Bachelor's Thesis

Jonas Möller

The Socio Contextual Relation between Anxiety and Depression - An Experience Sampling Study

Department of Psychology, Health & Technology

University of Twente

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First Supervisor: Dr. P.M. ten Klooster

Second Supervisor: J.T. Kraiss

UNIVERSITY OF TWENTE.

Abstract

Depression and anxiety have been widely studied as traits, largely measured by cross-sectional studies, and therefore mostly regarded as stable individual constructs. Due to high comorbidity, overlapping behavioral influences and how both disorders share common ground on how they could be triggered in an individual a strong relationship is apparent. The experience sampling method (ESM) can be used to assess state dynamics which depict a more detailed picture than a pure trait assessment. The current study explores the relation between depression and anxiety over the course of two weeks via a daily assessment in 25 university students. The aims of this study were to explore emotional fluctuations over this period, their association with socio-context and their association with trait-levels of anxiety and depression. Analyses were performed using repeated-measures linear mixed models. The results showed a strong correlation between both state variables over time (B= 0.5, p<.001). Contact, in general, had a positive effect on both anxiety and depression compared with being alone, however, depression was most reactive to social contact and was highly reduced through close friends by averagely 10.62 on a 0-100 scale (M= 10.24, t= -5.37, p< .001). Contact through electronic devices also significantly reduced depressive symptoms by 5.46 points (M= 15.62, t= -2.33, p= .02). Anxiety was only significantly reduced through contact with family members averagely by 3.34 points (M= 16.43, t= -2.92, p= .033) and through contact with close friends by 4.55 points (M= 15.31, t= -2.92, p<=.004). Also, only contact outside of their own home significantly associated with reduced anxiety by 8.90 points (M= 12.19, t= -4.04, p= .001). The trait scores were not significantly predictive of the degree of emotional fluctuations through a regression analysis, but an additional visual analysis of high and low trait groups suggested more fluctuating values for high depression individuals. The implications from this study are that state depression and anxiety also seem to share an underlying factor and that the positive effect of social support is perceptible through electronic devices, especially in the case of depression, posing an argument for future online interventions based on experience sampling.

Introduction

Everybody knows what is meant when speaking of fear or feeling blue at times, some days seem to be darker and more stressful than others. Waking up without feeling rested, knowing one must be productive or fearing the day at work thinking about all the things one could be confronted with. But what it is like when every day is one of these days, possibly resulting in the wish of retreating rather than to be confronted with the problems of the outside world. According to the World Health Organization (WHO) estimation from 2015, more than 300 million people worldwide are affected by these thoughts, they suffer from depression while it is expected that approximately 264 million people also experience a range of anxiety disorders.

Due to the high comorbidity of depression and anxiety individuals often experience both symptoms which taken together can lead to a great deal of distress, having a debilitating effect on nearly every aspect of their lives. The WHO is expecting that Europe is responsible for a prevalence of 12% in 2015, or 40.27 million cases of the depressive disorder making it the second-lowest region compared to e.g. the western pacific region with 27% or the South-East Asia region with 21% of total cases. The number of people suffering from anxiety disorders in Europe is similar with an expected 14%, or 36.17 million people. In both cases, the female population is more affected than male, especially related to anxiety disorder where females make out 75% of the cases (Global Burden of Disease Study, 2015). Based on these numbers one can see that anxiety and depression constitute the top of mental disorders regarding their prevalence, and especially people who are sensitive or exposed to a lot of stress are at risk. Extensive research has been carried out to indicate a wide array of factors that are negatively affecting university students, leading to the conclusion that also students are vulnerable to mental health problems.

The academic life of a student brings a lot of change with it, undergraduates become more autonomous and have to take care of themselves while dealing with academic and social demands. For instance, two studies assessed anxious and depressive symptoms of European university students. The first study conducted a systematic literature review of peer-reviewed articles (24 in total) from 4 different databases which reported on depression among undergraduates. They estimated a mean prevalence rate of depression at 8.6% concerning university students in Europe while 10.05% of females were affected and 6.61% of males (Ibrahim, Kelly, Adams & Glazebrook, 2013). The second study assessed among other things the extend of anxiety symptoms in Turkish undergraduates with the Depression Anxiety and Stress Scale (DASS). About 20.8% of the students

were classified for severe or extremely severe anxiety. Once again were females more at risk and reported significantly higher mean anxiety scores than males (Bayram & Bilgel, 2008).

If not treated properly can these conditions lead to actual disorders and long-term disability and in extreme cases to suicide. The consequences of these disorders are severe, the WHO ranked depression as the single main contributor to the global disability with around 7.5% years lived with disability (YLD; multiplying prevalence with the average level of disability) and suicide in 2015 whereas anxiety is ranked on the 6th place. The organization further estimated that 788 000 people committed suicide in 2015, placing suicide as the second leading cause of death among 15-29-year old's (Global Burden of Disease Study, 2015). Several speculated factors could contribute to the development of these mental disorders, such as the change of their lifestyle disturbing their sleeping and eating pattern, alteration of relationships to friends/family, financial reasons, academic worries and the dispute with the post-graduate life (NIMH, 2009).

Despite being classified as two different disorders, depression and anxiety are strongly comorbid and share common ground on how they could be triggered in a person. These two conditions occur so frequently together that the diagnostic category "mixed anxiety/depressive disorder" was developed to account for people experiencing a mix of symptoms (Roy-Byrne, Katon, Broadhead, Lepine, Richards, Brantley, Russo, Zinbarg, Barlow & Liebowitz, 1994). This overlap between feelings of depression and anxiety has led some researchers to suggest that these two disorders are not truly independent but are subcategories of a larger group of emotional disorders with symptoms that can often intermingle (Watson, 2005). Besides, the tripartite model by Clark and Watson (1991) supports the notion that general distress or negative affect is influencing both disorders and have therefore a shared underlying factor which could trigger both disorders, explaining the high comorbidity. This model also explains that physiological hyperarousal is specific to anxiety while the absence of positive affect is specific for depression.

Depression is a mood disorder characterized by several symptoms which incorporate emotional, motivational, behavioral, physical and cognitive impairment. Feeling depressed means exhibiting a negative state which is described along the lines of being sad, hopeless, dejected, miserable and discouraged, rarely do depressed people report positive feelings or experiences; the loss of humor and less frequent show of positive facial expression is likewise commonly reported (Sloan, Strauss & Wisner, 2001). Also, a motivational discrepancy is possible which is linked to a loss of joy in the general daily life, in hobbies and in activities, in addition, are depressive feelings

accompanied by a shortage of initiative or in other words a general attitude ‘to not care anymore’. Activities which were once enjoyed and pursued out of pleasure lost their charm. Severe levels of these depressive feelings can reach up to the point where the desire for food, appetite, and sexual activities is significantly reduced. This general loss of desire and pleasure is harmful to social life because being depressed leads to increased withdrawal, being more inclined to stay home and to be left alone (Davey, 2008). Most notably or notorious are the cognitive features which occur with prolonged depressive feelings, individuals develop particularly negative views about themselves and everything around them; a pessimistic pattern arises leading them to believe that nothing can be improved (Gable & Shean, 2000). This negative attitude negatively affects their ability to think, leading to poor concentration and decision making. This vicious circle of negative thoughts and experiences reinforce themselves where sufferers believe they are worthless, accompanied by feelings of shame and guilt. Dysfunctional beliefs manifest themselves to the point where they believe that death is the only option, recurrent suicidal thoughts begin to show (Davey, 2008).

Anxiety itself is a natural response to certain challenging situations which should help people to perform more effectively. However, this response can become maladaptive when individuals exhibit a great deal of stress impeding them in their day to day life (Lepine, 2002). It is characterized “by an excessive or aroused state and feelings of apprehension, uncertainty and fear” (Davey, 2008, p. 146). Responses by individuals suffering from anxiety may be disproportionate to low threat events, and in more severe cases the state of fear is constant, and sufferers are unable to attribute it to a specific situation. The reason for such reactions is a cognitive bias which is prevalent in almost all anxiety disorders, letting the victim selectively attend to threatening stimuli (Mathews & MacLeod, 2005). This information processing is the reason for continuous dysfunctional behavior and thoughts which occur uncontrollably and are further preserved by the anxious individual, for instance through constant worrying (Davey & Wells, 2006). The context the individual finds herself/himself in seems to be of importance.

One of the more prevalent subtypes of anxiety is social anxiety, this classification is focused on the social context and how this environment influences the subjective experience of anxious individuals. The DSM-5 describes this type of disorder as showing anxiety symptoms in social situations where the individual is afraid of being evaluated negatively which includes fear of humiliation, embarrassment, or rejection. For instance, it is possible that anxious individuals experience conversations as stressful because they fear to embarrass themselves. Bodily symptoms

prevalent in the social anxiety disorder are tremors, sweating, palpitations, muscle tension, blushing and confusion, in extreme cases of anxiety are also panic attacks possible. The impairment which comes along with this disorder leads to a general reluctance to engage in social situations that also include, romantic relationships, education, and the workplace, leading to underperformance or drop out (Stein & Kean, 2000). Generally, anxious people begin to withdraw themselves, living in isolation out of fear to misbehave in social situations because they feel that they are unable to cope with the negative outcome.

The general assumption of much research into depression and anxiety is that the characteristics of these two disorders are assumed to be relatively stable over time, meaning the experience of symptoms should occur steadily with roughly the same intensity. In these cases, people refer to anxiety and depression as traits. For instance, the American psychological association (APA) defined a trait as "an enduring personality characteristic that describes or determines an individual's behavior across a range of situations" (APA, n.d.a). To determine if an individual is suffering from depression or anxiety, many questionnaires have been developed that help professional to determine the presence and severity based on the score the person reaches. One of such questionnaires is the Hospital Anxiety and Depression Scale (HADS) developed by Zigmond and Snaith (1983), a screening instrument for patients in psychiatric hospital clinics that contains 14 items in total, seven questions for each disorder. A score between 0-21 points can be reached, where scores from 0-7 seven predict so-called 'non-cases', 8-10 'doubt foul cases' and from 11-21 'definite cases' (Hinz & Brähler, 2011).

However, in most people emotional states are not continuously present, one situation might invoke anger in us, but this state is not present from the point of experience until eternity. Emotions have a dynamic nature which is dependent on three principles we can control only to some degree. The first principle is the *principle of contingency* that describes our emotional responsiveness to situations. "Emotions are typically contingent on internal or external events, often social in nature, that touch on our concerns and well-being. As these events, or rather appraisals or constructions of them, change or unfold, so do emotions" (Kuppens & Verduyn, 2017, p.22). The *principle of inertia* resembles the assumption of stable traits as mentioned above because humans tend to perceive and interpret their surroundings partly based on the current emotional states displaying an intrinsic resistance to change, they gain momentum and tend to be carried from one moment to the next. The last one, the *principle of regulation*, on the other hand, is congruent with the fluctuation

of emotions because it argues that people regulate their emotion to make them fit with the current desired state. There is a tendency to down-regulate emotions to avoid endless persistence and extreme states, but individuals also engage in upregulation when they anticipate certain circumstances or to reach a current goal. This implies a balance of emotional states; a tendency to resist and regulate, which changes over time, determining how people emotions unfold over a period (Kuppens & Verdun, 2017).

This variability in emotional states is not accounted for in typical cross-sectional questionnaires and longitudinal intensive studies on the prevalence of feelings of depression and anxiety may provide quite valuable information when looking at how these two correlating constructs or emotions behave in relation to each other over a period of time between and within individuals. Measuring the in the moment experience is therefore referred to as a state measurement. State anxiety is defined as a "transitory emotion characterized by physiological arousal and consciously perceived feelings of apprehension, dread, and tension" (Spielberger, 1966). Like mentioned above, state anxiety can vary in the degree of intensity and is subject to variations over time, compared to the trait as a chronic uninterrupted personality characteristic resembles the state a response to situations (Weeks, Hayley & Stough, 2019).

It appears that research examining the separation between state and trait in the case of depression is less prominent as with anxiety. The only readily available definition of depression as a state occurs in the *State-Trait Depression Scales* (STDS) developed by Spielberger (1995). Here subjects specify on a four-stage intensity scale how they feel at the moment, the state here is defined trough two different items types. The first type is related to depression positive items, summarized under the term *Dysthymia* that incorporates questions about the current experience of negative emotions like '*feeling pressed'*, *'miserable'*, *'dejected'*, *'sad'* and *'melancholic'*. On the other half are questions aimed at the contrary state, *Euthymia*, and includes items like *'feeling inwardly strong'*, *'full of energy'*, *'secure'*, *'healthy'* and *'hopeful'*. This means that a strong depressive state is not only characterized by the occurrence of Dysthymia but also through the absence of Euthymia, which marks a depressive state as a low level of positive affect whereas state anxiety is predominantly physiological overexcitation (Clark & Watson, 1991).

To further clarify the interaction between state and trait depression in an individual, one can define trait depression as a base which influences the subjective experience based on the trait severity. For instance, if a person is characterized as high in trait depression, stressful situations

such as the witnessing of failure are assumed to be more impactful, leading to a more intense rise in state depression as compared to an individual with low trait depression. Therefore, a high score in trait depression could be of significance based on the interaction it has with state depression because it interrelates with factors like environmental stressors or lack of social support which together is expected to reinforce the cognitive-affective cycle upholding the depressive feelings (Teasdale, 1988).

Having explored the dynamics of emotional states regarding depression and anxiety, it appears that both can be associated with the context the individual finds herself/himself. Feeling depressed negatively influences the anticipation of social events, making them wish to be alone, which was further validated by the findings that the wish to be alone is associated with an increase in negative affect compared to healthy individuals. The research by Winkel, Nicolson, Wichers, Viechtbauer, Myin-Germeys & Peeters (2015) additionally supported the notion that daily life increased negative affect reactivity to social stress, therefore increasing the risk for the recurrence and development of a depressive episode.

The wish to be alone, or generally speaking avoidance, appears to play a central role in both anxiety and depression. Ferster (1973) initially proposed this connection and suggested that people suffering from depression generally tend to avoid or escape from perceived unpleasant situations. Indeed, is depression associated not only with objective social isolation but also with high levels of social avoidance in relation to social and nonsocial domains (Matthews, Danese, Wertz, Odgers, Ambler, Moffitt & Arseneault, 2016). This behavioral spectrum is described through statements like:" I avoid attending social activities (Behavioral social)" and "Rather than try new activities, I tend to stick with the things I know (Behavioral nonsocial)" (Ottenbreit, Dobson & Quigley, 2014, p. 83). Individuals who suffer from both Major depressive disorder and Social anxiety disorder show a significantly greater increase in avoidance behavior found compared to people who were diagnosed with only one condition. Yet also nonsocial situations, like work or school, are affected by this reaction because there is a significant social component such as interaction with colleagues involved. Thus, giving rise to the assumption that the engagement in avoidant behavior could be triggered by a slight chance of social interaction, at least in the case for severely anxious people (Berman, Wheaton, McGrath & Abramowitz, 2010).

Furthermore, depression is associated with loneliness and therefore also with increased negative affect regarding a negatively appraised company. The affective state of loneliness is

additionally context-dependent and might lead to a different reaction to environments, compared to non-lonely people, which can sustain their level of loneliness (Van Roekel, Goossnes, Verhagen, Wouters, Engels & Scholte, 2013; Van Roekel, Verhagen, Engels, Scholte, Cacioppo & Cacioppo, 2018). Furthermore, was it observed that individuals who show high levels of emotional variability during their daily lives were found to be prone for higher levels of depression as well as low self-esteem (Kuppens, Allen & Sheeber, 2010). Taken these findings together is it apparent that anxiety and depression may influence the behavior of people in a quite similar way, mainly withdrawal and avoidance, the question arises then whether this association is also apparent within individuals over time through the intensive measuring of state or trait variables.

The most common measurement used in research regarding the association of anxiety and depression is the cross-sectional study which evaluates the condition of an individual at a specific point in time. These studies conceptualize psychological constructs as traits, asking questions regarding the individual's subjective experience of the past week(s) or month. Such tests are easy to administer because they are hardly time-consuming, a couple of self-report measures account for a long period of time, and a large sample can, therefore, be addressed easily. The use of such studies is mainly to estimate the prevalence of disorders in a given population at a specified point in time, which makes them unusable to address the cause and effect variables. However, to assess fluctuations of emotional states based on the context, such retrospective cross-sectional self-reports are less than ideal.

Individuals suffering from depression or anxiety disorder have a tendency to report past experiences in an overly negative way or make their self-reports dependent on their current mood leading to a biased answer (Dalgleish & Watts, 1990). Research also suggests that at the same time healthy people without psychopathological symptoms are neither good at reconstructing past experiences nor able to reliably assess the complete dimensions of emotions regarding their experiences (Yarmey, 1979). To avoid such potentially biased reports of participants, the experience sampling method (ESM) was developed which is a procedure used to study what people think, feel, or do during their daily lives.

The ESM is defined as an intensive longitudinal research methodology with usually smaller sample sizes, in comparison to typical cross-sectional studies. “The objective of the Experience Sampling Method is to obtain self-reports for a representative sample of moments in people’s lives” (Larson & Csikszentmihalyi, 2014, p. 23). Individuals are asked to fill out systematic self-reports

at random occasions over a day containing questions regarding various elements of their daily activities, a diary technique so to say allowing the assessment of their private life and environment without disrupting or influencing it (Berkel, Ferreira & Kostakos, 2017). This procedure reduces the retrospective bias because participants are instructed to report as soon as possible in accordance of their current state, while also possessing a high ecological validity since the assessment is occurring during real-life (Versluis, Verkuil, Lane, Hagemann, Thayer & Brosschot, 2018). Thus, it allows for the assessment of temporal variability of emotional states, useful to study the influences of contexts in relation to anxiety and depression.

The objective of the current study is, therefore, to explore the relationship between state anxiety and state depression in a non-clinical sample on several levels. First, the association between state measurements of anxiety and depression over time was examined to explore if depressive and anxious states influence each other, in other words, if a rise/fall in one of the states leads to an increase or decrease in the other state and vice versa. Research has shown that individuals suffering from both symptoms experience a similar accumulation of negative emotions, indicating a possible common underlying factor such as 'general distress' (Bakish, 1999; Clark & Watson, 1991). Second, it was examined how social contexts affect the reported states of depression and anxiety. Previous research showed that social contact and perceived social support have a longitudinal and negative relation to depression, indicating that socially active participants have relatively low values in state and trait depression (Peirce, Frone, Russel, Cooper & Mudar, 2000). Furthermore, high anxiety values have been linked to avoidance which further reinforces the assumption that individuals reporting low values of trait and state anxiety are also more socially active. Third, the trait measures of the Hospital Anxiety and Depression scale were used to establish a baseline of psychopathological symptoms and to examine if trait values of anxiety and depression are predictive of the intensity of emotional fluctuations over the days. Based on the given literature was it expected that high trait depression and trait anxiety would contribute to a higher rate in emotional fluctuations (Kuppens, Allen & Sheeber, 2010).

Method

Study Design and Procedure

This study applied the intensive longitudinal experience sampling method (ESM) to assess the intensity of state depression and state anxiety in university students over a period of two weeks. The ESM involved asking participants a set of identical questions via their smartphones three times a day on random occasions but within specific time frames. They were instructed to respond as soon as possible for the sake of accurate judgment. The overarching goal of the data collecting was to minimize the burden put on the participants while still receiving data relevant both in extensiveness and quality. Research conducted by Connor & Lehman (2012) indicated some guidelines on how to conduct a successful experience sampling study which were used as a means to construct a data collection framework.

First off, it was advised to assess experiences between four to ten times a day when measuring ongoing experiences such as mood. For the current study, it was decided on three prompts a day to further decrease the burden on participants. Students are especially in the period where the study was conducted subjected under a lot of pressure which might decrease the motivation to take part in the assessments on a daily basis. The recommended duration for this type of method is at least one week to receive a representative sample of individuals feelings and social contexts they found themselves in (Hektner, Schmidt & Csikszentmihaly, 2007). Additional sources of literature support the notion of an experience sampling duration of three days to three weeks, with a longer period allowing for the gathering of more representative data given the probability that some assessments will be missed by participants (Conner & Lehman, 2012). While this study decreased the burden by limiting the prompts to three times a day, the duration was increased to two weeks as a tradeoff for the sake of quality. Additionally, it was estimated that the daily questionnaires would take about two minutes to complete, making them especially short therefore putting even less stress on the subjects, and this in turn allowed for a longer duration of the study (Delespaul, 1992). A further convenience of a two-week period is the ability to compare the data sets of each week with another, fluctuations of in-week and weekend states can be explained relating it to the other week's measurement.

Furthermore, a survey design was utilized to gather data about the demographics of participants as well as their trait measures of depression and anxiety. Both daily and baseline

questionnaires assessed through the '*Ethica*' app (https://ethicadata.com/product) which participants had to download on their smartphones. The study was approved by the ethical commission of the university of Twente, faulty BMS, on the 18th November of 2019.

The first questionnaires were required to be answered on the 6th of April 2020 whereas the last questionnaires were administered on April 20th. Apart from the assessment of the demographics and the trait measurements of depression and anxiety via the HADS, each day three-time windows were indicated in which the participants had the chance to answer the set of momentary questions. These were set in the morning beginning at 10 a.m., afternoon at 3 p.m., and evening at 8 p.m. At these points in time, a push notification was sent via the ethica app that a new questionnaire was available to be completed, another notification was sent after 90 minutes as a reminder. It was feasible to conduct a self-report in a timeframe of 180 minutes for the morning and afternoon assessment and 240 minutes regarding the evening questionnaire. If it were not possible to give an answer in these time frames the opportunity expired, and participants could not retroactively respond. That implies participants were able to assess the daily questionnaires between 10 a.m. – 1 p.m. for the morning questionnaire, 3 p.m. – 6 p.m. for the afternoon questionnaire and 8 p.m. – 12 p.m. for the evening questionnaire.

At the beginning of the study, individuals were invited via email to register as a participant. In the email, a URL code was provided which directed them to the ethica internet site and prompted them to download the app first from the "Google Play" or the "App Store". This required them then to manually sign up with the provided registration code. If the individual already downloaded the app beforehand, they were automatically redirected to the application for the registration. From this point on all additional information, instructions and the informed consent (Appendix 5) were provided in the ethica app. This incorporated the reason and goal of research as well as how long this procedure will take place. It was estimated that the daily questionnaires would take two minutes to complete while demographics and the HADS questions would require about ten minutes in total.

Materials and apparatus

The questionnaires were accessible through the "ethica" app, subjects were instructed to download the program onto their smartphones which either used Android or iOS as an operating system. This app was initially developed as a research project at the University of Saskatchewan under the name "iEpi" to track the spread of the H1N1 virus back in 2009. The success led the app to be developed further as a mean to conduct research online, making tasks possible such as screening, distributing informed consent, context-dependent surveys, application of controlled tasks and much more without establishing a physical meeting with anyone, putting minimal burden on participants. Push notifications were sent out as a reminder each day as soon as it was required for the participants to conduct a self-report about their feelings and social context.

The first section of the daily questionnaires was focused on the assessment of feelings. Here participants had to indicate the strength of the at the moment experienced psychopathology which was assessed through two 0-100 visual analogue scales (1) "How anxious do you feel right now?" and (2) "To what extent do you feel down right now?". Both of these questions were accompanied with one scale for each inquiry, on this scale subjects had to specify their experienced intensity via a slider from zero, "not at all", to one hundred, "extremely" (Appendix 1). This item and measurement method were derived from the ecological momentary assessment study by Cox, Sterba, Cole, Upender and Olatunij (2018) and which proved itself useful as a momentary assessment. This study extended the tool to also measure the subjective experience of depressive symptoms.

The second section of the daily questionnaire was composed out of two questions which depicted several context options to choose from. The overarching question stated:" Who did you spend time with within the last 2 hours? (select the one category of people that you personally feel most connected to if you spend time multiple people)". Participants could then choose from five different answers which were the following (1) "Partner", (2) "Close friend(s)", (3) "Family members", (4) "Acquaintances (e.g., colleagues / fellow students)" and (5) "This does not apply, I was by myself". The follow-up question:" How did this contact take place?" further specified where or how the individual interacted with the said person through four more options, (1) "Outside home, in-person", (2) "At home, in-person", (3) "Online (electronic devices)" and (4) "This does not apply, because I was by myself" (Appendix 2 & 3).

As a mean to establish a baseline of psychopathology as trait measures the hospital anxiety

and depression scale (HADS) was used (Appendix 4). Here participants are asked to indicate how they felt in the past week using numbers ranging from zero, “not at all”, to three, “very often”. The HADS includes fourteen items in total, one-half (or seven questions) measures anxiety-related feelings, whereas the other half measures depression-related experiences. A literature review examined 747 papers that used the HADS and concluded that the Cronbach’s alpha varied from 0.68 to 0.93, with a mean of 0.83 regarding the anxiety subscale. For the depression subscale was a Cronbach’s alpha detected from 0.67 to 0.90 with a mean of 0.82. The reported sensitivity and specificity for both subscales was approximated to 0.80 making it a suitable questionnaire to assess symptom severity and caseness of both disorders (Bjelland, Dahl, Haug & Neckelmann, 2002). In this study, a Cronbach’s alpha of 0.70 was calculated for the complete questionnaire while the subscale anxiety possessed a Cronbach’s alpha of 0.79 and depression reliability of 0.66. The questionnaire was administered at the start of the assessment of ESM questions.

The administration of the pretest HADS occurred simultaneously with the self-report measure of questions about the subject’s demographical data. Here individuals disclosed sociodemographic information regarding their gender, nationality, level of education and field of study.

Participants

39 participants were recruited for this study through the convenience sampling method from bachelor and/or master studies enlisted in the University of Twente. Subjects were contacted through various social media apps, per mail, friends and in person. Inclusion criteria formulated incorporated the following points (1) a sufficient understanding of the English language and (2) a mobile device with iOS or Android. Based on the research by Van Berkel, Ferreira & Kostakos (2018) who concluded that a median of 19 participants is needed as a representative sample for ESM, a minimum of 30 individuals was agreed upon regarding this study to account for potential dropouts and people who only partially took part. 14 subjects did not complete the daily questionnaires and/or the HADS which led to the exclusion of these individuals which left a total of 25 suitable for the analysis.

Data Analysis

For the data analysis, the statistical program IBM SPSS Statistics (Version 24) was used. Two different datasets were obtained, one regarding the daily assessments which included the state measurements of anxiety and depression and the context-related questions. The other datasets included information regarding the participant's demographics and the baseline measurements from the HADS. Both datasets were merged into a long format dataset and trimmed based on two criteria, first, the HADS baseline assessments need to be completed, and second, the state assessments completion ratio had to be equal or above 50%. This left from the initial 39 participants a total of 25 participations that were qualified for the data analysis. Descriptive statics were used to analyze the data concerning the demographics to assess the distribution of gender, age, nationality, earned degree and the field of study. Further descriptive statistics were used regarding the emotional fluctuations each participant had over the course of the assessment. The frequencies procedure allowed for the calculation of the within-person variance the participants had in their self-reported state assessments of depression and anxiety. In addition, the sum scores of the depression and anxiety subscales from the HADS questionnaire were calculated.

A series of linear mixed model analyses with an autoregressive covariance structure were utilized, first to assess the relationship between both state anxiety and state depression, second to gain insight on how the social context influences reported states. This procedure accounts for missing records and the nested structure of the data which is crucial in an ESM study because of the repeated measurements that took place over the days. Regarding the influence, these two states might have on each other, estimated marginal means were obtained for both state assessments per participant and per time point. In all analyses, the repeated covariance type was set to first-order autoregressive or abbreviated AR (1). This option was chosen based on the assumption that the data regarding the state assessments are correlating less as time progresses, this means measurements of day one were more correlated with day two as with day ten for instance. Another advantage is that this function treats variability as constant, which means in this study that the point in time has no influence on the variability of this construct. The fixed independent factor was either the IDs of the participants or the point of time. The dependent variable was either state depression or anxiety. This allowed for the evaluation of each day via the estimated marginal means to see how the intensity of both anxiety and depression changed over the course of two weeks. SPSS was also used for the creation of the graphs of the calculated means concerning the state assessments

of anxiety and depression and time point as well for the trait sum values.

To statically test the relation between state anxiety and state depression over the course of two weeks one linear mixed model was used with state depression as the dependent variable and state anxiety as a covariate. To gain insight into the effect that the context the participants found themselves in might have on their reported states similar linear mixed models were fitted in which the type of contact was the fixed factor while either state depression or anxiety was included as the dependent variable. The first contact assessment was concerned with which persons the participant had contact in the last two hours, while the second assessment gathered data about how this contact took place. For the latter analyses the fixed factor was set to how the contact took place while the dependent variables remained the same. Estimated marginal means were then used to evaluate what the average intensity of the reported states was for each context-specific question.

For each participant, a total variance value of the daily state anxiety and depression assessments was calculated. Together with the total scores on the trait assessment of anxiety and depression they were utilized in a simple linear regression analysis to evaluate if higher traits scores correlated with more emotional fluctuations of both depression and anxiety states. The dependent variables were in one analysis the variability of the total state depression scores and in the other analysis the variability of the total state anxiety. The independent fixed covariate was on both cases the total trait scores of either depression or anxiety.

For an additional visual analysis the participants were split into high and low traits groups based on the calculated median for each subscale. Individuals who scored the exact median value were left out for this part of the analysis. Four linear mixed models were used to analyze the emotional fluctuations for high and low trait depression and anxiety. For each analysis, the fixed factor was day and the dependent variable was either depression or anxiety. The estimated marginal means were then transformed into a graph to plot low trait against high trait to visually assess the differences.

Results

Demographics

25 participants qualified for the analysis, ranging from 19 to 32 years of age (mean= 23.52). From these individuals 11were females (or 44%) and 14 males (or 56%). Twenty-two (88%) of these stated they were from German nationality, 1 (or 4%) Australian and 2 (or 8%) other. 15 (or 60%)

subjects indicated that their highest obtained degree was a high school diploma and 10 (40%) reported that they either completed or were enrolled in a bachelor program. 24 people indicated a specific field of study meaning that only one person was never enrolled in a university. 18 people (or 72%) picked Social Science as their field of study, 1 Natural Science (or 4%), 1 Arts (or 4%), 4 Other (or 4%) and 1 not applicable (or 4%). See Table 1 for an overview of the descriptives.

Table 1: Frequencies *(n)*, Mean *(M)* and Percentages *(%)* for demographics and the HADS

Item	*Category*	*n*	*M*	*%*
Gender	Male	11	-	44%
	Female	14	-	56%
	Total	25	-	100%
Age	19	2	-	8%
	21	2	-	8%
	22	5	-	20%
	23	6	-	24%
	24	4	-	16%
	25	2	-	8%
	26	1	-	4%
	28	2	-	8%
	32	1	-	4%
	Average	25	23.52	100%
Nationality	German	22	-	88%
	Australian	1	-	4%
	Other	2	-	8%
Highest degree	High School	15	-	60%
	Bachelor	10	-	40%
Field of study	Social science	18	-	72%
	Natural science	1	-	4%
	Arts	1	-	4%
	Other	4	-	16%
	Not applicable	1	-	4%
HADS				
	Anxiety score	-	11.52	-
	Depression score	-	14.28	-

Trait anxiety and depression

At the beginning of the study the HADS questionnaire was answered by all the participants as a baseline assessment for trait anxiety and depression. The sums for each subscale were separately calculated. Table 1 also illustrates the trait mean scores which was calculated based on all 25 participants, the average score for depression was 14.28 (SD= 3.19) and regarding anxiety 11.52 (SD= 2.40). Figure 1 further visualizes the individual mean trait scores, for instance 6 participants had a higher average score for depression than anxiety score. Participant 25814 scored the highest in terms of anxiety with a total score of 20, while the lowest was linked to 25827 with a score of 9. Subject 25808 achieved the lowest score in trait depression, a sum of 8 while the highest recorded value was ascribed to participant 25385 with 18. Figure 1 shows an illustration of the total trait scores, especially striking is the anxiety score by participant 25814 who had a sum of 20, the highest recorded score. Other relatively high scores were achieved by 24801, 25608 and 25819 who scored close to twenty. The lowest score is linked to subject 25808 who achieved a value of 8. In terms of depression scored participant 25835 the highest with 18 points, while the lowest score was again 8 in the case of subject 25808.

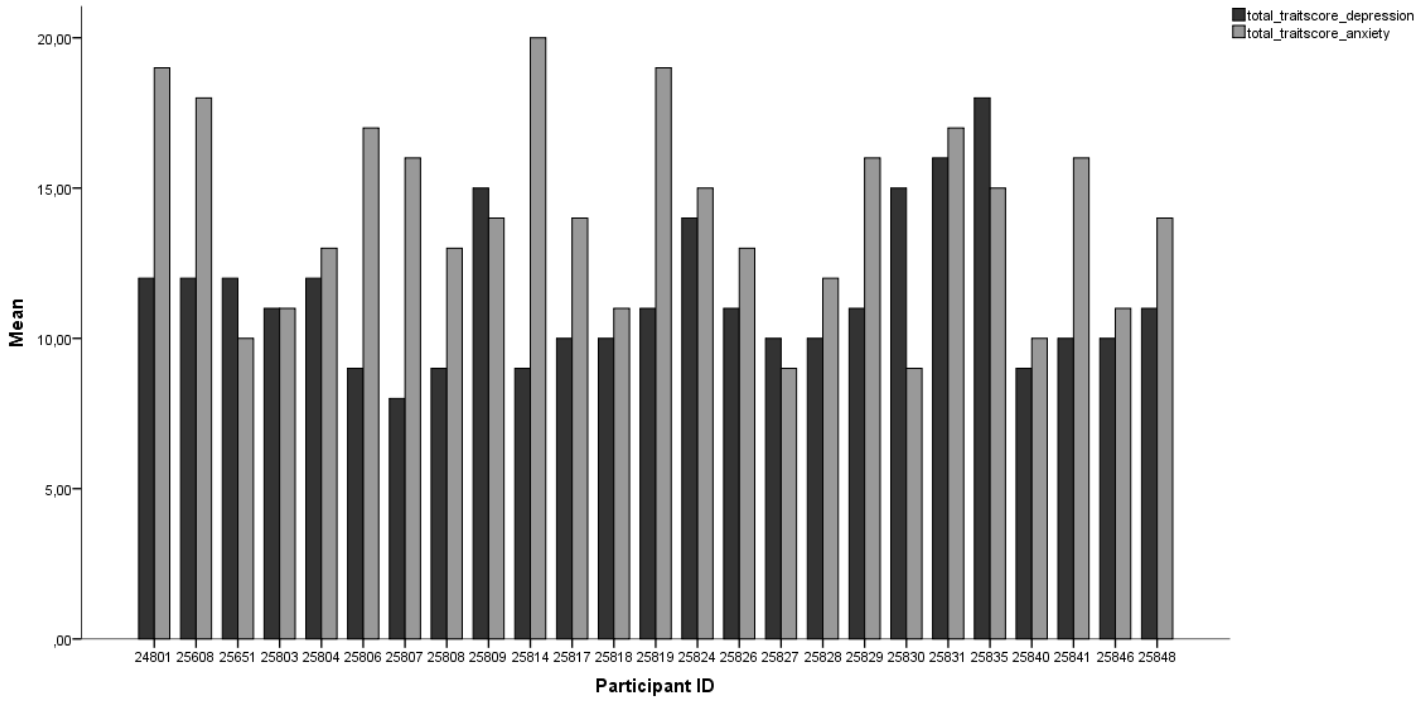


Figure 1: Mean trait score of anxiety in grey and depression in black per participant

Variance of state anxiety and depression scores

Further descriptive procedures were used to calculate the variance and the mean for both of the state scores for each participant (Appendix 7). In terms of anxiety, the by far highest variance value was achieved by participant 25803 with 804.984, followed by 25817 who achieved nearly half less with 497.303. Nearly no variance was detected in subject 25804 with 0.06. The same individual also scored the second lowest average score in the state depression with 0.52 while the lowest value was detected from participant 25615 who scored a variance in depression of 0.47. With a value of 1637.796 was subject 25804 the highest-ranking individual, which is nearly 2.5 times as much as of the second-highest scoring participant 25848 who achieved 675.990. The variance for state depression was in 14 of 25 cases notably higher than compared to anxiety. Participant 25840 has been omitted by SPSS because no variance was detected regarding his/her state anxiety. The variance mean scores were later used to conduct a regression analysis.

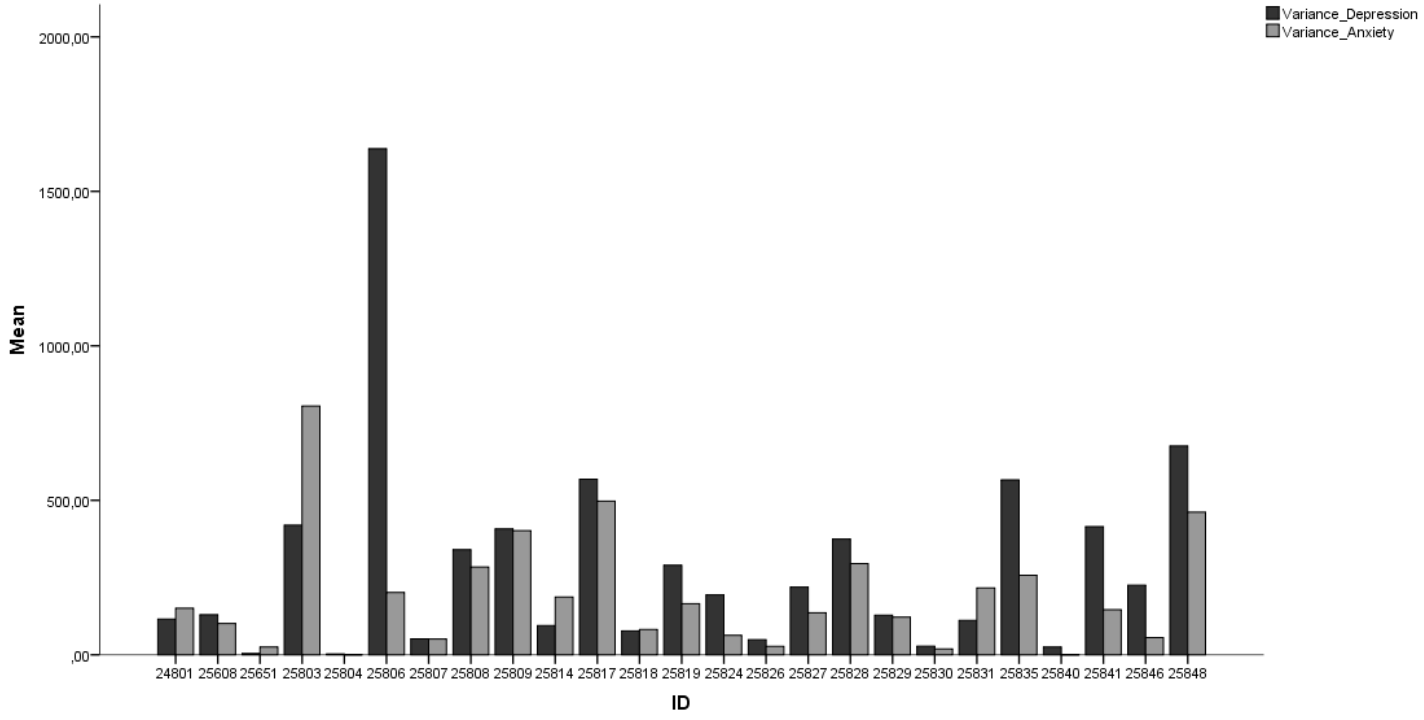


Figure 2: Variance of state depression scores in black and state anxiety scores in grey

State anxiety and depression over time

The linear mixed modelling analysis calculated the state anxiety and depression scores to acquire the estimated marginal means for all measurement points per person. The factor participant was found to have a significant fixed effect (depression: F= 8.987, p< .001: anxiety: F= 29.659, p< .001) indicating significant differences between participants in both anxiety and depression scores over time. Figure 2 illustrates in a graph how the mean scores vary between the participants. The graph shows sizeable interindividual variations between the scores, for instance, participant 25818 reported the highest state anxiety mean value with 80.51 while his/her depression score was relatively low with 9.03. The lowest recorded mean anxiety score was in fact 0 which belongs to subject 25840. In terms of depression was the lowest score of 0.53 acquired by participant 25804, while the highest mean depression value belongs to 25835 with 40.65. The mean of state anxiety was 17.47, which was nearly equal but still a bit higher than the state depression mean of 17.18.

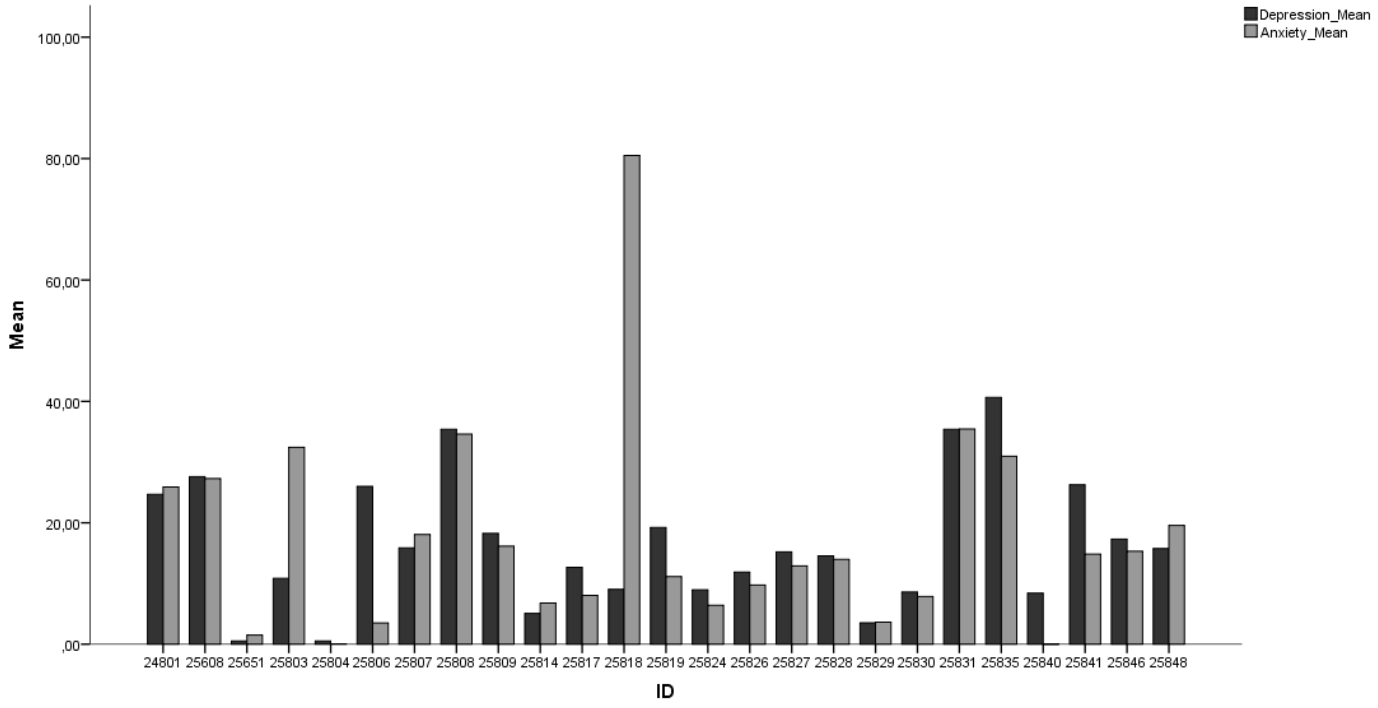


Figure 3: Mean state anxiety in black and mean state depression in grey per participant

Association between State Anxiety and state depression

The second linear mixed modelling analysis was conducted with anxiety as the fixed covariate. A significant effect for the factor state anxiety was found (state anxiety: B= 0.50, t= 15.545, p< .001). This means that time-varying anxiety scores were strongly associated with time-varying depression scores and for every 1-point increase in depression also increased the anxiety score by 0.50. Figure 4 illustrates how the calculated means of state anxiety and state depression fluctuated over the course of 14 days. Starting with the first measurement which was conducted on day 0, which was a Monday, it is apparent that the trajectories of both anxiety and depression mean scores were roughly the same. Both curves seem to fluctuate similarly until day 2, Wednesday, the mean of anxiety surpasses the mean of the state depression indicating a generally more felt intensity of anxiety. Fluctuations appeared equally distributed, despite the difference in the experienced intensity of the participants. Up to day 10 anxiety scores tended to be higher than depression. After the initial spike at day 3 are both constructs declining, arriving at their lowest point at the weekend. For the mean of depression is that day 5 which was a Saturday, while anxiety declined until Sunday. After the weekend rose both means again spiking both at day 8, a Tuesday. After this day were anxiety and depression declining again until the second weekend where they levelled off on day 13.

Given this visual representation, it is apparent that anxiety and depression seem to fluctuate similarly over time, while anxiety is, for the most part, more intensely felt. The weekends had for both construct an easing effect. While the first weekend had a far more positive effect on the felt intensity of measured emotions was the second weekend apparently more stressful for the participants. The values of both weeks were over the course in terms of intensity alike, both spikes of depression had roughly the same score when comparing day 2 and day 9. Anxiety, on the other hand, was generally higher in the first week of assessment in comparison to week 2, also were the spikes in terms of intensity and day of appearance dissimilar in comparison to depression.

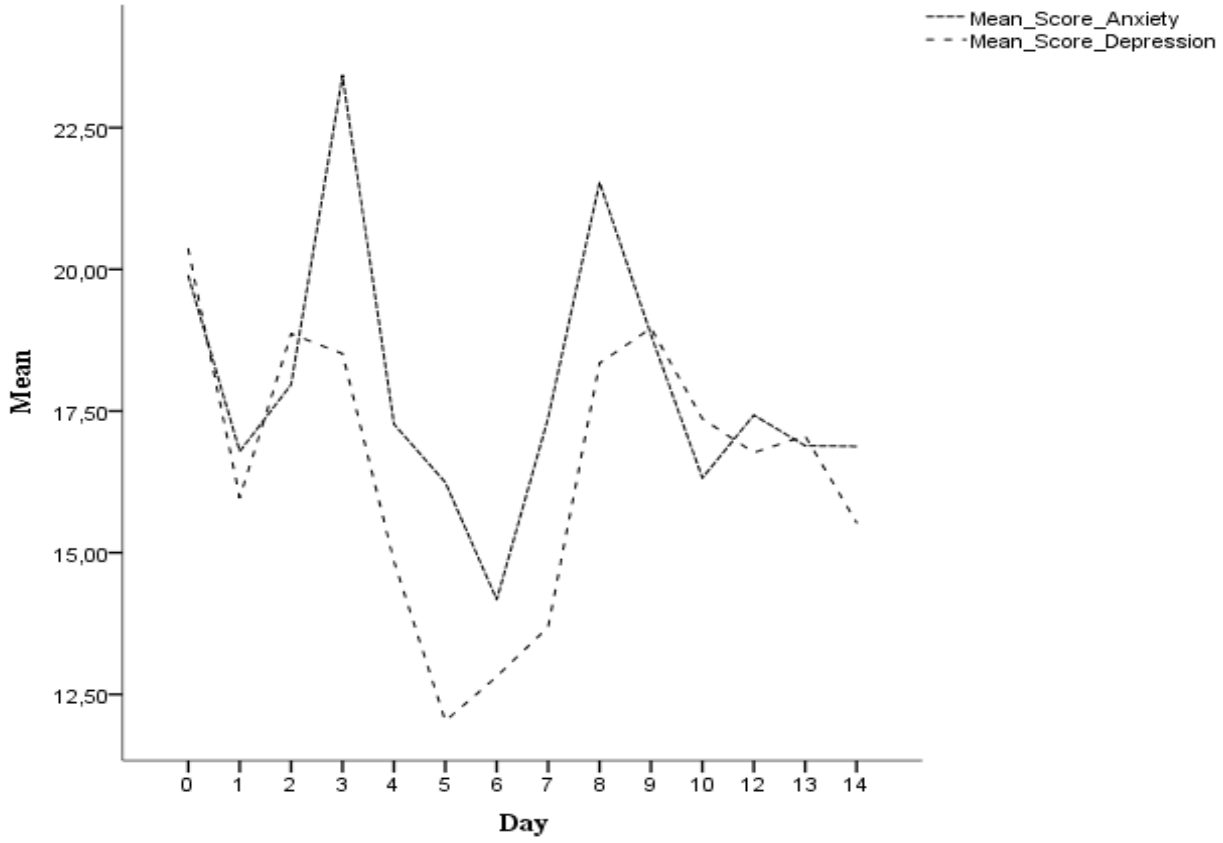


Figure 4: Mean state anxiety and mean state depression per day over a course of two weeks

Influence of the context on state anxiety and state depression

Based on the two context questions two analyses were conducted with the fixed factor 'who did you spend time with within the last 2 hours?' and two 'how did this contact take place?'. For each of the two factors, one analysis was conducted with anxiety as the dependent variable and one with depression as the dependent variable. Every social context was compared to the last category, 'this does not apply, I was by myself', to see how the way of the contact and with whom had an influence on the reported states of depression and anxiety in comparison to no contact at all.

Starting with anxiety, an intercept Estimate of 19.85 was found for the factor 'who did you spend time with within the last 2 hours?', these estimate scores represented for all factors the mean for the comparison category 'this does not apply, I was by myself' meaning individuals scored averagely 19.85 on anxiety when they were alone. There were two significant fixed effects found

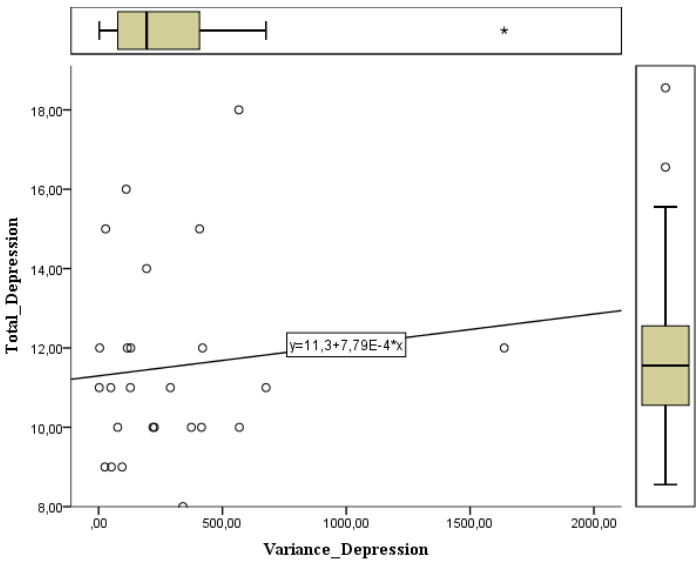
for ‘close friends’ with an estimate of -4,55 (M= 15.31, t= -2.92, p= .004) and for ‘family members’ with an estimate of -3.43 (M= 16.43, t= -2.92, p= .033). Regarding anxiety, the scores were significantly lower when in the presence of close friends or family, while close friends were most effective, and reduced the scores averagely about 4.5 points. No significant effect was found for ‘partner’. In the case of the fixed factor ‘how did this contact take place?’ the intercept estimate was 19.97. One significant fixed effect was found for ‘outside home, in-person’ with an estimate of -4.00 (M= 15.97, t= -2.31, p= .021). This means that the only viable contact to reduce anxiety was established outside of their home, leading to an average reduction of 4 points when compared to no contact at all. No significant effect was found for ‘at home, in person’ or for ‘online (electronic devices)’.

In terms of depression with the fixed factor ‘who did you spend time within the last 2 hours,’ the Intercept Estimate was found to be 20.86, again constituting the average score when no contact took place. There were three significant effects found for ‘partner’ with an estimate of -3.79 (M= 17.01, t= -1.97, p= .049), for ‘close friends’ with an estimate of -10.62 (M= 10.24, t= -5.37, p< .001) and for ‘family members’ with an estimate of -4.74 (M= 16.11, t= -2.48, p= .013). All possible options of contact with persons close to oneself were significant when looking at close friends up to the point where the average score in depression was cut in half when in the presence of friends. No significant effect was found for ‘Acquaintances’. For the fixed factor ‘how did this contact take place?’ an intercept estimate of 21.08 was found while three significant fixed effects were found for ‘outside home, in-person’ with an estimate of -8.90 (M= 12.19, t= -4.04, p< .001), for ‘At home, in-person’ with an estimate of -5.12 (M= 15.96, t= -3.24, p< .001) and for ‘online (electronic devices)’ with an estimate of -5.46 (M= 15.62, t= -2.33, p= .02). Looking at these similar scores between contacts at home in person and online is it apparent that online and offline contact had no notable difference, they all led to an average reduction of approximately 5 points in depression. However, leaving the house to establish contact was by far the most effective method to reduce blue symptoms with a near 9-point reduction.

Association between trait scores and emotional fluctuations

A regression analysis was conducted to assess if anxiety and depression trait scores predicted the intensity of emotional fluctuations. For the construct depression (Beta= .11, F= .28, p= .60) (Figure

5) and anxiety (B= -.08, F= .13, p= 0.72) (Figure 6) the regression indicated no correlation of trait with state score variances.



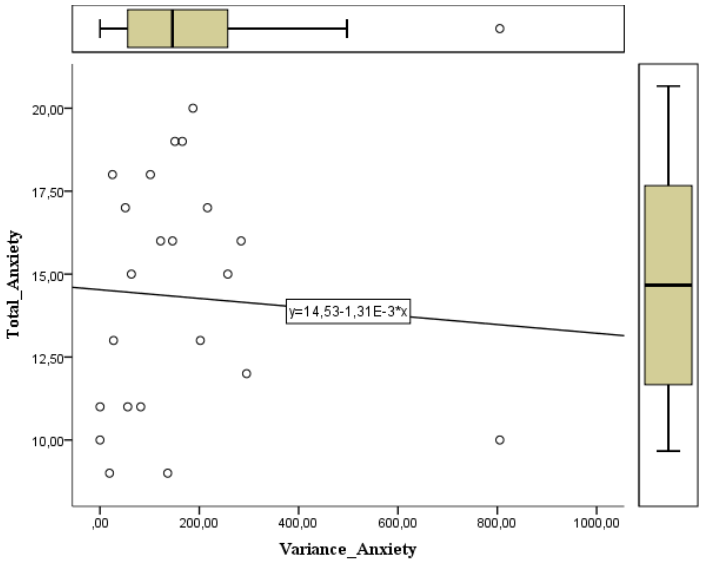


Figure 5 & 6: Correlation between individual trait values and their state variance scores

Difference between high trait and low trait groups

Despite the non-significant results of the regression analysis, a visual analysis was conducted to see if trait scores are correlated to emotional fluctuations. The mean state scores were calculated for each day and the participants were split into two groups for each HADS subscale, one incorporated subjects with high trait values and one with low trait values. To decide who will be in which group was the median for each subscale calculated, for trait depression was the median 11, while for trait anxiety 14. The obtained estimated means for each group per day were then plotted against each other.

Beginning with depression fluctuations of the state values did appear to differ between the high trait and low trait groups (Figure 7). Participants in the high trait group scored a mean value of 19.16 in the two weeks, their minimum score was 10.57 and their maximum 26.23. They tended to generally score higher, aside from day 9 and 13 where the low trait group surpassed their mean

values. The high depression group overall fluctuated more, counting 6 peaks and 5 dips in total. Their fluctuations happened more drastically, the values rose and fell on a day to day bases, especially the period of day 9 until the end showed high variation in the scores. In comparison the low trait value group scored a mean of 16.28 with a minimum value of 8.3 and a maximum value of 26.67, slightly surpassing the high-value group in that regard and showing a wider range of obtained scores. Their highs and lows were more intense. However this group peaked and dipped 3 times over the course of two weeks, showing more stability in the values with fewer fluctuations and in comparison, a steadier rise and fall of scores.

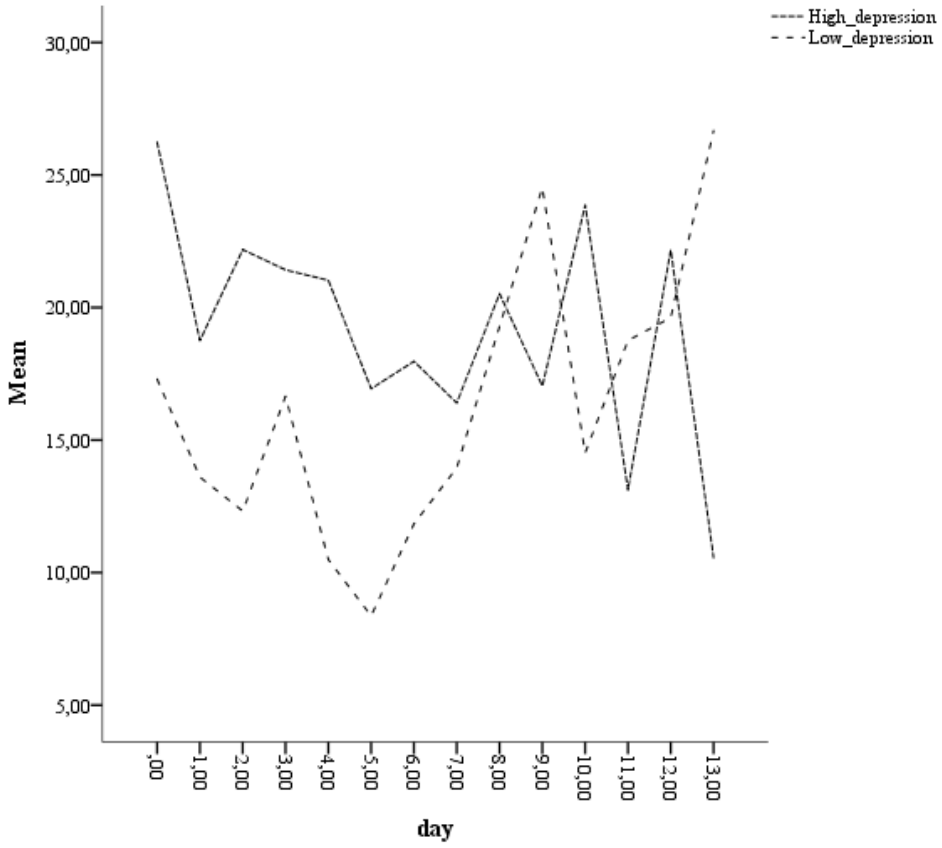


Figure 7: Mean state depression of low and high trait depression groups over two weeks

Anxiety on the other hand depicted a less clear picture regarding the difference between the low trait and high trait group (Figure 8). The individuals with high anxiety scored on average 17.59 over the course of two weeks with a maximum value of 24.80 and a minimum of 12.02. They indicated a relative high experience in the first few days but were surpassed at day 4 by the low trait anxiety group. They peaked 3 times and dipped 3 times in their scores looking overall less fluctuating in comparison to the low trait group. This group scored on average 18.65 with a minimum of 9.81 and a maximum value of 22.39, scoring not only on a wider range but also generally higher than the high trait group. They also fluctuated more in their scores, counting 4 peaks and 5 dips in total. These differences in scores also came about more abrupt like in the high trait depression group, but less often, it seemed that the values changed on a two-day basis concerning low trait anxiety.

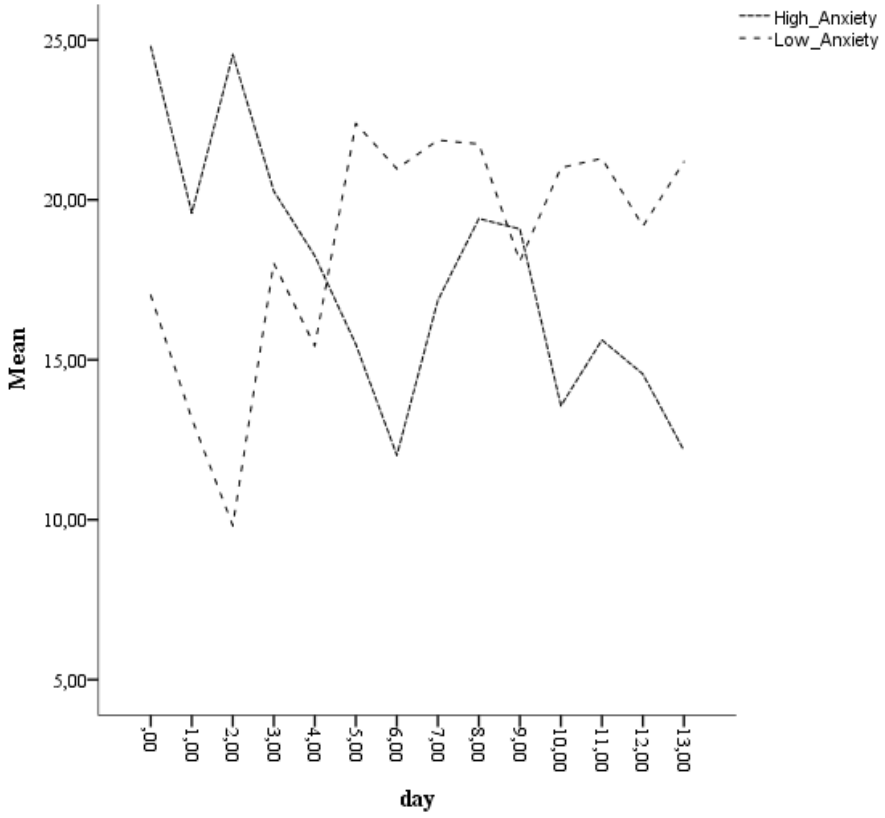


Figure 8: Mean state anxiety of low and high trait anxiety groups over a course of two weeks

Discussion

The objective of this study was to examine the relationship between anxiety and depression over time, how these constructs differ in social contexts and if the degree of emotional fluctuations in depression and anxiety are related to their respective trait scores. The results showed that anxiety and depression in terms of their state experience are closely related. Anxiety increased by 0.5 for each one-point rise in state depression. On average, the fluctuations in anxiety and depression captured over two weeks showed similar trajectories in the felt intensity. Both fluctuated quite substantially but decreased on the days of the weekend where they shortly remained lower until a new week began. No significant correlation was detected between the trait scores of depression and anxiety and the degree of state score variance of their respective constructs, meaning the assessment of the psychopathological extent could not predict the intensity of emotional fluctuations. Finally, the contextual association analysis showed that depression is more contextual dependent than anxiety. Apart from acquaintances, every other type of contact led to a significant decline in state scores, every type of contact mattered including contact through online devices. Anxiety, on the other hand, was significantly reduced only through contact with family and close friends, while only contact outside of home led to a significant reduction in state anxiety.

Having a closer look at both constructs and their behavior over a period of time it is apparent that anxiety was the construct with higher trait scores. The anxiety scores were in 22 of 25 cases higher than the depression scores. Looking at the mean state scores per participant of both constructs such a discrepancy is not easy to spot. Merely 3 participants had a noticeably higher score in state anxiety then in depression, while depression state scores were in 6 cases distinctly higher when compared to their anxiety score. Especially striking is participant 25819 who had the highest anxiety score by far, being often double or triple the score of other subjects. This might be the reason why state anxiety seemed to be the construct with the highest mean scores per day.

As this study was conducted amid the COVID-19 pandemic it is plausible that this health crisis influenced the subjective experience of depression and anxiety. For instance, such an outbreak can increase the so-called health anxiety “which arises from the misinterpretation of perceived bodily sensations and changes […] particularly in the presence of inaccurate or exaggerated in formation from the media, health anxiety can become excessive (Rajkumer, 2020, p. 10-11)”. Another study including Chinese university students underlined the association of this

pandemic with increased anxiety as well as reporting the importance of social support and the negative correlation it has with the level of anxiety (Cao, Fang, Hou, Han, Xu, Dong & Zheng, 2020). According to another paper who assessed the prevalence scores of generalized anxiety disorder and depressive symptoms during the pandemic in china anxiety (35.1%) was more prevalent than depression (20.1%) in younger people (Huang, Zhao, 2020).

Comparing these findings with the studies conducted at other European universities regarding the prevalence rates of depression and anxiety, the target group of this study does not show a noticeable difference (Ibrahim, Kelly & Glazebrook, 2013; Bayram & Bilgel, 2008). Anxiety seemed to be more prevalent in university students then depression, but the intensity of the experience is based on the comparison of individual mean state scores not huge. The anxiety mean state score was 17.47, while in the case of depression 17.18, a difference of only .3 points. While the trait scores of both constructs differed by 3 points with an anxiety mean trait score of 11.52 and depression mean trait score of 14.28. Using the cutoff scores from the HADS, 11-21 points meaning 'definite cases', 20 participants were classified as anxious and 14 people as depressed.

Nine participants had perceptibly different state mean scores when comparing depression and anxiety, but the other 16 subjects had similar average scores regarding both constructs so a connection here is apparent. Also, the strong correlation of time varying state depression and anxiety scores is a possible indication for a shared underling factor such as 'general distress' at the between-person level (Bakish, 1999; Clark & Watson, 1991). The high comorbidity and the mix of symptoms which is categorized under the "mixed anxiety/depressive disorder" in the DSM are supported by the similar fluctuations in the reported states (Roy-Byrne, Katon, Broadhead, Lepine, Richards, Brantley, Russo, Zinbarg, Barlow & Liebowitz, 1994). However, the regression estimates from the linear mixed model analysis mixes between-person and within-person associations so a clear relation on which level they are interacting is not clear.

The experience of stress could trigger such an underlying source which leads to a wide array of different reactions that are classified under two disorders or constructs but seem to be triggered similarly. Anxiety and depression or mood disorders, in general, differ in some dimensions, which are important for the treatment but share common diatheses. Meaning that they have a tendency to be triggered by the same factors like a genetic predisposition for instance or trait vulnerability (Brown, Chorpita & Barlow, 1998). The tripartite structure proposed by Clark

and Watson (1991) shows that there are factors that distinguish the disorders from each other, but the construct general distress or negative affect is shared by both.

Equally compelling are the findings of the reactivity of these constructs. It can be concluded that negative states are constantly fluctuating from day to day. Not only were differences found between the days during the week and the weekend, but also between the weekends. Weekends had an overall positive effect on the mental health of the participants, on Thursdays and Fridays the values began to fall drastically and continued to decrease over the rest of the weekend. One could speculate that on weekends participants were less involved in their workload and therefore generally less stressed. This reduced stress level could have contributed to lower state scores because work related stress is positively correlated to depressive disorders and reduced mental health (Tennant, 2001). Students might still follow the routine they had acquired pre-pandemic, working during the week and taking days off or doing less on the weekends. The same holds probably true for a part-time job where it is more likely to do work-related business during the week. The first-weekend assessment turned out to be more positive, in terms of lower mean scores, in comparison to the second which must have been a universal experience of the participants. Something may have happened that generally affected all participants, or they became aware of their negative states and were able to pinpoint more precisely how they felt because they used the first week for comparison in which they generally tended to indicate higher intensities.

Depression was the construct most reactive to changes in social contexts. If participants reported that they were with close friends, family members or the partner, the experienced intensity of 'feeling down' dropped significantly. Close friends had the most soothing effect on the reported states, they led to an average drop of more than 10 points on the depression scale. That is double compared to contact with family members while the significant other of the participants contributed to the smallest decline of depression. No matter what, the experience of being in contact with persons that are close to you were of importance and contributed to a decrease in negative emotions related to depression. These results support the findings by Peirce, Frone, Russel, Cooper and Mudar (2000), who proposed that social contact and perceived social support have a negative relation to state depression. According to them, socially active individuals have low values in state and trait depression. Interestingly, how the contact was established, online through electronic devices/the internet or in person at home, was not essential when looking at depression. Contact which took place outside of the home of the participants helped the most and led to an average

decline of nearly 9 points. Surprisingly the other in-person contact inside their own home was less effective and was on par with contact established through online devices.

The COVID-19 pandemic might have reduced the perceived positivity of contact in their home because people were mostly confined to their own home during the data collection period. This can be explained by the reactivity to the contexts the individuals might have found themselves in, linking their environment to the pandemic because it was expected from you to be in quarantine could have led to an overall negative appraisal of that environment. Being confined at that time might have increased the perceived loneliness which studies linked to negatively appraising company, meaning because you disliked being confined to your home led to a lessened reduction of the construct by engaging in social activities (Van Roekel, Goossnes, Verhagen, Wouter, Engels & Scholte, 2013; Van Roekel, Verhagen, Engels, Scholte, Cacioppo & Cacicoppo, 2018).

Anxiety was less influenced by in social contexts. A well-known paper which thematized the relation of depression and anxiety to social support reported that anxiety has a less negative relation, but still significant, to social support when compared to depression (Zimet, Dahlem, Zimet & Farley, 1988). That could account for the comparable weaker impact social context had on anxiety. Contact with close friends had the most impact and reduced the state anxiety the most, followed by contact with the significant other. As opposed to depression, however the partner had no significant effect on the anxiety construct. Also, the way how these contacts were established were overall less effective for experienced anxiety. Again, contact outside of the home was the most effective, but also the only significantly effective way of reducing anxiety. Overall, these findings suggest that anxiety is less reduced through social contact or perceived social support. Several previous studies indicated that anxiety is more related to avoidant behavior than depression, especially people suffering under both conditions are more affected by apprising company negatively when compared to only depressed individuals (Ottenbreit, Dobson & Quigley, 2014; Berman, Wheaton, McGrath & Abramowitz, 2010). This could mean that anxious individuals are not as positively affected by social support or contact in general when compared to depressed individuals.

One expectation must be partially refuted because on the one hand the trait scores were not significantly correlating with the degree of variability in their related state values. But on the other hand, the visual analysis of low and high trait groups showed that emotional fluctuations did appear to differ between both groups. The findings by Kuppens, Allen and Sheeber (2010) indicated that

individuals who show high variability in their emotional states were more prone to depression. Having tested this for both constructs, these results are not statistically supported by the findings of the regression analysis. However, through the visual analysis of high and low trait groups is it apparent that the high trait depression group tended to show less variance in their scores but they fluctuated more heavily and at shorter intervals than the low trait depression group. The low trait group depicted a wider range in scores but also more stability, ergo supporting the study of Kuppens, Allen and Sheeber (2010) regarding depression.

Important to mention is that Kuppens, Allen and Sheeber (2010) focused on depression only and not on anxiety, whereas the current study also tested the relation of fluctuations and trait anxiety scores because of the underlying factor they might share and the possibility that they act in that regard similarly. The graph depicting the high and low anxiety group showed a different picture where the low trait group not only surpassed the mean state values of the high trait group over time but also illustrated more fluctuations over the days. It indicated an almost reverse relationship between emotional fluctuations and trait values over time. A study about the relationship of alexithymia, anxiety and depression published results that individuals with high trait anxiety values do not fulfil all criteria for alexithymia but they show a strong correlation with the inability to properly identify emotions (Berthoz, Consoil, Perez-Diaz & Jouvent, 1999). Furthermore, they stated that stress is associated with this inability and differentiation between bodily sensations and feelings. Indicating that the common underlying factor as proposed by Bakish, (1999) and Clark & Watson (1991) of general distress leads to this hindrance. Participants who scored high on trait anxiety in this study could be therefore suffering from more alexithymia which would explain the relationship between high trait, emotional fluctuations, and lower values in comparison to the low trait group.

This study showed that anxiety and depression are related to each other and in terms of their states also behave similarly over time, despite being differently influenced by social contexts. However, are there some short comings and limitations which could be improved in future studies. For instance, should the relation between the time varying scores of depression and anxiety be statistically examined, where the analysis is not mixing between-person and within-person associations like the linear mixed model did in this study. Also, through the convenience sampling method, a group was established which may not represent the average university student. Mostly students were recruited who have a background in social studies. Also, it was not possible to clearly

detect underlying disorders in this sample, despite the high trait scores, while theories used to build a foundation regarding this research were mostly using individuals who were clinically diagnosed with depression and/or anxiety disorders (Peirce, Frone, Russel, Cooper & Mudar, 2000; Kuppens, Allen & Sheeber, 2010; Matthews, Danese, Wertz, Odgers, Ambler, Moffitt & Arseneault, 2016). The included sample contained to a large degree university students who can be classified at risk for depression and anxiety, which is underlined by the relatively high HADS trait scores. But because of the workload the university, amongst other things, poses on them are they disadvantaged regarding increased anxiety, which was proposed by some studies (NIMH, 2009; Bayram & Bilgel, 2008).

Having additional reference groups might help to compare the state score fluctuations of depression and anxiety. An idea for further studies could be to have two groups consisting out of subjects diagnosed with either anxiety or depression and a healthy group. Measuring the state experiences of these groups with the ESM over a period of time might show how deeply the shared construct stress is influencing, depressed, anxious and healthy people. Also, the HADS should be administered as a pre- and post-test, in this study the traits were only assessed at the beginning of the study. Relating the pre- and post-assessment trait scores to the state scores could be helpful to examine the actual stability of trait measures and predictive ability of trait scores regarding the fluctuations of emotional states. Another implication for future studies is to incorporate the construct alexithymia into the measurements to examine the relationship of high trait values of anxiety and their state scores. The results from this study suggested a possible negative relationship between anxiety state and trait scores, which should be further investigated.

The promising contextual results from this study should be expanded to incorporate the option to measure how often they met up with a person, but also additional places like university and the workplace. Being at the university or at your workplace could alter your perception of the environment which possibly increases general distress because individuals not only behave in a certain way in their work environment but the demand of operational workload might impose further pressure. This was initially planned for this study but due to the coronavirus alterations were made based on the imposed quarantine restrictions. This global pandemic might be a factor which skewed the perceived negative emotions of the participants. Being mostly at home and being aware of the dangers of the virus leads to increased worrying about your health and the health of people close to you. Conducting a study without such influences might lead to different results.

Significant results were detected with regards to social support, having frequent contact reduces depressive symptoms and in certain ways also anxiety. This also holds for contact through the internet. Skyping with friends, the partner and family is an option when one feels blue. Especially in this time, it is a blessing that humans are able to stay in touch without meeting physically and this finding could also have good implications for the future of therapy and interventions. Establishing contact with a mental health professional or close ones over the internet may not be as effective as a meeting in person, but when in-person contact cannot be established an online meeting may be a good option. Despite these challenging times it seems important to keep loved ones close to you because they may improve your mental state and help you through these difficult times.

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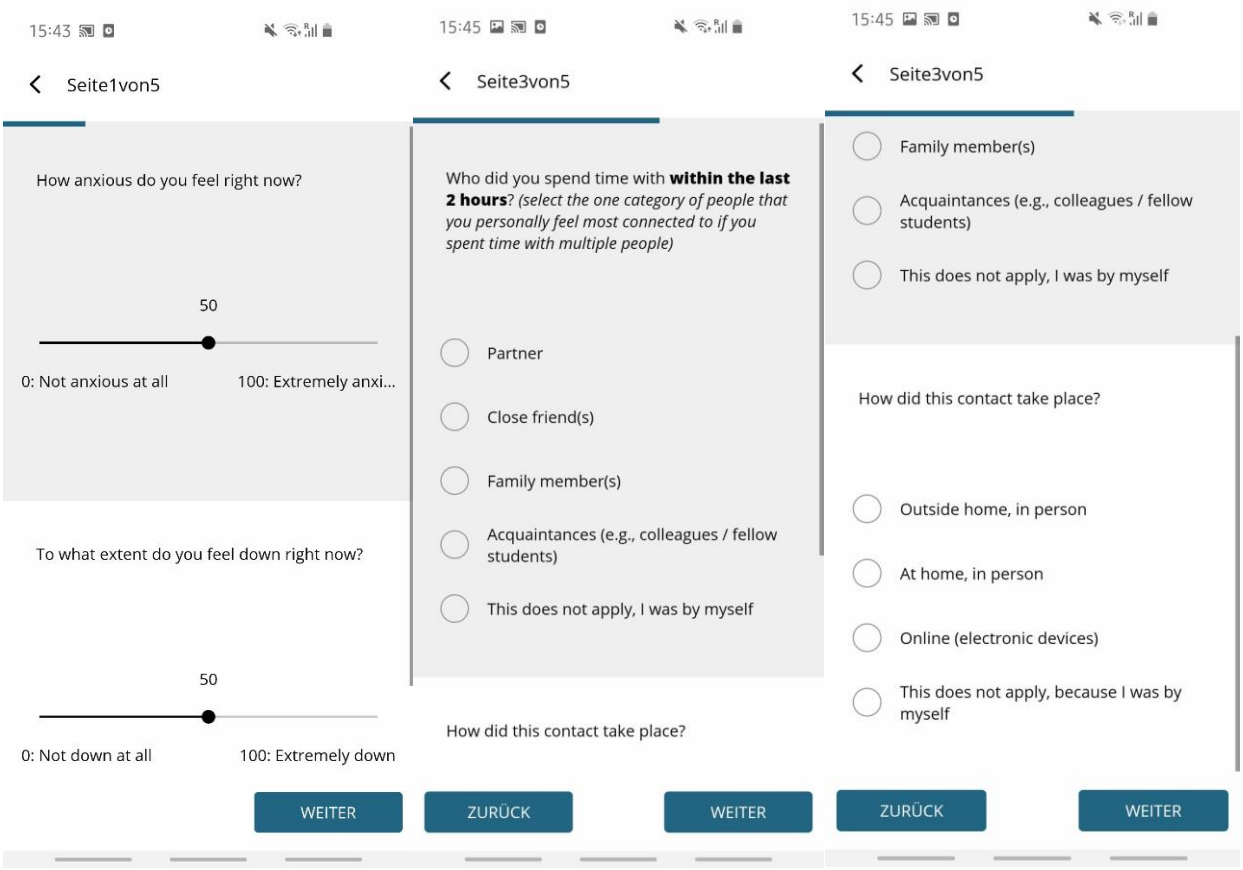
Appendix



Appendix 1: In App view of the slider *Appendix 2:* Context questions *Appendix 3:* Context questions

Hospital anxiety and depression scale (will be assessed at pre- and posttest)

Tick the box beside the reply that is closest to how you have been feeling in the past week. Don't take too long over you replies: your immediate is best.

	I feel tens or 'wound up'		**I feel as if I am slowed down**
3	Most of the time	3	Nearly all the time
2	A lot of the time	2	Very often
1	From time to time, occasionally	1	Sometimes
0	Not at all	0	Not at all
	I still enjoy the things I used to enjoy		**I get a sort of frightened feeling like 'butterflies' in the stomach**
0	Definitely as much	0	Not at all
1	Not quite as much	1	Occasionally
2	Only a little	2	Quite often
3	Hardly at all	3	Very often
	I get a sort of frightened feeling as if something awful is about to happen		**I have lost interest in my appearance**
3	Very definitely and quite badly	3	Definitely
2	Yes, but not too badly	2	I don't take as much care as I should
1	A little, but it doesn't worry me	1	I may not take quite as much care
0	Not at all	0	I take just as much care as ever
	I can laugh and see the funny side of things		**I feel restless as I have to be on the move**
0	As much as I always could	3	Very much indeed
1	Not quite so much now	2	Quite a lot
2	Definitely not so much now	1	Not very much
3	Not at all	0	Not at all
	Worrying thoughts go through my mind		**I look forward with enjoyment to things**
3	A great deal of the time	0	As much as I ever did
2	A lot of the time	1	Rather less than I used to
1	From time to time, bot not too often	2	Definitely less than I used to
0	Only occasionally	3	Hardly at all
	I feel cheerful		**I get sudden feelings of panic**
3	Not at all	3	Very often indeed
2	Not often	2	Quite often
1	Sometimes	1	Not very often
0	Most of the time	0	Not at all
	I can sit at ease and feel relaxed		**I can enjoy a good book or radio or TV program**
0	Definitely	0	Often
1	Usually	1	Sometimes
2	Not often	2	Not often
3	Not at all	3	Very seldom

Appendix 5: HADS

EDIT ×

Consent Materials:

Dear participant,

Thank you for your participation in this study. Before you participate, it is important that you understand the goal of this research and what the study will ask from you. The purpose of this study is to find out how different components of mental health are related to each other. To explore this relationship, we want to measure fluctuations in mental health in daily life to gather a more detailed picture of the dynamics of mental health.

For this study, we will ask you to fill in several questionnaires on your mobile phone. All questionnaires will be completed in the Ethica app. The study will start with a questionnaire concerning your demographics and general mental health. This initial questionnaire will take about 10 minutes to complete. After that, you will receive three daily (short) questionnaires each day for a period of two weeks. Notifications will remind you about the next questionnaire. The questionnaires will be provided in the morning, afternoon and evening. One daily questionnaire takes approximately 2 minutes to complete.

For the purpose of this study, it is important that you answer the questionniares as soon as possible after the notification. Make sure that you have switched on your notifications for the Ethica app on your mobile device, as you will receive a notification on your mobile device when to fill in the questions. We would also like to ask you to regularly check the Ethica application to see whether new questionnaires to answer are ready.

The information that we collect from this research project will be kept confidential. This means that only the researchers have insight into your answers. All personal data (such as age, gender etc.) will be anonymized and will not be published and/or given to a third party. Also for the researchers it will not be possible to determine which data belongs to which participant. Your participation in this study is voluntary. You are free to withdraw from this study at any time and without giving a reason.

Contact information

If you have any questions regarding this study, you can contact the principal investigators of this project Sina Völker (s.volker@student.utwente.nl) and Jonas Moller (j.moller@student.utwente.nl).

Appendix 6: Informed Consent

Appendix 7: Total variance per individual

Participant ID	*Variance depression*	*Variance anxiety*
24801	115.796	150.862
25608	129.775	101.524
25651	4.202	25.122
25803	419.461	804.984
25804	2.725	0.129
25806	1637.796	202.019
25807	51.578	51.128
25808	340.485	284.109
25809	407.636	401.680
25814	94.892	187.259
25817	568.336	497.303
25818	77.081	82.064
25819	289.833	165.733
25824	193.807	63.272
25826	49.034	27.893
25827	219.200	136.336
25828	374.460	295.156
25829	128.303	122.029
25830	28.064	19.256
25831	111.394	216.436
25835	566.256	257.328
25840	25.325	-
25841	415.220	145.983
25846	225.318	55.858
25848	675.990	461.811

a. How anxious do you feel right now? Is constant when Participant ID= 25840. It has been omitted