically, participant 5 experienced a lot of loneliness, while equally experiencing high levels of gratitude. However, participant 34 shows clearer opposing tendencies; increases in state loneliness beginning at measurement 13 are followed by decreases in state gratitude. Other participants, for instance, participant 3 and 4 experienced constant higher levels of gratitude and only low levels of loneliness. Overall, the majority of participants showed rather constant levels of state gratitude regardless of loneliness, which would be in line with the non-significant association.

Figure 6

State Gratitude and Loneliness of Participants High and Low in Trait Gratitude across One Week



Note. 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7), which indicated the degree to which they felt grateful or lonely in that moment, a higher score corresponds to higher levels of the construct. Each line represents a single participant.

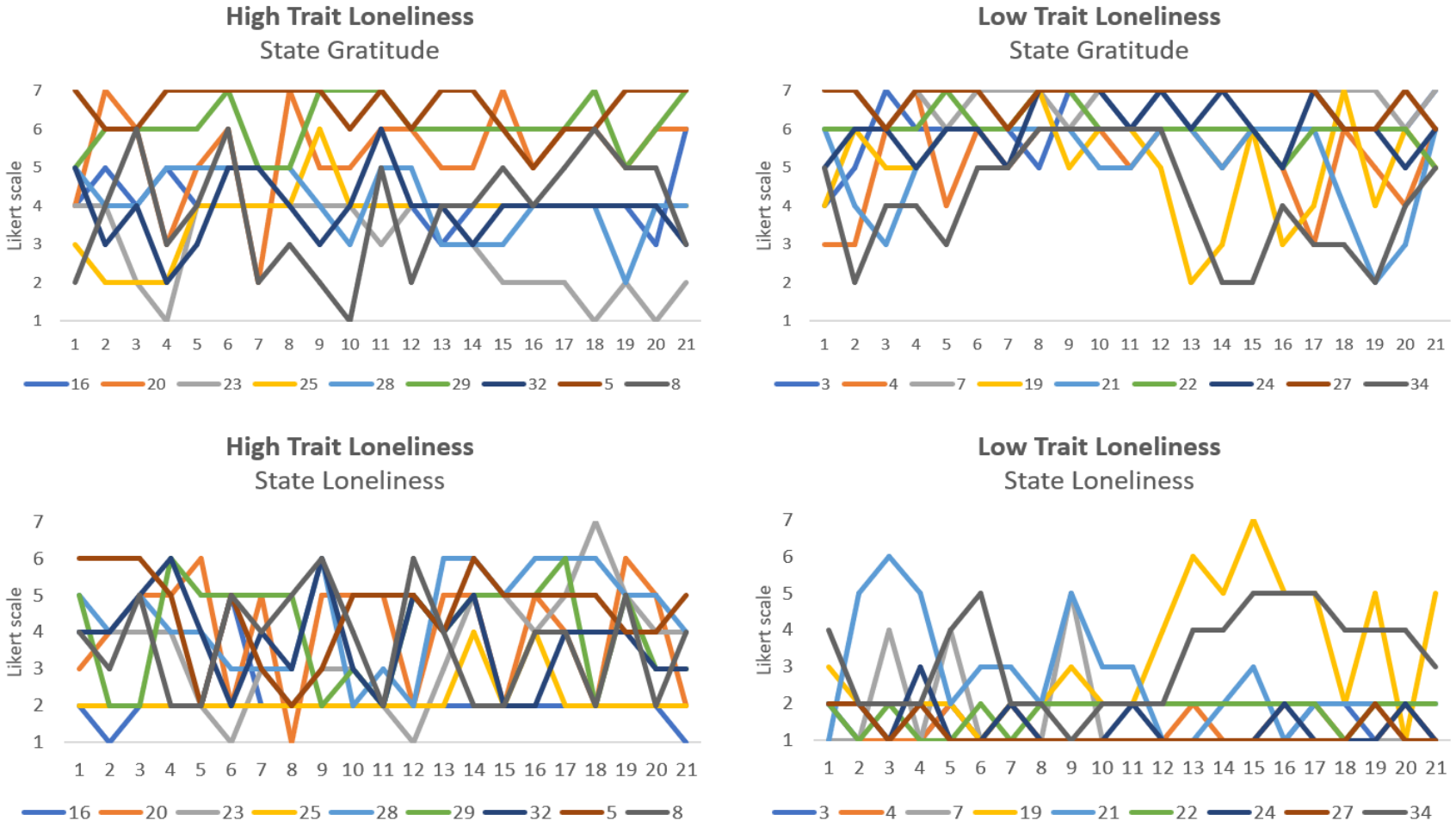
Moreover, with respect to research question 1b, an LMM indicated a significant interaction effect between the category of trait loneliness (high/low) and state gratitude in the association with state loneliness, β = .23, *SE* = .10, *p* = .022, 95% CI [.03, .43]. Therefore, each category was analysed independently. In the high trait loneliness group, state gratitude negatively predicted state loneliness, β = -.25, *SE* = .08, *p* = .002, 95% CI [-.40, -.09], this association was, however, small. Considering the low trait loneliness group, there was a significant, moderately negative association between state gratitude and state loneliness, β = -.47, *SE* = .06, *p* < .001, 95% CI [-.59, -.36]. Thus, state gratitude significantly predicted state loneliness in both groups.

As visible in Figure 7, state gratitude and state loneliness differed based on the trait level of loneliness. In the low trait loneliness group, state gratitude was concentrated around high levels with fluctuations towards low levels of gratitude. Around measurement 6 to 12, there were almost no low scores in state gratitude. Moreover, considering state loneliness in this group, an opposing tendency was visible. It was generally concentrated around low levels of state loneliness with some fluctuation towards high levels of state loneliness. It was also visible how some participants showed rather clear opposing movements in gratitude and loneliness. For example, participant 21 around measurement one to five, as well as participant 19 and 34, where peaks of state loneliness could be traced back directly to low levels of gratitude at these moments. Yet, as suggested by the moderate nature of the association, other participants showed no or less such tendencies. For instance, participants 4 and 7 had fluctuations in state gratitude which were not represented in changes in state loneliness, and participant 22 had constant high levels of gratitude and low levels of loneliness.

Looking at the high trait loneliness group, there were fewer clear connections visible. There was generally a stronger tendency towards higher levels of state loneliness. Most scores were clustered in the average levels while there was a lot of fluctuation. Participant 16 and 25 showed the fewest state loneliness, both having only very few peak experiences. However, they were an exception to the overall tendency. All other participants experienced more state loneliness than all participants in the low trait loneliness group. Considering state gratitude in this group, there was a lot of fluctuation visible, with no clear tendencies. Here, it was harder to identify whether peak experiences in loneliness were connected to low experiences of gratitude and vice versa. However, participant 23 indicated such patterns. For the other participants, the fluctuations were less clearly connected. Overall, this is in line with the small negative association between both constructs. There is a connection, but it is less strongly identifiable.

Figure 7

State Gratitude and Loneliness of Participants High and Low in Trait Loneliness across One Week



Note. 7-point Likert scale, ranging from "strongly disagree" (1) to "strongly agree" (7), which indicated the degree to which they felt grateful or lonely in that moment, a higher score corresponds to higher levels of the construct. Each line represents a single participant. The legend refers to the respective participant number.

Lagged Analysis

Lastly, to answer the last sub-question, a lagged analysis found that state gratitude at the previous measurement point did not significantly predict state loneliness at the following measurement (Table 1). Hence, increased levels of gratitude were not necessarily followed by less state loneliness later on. This can also be seen in Figure 3, where participant 13 had two instances where very high levels of state gratitude were followed by peaks in state loneliness (measurement 6 to 7 and measurement 13 to 14). In practice, however, there were also cases in which state gratitude constantly remained high across several measurements, with constantly low levels of state loneliness.

Discussion

This study aimed to examine state gratitude and state loneliness in the daily context, considering the trait levels of both constructs. More specifically, the design of this study considered the within-person effects and not merely between-person analyses. State gratitude and loneliness were associated negatively on the within-person level, while this association differed based on trait levels. In the high trait gratitude group, state gratitude and loneliness were not associated, in those high in trait loneliness, this association was small, while in low trait levels of both constructs the association was moderate. Lastly, the effect of state gratitude was not carried over across the next measurement on the same day, so that there was no association with state loneliness at the next measurement.

Main Findings

In line with expectations, those high in trait gratitude experienced state gratitude more frequently and state loneliness less frequently than their low trait gratitude counterparts. Similarly, those high in trait loneliness experienced state gratitude less frequently and state loneliness more frequently compared to the low trait loneliness group.

Furthermore, this study found a moderate negative association between state gratitude and state loneliness within individuals. Thus, an individual experiencing state gratitude did on average display less state loneliness at that moment, which aligns with previous findings (Bartlett & Arpin, 2019) and adds the momentary level to previous research describing a relationship between trait levels of gratitude and loneliness (Caputo, 2015; Ni et al., 2015; O'Connell et al., 2016).

In contrast to Wichers et al. (2007), who found a buffering effect of positive emotions against negative affect during stress, the current findings suggest that when loneliness rises, gratitude decreases and vice versa. In other words, both constructs seem rather incompatible,

which does not indicate buffering, where gratitude would specifically spike when loneliness rises.

According to the broaden-and-build theory, the experience of gratitude widens an individuals thought-action repertoire and thereby decreases the impact of negative emotions (Fredrickson, 2001; Garland et al., 2010). Nonetheless, the broaden-and-build theory does not consider daily fluctuations specifically, but merely suggests the broadening effect of positive affect momentarily and has shown that accumulation of such moments can lead to enduring resources. Research on this theory (e.g. Fredrickson, 2013) is perhaps more focused on the slope of increase in positive emotions and what effects the clustering of such emotions has. While the current study suggests that during the experience of gratitude individuals felt less lonely, it seems that these individuals were not able to maintain a broad attentional focus when loneliness increased but instead perceived gratitude as absent in those moments. This is in line with findings that negative emotions, such as fear, can increase selective attention (Finucane, 2011), and that state loneliness is associated with negative affect, withdrawal and a negative evaluation of social situations (Meng et al., 2020; van Winkel et al., 2017). While the association is bidirectional, gratitude prevailed loneliness most of the time and still implies that in moments of gratitude, loneliness is less present. Therefore, inducing gratitude can be beneficial. Consistently, a simple gratitude writing exercise had beneficial effects on loneliness in elderly people (Bartlett & Arpin, 2019). The present study implicates further that these types of interventions could help to reduce loneliness momentarily. Specifically, in light of a study that found that self-generating positive emotions can lead individuals to perceive themselves as more socially connected (Kok et al., 2013).

This study also revealed differences in the association between state gratitude and state loneliness depending on trait levels of gratitude. While for those being high in trait gratitude there was no significant association, for those low in trait gratitude there was a moderate negative association.

High trait gratitude was associated with a higher frequency of state gratitude and lower frequency of state loneliness, which aligns with previous research about increased prosociality and better relationships and availability of close others (Algoe et al., 2008; McCullough et al., 2002; O'Connell et al., 2018), as well as proneness to experience momentary gratitude (Emmons & Mishra, 2011). It seems reasonable that highly grateful individuals can identify gratitude regardless of momentary loneliness, which was not the case for those low in trait gratitude. These individuals reported fewer feelings of loneliness when they felt grateful and vice versa. Thus, they might experience a broader focus of attention

when experiencing gratitude, so that there is less experience of loneliness, and a narrower focus when feeling lonely. The former effect is in line with the broaden-and-build theory, while the latter is congruent with the idea that some negative emotions enhance selective attention (Finucane, 2011; Fredrickson, 2001; Garland et al., 2010), as well as the association of state loneliness with negative affect and withdrawal (Meng et al., 2020; van Winkel et al., 2017). Nonetheless, an important factor to understand how this relationship works might be the duration it takes to recover from such a negative emotion. In most cases, there were only short peaks of loneliness and gratitude outweighed loneliness most of the time. Individuals low in trait gratitude might be reactive to increases in loneliness, but quickly recover to higher levels of gratitude with correspondingly low levels of loneliness.

While those high in trait gratitude experienced loneliness as well, their gratitude was less affected by it. Grateful individuals might be more prone to experience gratitude for small pleasures (Watkins et al., 2004) regardless of loneliness. Similarly, they might be more nuanced in their experience of loneliness; experiencing one type of loneliness, such as the absence of a significant other or the absence of a network of friends (Weiss, 1973), while still feeling grateful for the other strain of interpersonal connection. As it can be hard to experience gratitude when loneliness rises, grateful individuals might possess a specific talent to experience gratitude despite loneliness. Overall, the repeated experience of gratitude may have led them to build enduring social resources (Fredrickson, 2001).

Considering trait loneliness, the association between state gratitude and state loneliness remained significant in both categories. Yet, those showing high levels of trait loneliness experienced a weaker association, while they experienced more state loneliness overall. For those low in trait loneliness, this association was moderate. This is in line with previous findings that lonely individuals evaluate situations as more negatively than less lonely individuals (Cacioppo & Hawkley, 2009; Hawkley & Cacioppo, 2010; Meng et al., 2020; van Winkel et al., 2017). Gratitude might not have a stronger association, as those very lonely individuals perceive situations generally as more negative compared to less lonely individuals. Hence, their loneliness might be less affected by the experience of gratitude. However, when they felt lonely, their gratitude was similarly less impacted. Nonetheless, the experience of negative, distressing feelings can narrow the focus of attention and lead individuals to enter a negative spiral, increasing the frequency of such negative feelings (Fredrickson, 2001; Garland et al., 2010). A recent study has shown that individuals with high loneliness react quicker to angry stimuli and slower to happy stimuli compared to a control condition, further emphasising the difference in focus (Grennan et al., 2021). In

contrast, those low in trait loneliness might experience the association between gratitude and loneliness similar to those low in trait gratitude.

Lastly, this study did not find a carry-over effect of gratitude, which means that the association between gratitude and loneliness did not remain in place at the following measurement. This was expected as the broaden-and-build theory argues that the experience of a positive psychological construct might lead individuals to enter a positive spiral, experiencing the respective emotion more frequently and building enduring social resources as a result (Fredrickson, 2001; Garland et al., 2010). However, the current study examined merely whether gratitude had a lasting effect of a few hours. Likely, it takes a significantly longer time to build such enduring resources so that short term effects are not present. Moreover, as moods of gratitude and loneliness both are temporary and closely related to situational factors (McCullough et al., 2001; McCullough et al., 2004; Rosenberg, 1998), and even the time of the day (van Roekel et al., 2018), they might simply not last long enough to exert a significant influence over the course of several hours.

Strengths and Limitations

The broaden-and-build theory has a large scientific foundation by now (see Fredrickson, 2013 for an overview), consisting of many study designs. Yet ESM studies are scarce. To the best of our knowledge, Wichers et al. (2007) offer the only other application of ESM considering both positive and negative constructs, while Hartmann et al. (2015) assessed only positive affect during an RCT. Hence, a strength of this study was the momentary and unobtrusive design, assessing gratitude and loneliness across one week. These data can be considered higher in ecological validity than cross-sectional data. The current study allowed the observation of the constructs developed and included the natural fluctuations within and between individuals. Additionally, the strong correlations between trait and state measures of gratitude and loneliness indicate good convergent validity, one item for each construct depicted the underlying construct correctly. Considering trait levels of gratitude and loneliness, both showed high internal consistency so that they allowed for a reliable measurement. This is particularly important, as the trait levels offered an important basis for this study.

However, several limitations apply to this study. Generally, the trait levels of gratitude within this study were higher than those in the sample used to validate the questionnaire (Morgan et al., 2017). A possible explanation could be the sample which consisted of psychology students at a university with a focus on positive psychology. Hence, participants might be specifically sensitive to positive emotions. Moreover, the categorisation

of high and low trait levels was arbitrary and based on the distribution in this specific study. Trends could deviate in samples where there is a more balanced distribution of trait gratitude. The distribution based on percentiles resulted in fewer cases in the respective analyses of trait levels, potentially distorting the results.

Another limitation concerns the technological realization of this study. There have been technical difficulties with the TiiM application, which led questions not to disappear after two hours as intended. Therefore, those questions might have been answered later that day, so that while answering too late, participants might be more prone to a false recollection of how they felt earlier or simply answered the questions with the current mood in mind. This, however, affects ecological validity as the study had specific timeslots spread across the day to maximise the validity.

Lastly, trait levels in this study were assessed after all momentary data were gathered. Therefore, participants might have been influenced by their previous answers. Consciously reporting levels of gratitude and loneliness 21 times might have led individuals to reflect differently on how they generally assess their gratitude and loneliness.

Future Research

While this study certainly found trends across different trait levels of constructs, future research should consider larger samples, so that distributions based on trait levels include more cases and increased statistical power. It could be valuable to study both constructs during an even longer period, which might depict trends more accurately. In a similar vein, it could be interesting to examine trait levels of the constructs before and after collection of momentary data. This might explain more precisely whether aggregation of state gratitude, for instance, leads to longer-lasting increases in trait levels of gratitude, as proposed by Garland et al. (2010). Including a question assessing whether there is a subjective buffering effect could also be insightful. Considering the carry-over effects of gratitude on loneliness at the next measurement, it might be valuable to study differences between different trait levels.

Lastly, the data of this study were collected before the outbreak of the SARS-CoV-2 pandemic. Future research should investigate how the lockdown and social distancing affect the relationship between gratitude and loneliness. It would be interesting to find out whether the effect grew stronger, as individuals might be increasingly grateful for the very few social contacts that are possible, or whether gratitude generally decreased as mental health seems to be affected negatively by the pandemic (e.g. Cullen et al., 2020).

Implications and Conclusion

The results of this study have several implications. High levels of trait gratitude lead individuals to remain grateful even in times of loneliness. Moreover, momentary gratitude and loneliness were oppositional in general, so that interventions, such as gratitude writing, can be beneficial to reduce loneliness momentarily. To understand how gratitude specifically reduces loneliness, investigating how exactly gratitude translates, and whether gratitude in moments of loneliness results in specific, prosocial behaviours is crucial. Moreover, understanding how highly grateful individuals conceptualise gratitude will be essential to understand what enables them to remain grateful despite loneliness. As the association between gratitude and loneliness was decreased for those high in trait loneliness, these individuals might require more tailored solutions to benefit from gratitude. This is pertinent since loneliness is associated with depression and decreased mental health (Beutel et al., 2017; Erzen & Çikrikci, 2018).

In conclusion, the results of this study suggest that high trait levels of gratitude or loneliness are associated with the more frequent experience of the respective construct and less momentary experience of the other construct. Moreover, state gratitude and state loneliness were associated moderately, meaning that they cancel each other out to a certain extent and are relatively incompatible. This effect was weaker among highly lonely individuals, while highly grateful individuals experienced gratitude regardless of their current level of loneliness. Gratefulness might therefore reduce emotional reactivity in lonely situations. Thus, accumulated gratitude is an asset, potentially incorporating enduring resources. Lastly, gratitude is fleeting and one cannot suppose that gratitude at one moment preempts loneliness later on. Still, state gratitude was associated with less momentary state loneliness and therefore, interventions inducing gratitude may be beneficial to reduce state loneliness.

References

Adam, J. T. (2020). *How the company of others and being alone affect feelings of loneliness and gratitude : an experience sampling study* [Bachelor's thesis, University of Twente]. http://essay.utwente.nl/80442/

Algoe, S. B., Haidt, J., & Gable, S. L. (2008). Beyond reciprocity: gratitude and relationships in everyday life. *Emotion (Washington, D.C.), 8*(3), 425-429. https://doi.org/10.1037/1528-3542.8.3.425

Bartlett, M. Y., & Arpin, S. N. (2019). Gratitude and loneliness: Enhancing health and well-being in older adults. *Research on Aging, 41*(8), 772-793. https://doi.org/10.1177/0164027519845354

Berkel, N. v., Ferreira, D., & Kostakos, V. (2017). The Experience Sampling Method on Mobile Devices. *ACM Comput. Surv., 50*(6), Article 93. https://doi.org/10.1145/3123988

Beutel, M. E., Klein, E. M., Brähler, E., Reiner, I., Jünger, C., Michal, M., Wiltink, J., Wild, P. S., Münzel, T., Lackner, K. J., & Tibubos, A. N. (2017, Mar 20). Loneliness in the general population: prevalence, determinants and relations to mental health. *BMC Psychiatry, 17*(1), 97. https://doi.org/10.1186/s12888-017-1262-x

Buecker, S., Maes, M., Denissen, J. J. A., Luhmann, M., & Laceulle, O. M. (2020). Loneliness and the Big Five Personality Traits: A Meta-analysis. *European Journal of Personality, 34*(1), 8-28. https://doi.org/10.1002/per.2229

Cacioppo, J. T., & Hawkley, L. C. (2009). Perceived social isolation and cognition. *Trends in Cognitive Sciences, 13*(10), 447-454. https://doi.org/10.1016/j.tics.2009.06.005

Caputo, A. (2015). The Relationship Between Gratitude and Loneliness: The Potential Benefits of Gratitude for Promoting Social Bonds. *Europe's journal of psychology, 11*(2), 323-334. https://doi.org/10.5964/ejop.v11i2.826

Caspi, A., Harrington, H., Moffitt, T. E., Milne, B. J., & Poulton, R. (2006). Socially Isolated Children 20 Years Later: Risk of Cardiovascular Disease. *Archives of Pediatrics & Adolescent Medicine, 160*(8), 805-811. https://doi.org/10.1001/archpedi.160.8.805

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2 ed.). Lawrence Erlbaum Associates.

Cullen, W., Gulati, G., & Kelly, B. D. (2020). Mental health in the COVID-19 pandemic. *QJM: An International Journal of Medicine, 113*(5), 311-312. https://doi.org/10.1093/qjmed/hcaa110

Curran, P. J., & Bauer, D. J. (2010). The Disaggregation of Within-Person and Between-Person Effects in Longitudinal Models of Change. *Annual Review of Psychology, 62*(1), 583-619. https://doi.org/10.1146/annurev.psych.093008.100356

DeWall, C. N., Lambert, N. M., Pond, R. S., Jr., Kashdan, T. B., & Fincham, F. D. (2012). A grateful heart is a nonviolent heart: Cross-sectional, experience sampling, longitudinal, and experimental evidence. *Social Psychological and Personality Science, 3*(2), 232-240. https://doi.org/10.1177/1948550611416675

Dickens, L. R. (2017, 2017/07/04). Using Gratitude to Promote Positive Change: A Series of Meta-Analyses Investigating the Effectiveness of Gratitude Interventions. *Basic and Applied Social Psychology, 39*(4), 193-208. https://doi.org/10.1080/01973533.2017.1323638

Emmons, R. A., & McCullough, M. E. (2003). Counting blessings versus burdens: An experimental investigation of gratitude and subjective well-being in daily life. *Journal of Personality and Social Psychology, 84*(2), 377-389. https://doi.org/10.1037/0022-3514.84.2.377

Emmons, R. A., & Mishra, A. (2011). Why Gratitude Enhances Well-Being: What We Know, What We Need to Know. In *Designing positive psychology: Taking stock and moving forward* (pp. 248-262). Oxford University Press. https://oxford.universitypressscholarship.com/view/10.1093/acprof:oso/9780195373585.001.0001/acprof-9780195373585-chapter-16

Erzen, E., & Çikrikci, Ö. (2018, 2018/08/01). The effect of loneliness on depression: A meta-analysis. *International Journal of Social Psychiatry, 64*(5), 427-435. https://doi.org/10.1177/0020764018776349

Etikan, I. (2016). Comparison of convenience sampling and purposive sampling. *American journal of theoretical and applied statistics, 5*(1), 1-4.

Finucane, A. M. (2011). The effect of fear and anger on selective attention. *Emotion, 11*(4), 970-974. https://doi.org/10.1037/a0022574

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotions [Article]. *American Psychologist, 56*(3), 218-226. https://doi.org/10.1037/0003-066X.56.3.218

Fredrickson, B. L. (2013). Chapter One - Positive Emotions Broaden and Build. In P. Devine & A. Plant (Eds.), *Advances in Experimental Social Psychology* (Vol. 47, pp. 1-53). Academic Press. https://doi.org/https://doi.org/10.1016/B978-0-12-407236-7.00001-2

Gallagher, S., Solano, A. C., & Liporace, M. F. (2020, 2020/07/01/). State, but not trait gratitude is associated with cardiovascular responses to acute psychological stress. *Physiology & Behavior, 221*, 112896. https://doi.org/10.1016/j.physbeh.2020.112896

Garland, E. L., Fredrickson, B., Kring, A. M., Johnson, D. P., Meyer, P. S., & Penn, D. L. (2010, 2010/11/01/). Upward spirals of positive emotions counter downward spirals of negativity: Insights from the broaden-and-build theory and affective neuroscience on the treatment of emotion dysfunctions and deficits in psychopathology. *Clinical Psychology Review, 30*(7), 849-864. https://doi.org/https://doi.org/10.1016/j.cpr.2010.03.002

Grennan, G., Balasubramani, P. P., Alim, F., Zafar-Khan, M., Lee, E. E., Jeste, D. V., & Mishra, J. (2021). Cognitive and Neural Correlates of Loneliness and Wisdom during Emotional Bias. *Cerebral Cortex*. https://doi.org/10.1093/cercor/bhab012

Gulliford, L., & Morgan, B. (2018). The meaning and valence of gratitude in positive psychology. In N. J. L. Brown, T. Lomas, & F. J. Eiroa-Orosa (Eds.), *The Routledge international handbook of critical positive psychology.* (pp. 53-69). Routledge/Taylor & Francis Group.

Hartmann, J. A., Wichers, M., Menne-Lothmann, C., Kramer, I., Viechtbauer, W., Peeters, F., Schruers, K. R. J., van Bemmel, A. L., Myin-Germeys, I., Delespaul, P., van Os, J., & Simons, C. J. P. (2015). Experience Sampling-Based Personalized Feedback and Positive Affect: A Randomized Controlled Trial in Depressed Patients. *PLOS ONE, 10*(6), e0128095. https://doi.org/10.1371/journal.pone.0128095

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness Matters: A Theoretical and Empirical Review of Consequences and Mechanisms. *Annals of Behavioral Medicine, 40*(2), 218-227. https://doi.org/10.1007/s12160-010-9210-8

Hawkley, L. C., Hughes, M. E., Waite, L. J., Masi, C. M., Thisted, R. A., & Cacioppo, J. T. (2008). From Social Structural Factors to Perceptions of Relationship Quality and Loneliness: The Chicago Health, Aging, and Social Relations Study. *The Journals of Gerontology: Series B, 63*(6), S375-S384. https://doi.org/10.1093/geronb/63.6.S375

Hawkley, L. C., Masi, C. M., Berry, J. D., & Cacioppo, J. T. (2006). Loneliness is a unique predictor of age-related differences in systolic blood pressure. *Psychology and Aging, 21*(1), 152-164. https://doi.org/10.1037/0882-7974.21.1.152

Jahng, S., Wood, P. K., & Trull, T. J. (2008). Analysis of affective instability in ecological momentary assessment: Indices using successive difference and group comparison via multilevel modeling. *Psychological Methods, 13*(4), 354-375. https://doi.org/10.1037/a0014173

Jans-Beken, L., Jacobs, N., Janssens, M., Peeters, S., Reijnders, J., Lechner, L., & Lataster, J. (2019, 2019/07/04). Reciprocal relationships between State gratitude and high- and low-arousal positive affects in daily life: A time-lagged ecological assessment study. *The Journal of Positive Psychology, 14*(4), 512-527. https://doi.org/10.1080/17439760.2018.1497684

Kok, B. E., Coffey, K. A., Cohn, M. A., Catalino, L. I., Vacharkulksemsuk, T., Algoe, S. B., Brantley, M., & Fredrickson, B. L. (2013, 2013/07/01). How Positive Emotions Build Physical Health: Perceived Positive Social Connections Account for the Upward Spiral Between Positive Emotions and Vagal Tone. *Psychological Science, 24*(7), 1123-1132. https://doi.org/10.1177/0956797612470827

Lambert, N. M., Graham, S. M., & Fincham, F. D. (2009, 2009/09/01). A Prototype Analysis of Gratitude: Varieties of Gratitude Experiences. *Personality and Social Psychology Bulletin, 35*(9), 1193-1207. https://doi.org/10.1177/0146167209338071

Matthews, T., Danese, A., Gregory, A. M., Caspi, A., Moffitt, T. E., & Arseneault, L. (2017). Sleeping with one eye open: loneliness and sleep quality in young adults. *Psychological Medicine, 47*(12), 2177-2186. https://doi.org/10.1017/S0033291717000629

McCullough, M. E., Emmons, R. A., & Tsang, J. A. (2002). The grateful disposition: A conceptual and empirical topography. *Journal of Personality and Social Psychology, 82*(1), 112-127. https://doi.org/10.1037/0022-3514.82.1.112

McCullough, M. E., Kilpatrick, S. D., Emmons, R. A., & Larson, D. B. (2001, Mar). Is gratitude a moral affect? *Psychological Bulletin, 127*(2), 249-266. https://doi.org/10.1037/0033-2909.127.2.249

McCullough, M. E., Tsang, J. A., & Emmons, R. A. (2004). Gratitude in Intermediate Affective Terrain: Links of Grateful Moods to Individual Differences and Daily Emotional Experience [Article]. *Journal of Personality and Social Psychology, 86*(2), 295-309. https://doi.org/10.1037/0022-3514.86.2.295

McGuire, A. P., Szabo, Y. Z., Murphy, K. M., & Erickson, T. M. (2020). Direct and indirect effects of trait and state gratitude on health-related quality of life in a prospective design. *Psychological Reports, 123*(6), 2248-2262. https://doi.org/10.1177/0033294119868784

Meng, J., Wang, X., Wei, D., & Qiu, J. (2020, 2020/10/15/). State loneliness is associated with emotional hypervigilance in daily life: A network analysis. *Personality and Individual Differences, 165*, 110154. https://doi.org/https://doi.org/10.1016/j.paid.2020.110154

Montag, C., Duke, É., & Markowetz, A. (2016). Toward Psychoinformatics: Computer Science Meets Psychology [Review]. *Computational and Mathematical Methods in Medicine, 2016*, Article 2983685. https://doi.org/10.1155/2016/2983685

Morgan, B., Gulliford, L., & Kristjánsson, K. (2017, 2017/03/01/). A new approach to measuring moral virtues: The Multi-Component Gratitude Measure. *Personality and Individual Differences, 107*, 179-189. https://doi.org/https://doi.org/10.1016/j.paid.2016.11.044

Mund, M., Freuding, M. M., Möbius, K., Horn, N., & Neyer, F. J. (2019, 2020/02/01). The Stability and Change of Loneliness Across the Life Span: A Meta-Analysis of Longitudinal Studies. *Personality and Social Psychology Review, 24*(1), 24-52. https://doi.org/10.1177/1088868319850738

Myin-Germeys, I., Kasanova, Z., Vaessen, T., Vachon, H., Kirtley, O., Viechtbauer, W., & Reininghaus, U. (2018). Experience sampling methodology in mental health research: new insights and technical developments. *World Psychiatry, 17*(2), 123-132. https://doi.org/10.1002/wps.20513

Newall, N. E., Chipperfield, J. G., Clifton, R. A., Perry, R. P., Swift, A. U., & Ruthig, J. C. (2009). Causal beliefs, social participation, and loneliness among older adults: A longitudinal study. *Journal of Social and Personal Relationships, 26*(2-3), 273-290. https://doi.org/10.1177/0265407509106718

Ni, S., Yang, R., Zhang, Y., & Dong, R. (2015). Effect of gratitude on loneliness of Chinese college students: Social support as a mediator. *Social Behavior and Personality: An International Journal, 43*(4), 559-566. https://doi.org/10.2224/sbp.2015.43.4.559

O'Connell, B. H., O'Shea, D., & Gallagher, S. (2016, 2016/08/01/). Mediating effects of loneliness on the gratitude-health link. *Personality and Individual Differences, 98*, 179-183. https://doi.org/10.1016/j.paid.2016.04.042

O'Connell, B. H., O'Shea, D., & Gallagher, S. (2018, 2018/12/01). Examining Psychosocial Pathways Underlying Gratitude Interventions: A Randomized Controlled Trial. *Journal of Happiness Studies, 19*(8), 2421-2444. https://doi.org/10.1007/s10902-017-9931-5

Perissinotto, C. M., Stijacic Cenzer, I., & Covinsky, K. E. (2012). Loneliness in Older Persons: A Predictor of Functional Decline and Death. *Archives of Internal Medicine, 172*(14), 1078-1084. https://doi.org/10.1001/archinternmed.2012.1993

Pinquart, M., & Sorensen, S. (2001, 2001/12/01). Influences on Loneliness in Older Adults: A Meta-Analysis. *Basic and Applied Social Psychology, 23*(4), 245-266. https://doi.org/10.1207/S15324834BASP2304_2

Reissmann, A., Hauser, J., Stollberg, E., Kaunzinger, I., & Lange, K. W. (2018, 2018/11/01/). The role of loneliness in emerging adults' everyday use of facebook – An experience sampling approach. *Computers in Human Behavior, 88*, 47-60. https://doi.org/10.1016/j.chb.2018.06.011

Rico-Uribe, L. A., Caballero, F. F., Martín-María, N., Cabello, M., Ayuso-Mateos, J. L., & Miret, M. (2018). Association of loneliness with all-cause mortality: A meta-analysis. *PLOS ONE, 13*(1), e0190033. https://doi.org/10.1371/journal.pone.0190033

Rosenberg, E. L. (1998, 1998/09/01). Levels of Analysis and the Organization of Affect. *Review of General Psychology, 2*(3), 247-270. https://doi.org/10.1037/1089-2680.2.3.247

Russell, D. W. (1996, 1996/02/01). UCLA Loneliness Scale (Version 3): Reliability, Validity, and Factor Structure. *Journal of Personality Assessment, 66*(1), 20-40. https://doi.org/10.1207/s15327752jpa6601_2

Simons, M., Lataster, J., Peeters, S., Reijnders, J., Janssens, M., & Jacobs, N. (2020, 2020/08/01). Sense of Abundance is Associated with Momentary Positive and Negative Affect: An Experience Sampling Study of Trait Gratitude in Daily Life. *Journal of Happiness Studies, 21*(6), 2229-2236. https://doi.org/10.1007/s10902-019-00181-z

Spence, J. R., Brown, D. J., Keeping, L. M., & Lian, H. (2014, 2014/09/01). Helpful Today, But Not Tomorrow? Feeling Grateful as a Predictor of Daily Organizational Citizenship Behaviors [https://doi.org/10.1111/peps.12051]. *Personnel Psychology, 67*(3), 705-738. https://doi.org/https://doi.org/10.1111/peps.12051

Tam, K. Y. Y., & Chan, C. S. (2019, 2019/04/15/). The effects of lack of meaning on trait and state loneliness: Correlational and experience-sampling evidence. *Personality and Individual Differences, 141*, 76-80. https://doi.org/10.1016/j.paid.2018.12.023

The BMS Lab. (n.d.). *The Incredible Intervention Machine*. https://bmslab.utwente.nl/the-incredible-intervention-machine-tiim/

van Roekel, E., Scholte, R. H. J., Engels, R. C. M. E., Goossens, L., & Verhagen, M. (2014, 2015/10/01). Loneliness in the Daily Lives of Adolescents: An Experience Sampling Study Examining the Effects of Social Contexts. *The Journal of Early Adolescence, 35*(7), 905-930. https://doi.org/10.1177/0272431614547049

van Roekel, E., Verhagen, M., Engels, R. C. M. E., Scholte, R. H. J., Cacioppo, S., & Cacioppo, J. T. (2018, 2018/11/02). Trait and State Levels of Loneliness in Early and Late Adolescents: Examining the Differential Reactivity Hypothesis. *Journal of*

Clinical Child & Adolescent Psychology, *47*(6), 888-899. https://doi.org/10.1080/15374416.2016.1146993

van Winkel, M., Wichers, M., Collip, D., Jacobs, N., Derom, C., Thiery, E., Myin-Germeys, I., & Peeters, F. (2017, 2017/04/03). Unraveling the Role of Loneliness in Depression: The Relationship Between Daily Life Experience and Behavior. *Psychiatry*, *80*(2), 104-117. https://doi.org/10.1080/00332747.2016.1256143

Visserman, M. L., Righetti, F., Impett, E. A., Keltner, D., & Van Lange, P. A. M. (2018). It's the motive that counts: Perceived sacrifice motives and gratitude in romantic relationships. *Emotion*, *18*(5), 625-637. https://doi.org/10.1037/emo0000344

Wallisch-Prinz, L. (2020). *Measuring feelings of self-compassion and stress in daily life : an experience sampling study* [bachelor's thesis, University of Twente]. http://essay.utwente.nl/80787/

Watkins, P. C., Grimm, D. L., & Kolts, R. (2004, 2004/03/01). Counting your blessings: Positive memories among grateful persons. *Current Psychology*, *23*(1), 52-67. https://doi.org/10.1007/s12144-004-1008-z

Weiss, R. S. (1973). *Loneliness: The experience of emotional and social isolation*. The MIT Press.

Wichers, M. c., Myin-Germeys, I., Jacobs, N., Peeters, F., Kenis, G., Derom, C., Vlietinck, R., Delespaul, P., & Van Os, J. (2007). Evidence that moment-to-moment variation in positive emotions buffer genetic risk for depression: a momentary assessment twin study. *Acta Psychiatrica Scandinavica*, *115*(6), 451-457. https://doi.org/10.1111/j.1600-0447.2006.00924.x

Wood, A. M., Maltby, J., Stewart, N., Linley, P. A., & Joseph, S. (2008). A Social-Cognitive Model of Trait and State Levels of Gratitude. *Emotion*, *8*(2), 281-290. https://doi.org/10.1037/1528-3542.8.2.281