# How the Company of Others and Being Alone Affect Feelings of Loneliness and Gratitude – An Experience Sampling Study.

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Bachelor Thesis

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January 23rd, 2020

## Abstract

**Background.** Gratitude as a psychological resource to alleviate or even prevent loneliness in people gains increasing attention. Gratitude exercises are increasingly being used to minimize loneliness. But there is a lack of research on how these two concepts are associated daily and whether it differs when we are surrounded by other people and when being alone. Insight into such differences can contribute to improved ecological momentary gratitude interventions (EMI), by adapting exercises to the specific social context. **Objective.** The present study investigated the daily association between gratitude and loneliness when surrounded by intimate others, non-intimate others, and when being alone. In that respect, differences between individuals with different trait levels have been explored. **Method.** An online experience sampling study with 34 college students (*M age* = 20.65) was conducted over the course of seven days. The UCLA Loneliness Scale and the Multi-Component Gratitude Measure were used to assess trait loneliness and gratitude. During the seven days, participants indicated three times a day how grateful and lonely they feel and with which people they are with at the moment. **Results.** All individuals feel most lonely when they are alone and most grateful when together with intimate others. Highly trait grateful people also feel grateful when they are alone. *Daily association:* A moderate negative trait-like association was found in aloneness and intimate company. A gratitude score at a certain time point – when being alone or with intimate others – is influenced by a person's average level of (state) loneliness. A weak to moderate negative momentary association was found in all contexts. A higher gratitude score at a time point is associated with a lower loneliness score at that time point and vice versa. Only (trait) lonely people show negative as well as positive momentary associations. **Conclusion.** Inferences about daily feelings of gratitude and loneliness based on a simple trait measure should be made with caution. (1) Before recommending gratitude interventions trait levels of loneliness and gratitude should be assessed together as well as state levels over a certain time period. (2) Daily gratitude and loneliness are differently affected by the type of people who are around and by aloneness. *Wider implication:* High lonely-little grateful people seem to lack the ability to reflect on the good and appreciative things in their life when being alone. It is recommended that EMIs adapt their exercises to the social situation: when being alone exercises focus on the person themselves and non-human things, when together with close people exercises focus on other people and/or the relationship itself.

**How the Company of Others and Being Alone Affect Feelings of Loneliness and Gratitude – An Experience Sampling Study**

The relationship between loneliness and gratitude has gained increasing attention in the last decade. Grateful people tend to show fewer feelings of loneliness (Bartlett & Arpin, 2019; Frinking et al., 2019;), perceive their interpersonal relationships as more positive (O'Connell et al., 2016), and gratitude exercises have been shown to be effective in reducing loneliness (Bartlett & Arpin, 2019). But the relationship has rarely been examined in daily life and it has never been explored how it is affected by the people who surround us. Since loneliness and gratitude are emotional experiences and thus are affective states, they can be variable and context-dependent (van Roekel et al., 2013) which highlights the importance of assessing them from moment to moment. State gratitude, for instance, is mostly considered as a feeling triggered by a specific beneficial event that involves other people **(**Hartanto, Lee, & Yong, 2019; Wood et al., 2010**)**. The question arises to what extent gratitude can be experienced if no specific event occurred and how this experience differs when someone is in the company of other people and when alone. Moreover, as gratitude exercises are used to alleviate the feeling of loneliness (Bartlett & Arpin, 2019), deeper insights into differences in the daily relationship could help to adapt these exercises – especially in ecological momentary interventions – to specific situations in everyday life of people. Gratitude might be experienced very differently when alone than with other people and therefore, exercises in these different situations should focus on different things. Therefore, the present study examined the relationship between loneliness and gratitude in the company of others and in aloneness by momentary assessments over the course of one week.

## Gratitude

Especially within the field of positive psychology special attention has been given to the concept of gratitude during the last decade. But there is no consensus between conceptualisations of gratitude. It appears to have different meanings in different contexts. For instance, gratitude has been conceptualized as an emotional response pattern, general attitude, personality trait, or coping resource to respond to stressful life events (Lambert, Graham, & Fincham, 2009; Sansone & Sansone, 2010). Perhaps, gratitude is all of that. When gratitude is understood as a persons' general tendency to perceive life events or circumstances in a positive light and is thereby able to appreciate those things (Hartanto, Lee, & Yong, 2019), attitudinal, emotional, and behavioural aspects play a role. More precisely, if someone thinks that it is important to be grateful (attitude) the person tends to reflect on different circumstances (behavioural), which results in more grateful feelings (emotional) and expressions (behaviour). Why a reflection of situations is understood as a behaviour becomes clear by looking at the study of Morgan, Gulliford, and Kristjánsson (2017).

Morgan and her colleagues (2017) created an operationalization of gratitude that reflects its inherent multi-dimensionality: the 'Multi-Component Gratitude Measure' (MCGM). It assesses gratitude as a moral virtue built up of four components covering emotional, attitudinal, behavioural,

and cognitive/conceptual aspects. *Grateful emotions* capture the frequency and strength of grateful feelings for people and things in a person's life. *Attitudes toward gratitude* not only capture attitudes about when gratitude should be expressed but also the attitude about how important gratitude is and how much priority should be given to it. G*ratitude-related behaviour* reflects the extent of direct expressions of gratitude as well as the self-reflection about what a person is and should be grateful for. This includes to remind oneself to be grateful and to express gratitude. The last component, a person's *conception of gratitude* explores how gratitude is understood by the person and is therefore especially beneficial for studies and experiments exploring individual thought processes behind the emotional, attitudinal and behavioural aspects of gratitude (Morgan et al., 2017). Morgan et al. (2017) propose to weigh which components are most practicable for the purpose of a study so that they can be used independently or in different combinations. Since the present study wants to capture an overview of the trait level of gratitude and not an individual's understanding of gratitude, the emotional, attitudinal, and behavioural components are used.

Past research has shown that more gratitude has many promising benefits. People who report more grateful experiences show higher life satisfaction and well-being (McCullough et al., 2002), perceive their relationships more positively, report less perceived stress, better sleep, better physical health (O'Connell et al., 2016), and less feelings of loneliness (Bartlett & Arpin, 2019; Frinking et al., 2019; Caputo, 2015; Ni et al., 2015; O'Connell et al., 2016). With such beneficial consequences, gratitude can function as a promising psychological resource (Frinking et al., 2019). As humans are able to change their behaviour and influence their own thinking, to some extent gratitude can be altered as well. This changeability and the positive effects of gratitude makes it an interesting and beneficial concept within the field of (positive) psychology. Gratitude interventions are increasingly used to stimulate people to reflect on things, situations and people and to remember what they appreciate in their lives.

State levels of gratitude have been found to be positively related to individuals' trait levels of gratitude. More precisely, individuals high on trait gratitude tend to report higher levels of gratitude in momentary assessments (McCullough, Tsang, & Emmons, 2004; Hartanto, Lee, & Yong, 2019; Sansone & Sansone, 2010; Wood, Maltby, Stewart, Linley, & Joseph, 2008). Wood et al. (2008) explain that this is due to the different processing of events. If a person is considered highly grateful, they are able to perceive a benefactor's action more positively than a less grateful person (Hartanto, Lee, & Yong, 2019). However, considering state gratitude merely as a response towards a benefactor fails to capture other "aspects of life that people report to be the source of their gratitude" (Wood et al., 2010). In a study of Emmons and McCullough (2003) for instance, participants listed daily what they are grateful for today. Besides others, lists included being grateful "to the Lord just another day", "[for] waking up in the morning", or "to God, for giving me determination" (p. 379). This suggests that, besides interpersonal sources, gratitude involves non-human sources, such as God, animals or the cosmos, and intrapersonal sources, such as own abilities or even the own body (Emmons &

McCullough, 2003). Steinke and Sloan (2014) found similar results in an ecological momentary gratitude intervention[1] where participants responses to a gratitude question – asked several times a day – included parents, friends, sleep, food, and nature. Sansone and Sansone (2010) state "gratitude is the appreciation of what is valuable and meaningful to oneself [...]", which keeps it to the individual itself what to be grateful for. This understanding of gratitude highlights that gratitude can be experienced in daily life without a specific event occurring.

Given that highly, compared to less, grateful people tend to process life events differently or more precisely, more positively than less grateful people (Hartanto, Lee, & Yong, 2019), it can be hypothesized that they are likely to perceive the mere presence of other people as well as aloneness more positively as well. Even though gratitude can be directed at intrapersonal or non-human sources, interpersonal gratitude might be the primary source in situations people spend time with others, because they recognize how much they appreciate the other person. When being alone, on the contrary, the source of gratitude could be everything. Since gratitude is associated with higher life-satisfaction and well-being (McCullough et al., 2002) and less loneliness (Bartlett & Arpin, 2019; Frinking et al., 2019; Caputo, 2015; Ni et al., 2015; O'Connell et al., 2016), highly grateful people may be better able to make use of aloneness compared to less grateful people. That is, since they tend to feel more satisfaction and experience their desired quality of interpersonal relationships, they may be able to appreciate and enjoy being alone as well. This assumption is supported by the fact that ungrateful people tend to be lonelier (Bartlett & Arpin, 2019; Caputo, 2015) and since lonely individuals have difficulty in coping with aloneness it is likely that these moments are appreciated much less. However, these are only assumptions and conclusions based on the literature discussed so far. Therefore, the present study will examine to what extent trait levels of gratitude affect state levels of gratitude in daily life when being alone and in the company of others.

**Loneliness**

Loneliness is a subjective feeling experienced when the actual quality and quantity of one's interpersonal relationships are discrepant to the relationships one desires (Perlman & Peplau, 1981). Occasional experiences of loneliness are common to most people, but long-term and chronic loneliness can have serious consequences for mental and physical health (Christiansen, Larsen & Lasgaard, 2016; Richard et al., 2017; Wolf & Davis, 2018; Hegeman, 2018; Gan, 2015). The differential reactivity hypothesis of loneliness states that lonely individuals react differently to their environment than non-lonely individuals, which may sustain their loneliness level (van Roekel et al., 2018). On the one hand, lonely individuals tend to get lost in a circle of more negative cognitions (Cacioppo, Cacioppo, & Boomsma, 2014), which leads to more pessimistic judgements. Hawkley, Preacher and Cacioppo (2007) found that lonely people assessed their daily social interactions as more

[1] Ecological Momentary Interventions (EMI) are provided to individuals during their daily life using mobile devices (Versluis et al., 2016). Their implementations have been shown to be effective for several health behaviours, psychological and physical symptoms (Heron & Smyth, 2011).

negatively and less satisfying as non-lonely people which in turn resulted in more negative moods and interactions. On the other hand, lonely, compared to non-lonely, adolescents are more positively affected by positive social environments (van Roekel et al., 2013) in that they show a greater decrease in negative affect when they entered a positive company. In an experience sampling study, Van Roekel et al. (2018) showed that even though all individuals felt lonelier when alone than in company, lonely adolescents showed even higher state loneliness in aloneness, with non-intimate others (classmates, teammates, strangers) and intimate others (family, friends) compared to their non-lonely peers. However, lonely, compared to non-lonely, adolescents showed a greater decrease in state loneliness when entering intimate company which indicates that intimate people represent a greater benefit for lonely individuals; i.e. they respond more positively to positive environments. Overall, these studies provide evidence for state loneliness to be a dynamic experience that changes depending on whether we are surrounded by other people and how close we feel to them. And that its changes are affected by trait levels of loneliness. Therefore, the present study will examine to what extent trait levels of loneliness will affect state levels of loneliness when being alone and in the company of others.

**Gratitude and Loneliness**

Grateful people tend to perceive their relationships more positively than less grateful people which partly explains why grateful people tend to experience less loneliness. O'Connell and colleagues (2016) state that one feels grateful because of the recognition that others have done something for oneself. So, the recognition leads to more appreciation and gratitude towards others which results in reduced feelings of loneliness and an increased perception of the quality of and satisfaction with the relationships (Algoe et al., 2008; Algoe, Gable, & Maisel, 2010). In addition, more grateful feelings toward other people are associated with more reciprocal and prosocial behaviours that promote the building and maintenance of interpersonal relationships (Bartlett & DeSteno, 2006; Bartlett et al., 2012). After controlling for other variables, gratitude accounts for around "one-fifth of the variability of loneliness" (Caputo, 2015) which highlights the benefits gratitude has in promoting social ties. Since the experience and expression of gratitude have so many positive consequences, gratitude exercises are increasingly being created that aim to enhance a person's general level of gratitude. Their efficiency has been demonstrated, among others, by Bartlett and Arpin (2019), who showed that a simple daily gratitude exercise can heighten daily gratitude and lessen daily loneliness. Hence, there are first indicators supporting that gratitude can serve as a versatile resource to reduce feelings of loneliness and to improve overall life satisfaction.

Even though several studies examined the relationship between loneliness and gratitude, to my knowledge, no study has explored this relationship in different social contexts in everyday life. Loneliness is always related to other people or at least to the subjective perception of relationships to other people (Perlman & Peplau, 1981**)**. Gratitude, on the contrary, does not necessarily be directed towards others but most research - examining gratitude in relation to loneliness - investigate gratitude

as a response to an event that involves other people (Wood et al., 2010). It seems that other persons play a crucial role in both concepts, thus, the type of person who surrounds us may also affect how lonely and grateful we are in the respective moment. Therefore, the present study examined state associations between gratitude and loneliness in the company of others and when being alone by momentary assessments. In addition, the study examined how these relationships may differ between people generally considered as highly trait lonely or non-lonely.

**Current Study**

The aim of the current study is to investigate how being alone and in the company of others affect daily feelings of gratitude and loneliness and their association. First, it will be separately explored how state gratitude and loneliness are experienced when we are alone and in the company of others and whether these experiences differ based on a person's level of trait gratitude/loneliness. It is assumed that trait lonely individuals respond more negatively to being alone and more positively to an intimate company than trait non-lonely individuals. As trait gratitude reflects a tendency to think and feel in an appreciative way about situations and people it is hypothesized that high, unlike low, trait grateful individuals show no difference in state gratitude when alone and in the company of others. Second, the daily relationship between loneliness and gratitude when being alone and in the company of others will be explored. Therefore, it will be investigated if their negative association is a trait-like and/or momentary association. It is hypothesized that a momentary association can be found at least when surrounded by intimate others because other people play a crucial role in both concepts; people tend to feel less lonely with close people (van Roekel et al., 2018) and gratitude is often directed at close people.

# Methods

## Participant Characteristics and Inclusion Criteria

The study included 34 college students aged between 18 and 31 years ($M_{age}$=20.65; $SD_{age}$=3.15). 85.3 % of them identified as woman, 8.8 % as man, 2.9 % as a transgender woman, and 2.9 % as gender variant/non-conforming. Participants of different nationalities took part in the study, including German (50%), Dutch (38.2%), Indian (2.9%), Bulgarian (2.9%), Vietnamese (2.9%), and Indonesian (2.9%). Inclusion criteria for participants were to be a registered student, above the age of 18, being proficient in the English language, and to own either an Apple or Android smartphone for being able to download and use The Incredible Intervention Machine (TiiM) application (The BMS Lab, n.d.).

## Materials and Measures

The online survey was created with The Incredible Intervention Machine (TiiM), developed and owned by the University of Twente. Since the present study was part of bigger research the overall test battery contains more measures than has been used for the present study purpose. The test battery consisted of six daily ESM questions and four trait questionnaires, The Multi-Component Gratitude Measure (MCGM) (Morgan et al., 2017), the UCLA Loneliness Scale (Third Version) (Russell, 1996), the Perceived Stress Scale (PSS), and the Self-Compassion Scale Short Form (SCS-SF). For the present purpose only the three relevant daily questions, the MCGM and the UCLA are described in more detail.

### *The Incredible Intervention Machine (TiiM)*

TiiM is an intervention and survey tool created by the BMS Lab of the University of Twente and can be used on Android and iOS operating systems. Questions can be packed into modules, which are made available to participants at a fixed time on their smartphone. As soon as new questions need to be answered participants receive a reminder in the form of push notifications. How long a module can be responded to can also be timed. The present study used three time frames a day over a period of seven days where participants needed to answer ESM questions between 8 and 10 am, 12 and 2 pm, and 7 and 9 pm. Since participants are college students three times per day might be a good chance to get data in different social contexts, as many are living in shared flats, are in classes and meet friends. The seven days also increases the likelihood to obtain data from within family context, as many students visit their families on weekends. While creating the survey, individual modules were repeatedly tested and adjusted to make responding to questions as easy as possible. A one-day pilot study was conducted with two participants that tested the surface of the survey, the timing and the response function.

The first four registered participants have been asked to set three different alarm clocks on their own smartphone that reminded them to answer the questions at eight o'clock, 12 o'clock, and 19

o'clock. This strategy was intended to compensate for the reminder that should have been sent through TiiM automatically. However, the low response rates of these participants indicated that this strategy did not work as intended. Either because alarm clocks were not set at all or they were ignored. The research team started to send each participant a reminder manually via the BMS Lab Dashboard in the form of push notifications which resulted in immediate responses of participants. Since these direct reminders seemed to increase participants' response rates the instruction to set alarm clocks on their phone has been removed and all further participants received individual reminder at eight o'clock, 12 o'clock, and 19 o'clock every day (see Appendix 1). These signal-contingent triggers reduce participants' burden (Berkel, Ferreira, & Kostakos, 2017). Additionally, the researcher checked the response rates 30 minutes before the end of each time frame and sent those who did not respond yet additional reminder. Table 1 in Appendix 4 shows which reminders were sent at which time.

***Daily Questionnaire***

The daily questions were randomly ordered within each time frame to avoid habituation in responding.

**State Gratitude**. In previous studies different single (DeWall, Lambert, Pond, Kashdan, & Fincham, 2012) or multiple items (McGuire, Szabo, Murphy, & Erickson, 2019) have been used to measure state gratitude, depending on the scope of other daily measurements, sample characteristics and sampling method. To minimize the effort and time to respond and thereby, to increase response probability, state gratitude has been assessed by the single item 'I am grateful right now'. Participants filled out to what extent they agree with this statement on a 7-point Likert-Scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The validity of the single item will be discussed in the results.

**State Loneliness**. State loneliness has been assessed by the statement 'I feel lonely right now' which has already been used in Dutch and US samples of early and late adolescents (van Roekel, Verhagen, Engels, Scholte, Cacioppo & Cacioppo, 2018). Participants filled out to what extent they agree with this statement on a 7-point Likert-Scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The validity of the single item will be discussed in the results.

**Social Context**. Social context is often asked by using an open question where answers are coded into categories such as 'family', 'friends', and 'being alone' (van Roekel et al., 2013; van Roekel, et al. 2018). In order to minimize the effort and time to respond, answer categories were defined from the outset. Participants could choose between 'Family', 'Partner', 'Friends', 'Fellow Students, Co-Worker', 'Other', and 'I am alone' to answer the question 'Which people are you with at the moment?'. Multiple answers were possible, for instance, if a participant has been with family members and their partner at the same time. Responses have been categorized afterwards into 'alone', 'intimate company' (family, partner, friends), and 'non-intimate company' (fellow students, co-workers, other). If multiple answers have been chosen at a single measurement point, the intimate

category has been used for analysis. For instance, if a person has been with friends and fellow students at the same time, the answer was coded as an intimate company.

### *Trait Questionnaires*

**The Multi-Component Gratitude Measure (MCGM).** The Multi-Component Gratitude Measure assesses gratitude as a moral virtue. The present study used the emotional, attitudinal, and behavioural component of the MCGM. That means, included has been 29 items belonging to the three components (see Appendix 2) which could be answered on a 7-point Likert-Scale from one (strongly disagree) to seven (strongly agree). Six items measure the emotional component, ten items measure the attitudinal component and 13 items measure the behavioural component of gratitude. Example items are 'I feel grateful for the people in my life' (emotion), 'I don't think it is necessary to show your gratitude to others' (attitude), and 'I reflect on all the good things I have' (behaviour). Ten items needed to be reversed before scoring. The sum score of all items represents the level of gratitude and ranges from 29 to 203 where a higher score indicates a higher level of gratitude as a virtue. The emotional, attitudinal and behavioural components show good reliability (Cronbach's alpha above 0.70) and good construct validity when compared with existing gratitude measures and well-being scales (Morgan et al., 2017).

**The UCLA Loneliness Scale (Version 3)**. The third version of the UCLA Loneliness Scale assesses how often a person experiences the feeling of loneliness (Russell, 1996). The measure consists of 20 items (see Appendix 3) which can be answered on a 4-point scale where one refers to 'never', two to 'rarely', three to 'sometimes', and four to 'always'. Eight items are positively worded and thus, needed to be reversed before scoring. Example items are 'How often do you feel that you lack companionship?' and 'How often do you feel outgoing and friendly?' (reversed item). The sum score of all items represents the level of loneliness and ranges from 20 to 80 where a higher score indicates greater loneliness. Across different sample populations the UCLA shows to have good validity and reliability (internal consistency estimates ranging from .89 to .94; test-retest reliability coefficient r = .73) (Russell, 1996; Vassar & Crosby, 2008). Especially results of university student samples have shown high correlations with other loneliness measures and the UCLA represents the most reliable measure of loneliness in students so far (Vassar & Crosby, 2008; Russell, 1996).

## Study Design and Procedure

To measure daily real-life experiences of gratitude and loneliness an experience sampling method has been used. The longitudinal online survey has been ethically approved by the Behavioural, Management and Social Sciences (BMS) Ethics Committee of the University of Twente (UT) (Request-Nr: 191272). Data have been collected during November 2019. A convenience sampling strategy was used by means of the Test Subject Pool BMS (SONA) System of the University of Twente and by sharing the survey-subscription link directly through personal contact and Facebook.

Those who subscribed via the SONA-System were rewarded with 2.5 credit points as compensation for their effort during the week; for participants outside the UT, no compensation could be offered.

The study took place over a course of nine days, where day one was merely meant to inform the participants about the study and making sure they are prepared for the next eight days, the actual study. Participants could either subscribe to the study via the SONA-System or directly via the URL subscription link of TiiM. Either way, they ended up on the subscription page and needed to register with a valid email address and password, choose their age, gender identity, nationality and confirm that they are registered students (see Appendix 4.1). This was followed by the request to install the TiiM application on their smartphone; For this, both a link to the Apple and Google Play Store was provided. Participants were advised that this was everything to do for today and more information will be available in the app tomorrow morning.

The next day (day 1) participants received further information in the app about the study background, how it is set up over the week, and about their rights and contact information. In the end, the participant had to give active online consent to participate in the study. For the next seven days (day 2-8) the participants needed to answer the same six questions three times per day (see Appendix 4.2 for the three questions used for the present study). An answer had to be given to each question before going to the next one. The study ended (day 9) with the trait questionnaires. The gratitude questionnaire was made available for participants at eight o'clock in the morning. It was followed by the self-compassion questionnaire, stress, and loneliness measure. Each time a questionnaire was completed a new one was accessible.

**Data Diagnostics**

The data analysis was conducted with IBM SPSS Statistics (Version 24). Only participants with a 100% response rate of the state and trait questionnaires are included in the analysis. Descriptive statistics are calculated for age, gender identity and nationality, and to check for distributions and mean scores of trait gratitude and loneliness across the sample. Person means (PM) were computed for state gratitude and state loneliness which reflect the average gratitude and loneliness level over the course of seven days per participant and to allow for between-person analyses. In addition, for each participant person mean-centred scores (PM-centered) were calculated for all measurement points of loneliness and gratitude. These scores reflect how much the level at each single measurement point differs from the person mean and thereby, allows for within-person analyses.

Responses to the daily social context question have been recoded into the variable 'type of company' with the categories 'alone' (A), 'non-intimate others' (NIC), and 'intimate others' (IC). Frequencies of the different categories have been calculated for the total sample. Moreover, to be able to compare trait lonely with trait non-lonely and trait grateful and less trait grateful individuals, trait loneliness (TL) and trait gratitude (TG) groups have been divided by ~25 and ~75 percentiles based on participants trait scores.

For assessing reliability of the UCLA Loneliness Scale and the MCGM within the present sample, Cronbach's alpha has been calculated; An alpha >.9 is considered to be excellent, >.8 is good, >.7 is acceptable, >.6 is questionable, and <.6 is unacceptable (Blanz, 2015). The validity of the single state gratitude and loneliness items were assessed by Pearson Correlation analyses between state gratitude (PM) and the MCGM, and between state loneliness (PM) and the UCLA Loneliness Scale. The common effect size suggestion of Cohen (1988) was used for interpreting the correlation coefficient r: r > .50 indicates a strong effect, r >.30 a moderate effect, and r > .10 a weak effect.

**Analytic Strategy**

Pearson Correlation analyses were used to explore the relationship between trait gratitude and trait loneliness, trait loneliness and state loneliness (PM), and trait gratitude and state gratitude (PM). Further, a series of Linear Mixed Model (LMM) analyses were conducted with an autoregressive structure because it accounts for missing data in the momentary assessments and controls for dependency between data. First, to explore state levels of loneliness in aloneness and in the company of others a multigroup model was used to explore each TL group separately. State loneliness was set as dependent variable and type of company as a fixed independent categorical variable with intimate company as the reference group (1=A, 2=NIC, 3=IC). Second, to investigate state levels of gratitude in aloneness and in the company of others a multigroup model was used to explore each TG group separately. State gratitude was set as the dependent variable and type of company again as fixed independent variable. Third, it was explored whether the association between gratitude and loneliness is a trait-like (between-person) and/or momentary (within-person) effect and whether this differs in aloneness and the company of others. Therefore, another multigroup LMM was used to assess each type of company separately. Therefore, state gratitude was set as the dependent variable and PM loneliness (between-person association) and PM-centered loneliness (within-person association) as fixed independent variables. And a last multigroup LMM analysis (for each TL group) was conducted to explore whether there are differences in the strength of the negative state association between situations of aloneness and in the company of others. State loneliness was set as the dependent variable, state gratitude, type of company, and an interaction effect between both have been set as fixed independent variables. To support the findings, figures and tables have been created with Microsoft Excel 2019 as well as graphical representations of the individual cases for further visual analysis.

# Results

## Participant Flow

In total, 59 students signed up for the study, of which 12% possessed an Apple device and thus, could not take part because technical issues hindered the compatibility of the TiiM application with the iOS operating system. Further, five participants have been excluded because of not filling out the trait questionnaires. Another participant has been excluded because they scored highest on state gratitude and lowest on state loneliness at each of the 21 measurement points and at 20 timepoints they have been in company and only one time alone. It is not assumed that the participant did not take the survey seriously, rather, the high age (~ 6 SD above the average) suggests that the person is in a different stage of life than an average undergraduate student and therefore has greatly different experiences of gratitude and loneliness.

**Descriptive Statistics**

Table 1 provides an overview of minimum and maximum scores as well as mean scores of trait gratitude and loneliness of the sample. Both gratitude and loneliness are normally distributed, but the overall sample appears to be very grateful. The gratitude minimum score of 104 already indicates an average level of gratitude. In total, participants have spent most of their time alone (43.4%) and with intimate others (38.5%), and less often with non-intimate others (18.1%). Through the division of participants into TL and TG groups, each low group included nine (26.5%) participants, the average groups 16 (47.1%) participants and the high groups nine (26.5%) participants.

Simple correlation analysis within the present study showed a strong association between state gratitude (person means) and the MCGM (trait gratitude) ($r=.683$, $p<.001$), indicating that the single gratitude item is a valid measure of state gratitude. Another correlational analysis showed a strong association between state loneliness (person means) and the UCLA Loneliness Scale ($r=.651$, $p<.001$), indicating that the single loneliness item is a valid measure of state loneliness. To assess the internal consistency of the UCLA Loneliness scale (trait loneliness) and the MCGM (trait gratitude), Cronbach's alpha was calculated. As excepted, the UCLA Loneliness Scale shows excellent reliability with a Cronbach's alpha of .94. The MCGM shows, with a Cronbach's alpha of .87, good reliability, as well as its emotional subcomponent ($\alpha=.89$) and behavioural subcomponent ($\alpha=.85$). The attitudinal sub-component consists of two parts, of which one ('attitude of gratitude') shows acceptable ($\alpha=.73$) and the other ('attitude to appropriateness') unacceptable internal consistency with a Cronbach's alpha = .37.

**Table 1**

*Minimum and Maximum Scores, Means (M) and Standard Deviations (SD) of Trait Gratitude and Trait Loneliness*

| Variables | Minimum (scale minimum) | Maximum (scale maximum) | M | SD |
|---|---|---|---|---|
| UCLA Loneliness Scale, M (SD) | 27 (20) | 71 (80) | 45.62 | 10.88 |
| MCGM: Sum score, M (SD) | 104 (29) | 180 (203) | 144.74 | 17.11 |
| Emotional Component, M (SD) | 18 (6) | 42 (42) | 33.59 | 3.66 |
| Attitudinal Component, M (SD) | 41 (10) | 61(70) | 51.03 | 4.97 |
| Behavioural Component, M (SD) | 42 (13) | 81 (91) | 60.12 | 10.43 |

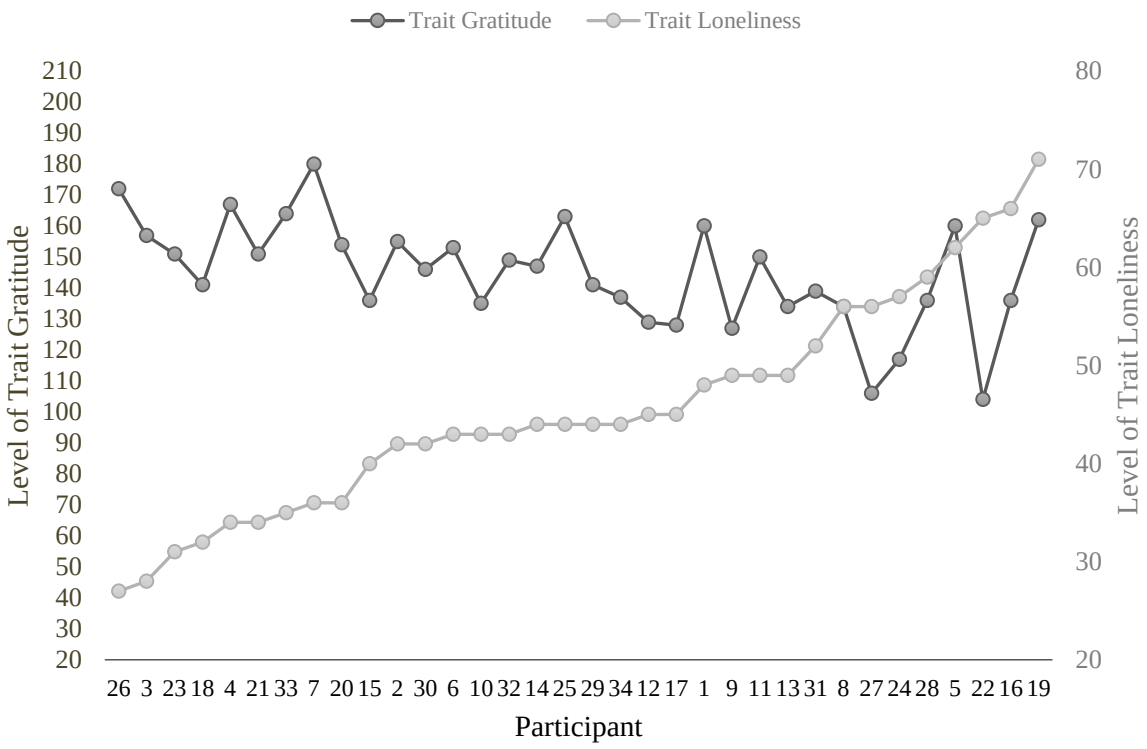
*N=34*

***Trait Loneliness and Trait Gratitude***

Bivariate Pearson correlation analysis was used to confirm the in previous studies found trait association between loneliness and gratitude also in the current sample. As expected, a significant moderate negative correlation between trait gratitude and trait loneliness was found ($r = -.479$, $n = 34$, $p < .001$). That means as scores on trait loneliness increase the scores for trait gratitude decrease. What can be seen in Figure 1, however, is that, as mentioned earlier, the scores of gratitude tend to be relatively high, there are no participants who could be considered as ungrateful or little grateful. In addition, the highly lonely participants 5 and 19 scored very high on gratitude as well, which is contrary to the normally expected association. So, comparisons between low and high grateful people in this sample should be made with caution.

**Figure 1**

*Levels of Trait Gratitude and Loneliness per Participant*




*Note.* The participants (x-axis) are sorted according to their loneliness score, so loneliness scores rise from left to right.

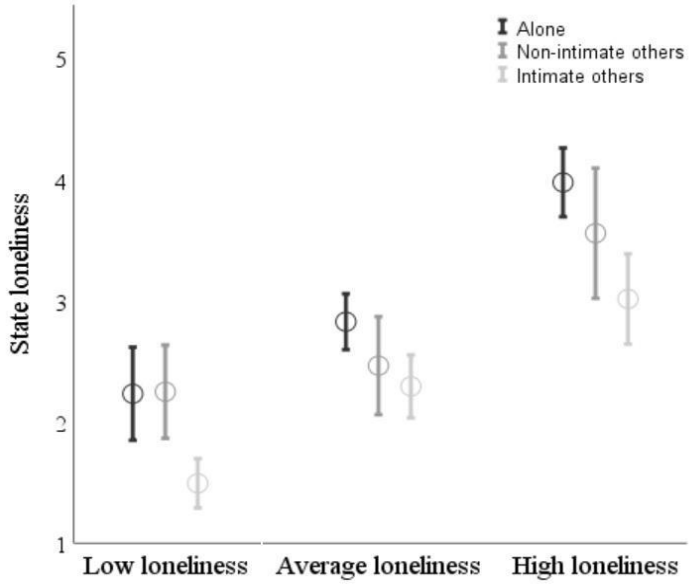
## Data Analysis

### *Trait and State Loneliness*

As expected, simple correlation analysis shows a significant strong association between trait loneliness and state loneliness (PMs) ($r = .651$, $n = 34$, $p < .001$). Indicating that high, compared to low, trait lonely people tend to show higher levels of state loneliness in their daily life. Further, results show a significant effect of being alone on state loneliness for all groups with intimate company as reference group ($\beta_{Low\text{-}TL} = .70$, $SE_{Low\text{-}TL} = .18$, $p < .001$; $\beta_{Average\text{-}TL} = .56$, $SE_{Average\text{-}TL} = .17$, $p < .001$; $\beta_{High\text{-}TL} = .89$, $SE_{High\text{-}TL} = .22$, $p < .001$). That means all individuals feel lonelier when alone than in the company of intimate others. Figure 2 supports this difference as there is no overlap of error bars between alone and intimate others within each group. What is also visible is that there is no overlap between non-intimate and intimate others within the low loneliness group. Analysis show that this difference is significant as well ($\beta_{Low\text{-}TL} = .65$, $SE_{Low\text{-}TL} = .18$, $p < .001$). That means, less lonely individuals feel significantly lonelier with non-intimate people than with intimate people, but average and high lonely individuals do not feel significantly more or less lonely with non-intimate or intimate others. Noticeable as well is that highly trait lonely individuals still experience higher feelings of loneliness with intimate others ($M_{SL} = 3.02$) than non-lonely individuals experience when being alone ($M_{SL} = 2.23$). Which is consistent with the overall positive correlation between levels of trait and state loneliness.

**Figure 2**

*State Loneliness in Different Types of Companies per Trait Loneliness Group*



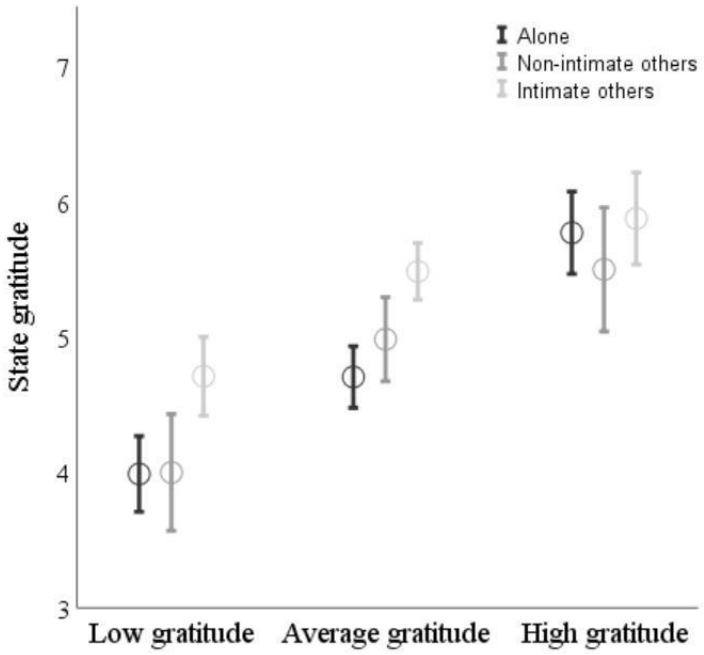

*Note.* The circles reflect state loneliness means with error bars showing variability of loneliness (95 % confidence interval).

***Trait and State Gratitude***

Simple correlation analysis shows a significant strong association between trait gratitude and state gratitude (PMs) ($r = .683$, $n = 34$, $p < .001$). Indicating that higher levels of trait gratitude are associated with higher levels of person mean state gratitude. Further results show that low and average trait grateful individuals experience different levels of state gratitude in non-intimate company ($\beta_{Low\text{-}TG} = -.70$, $SE_{Low\text{-}TG} = .27$, $p < .05$; $\beta_{Average\text{-}TG} = -.35$, $SE_{Average\text{-}TG} = .17$, $p < .05$) and when alone ($\beta_{Low\text{-}TG} = -.78$, $SE_{Low\text{-}TG} = .19$, $p < .001$; $\beta_{Average\text{-}TG} = -.70$, $SE_{Average\text{-}TG} = .14$, $p < .001$) compared to situations with intimate others. Specifically, both groups feel more grateful when surrounded by intimate people than by non-intimate people or when alone (see Figure 3). Further, no differences in the high TG group was found. As visible in Figure 3, loneliness scores overlap in both company types as well as in aloneness. That is, highly trait grateful people neither experience significantly more or less gratitude in different companies or when alone.

**Figure 3**

*State Gratitude in Different Types of Companies per Trait Gratitude Group*




*Note.* The circles reflect state gratitude means with error bars showing gratitude variability (95 % confidence interval).

***State Loneliness and Gratitude***

First, it was investigated whether state gratitude is dependent on state loneliness (i.e. within-person, momentary association) or on the average loneliness level of a person (i.e. between-person, trait-like association) and whether this differs in aloneness and the company of others.

**Aloneness.** Results show a significant between-person association ($\beta$ = -.31, *SE* = .14, $p < .05$) and a significant, but slightly weaker, within-person association ($\beta$ = -.20, *SE* = .05, $p < .001$). So, a gratitude score at a certain time point when being alone is mainly dependent on a person's average loneliness level and less on the loneliness score at this specific time point. Participants with higher loneliness scores on average than others tend to show lower gratitude scores at different time points and vice versa.

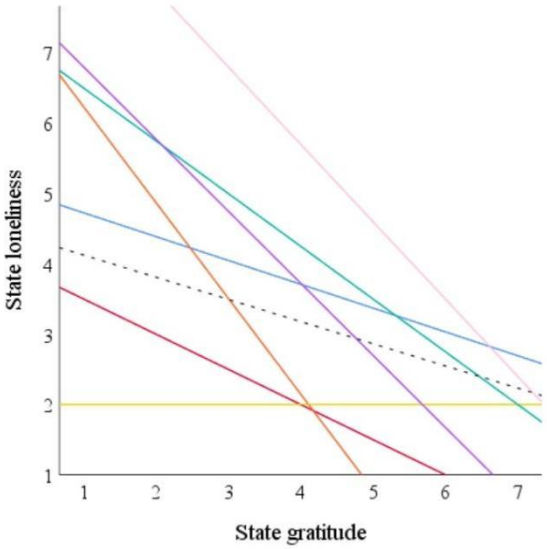
**Non-intimate others.** Results show one significant moderate within-person effect ($\beta$ = -.31, *SE* = .09, $p < .01$). Indicating that the association between gratitude and loneliness at certain timepoints with non-intimate others is a momentary association only. That means, at certain time points when being with non-intimate others where a person has higher loneliness scores than their own average, they show lower gratitude scores than their own average at these time points and vice versa.

**Intimate others.** In the company of intimate people, a significant moderate between-person effect ($\beta$ = -.40, *SE* = .11, $p < .01$) as well as a within-person effect ($\beta$ = -.37, *SE* = .06, $p < .001$) were found. That is, a gratitude score at a certain time point when being with intimate others is dependent on a person's average loneliness level and on the loneliness score at this specific time point.

Second, another LMM has been used to explore whether there are differences in the strength of the negative momentary association between situations of aloneness and in the company of others. One significant difference in the interaction between state loneliness and gratitude when being alone compared to the intimate company was found ($\beta$ = .16, *SE* = .08, $p < .05$). When surrounded by intimate others the negative association between state gratitude and loneliness is stronger compared to situations of aloneness. As the coefficient ($\beta$ = .16) appears to be very low, multigroup LMM analyses have been used to check whether this is due to differences between trait loneliness groups. In fact, results point out that neither the low nor average TG group show significant differences in strengths of the state associations when being alone and in an intimate company. Only the high trait lonely group show a significant difference in the interaction effect between state gratitude and loneliness when with intimate others and when being alone ($\beta$ = .45, *SE* = .15, $p < .005$). Figure 4 illustrates that highly trait lonely individuals, except for one case, show a negative state association between gratitude and loneliness when they are in intimate company. In aloneness, on the contrary, as illustrated in Figure 5, no clear association between gratitude and loneliness across the participants can be seen. Some of them seem to show the expected negative association between gratitude and loneliness, however, two of them even show a positive association, so, higher loneliness scores seem to be associated with higher gratitude scores.

**Figure 4**

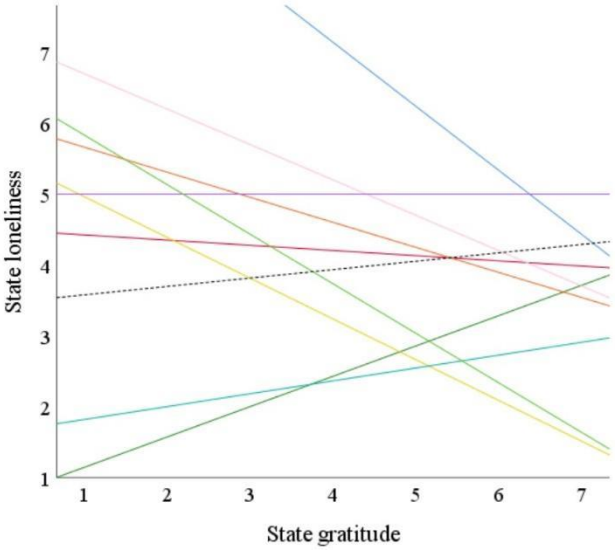
*State G-L Association per High Lonely Participant in Intimate Company*




*Note.* The dotted line represents the association within the total group (N=8).

**Figure 5**

*State G-L Association per High Lonely Participant in Aloneness*



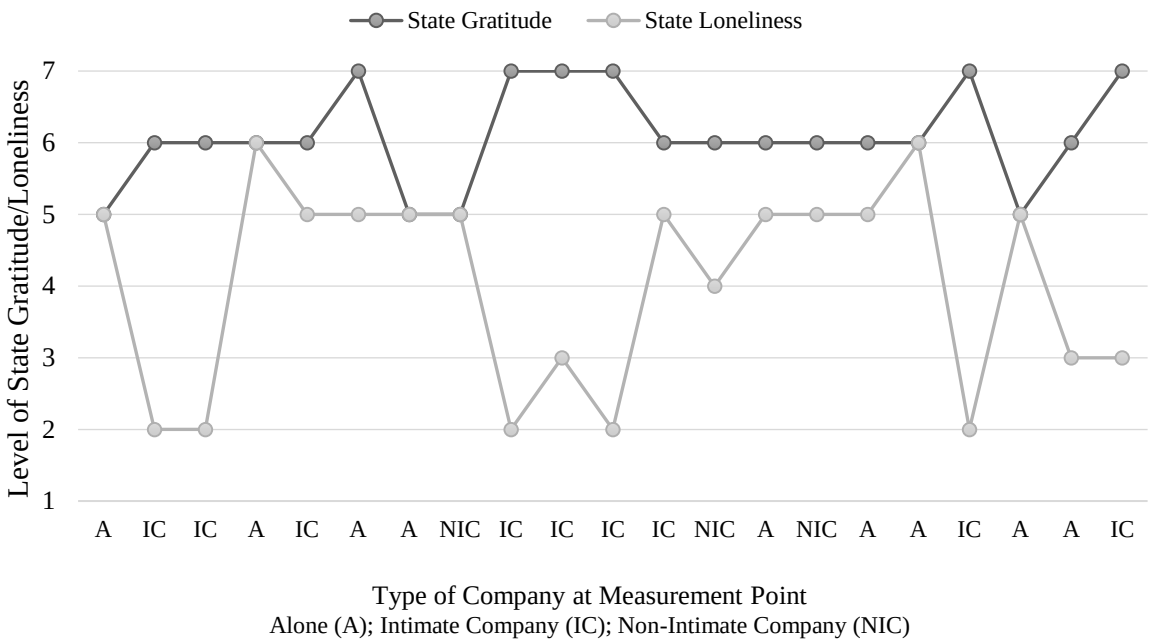

*Note.* The dotted line represents the association within the total group (N=9)

**Visual Analysis of Individual Cases.** The data of four participants have been illustrated in individual figures to capture the naturally occurring gratitude and loneliness experiences over the course of one week. Thereby, paying special attention to the differences in intimate company and when being alone.

***Participant 28.*** The first case has a high trait loneliness score (59) and average trait gratitude score (136). As can be clearly seen in Figure 6 is that the feeling of loneliness decreases, except for two occasions, when surrounded by intimate others. Further, gratitude and loneliness are visibly negatively associated in intimate company but not in aloneness. When being alone, participant 28 experiences feelings of loneliness but also of high gratitude, so the association appears to be positive but very stable. Their gratitude, compared to loneliness, feelings are rather stable over time and hence, independent of being alone or with others.

**Figure 6**

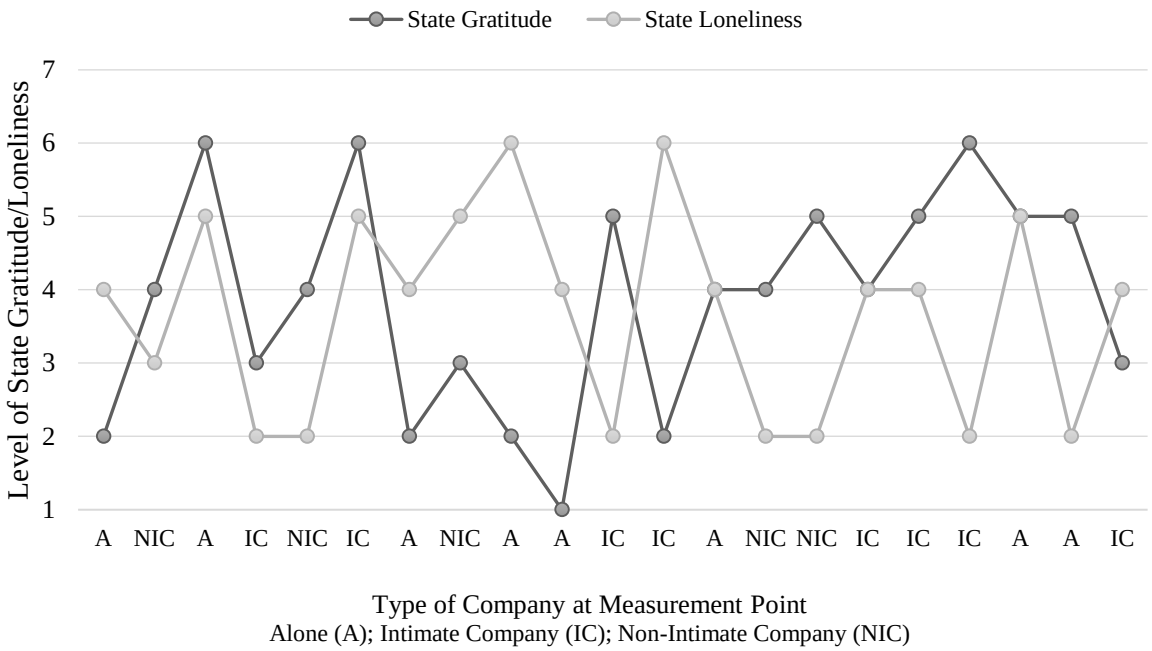
*Levels of State Loneliness and Gratitude of Participant 28 per Measurement Point*



***Participant 8.*** The second case is highly trait lonely (56) and low trait grateful (134). Contrary to participant 28, this individual shows high fluctuations in gratitude and loneliness in both intimate company and aloneness (see Figure 7). In four out of eight occasions with intimate others, a clear negative association between gratitude and loneliness can be seen. In aloneness, a clear negative association appears in three out of eight occasions and a slightly positive association at five times. So, the momentary association between gratitude and loneliness within this participant varies a lot.

**Figure 7**

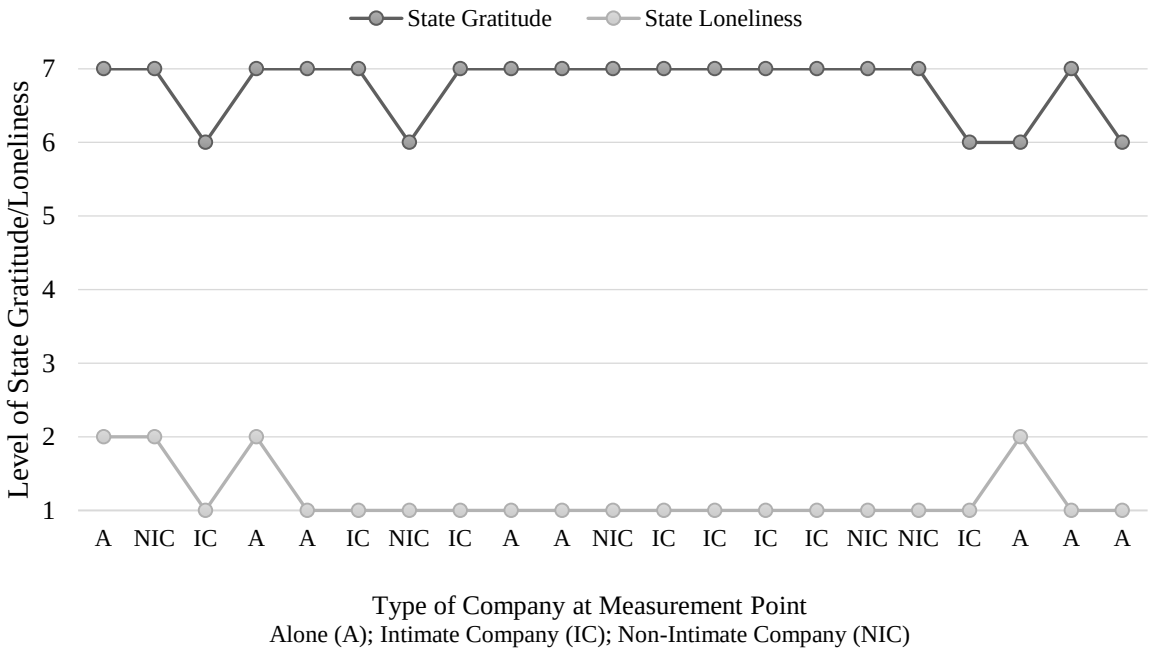
*Levels of State Loneliness and Gratitude of Participant 8 per Measurement Point*



***Participant 26.*** The next case has the lowest trait loneliness score (27) and the second-highest trait gratitude score (172) across the sample. As visible in Figure 8, neither loneliness nor gratitude shows strong fluctuations over time. Gratitude feelings range from six (grateful) to seven (highly grateful) and loneliness scores from one (not lonely at all) to two (not lonely). These minimal changes occur in aloneness, with non-intimate others, as well as intimate others. The state association between gratitude and loneliness appears to be very strong and stable across all measurement points and independent of being alone or with others.

**Figure 8**

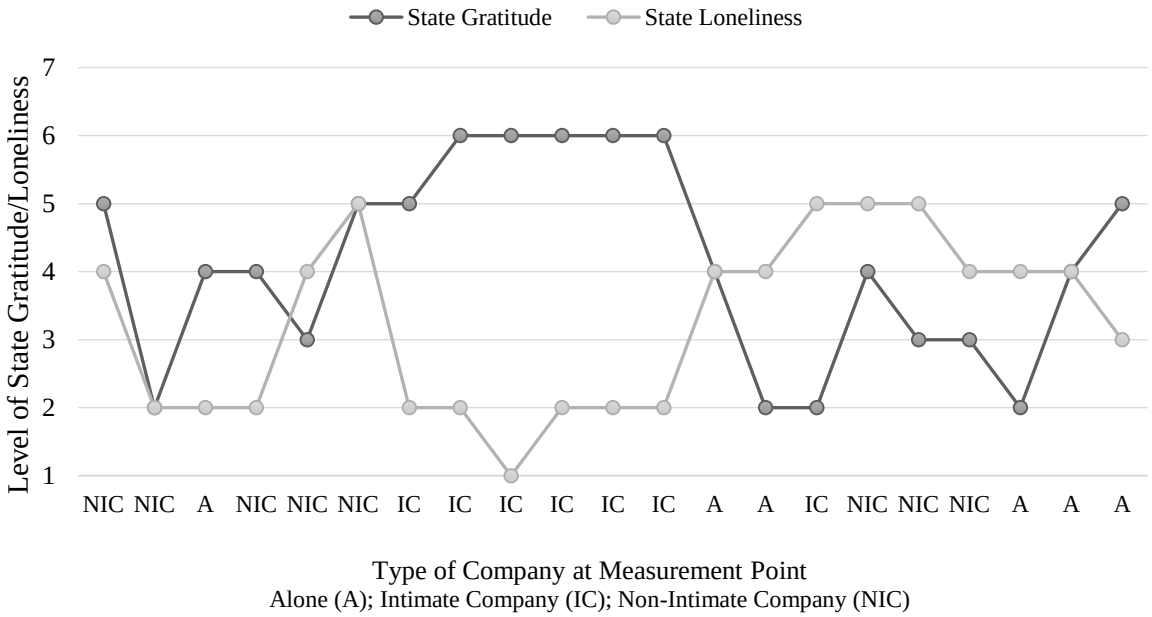
*Levels of State Loneliness and Gratitude of Participant 26 per Measurement Point*



***Participant 33.*** The last case is also highly trait grateful (164) and low trait lonely (35). Contrary to the previous highly grateful person, this participant did not show similar gratitude in aloneness and intimate company, rather, with intimate people, gratitude feelings are much higher and more stable (see Figure 9). Moreover, loneliness levels are similar when alone and with non-intimate others and are visibly higher than in intimate company, which is consistent with the finding that trait non-lonely people tend to show similar levels of loneliness in aloneness and non-intimate company. Further, a stronger negative association can be seen with intimate others than in aloneness. In intimate company less loneliness is clearly associated with higher gratitude.

**Figure 9**

*Levels of State Loneliness and Gratitude of Participant 33 per Measurement Point*




All in all, the four examples suggest that gratitude and loneliness are differently associated when being alone, with intimate others, and non-intimate others but that these associations also differ between persons with similar trait levels of gratitude and loneliness. In one case, a strong negative association between gratitude and loneliness could be found in all situations. In three cases no clear association could be seen when being alone; at some measurement points gratitude and loneliness seem to associate rather positively – either feeling highly lonely but still highly grateful or non-lonely but also ungrateful. For two of these three a clear negative association, when surrounded by intimate others, can be seen, but it is not clearly visible in the other case.

# Discussion

The present study aimed at investigating how being alone and being with others affect daily feelings of gratitude and loneliness, and their association. Moreover, differences in the daily experiences of gratitude and loneliness between high and low trait lonely/grateful individuals were examined. As expected, the present study supports that gratitude and loneliness fluctuate from one moment to another, dependent on the social context. Further, it is confirmed that the negative association between gratitude and loneliness is a trait-like as well as momentary association with two exceptions. First, on occasions with non-intimate others, no trait-like association could be found which is also reflected in greater variability of daily gratitude and loneliness in these situations. Second, in aloneness negative as well as positive associations were found for highly trait lonely individuals. Overall, being with intimate others appears to be beneficial for all individuals, in the sense that less loneliness and more gratitude is experienced. Only high trait lonely people show similar levels of gratitude in all situations.

## Similarity of Results and Interpretation

### *Loneliness*

The present study provides further evidence for the hypothesis that trait lonely individuals respond more negatively to being alone than non-lonely individuals. More precisely, trait lonely people tend to feel lonelier. In accordance with the paper of van Roekel et al. (2018), trait lonely individuals also show higher state loneliness in all companies compared to non-lonely individuals. That is in line with Hawkley, Preacher and Cacioppo (2007), who state that lonely, compared to non-lonely, people perceive their interactions with intimate others more negatively and less satisfying. Thus, even when together with friends, family or significant other they feel lonelier than non-lonely individuals. Contrary to van Roekel's (2018) findings, the present study found no support for the hypothesis that trait lonely individuals respond more positively to intimate company than their non-lonely peers. Instead, the opposite seems to be the case within the present study: Non-lonely individuals seem to respond more positively to intimate than non-intimate company. In van Roekel's (2018) study, trait lonely, compared to non-lonely individuals, showed stronger decreases of state loneliness between alone and intimate company, and between non-intimate and intimate company. Yet, the decrease of state loneliness between alone and intimate company – within the present study – was similar between all individuals. Looking at the decrease between non-intimate and intimate company, trait lonely individuals show no significant decrease. Indicating they experience similar feelings of loneliness in both companies. Whereas trait non-lonely individuals show a significant decrease in state loneliness between non-intimate and intimate company. Hence, trait non-lonely, but not trait lonely, individuals feel lonelier with non-intimate than intimate others. This may indicate that non-lonely, but not lonely, individuals find more relief in intimate people than non-intimate people.

Moreover, being with non-intimate others seem to have no beneficial effect, neither for non-lonely nor lonely individuals. But striking is that state loneliness showed the greatest variability in

situations with non-intimate people across the total sample. That means, independent of the trait level of loneliness the feeling of state loneliness can vary a lot when surrounded by fellow students, co-workers or strangers (non-intimate people).

There might be two explanations for the finding that high lonely individuals do not respond more positively to intimate others than non-lonely individuals. First, the present study assumed that intimate people are positive company. But most participants within this study are first- and second-year German students of the University of Twente which means most of them recently moved to another city and even country. That, in turn, increases the likelihood that they did not spend much time with their family. They just built new friendships which are therefore not as close as the friendships the early and late adolescents in van Roekel's (2018) study had. Adolescents usually live at home, thus spend more time with their families, and are likely to have friendships that last for several years already. Because non-lonely individuals perceive their relationships as more satisfying and positive than lonely individuals (Hawkley, Preacher, & Cacioppo, 2007), they are still more able to perceive even new friendships more positively. As a result, the perception of the quality of relationships is different for new friends and fellow students, which explains why non-lonely people feel less loneliness when surrounded by friends (i.e. intimate company) than by fellow students (i.e. non-intimate company). This, on the contrary, is not the case for lonely individuals. Since they tend to perceive their relationships less positively the perceived quality of new friendships might have not been so high and thus, similar to that of non-intimate people (e.g. fellow students). In that respect, feelings of loneliness in non-intimate and intimate company do not differ significantly.

A second reason can be that the average state loneliness scores per participant have been quite low compared to the trait levels of the sample. So, even high trait lonely individuals showed comparatively low state loneliness over the week. Since trait measures loneliness are self-reports and require thinking about a past period, their results may not be consistent with how people actually feel in their daily life. Some people may think they are very lonely – maybe because they used to be lonely – but in real-life situations, they do not feel lonely anymore. If the sample would have included high trait lonely individuals who also show high loneliness scores in their daily life, the difference in state loneliness might have also been greater between aloneness, intimate and non-intimate company.

***Gratitude***

The present study supports the assumption that high trait grateful individuals show no differences in state gratitude when alone or in the company of others. In contrast, less trait grateful individuals experience more gratitude with intimate others than with non-intimate others or when alone. An explanation for these differences in state gratitude could be different sources of gratitude in the specific moment. O'Connell and colleagues (2016) said grateful people perceive their relationships more positively than less grateful people. Even though the present study did not ask how grateful the participant is *for the person*, the fact that the highest levels of gratitude are experienced with intimate

others strongly suggests that in these moments the source of gratitude is interpersonal. In aloneness on the contrary, the source of gratitude can be everything. For many people, aloneness can be hard to endure and enjoy. Since highly grateful individuals are able to perceive events and situations more positively (Hartanto, Lee, & Yong, 2019), they might be also able to perceive being alone as more positive and enjoyable than less grateful individuals. The present study supports this assumption by showing that highly trait grateful people show similar state gratitude in aloneness as in intimate company. In contrast, less grateful individuals are less able to appreciate being on their own and therefore, experience less gratitude in aloneness.

These findings suggest that less grateful people may be able to make use of interpersonal relationships by feeling more grateful when surrounded by them. But in aloneness less grateful people may lack the ability to appreciate themselves or non-human things, and/or they are unable to remind themselves what they should be grateful for. This assumption is supported in that less grateful individuals scored significantly lower on the behavioural component of the MCGM than high grateful individuals. The behavioural component includes items like the following: 'I forget to reflect on the things that I am grateful for' or 'I reflect on all the good things I have' (see Appendix 2). A lower score on such items means that a person is less able to remind themselves of all the things they are grateful for (Morgan et al., 2017), let it be interpersonal, intrapersonal or non-human aspects of life. With these findings, the present study provides new insight into the dynamics of daily gratitude experiences and how these differ based on a person's trait level of gratitude.

### *Loneliness and Gratitude*

Besides investigating gratitude and loneliness separately, it has also been explored more deeply how they are associated on a daily basis and in the different social contexts. It was investigated whether the, in previous research found, negative association between trait gratitude and loneliness is a trait-like association and/or whether it can also be seen at the specific time points (momentary association). The results above already indicate that there must be both, a trait-like between person and a momentary within-person association.

**Trait-like Association.** A trait-like association was found in aloneness and intimate company, but not in non-intimate company. Individuals with higher (or lower) state loneliness scores on average than others show lower (or higher) state gratitude when alone and with intimate others over the week. So, because someone is generally lonelier than other people, they experience less gratitude at the different moments when alone and with close people, and vice versa. This trait-like association is in line with previous research that found an association between more daily experiences of gratitude and less loneliness in the long run (Bartlett & Arpin, 2019; Frinking et al., 2019; Caputo, 2015; Ni et al., 2015; O'Connell et al., 2016). Conversely formulated, the less loneliness on average, the more grateful feelings in everyday life. That this association was not found in non-intimate company might be due to the higher variability of state gratitude and loneliness in non-intimate others. It suggests that

the average score of loneliness and gratitude do not tell something about grateful and lonely feelings when surrounded by non-intimate people. Lonely and non-lonely individuals can feel grateful as well as ungrateful when surrounded by fellow students or co-workers (i.e. non-intimate company). However, the results show that when surrounded by non-intimate people, gratitude and loneliness are momentarily associated.

**Momentary Association.** A momentary association was found in all contexts. It means that at a certain time point where a person shows a higher loneliness score than their own average, they tend to show a lower gratitude score at this time point as well, or lower loneliness and higher gratitude. That this is the case in intimate company is in line with O'Connell et al. (2016), in that, a person who is surrounded by close people can either recognise the value of these people and is thereby able to appreciate them which then leads to reduced loneliness. Or a person does not recognize the value of that company, thus, does not feel grateful and lonelier. Recognition may play the same crucial role when being alone. Here, however, it is also about recognizing things in oneself or non-human things one can or should be grateful about. As Steinke and Sloan (2014) and Emmons and McCullough (2003) showed, most people feel grateful for many different non-human things like food, nature, God, or a new day. So, people who are able to recognize such things feel more gratitude which decreases the likelihood of loneliness in these moments.

One outlying result here is that the momentary association was not found when highly trait lonely individuals are alone. Some of them felt lonely and grateful at the same time or not lonely but also not grateful. An explanation for these positive associations can be that some highly trait lonely individuals also show high levels of trait gratitude. As discussed in the gratitude section above, high trait grateful individuals also show high levels of state gratitude when alone. So, a high grateful/high lonely person can experience both feelings on a similar level (for a case example see Figure 6, p. 22). This suggests that the mere recognition of something one can be grateful for when being alone does not always reduce the feeling of loneliness. Inferences about daily feelings of loneliness based on a person's trait level should also be made with caution, at least for those with high trait scores. It can be helpful to assess trait loneliness and trait gratitude together as well as investigate them over a certain period in real-life while taking into account how these feelings change in aloneness.

## Generalizability

The main strength of the study is its high ecological validity by using the experience sampling method which allows measuring feelings of gratitude and loneliness directly in the daily lives of people. However, because of technical problems within TiiM, daily questions did not disappear after two hours. That means, the morning questions, for instance, could have been answered later the day where people either tried to remember what they felt in the morning or simply indicated how they felt in the moment. Which in turn would have reduced the ecological validity of the present study. A second limitation is that trait gratitude scores have been relatively high across the total sample which

made it difficult to compare highly grateful individuals to those who would be really considered ungrateful. In addition, internal consistency showed to be unacceptable for the items of 'attitude to appropriateness' (see Appendix 2). It indicates that these items do not correlate well with each other within the present sample. Two participants gave email feedback and stated that these items were difficult to understand. This might have been the case for other participants as well. English as a second language of the participants leads to a language barrier in understanding. Therefore, future studies should examine the internal consistency of the Multi-Component Gratitude Measure and hot gratitude is distributed in other samples, taking into account whether English is the first or second language.

Third, by categorizing different people into intimate and non-intimate company it is assumed that people tend to feel closer to intimate people. This is not necessarily the case for all individuals because some do not feel close to or any intimacy with, for instance, family members. Or as described above, participants within this study do not feel very close to their friends yet because the friendships are relatively new, compared to those of the adolescent sample in the study of van Roekel et al. (2018). Future studies may take the individual perceived intimacy into account. Fourth, for comparing groups the present sample size is quite low so the generalizability of the results should be viewed with caution. A larger sample would have also resulted in more measurement points, thus, more occasions of the different company types. Several analyses did not find any significant effect of being in non-intimate company even though figures let assume that there is a difference compared to aloneness or intimate company. 18.1% of all measurement points occurred in the company of non-intimate others, which is much less than for aloneness and intimate others. With a larger sample and thus more measurement points in non-intimate company, the possible effects of this company might become stronger. Furthermore, by analysing each trait loneliness and gratitude group separately the group sample sizes got smaller and even smaller through the additional comparisons between occasions of aloneness and both company types within each group.

**Implications**

First, it is especially recommended to use a larger sample size to be able to make stronger conclusions about differences between trait lonely and non-lonely individuals. Second, as most high trait lonely people even showed relatively low mean scores of state loneliness further research should compare trait and state measures and identify factors that lead to such inconsistencies between trait self-reports and real-life experiences. A third recommendation is to strengthen the assumption that intrapersonal and non-human things are the source of gratitude when a person is alone by exploring thought processes of highly grateful people in aloneness in more detail. Besides studies should examine whether ecological momentary gratitude interventions lead to higher gratitude and lower loneliness when daily exercises are adapted to the social context a person is currently in. That is, when a person indicates to be alone the exercise may focus especially on intrapersonal and non-human

aspects, such as ‘Name two things you are grateful for about yourself’, or ‘Name one good thing you are grateful for that you have done or seen during the last hour’ (e.g. a good meal, workout, nice bird chirp, or a beautiful flower). And when surrounded by close people, exercises can focus on interpersonal aspects in general and even on the specific present person; for example ‘Name two things someone did for you that you are grateful for’ or ‘Name one thing about the other person that you appreciate.’ Lastly, a rather practical implication is to assess both trait loneliness and trait gratitude together before recommending gratitude interventions for an individual person. Since not all high lonely individuals are ungrateful, inferences based on a simple trait measure of loneliness may lead in the wrong direction. To be more precise, a gratitude intervention done by an already highly grateful person will probably fail to reduce the person’s loneliness.

## References

Algoe, S. B., Gable, S. L., Maisel, N. C. (2010). It's the little things: Everyday gratitude as a booster shot for romantic relationships. *Personal Relationships, 17,* 217–233. doi:10.1111/j.14756811.2010.01273.x

Algoe, S. B., Haidt, J., Gable, S. L. (2008). Beyond reciprocity: Gratitude and relationships in everyday life. *Emotion, 8,* 425–429. doi: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. doi:10.1177/0164027519845354

Bartlett, M. Y., Condon, P., Cruz, J., Bauman, J., DeSteno, D. (2012). Gratitude: Prompting behaviors that build relationships. *Cognition & Emotion, 26,* 2–13. doi:10.1080/02699931.2011.561297

Bartlett, M. Y., DeSteno, D. (2006). Gratitude and prosocial behavior: Helping when it costs you. *Psychological Science, 17,* 319–325. doi:10.1111/j.1467-9280.2006.01705.x

Cacioppo, J. T., Cacioppo, S., Boomsma, D. I. (2014). Evolutionary mechanisms for loneliness. *Cognition and Emotion, 28,* 3–21. doi:10.1080/02699931.2013.837379

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. doi:10.5964/ejop.v11i2.826

Christiansen, J., Larsen, F. B., & Lasgaard, M. (2016). Do stress, health behavior, and sleep mediate the association between loneliness and adverse health conditions among older people? *Social Science & Medicine, 152,* 80–86.

Cohen, J. (1988). Statistical Power Analysis for the Behavioral Sciences (2nd ed.). Hillsdale, N.J.: Lawrence Erlbaum.

DeWall, C. N., Lambert, N. M., Pond, R. S., 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. doi:10.1177/1948550611416675

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. doi:10.1037/00223514.84.2.377

Frinking, E., Jans-Beken, L., Janssens, M., Peeters, S., Lataster, J., Jacobs, N., & Reijnders, J. (2019). Gratitude and loneliness in adults over 40 years: examining the role of psychological flexibility and engaged living, *Aging & Mental Health*. doi:10.1080/13607863.2019.1673309

Hartanto, A., Lee, S. T. H., & Yong, J. C. (2019). Dispositional gratitude moderates the association between socioeconomic status and Interleukin-6. *Scientific Reports, 9*(1). doi:10.1038/s41598-018-37109-1.

Hawkley, L. C., Preacher, K. J., & Cacioppo, J. T. (2007). Multilevel modelling of social interactions and mood in lonely and socially connected individuals: The MacArthur social neuroscience studies. In A. D. Ong & M. H. M. van Dulmen (Eds.), *Series in positive psychology. Oxford handbook of methods in positive psychology* (p. 559–575). Oxford University Press.

Hegeman, A., Schutter, N., Comijs, H., Holwerda, T., Dekker, J., Stek, M., & Van der Mast, R. (2018). Loneliness and cardiovascular disease and the role of late-life depression: Loneliness and cardiovascular disease. *International Journal of Geriatric Psychiatry, 33*(1), e65–e72.

Heron, K.E., & Smyth, J.M. (2011). Ecological momentary interventions: incorporating mobile technology into psychosocial and health behaviour treatments. *British Journal of Health Psychology, 15*(1), 1-39. doi:10.1348/135910709X466063

Gan, P., Xie, Y., Duan, W., Deng, Q., & Yu, X. (2015). Rumination and loneliness independently predict six-month later depression symptoms among Chinese elderly in nursing homes. *PLoS One, 10*(9), e0137176.

Lambert, N. M., Graham, S. M., & Fincham, F. D. (2009). A prototype analysis of gratitude: Varieties of gratitude experiences. *Personality and Social Psychology Bulletin, 35*(9), 1193–1207. doi:10.1177/0146167209338071

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

McCullough, M. E., Tsang, J., & Emmons, R. A. (2004). Gratitude in intermediate affective terrain: links of grateful moods to individual differences and daily emotional experience. *Journal of Personality and Social Psychology, 86*(2), 295-309. doi:10.1037/00223514.86.2.29

McGuire, A. P., Szabo, Y. Z., Murphy, K. M., & Erickson, T. M. (2019). Direct and indirect effects of trait and state gratitude on health-related quality of life in a prospective design. *Psychological Reports*. doi:10.1177/0033294119868784

Morgan, B., Gulliford, L., & Kristjánsson, K. (2017). A new approach to measuring moral virtues: The Multi-Component Gratitude Measure. *Personality and Individual Differences, 117,* 179-189.

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, 43,* 559–566. doi:10.2224/sbp.2015.43.4.559

O'Connell, B. H., O'Shea, D., Gallagher, S. (2016). Mediating effects of loneliness on the gratitude health link. *Personality and Individual Differences, 98,* 179–183.

Perlman, D., & Peplau, L.A. (1981). Toward a social psychology of loneliness. In Gillmour, R., & Duck, S. (Eds.), *Personal relationships 3: Personal relationships in disorder* (pp. 31–56). London, UK: Academic Press.

Richard, A., Rohrmann, S., Vandeleur, C., Schmid, M., Barth, J., & Eichholzer, M. (2017). Loneliness is adversely associated with physical and mental health and lifestyle factors: Results from a Swiss National Survey. *PLoS One, 12*(7).

Russell, D. W. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of personality assessment, 66*(1), 20-40.

Sansone, R. A., & Sansone, L. A. (2010). Gratitude and well-being: the benefits of appreciation. *Psychiatry (Edgmont (Pa.: Township)), 7*(11), 18–22.

The BMS Lab (n.d.). TIIM (The Incredible Intervention Machine). Retrieved from https://bmslab.utwente.nl/knowledgebase/tiim/

van Berkel, N., Ferreira, D., & Kostakos, V. (2017). The experience sampling method on mobile devices. *ACM Computing Surveys, 50*(6). doi:10.1145/3123988

van Roekel, E., Goossens, L., Verhagen, M., Wouters, S., Engels, R. C. M. E., & Scholte, R. H. J. (2013). Loneliness, affect, and adolescents' appraisals of company: An experience sampling method study. *Research on Adolescence, 24*(2), 350-363. doi:10.1111/jora.12061

van Roekel, E., Verhagen, M., Engels, R. C. M. E., Scholte, R. H. J., Cacioppo, S., & Cacioppo, J. T. (2018). 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. doi:10.1080/15374416.2016.1146993

Vassar, M., Crosby, J. W. (2008). A reliability generalization study of coefficient alpha for the UCLA Loneliness Scale. *Journal of Personality Assessment, 90,* 601-607.

Versluis, A., Verkuil, B., Spinhoven, P., van der Ploeg, M. M., & Brosschot, J. F. (2016). Changing mental health and positive psychological well-being using ecological momentary interventions: A systematic review and meta-analysis. *Journal of Medical Internet Research, 18*(6). doi:10.2196/jmir.5642

Wolf, L., & Davis, M. (2014). Loneliness, daily pain, and perceptions of interpersonal events in adults with fibromyalgia. *Health Psychology, 33*(9), 929–937.

Wood, A. M., Froh, J. J., & Geraghty, A. W. A. (2010). Gratitude and well-being: A review and theoretical integration. *Clinical Psychology Review, 30*(7), 890-905.

Wood, A. M., Joseph, S., & Maltby, J. (2008). Gratitude uniquely predicts satisfaction with life: Incremental validity above the domains and facets of the five-factor model. *Personality and Individual Differences, 45*(1), 49-54.

# Appendices

## Appendix 1: Push Notifications

**Table 1**

*Timing of Push Notifications*

| **Time** | **Push Notification** |
|---|---|
| After assigning participants to study: | Welcome! Further information will follow tomorrow! :) |
| Day 1: 08:00:<br>19:00 (if not done yet): | Thank you for your patience; New information are available!<br>Have you read all information? We'll start tomorrow morning :) |
| Day 2 - 8: 08:00:<br>12:00:<br>19:00:<br><br>09:30, 13:30, 20:30 (if not done yet):<br>To encourage | Good morning :) Tell me how you are feeling!<br>Lunch time :) Tell me how you are feeling!<br>Tell me how you are feeling! And enjoy your evening :)<br><br>Don't forget to tell me how you are feeling :)<br>You are doing great! 4 more days to go!<br>Good morning :) Only 2 more days. You're doing great!<br>A few missed answers are no problem! Keep doing! |
| Day 8: 21:00: | You've made a great job this week! :) Tomorrow you'll receive the ending questionnaires. |
| Day 9: 08:00:<br>14:00 (if not done yet):<br>19:00 (if not done yet): | Today is your last day! Please fill in the 4 questionnaires.<br>Great job so far! Don't forget to fill in the last questionnaires! :)<br>Great job so far! Don't forget to fill in the last questionnaires! :) |

## Appendix 2: The Multi-Component Gratitude Measure (MCGM)

** Items with reversed scoring*

Items that measure the emotional component of gratitude:

1. There are so many people that I feel grateful towards
2. There are so many people that I feel grateful for
3. I feel appreciative of the support of many people in my life's journey
4. I feel grateful for the people in my life
5. Thinking about all I have to be grateful for makes me feel happy
6. There are many things that I am grateful for

Items that measure the attitudinal component of gratitude:

*Attitude to appropriateness:*

7. Gratitude should be reserved for when someone does not want anything in return (*)
8. Gratitude should be reserved for when someone intends to benefit you (*)
9. I only show gratitude to people who have benefitted me without wanting anything in return (*)
10. I only show gratitude for the things that are not already due to me/are mine by right (*)
11. I only show gratitude towards people who clearly intended to benefit me (*)
12. I only feel grateful when the benefit is of genuine value to me

*Attitude of gratitude:*

13. I don't think it is necessary to show your gratitude to others (*)
14. I believe it is important to thank people sincerely for the help they give me
15. I believe gratitude is an important value to have
16. It is important to acknowledge the kindness of other people

Items that measure the behavioural component of gratitude:

*Behavioural shortcoming:*

17. I forget to let others know how much I appreciate them (*)
18. I forget to reflect on the things that I am grateful for (*)
19. I overlook how much I have to be grateful for (*)
20. I forget to remind myself that there is so much in life to be thankful for (*)

*Rituals & Noticing Benefits:*

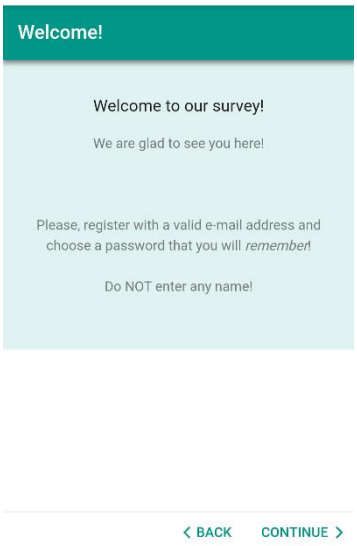
21. I stop to recognize all the good things I have in my life
22. I recognise how many things I have to be grateful for
23. I stop and think about all the things I am grateful for
24. I reflect on all the good things I have
25. I remind myself of the benefits I have received
26. I make it a priority to thank others
27. I express thanks to those who help me
28. I notice the people who are kind to me
29. I go out of my way to thank others for their help

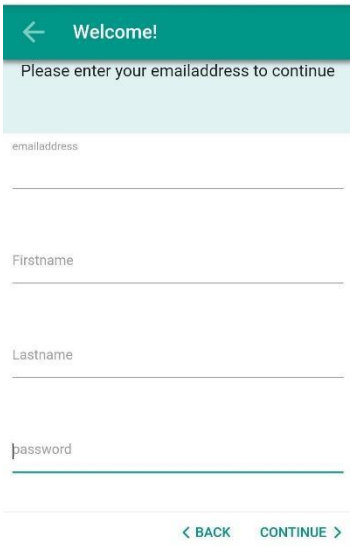
## Appendix 3: The UCLA Loneliness Scale

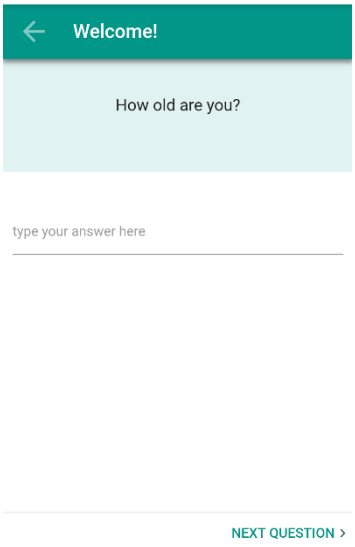
1. How often do you feel that you are “in tune” with the people around you?
2. How often do you feel that you lack companionship?
3. How often do you feel that there is no one you can turn to?
4. How often do you feel alone?
5. How often do you feel part of a group of friends?
6. How often do you feel that you have a lot in common with the people around you?
7. How often do you feel that you are no longer close to anyone?
8. How often do you feel that your interests and ideas are not shared by those around you?
9. How often do you feel outgoing and friendly?
10. How often do you feel close to people?
11. How often do you feel left out?
12. How often do you feel that your relationships with others are not meaningful?
13. How often do you feel that no one really knows you well?
14. How often do you feel isolated from others?
15. How often do you feel that you can find companionship when you want it?
16. How often do you feel that there are people who really understand you?
17. How often do you feel shy?
18. How often do you feel that people are around you but not with you?
19. How often do you feel that there are people you can talk to?
20. How often do you feel that there are people you can turn to?

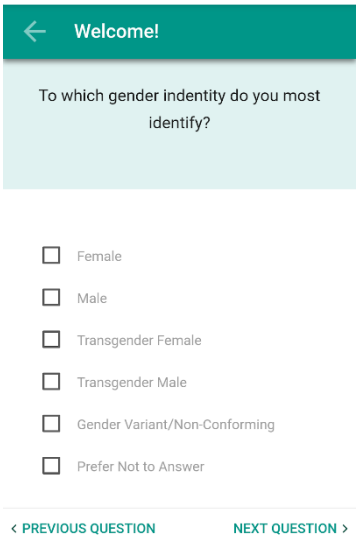
# Appendix 4: The Incredible Intervention Machine (TiiM)

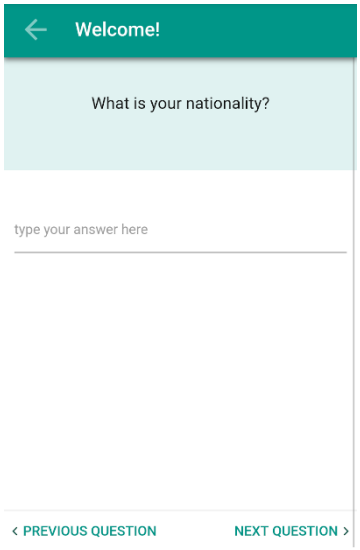
## 4.1 Subscription

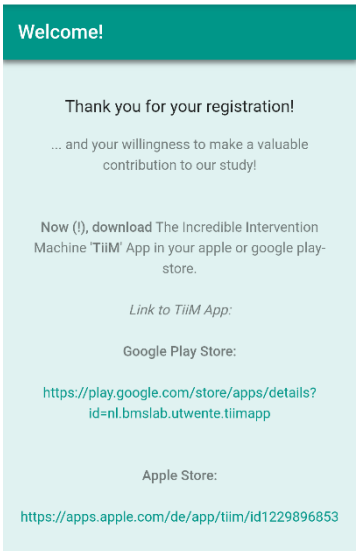


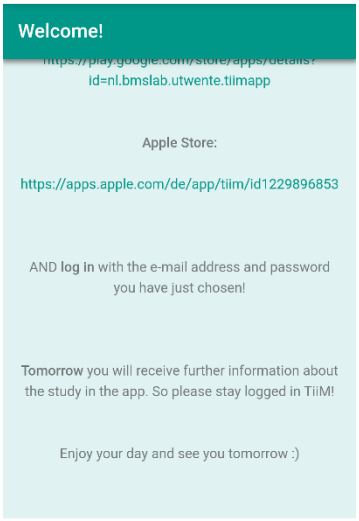



## 4.2 Daily ESM Questions