Homo Sedens: Exploring Associations Between Daily Sedentary Behaviour, Mood, and Neuroticism Among University Students – An Experience Sampling Study

Thesis by Lina Skupin

1st Supervisor: Gerko Schaap, MSc
2nd Supervisor: Matthijs Noordzij, Dr.

January 26, 2022

University of Twente
Positive and Clinical Psychology and Technology
Faculty of Behavioural, Management, and Social Sciences

Abstract

Background: Students tend to spend a majority of their waking hours sedentary while, for example, studying or watching Netflix. Previous research has proven that high amounts of sedentary behaviour can lead to detrimental (mental) health outcomes, such as obesity, depression, or changes in mood. It seemed that the type of sedentary behaviour, mentally active or passive, influences the increase or decrease in mood. Since previous results were mostly based on cross-sectional studies, ignoring daily changes, there was a need of a closer look at the relationship between sedentary time and mood. Furthermore, preceding explorations of this relationship ignored neuroticism's potential as a moderator. However, individuals high in neuroticism tend to engage in unhealthy behaviours and are prone to mood swings. Therefore, this study served as a further exploration of the relationship between sedentary behaviour and mood, including the moderating effect of neuroticism.

Methods: An Experience Sampling Study was conducted with a sample consisting of 37 university students (M_{age} = 20.68, SD_{age} = 2.17, 73% female). Over the course of one week the app Ethica was used to provide participants with the three surveys per day measuring state mood. Furthermore, the morning questionnaire asked participants to report their daily sedentary time of the previous day. Estimated marginal means and linear mixed models were used to analyse the association between daily sedentary behaviour and mood, as well as the moderation effect of neuroticism.

Results: No significant relationships between daily sedentary time and mood (p = .364) as well as between daily passive sedentary time and negative mood (p = .637) were found. Similarly, the moderation effect of neuroticism on the relationship between daily sedentary time and mood (p = .527) was insignificant. However, a small insignificant trend of a negative effect of neuroticism on mood could be found (p = .063).

Conclusion: In contrast to expectations this study showed no association between daily sedentary time and mood. This might be caused due to the homogenous sample, short study period or other factors influencing mood, such as the quality social contact or hormones. However, it serves as an addition to a small section of research analysing the effects of daily sedentary behaviour on students' mood, while being the first to incorporate neuroticism as a moderator.

Keywords: sedentary behaviour, mood, neuroticism, mentally activeness, experience sampling

Table of Content

1. Introduction

Individuals spend a vast part of their day seated. For example, while working, catching up with friends or binge watching their favourite Netflix show. Sedentary behaviour is not only affecting the human body physically, by becoming obese or experiencing backpain, also, psychological impacts can be seen, such as its impact on mood (Endrighi et al., 2016). The current study focuses on the associations between sedentary behaviour and mood. Furthermore, especially highly neurotic people tend to engage in unhealthy behaviours, such as sedentary behaviour. Thus, the potential impact of neuroticism as a moderator is addressed as well.

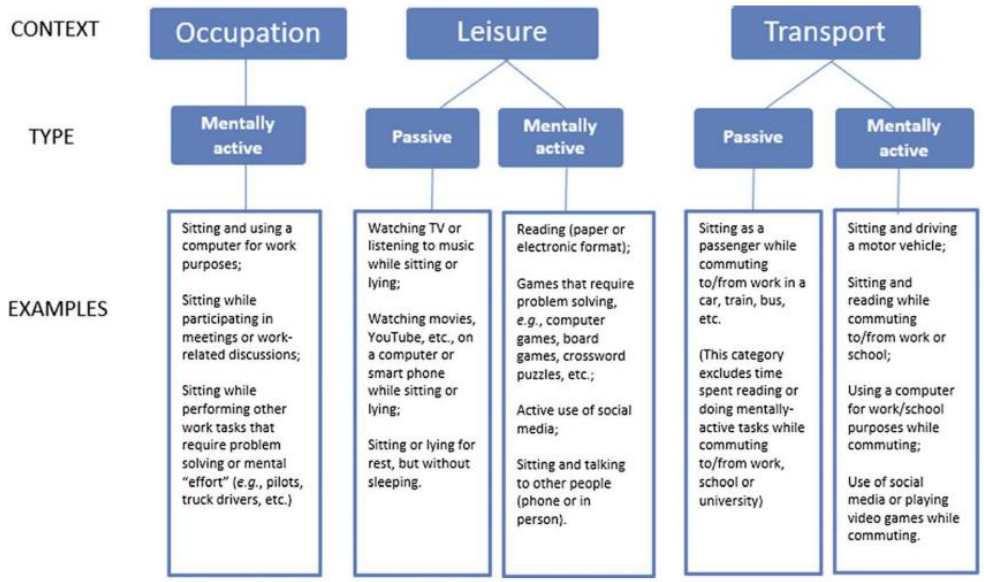
1.1 Sedentary Behaviour

Throughout the last decades industrialization and the development of technologies focused on enhancing human life. For example by autonomously driving cars or Netflix, one of the most visited streaming platforms (SEMrush, 2020). These "enhancements" most likely contributed to the increase in sedentary behaviour many people practice today (López-Valenciano et al., 2020). Sedentary behaviour can be defined as "any waking behaviour characterized by an energy expenditure ≤ 1.5 METs while in a sitting, reclining or lying posture." (SBRN, as cited inTremblay et al., 2017, p. 5) . In research this behaviour is often operationally defined as sitting time (Biddle et al., 2019). Furthermore, it is important to make a distinction between physical inactivity and sedentary behaviour because both can have different health outcomes (Park et al., 2020). Thivel et al. (2018) defined physical inactivity as the "non-achievement of physical activity guidelines" (p.2), which are set by the World Health Organization (2020). One can engage in high amounts of physical activity and meet these guidelines, while still being sedentary for a vast part of their life (Owen et al., 2011). Therefore, these two concepts do not eliminate each other. Furthermore, two differentiations between sedentary behaviours were made.

Many studies focus on sedentary behaviour during leisure time, including activities such as watching TV or the general screen time (Hallgren et al., 2020; Hoare et al., 2016; Saunders et al., 2020). As Figure 1 shows, these types of sedentary behaviour can be categorized as mentally passive (Hallgren et al., 2020). However, leisure time activities such as reading or computer games, can be categorized as mentally active. Only within the domain occupation Hallgren et al. (2020) made no differentiation between mentally active and passive tasks, because activities such as using a computer or participating in a meeting, only demand mental activity.

Figure 1

Framework Differentiating Between Mentally Active and Passive Task Within Three Contexts of Sedentary Behaviour by Hallgren et al. (2020).



Sedentary behaviour arises in multiple environments, contexts and social settings, such as during leisure time, in transportation, one's occupation or household (Owen et al., 2011). For example, students engage in sedentary activities daily, such as watching Netflix with friends during leisure time, taking the bus to university, sitting at a desk while studying or eating dinner seated at a table at home.

1.2 Prevalence and Target Group

Every human engages in sedentary behaviour, but differences occur in duration. Ussery (2018) states that 25.7% of an US sample indicated to sit for more than 8 hours a day. Furthermore, Stockwell et al. (2021) discovered that the lockdowns following the COVID-19 outbreak contributed to an increase in sedentary behaviour, as well as a decrease in physical activity. A meta-analysis by Castro et al. (2020) showcases that even before COVID-19, university students between the age of 18-29 spent on average 7.29 hrs in sedentary behaviour. When using self-report questionnaires instead of accelerometers the results seemed to be 1-2 hours lower. Most likely due to an underestimation by self-report measures. Especially the tasks of students, such as writing assignments or attending lectures, are performed sitting down. Moreover, university students are likely to proceed into office jobs, which promote sedentary

behaviour (Moulin, 2016). These factors make student a vulnerable group to be affect by the consequences of sedentary behaviour.

1.3 Consequences of Sedentary Behaviour

The last decades of research came to one conclusion: prolonged sitting is jeopardizing physical and mental health (Chau et al., 2013; Patterson et al., 2018; Stockwell et al., 2021; Ussery, 2018; van der Ploeg & Hillsdon, 2017; Wilmot et al., 2012). A systematic review and meta-analysis by Wilmot et al. (2012), focused on the association between sedentary time and diabetes, cardiovascular disease and all-cause mortality. Within this analysis they have found a 147% increase in relative risk of cardiovascular disease, 112% increase for diabetes, 90% of cardiovascular mortality and 49% increase in the risk of all-cause mortality (Wilmot et al., 2012). In detail, Grøntved (2011) discovered a relative risk of 1.13 for all-cause mortality per every 2-hours watching TV a day.

Although, researchers have established a relationship between prolonged sitting and negative health outcomes, there is still an inconsistency in the operationalisation of sedentary behaviour. As the systematic reviews of Saunders et al. (2020) and Hoare et al. (2016) showcase, some studies focus on screen time as a measurement, while others see the lack of physical activity as an indicator for sedentary behaviour. Furthermore, several systematic reviews, collected by Saunders et al. (2020), led to the conclusion that sedentary behaviour does not only lead to physical health problems but is also related to depression, anxiety and stress (Endrighi et al., 2016). This result accentuated an earlier systematic review conducted by Hoare et al. (2016). At least 10 of the 21 included studies which examined depression, showed a significant positive relationship between sedentary behaviour and depression.

Not only the time spent in sedentary behaviour is relevant in this association, but also the activity a person is engaging in. Findings from a longitudinal study conducted by Hallgren et al. (2018) imply that mentally passive activities increase the risk of depression, while mentally active activities decrease the risk. Additionally, Huang et al. (2020) discovered a positive association between sedentary behaviour while watching TV, a mentally passive task, and the risk of depression. In contrast, no positive association was found when using a computer, an activity which can, based on Hallgren et al. (2020) be categorized as mentally active.

1.4 Mood

A construct often altered in mental disorders, such as depression, is mood. Mood itself can be defined as affective state, which is not focused on a specific object. It is a varying construct,

which is always present and shaping moment to moment experiences (Lischetzke, 2014). Additionally, Watson and Tellegen (1985) conceptualized mood in a two dimensional model, consisting of positive and negative affect. When relating sedentary behaviour to mood, DeMello et al. (2018) discovered an association between these constructs. Furthermore, within Endrighi et al. (2016) experimental study an increase in negative mood was observed as sedentary behaviour elevated. Additionally, a decrease in positive affect was observed as sedentary behaviour increased (Elavsky et al., 2016). Furthermore, Giurgiu et al. (2019) and Richter (2021) were able to find associations between sedentary behaviour and mood, using daily diary and experience sampling methods. Looking at these results, it becomes apparent that sedentary behaviour seems to have an impact on mood. So far, the distinction between mentally active and passive sedentary tasks was not studied. Thus, it is of relevance to investigate the association of mentally active or passive sedentary behaviour and mood.

1.5 Neuroticism

One psychological construct influencing mood and predicting health behaviour, such as sedentary behaviour, are personality traits. These are relatively stable and enduring internal characteristics, which are presented in ones behaviour, habits and feelings (*APA Dictionary of Psychology*, 2022). Within this paper a closer look at the personality trait neuroticism is taken, which can be defined as "the tendency toward emotional instability, turmoil, and general distress" (Groth-Marnat, 2016). Individuals scoring high in neuroticism are prone to experiencing mood shifts, anxiety, depression, loneliness, low self-esteem, impulsivity and shame or guilt (Groth-Marnat, 2016; Zhang, 2020). In contrast, individuals low in neuroticism are emotionally stable, secure, less impulsive and showcase low levels of negative emotions (Groth-Marnat, 2016; Zhang, 2020).

Early findings indicate an association between neuroticism and the presence of harmful health behaviour as well as the absence of effective health behaviour (Boothkewley & Vickers, 1994). The impulsiveness facet of the trait might be a reason for the association with detrimental health behaviour, such as obesity, as found in European and Australian samples of a systematic review by Gerlach et al. (2015). Additionally, Furnham and Cheng (2019) found a negative association between neuroticism and gratification delay. Meaning, people scoring high in neuroticism might tend to easily engage in joyful but unhealthy, e.g. sedentary, activities, such as watching Netflix. Furthermore, a meta-analysis by Marciano et al. (2020) found that individuals scoring high in neuroticism engage in high amounts of internet usage, which is usually performed sedentary. In general, findings suggest that individuals high in neuroticism

spend higher amounts of time being sedentary, which can be categorised as a form of detrimental health behaviour (Allen et al., 2017; Stephan et al., 2020; Sutin et al., 2016). Not only was neuroticism associated with physical health and healthy behaviour, but also with alcohol abuse, depression, anxiety and panic disorders (Friedman, 2019; Hakulinen et al., 2015). The association with mental health is further accentuated as positive correlations between neuroticism and negative affect, as well as negative correlations between neuroticism and positive affect were identified (Costa & McCrae, 1980; Eysenck, 1974). Thus, neuroticism seems to influence not only physical and mental health, but also mood. Therefore, the moderating effect of neuroticism will be analysed within this study. Even though, this effect was not yet observed in relation to sedentary behaviour and mood, neuroticism has proven to moderate several other relationships (Fadda & Scalas, 2016; Hill et al., 2014; Ho et al., 2013; Mertens et al., 2022; Zweig & Webster, 2003).

1.6 Experience Sampling Method (ESM)

The majority of above-named meta-analyses is based on cross-sectional studies focusing on sedentary behaviour. Two major disadvantages of these are that the direction of the relationship, as well as daily changes within individuals cannot be ascertained. Therefore, longitudinally studies, focusing on fluctuations, should be used to provide more reliable data of varying constructs such as mood and sedentary behaviour. Besides, self-reports, which are often applied no more than once, can be subject to recall bias, which might threaten the study's reliability (Woltjes, 2019). To avoid such problems, the experience sampling method (ESM) will be used within this study.

Experience sampling method can be explained by four characteristics: 1) measurements take place in in real-life environment, 2) measurements focus on the individuals current state, 3) moments of measurements are strategically selected, 4) participants complete multiple assessments over a continuous time frame (Shiffman et al., 2008). This allows to examine individuals' fluctuations and their correlating factors over a longer period, while gaining realistic data. Meaning, by measuring within the real-life environment and at multiple points per day, ecological validity is ensured (Stone et al., 2007; van Berkel et al., 2017). Furthermore, multiple measurements help decreasing the impact of recall bias.

1.7 The Present Study

To summarise, the associations between sedentary behaviour and mood or sedentary behaviour and neuroticism is illustrated in previous cross-sectional and some ESM studies. However, the relevance of mental activity was disregarded since most research focused

on sedentary behaviour as screen time or watching TV (Allen et al., 2017; Chau et al., 2013; Huang et al., 2020). These behaviours can mainly be categorized as passive sedentary behaviour. In contrast, the majority of a student's day is spent studying and sitting in lectures, thus rather mentally active behaviours (Castro et al., 2020; Hallgren et al., 2020). When relating mood or personality to sedentary behaviour, one should be cautious which type of sedentary behaviour is measured. Since the constructs within the present study, daily sedentary behaviour and mood, are varying, ESM will be used to research the following questions. *(1.) In what way are daily sedentary time of students and state mood associated over time?* Based on previous findings, daily sedentary time is expected to be negatively associated with state mood. The more time a participant is spending in sedentary behaviour, the lower their mood score should be. (*2.) In how far does daily passive sedentary time predict negative affect (mood) in students?* According to inter alia Endrighi et al. (2016) passive sedentary time is expected to lower the mood. Thus, an increase in negative affect should occur as daily mentally passive sedentary time increases. *(3.) To what extend is the overall relation between daily sedentary time and mood moderated by trait neuroticism?* As mentioned above, neuroticism is associated with sedentary time and mood. Thus, neuroticism is expected to moderate the relationship between daily sedentary time and mood. In detail, it might increase the strength of the relationship, as neurotic individuals tend to respond to negative emotions more strongly.

2. Methods

2.1 Design

To answer the formulated research questions an ESM study was conducted using the Ethica app. This paper is part of a larger research project observing sedentary behaviour and the influence of several other variables. Since a joint data collection was executed, the questionnaires contained items applicable to this study but also others. Ethical approval from the Ethics Committee of the University of Twente was received on October 10, 2021 (Case number: 211236). Considering ESM studies are usually conducted over a period of one to four weeks, the data was collected within 9 days (Conner & Lehman, 2012; van Berkel et al., 2017). This was done to limit a decrease in adherence, because longer durations increase the burden on participants (van Berkel et al., 2017). In return this could lead to larger amounts of missing data. After the initial design was developed it was pilot tested for a period of 4 days among eight participants. The researchers participated as well to see any issues caused by them or the app Ethica. This resulted in some minor setting changes. After modifying the questionnaires and the final approval of the ethics committee was given, the actual data collection took place

from November 23, 2021, to December 1, 2021.

Similar to other ESM studies, signal contingent sampling was used to ask participants about their behaviour and mood (Wheeler & Reis, 1991). To reduce the burden on participants, questionnaires were sent three times a day (Conner & Lehman, 2012). After receiving the informed consent form and a baseline questionnaire participants received three questionnaires a day at random times within fixed intervals (Table 1). However, the morning questionnaire was an exception, regarding its trigger timepoint. Since the sedentary behaviour measurements focused on the previous day and seemed the most important construct, it was decided to trigger this survey at a fixed time point. In total participants should have answered 24 questionnaires including the informed consent.

Table 1

An Overview of the Study's Set-Up and Content of the Questionnaires.

Date	**Questionnaires**	**Variables**	**Trigger**	**Expire Time**	**Reminder**
23rd Nov.	Informed Consent, Baseline	Informed Consent Neuroticism, Demographics	10am (not sign-up)	Never	Onset & 2 hrs
24th Nov.	Morning, Afternoon, Evening	Mood	7am, 1-3pm, 7-9pm	5hrs 3hrs	2 hrs & 4hrs Onset & 2hrs
25th – 30th Nov. (6 Days)	Morning, Afternoon, Evening	Mood + Sedentary Time	7am, 1-3pm, 7-9pm	5hrs 3hrs	2 hrs & 4hrs Onset & 2hrs
1st Dec.	Morning	Sedentary Time	7am	5hrs	2 hrs & 4hrs

2.2 Participants

The participants for this study were recruited by using non-probability convenience sampling: the researchers asked individuals in their close environment to participate. Since the study's duration was quite short, the advantages of this sampling method were crucial. Namely, its low cost, efficiency and simplicity to implement (Acharya et al., 2013). Furthermore, friends and close contacts tend to complete the surveys more dutifully than strangers. The study was also published on the University of Twente SONA System website. On their website participants could find the same information as in the invitations from the researchers. This information entailed a short description of the study and its purpose, as well as instructions to download Ethica and the study registration code. Thus, participants were able to download the app, register as a participant and use the given code to sign up. The only difference was that UT students who used SONA, received SONA credits. Everyone else who was invited privately did not receive any compensation. All participants needed to be at least 18 years old and enrolled at a University (of Applied Science). They had to be sufficient in English and in possession of a device which was able to run 'Ethica' e.g. smartphone or notebook. Due to the studies longer timeframe, it was difficult to foresee the number of participants. Thus, the general aim was to gather at least 19 participants, corresponding to the median van Berkel et al. (2017) found. Although, for such a short ESM study no large sample size is necessarily needed, a number closer to 53 participants, the mean van Berkel et al. (2017) identified, was preferred by the researchers.

2.3 Materials

2.3.1 Ethica

For the data collection the app Ethica was used. Participants were able to download it via a link provided within the study invitation and study description. The app gave participants the possibility to answer every survey independent from their whereabouts, multiple times a day. It was possible to create several different surveys, which were triggered at random timepoints and contained questions in random order. Therefore, it was suitable for this ESM study. Furthermore, the app notified all participants as soon as a survey was online.

2.3.2 Informed Consent Form

First participants received an informed consent form (Appendix A) in Ethica. It contained the subject of the study, information on how the data will be handled and the possibility to withdraw at any point. Moreover, a warning was included which elaborated on the potential for participants to be more focused on the researched concepts e.g., mood, anxiety,

stress within daily life. Therefore, participants could decide for themselves if they feel comfortable to deal with their own e.g., anxiety levels. Otherwise, no risks were expected. To ensure the wellbeing of participants, they were reminded to reconsider participation if they are sensitive to any of these concepts e.g., experiencing a depressive phase. Besides, contact details were provided which could be used to approach the researchers if any questions would arise. At the end of the form participants had to active consent, by ticking 'Yes'. If someone ticked 'No' instead, they were sent to an information item ensuring the immediate stop of their participation and data processing, while instructing the participant to delete Ethica.

2.3.3 Baseline Questionnaire

The second survey participants received was the baseline questionnaire (Appendix B). It included questions asking for demographics such as age, gender, nationality, and study programme. Within the baseline questionnaire trait neuroticism was assessed with items from the 'Big Five Inventory' (BFI), a personality questionnaire developed by John and Srivastava (1999). This questionnaire consists of 44 items, from which eight to nine measure each trait. Just the eight items measuring neuroticism were provided to participants within this study. Out of these eight items, three were reverse scored. An example is *"I see myself as someone who is depressed, blue"*, while one of the reversed items is *"I see myself as someone who is relaxed, handles stress well"*. Participants indicated in how far they agreed with the item statement on a 5-Point-Likert-Scale *(*1 = *not at all to* 5 = *extremely).* Rammstedt and John (2007) found good convergent validity of .78 when correlating the BFI scores of a student sample with the NEO-PI-R. Furthermore, they disclosed excellent test-retest reliability with an average of .84 (Rammstedt & John, 2007).

2.3.4 Sedentary Time Measurement

In order to measure sedentary time, an adapted version of the 'Past-Day Adult's Sedentary Time -University' (PAST-U) questionnaire (Appendix C) was used. This is a modified version of the PAST, specifically used for university students. To fit to the research questions of the team, it was further modified. The original PAST-U contains nine items measuring general sedentary time, as well as sedentary time spend in different contexts and levels of mental activity (Clark et al., 2016). However, it was slightly outdated as streaming services such as Netflix were not included. Moreover, in some areas, such as transportation, no differentiation between mentally active and passive tasks was made. Thus, the differentiation of Hallgren et al. (2020) was used to modify the PAST-U items, fitting them to mentally active and passive behaviour, as well as the current decade. Participants were presented with 14 items

asking for example: *"How long were you sitting at your workplace or working from home in a paid position yesterday? (Examples: babysitting, sitting at the reception, minding a stall/shop, data entry/administrative paperwork, tutoring, etc.)"*. Then they had to indicate how many minutes they have spent within the given activity. After adding these items together, an overview of how much time participants spend sedentary and within which activity is given. Furthermore, Clark et al. (2016) found a moderate correlation with the activePAL sedentary time of .64, for students specifically .59, as well as a moderate validity of .57. Indicating, the original PAST-U to be a valid tool to measure sedentary time.

2.3.5 Mood Measurement

Within this study mood was assessed with the self-report measure 'International Positive and Negative Affect Schedule Short Form' (I-PANAS-SF) (Appendix D) developed by Kercher (1992) and based on the original PANAS by Watson et al. (1988). These questionnaires were built on the two factor model by Watson and Tellegen (1985) in which mood is divided into positive affect (PA) and negative affect (NA). In greater detail, the amount of enjoyment and enthusiasm a person experiences is part of positive affect, while negative affect captures feelings of upset or unpleasant arousal (Watson & Tellegen, 1985). Within the I-PANAS-SF each factor is measured by five items, for example "Afraid" (NA) or "Inspired" (PA) (p.240) (Thompson, 2007). Participants answer these items using a Five-Point-Likert-Scale to indicate how they.

Previously psychometrics of the I-PANAS-SF have proven to be good. Thompson (2007) found high correlations to the original PANAS (r = .92) and acceptable reliability for the PA (α = .78) and the NA (α =.76). Furthermore, the correlations between the PANAS short-form and Diener (1984) 5-item measure of subjective well-being, as well as the four-item subjective happiness scale by Lyubomirsky and Lepper (1999), were researched. For PA positive correlations (r = .33; r =.39) and for NA negative correlations (r = -.33; r = -.51) were found, indicating low to moderate convergent validity. Thus, the I-PANAS-SF has proven to be a reliable and valid measurement tool for mood.

In order to use the I-PANAS-SF for multiple measurements of state mood per day, it was adapted to fit the momentary assessment. Thus, within this study participants were asked*: "To what extend do you feel [insert item here] right know?"*. Since ESM is characterized by multiple short measurements per day, the number of items was reduced, as many other studies did beforehand (Degroote et al., 2020; Hansen, 2021; Merz & Roesch, 2011). By using six instead of 10 items the burden on participants can be reduced, while staying close to the I-

PANAS-SF and its good psychometrics (Hansen, 2021). Based on the highest factor loadings three items of each subscale were chosen. These were: Determined (.77), Attentive (.77) and Active (.74) for PA, and Nervous (.76), Afraid (.75) and Upset (.68) for NA (Thompson, 2007).

2.4 Procedure

Participants were invited to take part in the study, provided with a short description of the study and its purpose, as well as instructions to download Ethica and the study registration code. As soon as participants signed up for the study, they received the study description and contact details of the researchers again. A few seconds after the registration the informed consent form became available and had to be agreed on to further participate in the study. Afterwards, the baseline questionnaire was triggered, which participants had time to fill out throughout the complete duration of the study.

From day 2 to 8, participants received three questionnaires asking about mood a day. These could be answered within a period of 5 hours. The first questionnaire was sent in the morning at 7am, the second one between 1pm and 4pm, while the evening survey was sent between 7pm and 10pm. Additionally to the first notification, as soon as the survey was online, they received a short reminder 1 hour before the survey expired. From day 3 to 9, sedentary behaviour and physical activity of the previous day were assessed in the morning as well. Thus, in addition to the mood measurement at 7am.

After each day participants were reminded to ask questions at any point and were provided with the researchers contact details again. The final questionnaire included a thank you note as well as the option to contact the researchers if a participant was interested in the final project results.

2.5 Data Analysis

For the analysis, the data was exported from Ethica to Excel and then transferred to SPSS (Version 25). Since Ethica created a separate dataset for each survey, Excel was used to partially merge before the transfer. First, it was made sure that the dataset is in long format. Then, variables were renamed, recoded and all participants with no consent or insufficient response rates were removed. In detail, every participant with a response rate lower than 70% was excluded, as this was the average response rate van Berkel et al. (2017) found in their reviewed papers. Afterwards, the dataset was morphed, so the measurements of mood and sedentary time regarding one day would overlay, because sedentary time was measured retrospectively on the next day. Besides, the final variables for total, active and passive sitting time as well as mood, negative and positive affect were computed. State mood was calculated

by subtracting the state negative affect scores from the state positive affect scores. The variable total sitting time in hours was calculated by adding up all the minutes stated in the PAST-U items for each day and dividing the result by 60.

After the data was prepared, the age, total sedentary time, neuroticism and mood were analysed by running descriptive statistics, calculating the mean and standard deviation (SD). Additionally, frequency tables for gender, nationality and the study programme were created.

In order to account for internal reliability of the items used, a reliability analysis was conducted (Csikszentmihalyi & Larson, 2014). This was done to all questionnaires which were adapted, thus the PAST-U and the PANAS. For each test the data was brought into wide format and corresponding items were split into two groups. They were transformed into two new variables consisting of the mean score of measure 1-10 and 11-21. Then these two variables were correlated using the Spearman's Rho, which accounts for the data to be split up. For the neuroticism scale Cronbach's Alpha was computed.

Due to the repeated measurements, the dataset had missing as well as clustered data. Meaning, the data was not independent from the participant, for example mood was measured repeatedly per participant. Therefore, the remaining data analysis was done by creating estimated marginal means (EMMs) and using linear mixed models (LMMs) with a first-order autoregressive covariance structure. LMMs take clustered or nested, and missing data into account (Smith, 2012). The data is nested as measurements are taken from multiple individuals within a group, on multiple time points. Thus, the data is nested within individuals and within days. The first-order autoregressive covariance structure takes into account, that measurements close to each other, e.g. afternoon and evening, will most likely show a higher association as those lying far away from each other e.g. morning and evening measures.

Before focusing on the research questions the data was visualized using estimated marginal means (EMMs). This was done to see differences between participants and timepoints. As a base for all LMMs *Name ID* identified the subject and *measuring point* identified the repeated measure. For the EMMs, calculated per participant, the *Name ID* was chosen as fixed factor, while the dependent variable was either *sedentary time* (total, active or passive) or *mood* (total, positive or negative affect). The EMMs over time were calculated with *measuring point* as fixed factor and the same dependent variables. After calculation Excel was used to generate graphs. The results were reported as unstandardised estimates in combination with their p-values and confidence intervals.

For testing the relationships, a LMM between total *sedentary time in hours* (IV) and

total *mood* (DV) was constructed. In this case sedentary time in hours was chosen as a fixed covariate. Thirdly, a LMM between *passive sedentary time* (IV) and *negative affect* (DV) was performed, with passive sedentary time as fixed covariate. Lastly, a moderation analysis was performed. Therefore, *neuroticism score* was added as a covariate as well as t interaction effect between ST in hours and neuroticism.

3. Results

3.1 Demographics

In total 84 individuals participated in the study. Those participants, who joined the study within the last few days, or had a response rate < 70%, as well as people with a sitting time above 24 hours were excluded. This was done because some participants indicated more sitting time than there are hours within a day. While 24 hours sedentary time might seem unlikely, it is possible and was chosen as cut-off point. In the end, 37 participants remained and were included in the analysis. The final dataset consisted of participants between 18 and 26 years (M = 20.68, SD = 2.17) and was mainly female (73%, n = 27), German (56.8%, n = 21) and studying psychology (83.8%, n=31) as seen in Table 2.

Table 2

Summary of the Baseline Information of the sample.

Baseline Characteristics	**n**	**%**
Gender		
Female	27	73.0
Male	10	27.0
Nationality		
Dutch	7	18.9
German	21	56.8
Other EU	5	13.5
Other Non-EU	4	10.8
Study Programme		
Psychology	31	83.8
Other [b]	6	16.2

Note. [b] other study programmes reported were Mechanical Engineering, Psychotherapy, Mechatronics, Informatics, Business Mathematics

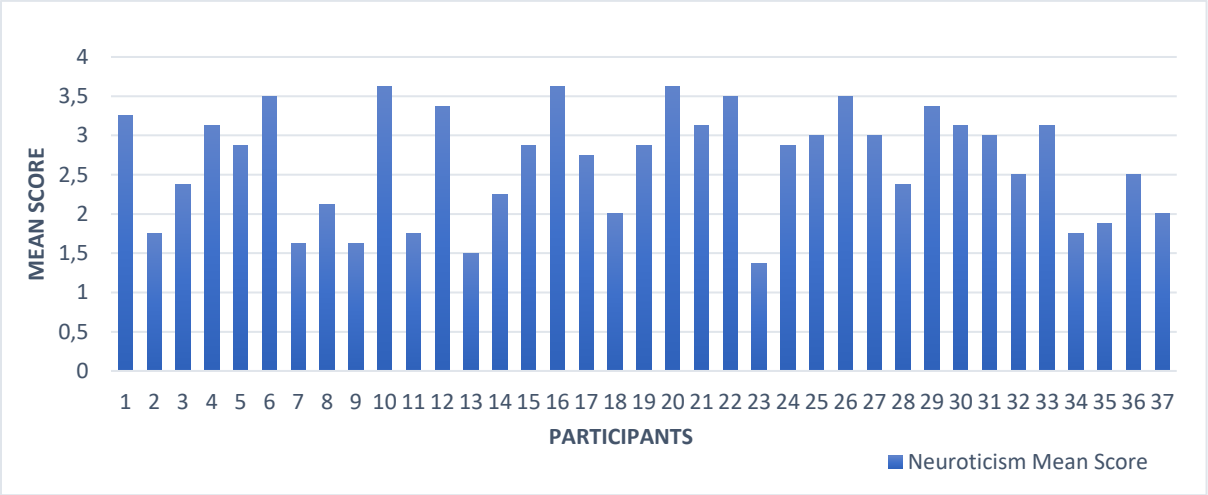
3.2 Reliabilities and Descriptive Statistics

The Cronbach's alpha coefficient for the neuroticism scale indicates good reliability of r = .863. Furthermore, the sedentary behaviour items showed reliabilities ranging from poor r_s =.353 (p = .077) to excellent r_s = .865 (p < .001) reliability. Lastly, the PANAS items reliabilities are ranging from acceptable (r_s = .585, p < .001) to good (r_s = .758, p < .001). See Appendix E for all statistics.

Within the sample the neuroticism mean scores ranged from 1.38 to 3.63 (M = 2.66, SD = 0.69). This indicated a moderate neuroticism level in the participants. Nevertheless, as seen in Figure 2 there are large differences between some participants, such as participant 2,7,9 and 1,4,6.

Figure 2

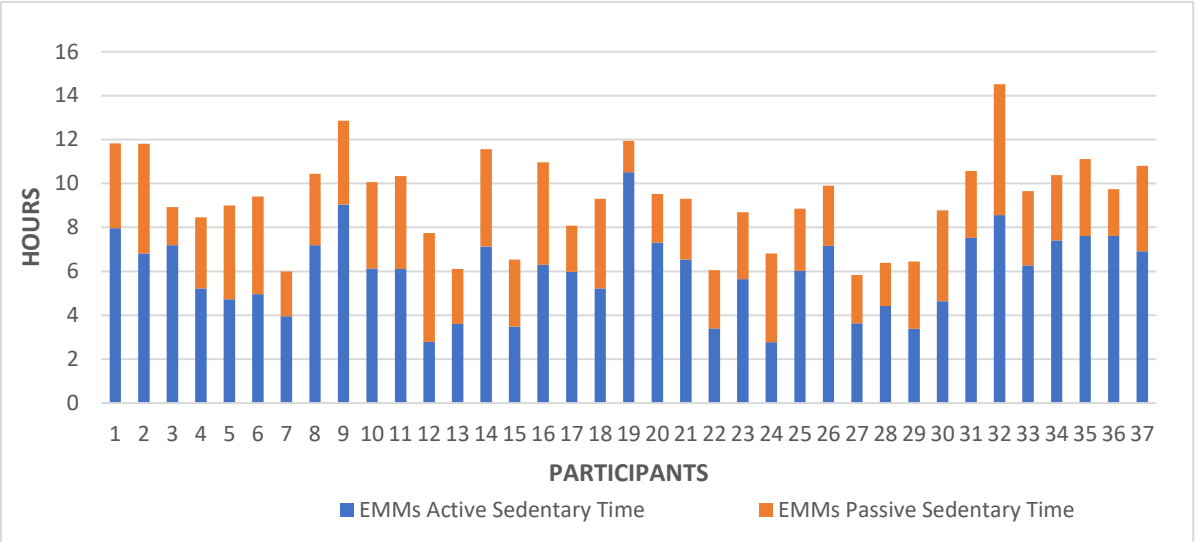
Neuroticism Mean Score per Participant.



On average the sample spend 9.27 hours (SD= 3.26) sitting, while rather engaging in active (M= 5.62, SD= 3.02) than passive (M= 3.39, SD= 1.85) sedentary behaviour (see also Appendix F). The visualisation of EMMs (Figure 3) display only participant 12 and 24 to sit more passively than actively. Furthermore, no significant variation between participants for total daily (F (36,19.22) = 1.119, p = .406)., active (F (36,22.85) = .987, p = .525) and passive (F (36,30.89) = 1.014, p = .488) sedentary time was found.

Figure 3

Estimated Marginal Means of Daily Sedentary Time, divided in Mentally Active and Passive Sedentary Time per Participant.

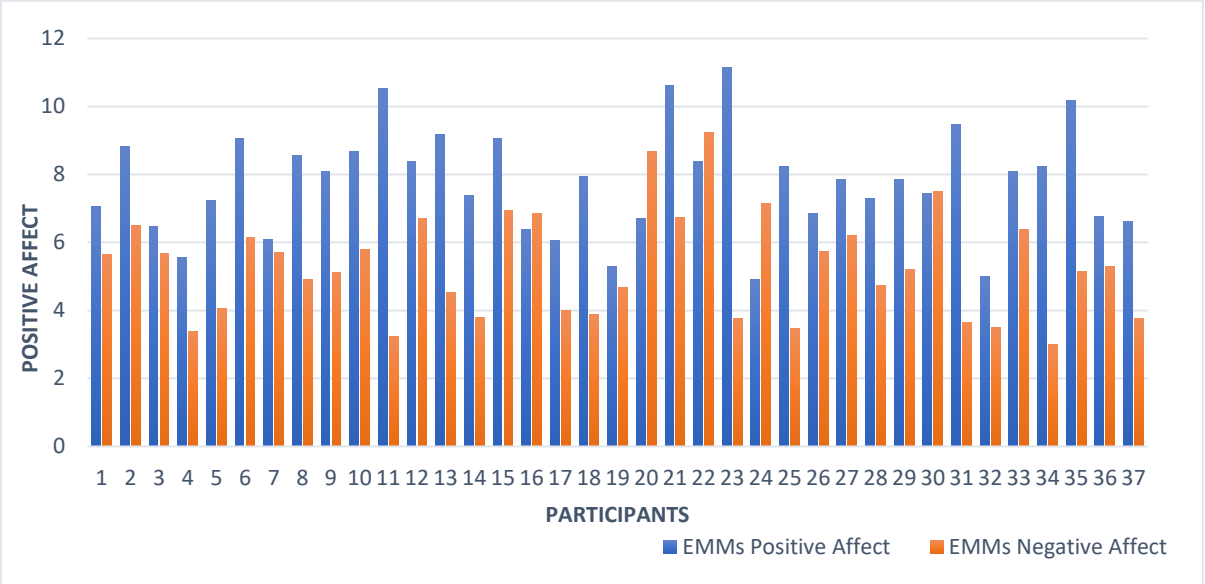


Sedentary time gradually decreased over time, reaching its lowest points during the weekend before increasing as the week starts again (Appendix G). Significant variation over time was found for daily (F (20,524.23) = 2.531, p < .001) as well as active sedentary time (F (20,504.46) = 3.525, p < .001). However, this variation is rather small. There was no significant indication for variation in passive sedentary time (F (20, 496.45) = .878, p = .616) over time.

The EMM scores of mood vary strongly and significantly between participants (F (36,194.443) = 9.648, p < 0.001). In Figure 4 its shown, that some participants have quite mixed mood measurements, such as participants 3,7, and 16, while others display a huge difference between positive and negative affect. For example, participants 11, 13, and 23. Nevertheless, except from four participants (16, 20, 22 and 30), everyone scored higher in positive (M = 7.77, SD = 2.79), than negative affect (M = 5.31, SD = 2.48) (see also Appendix F). For both affects significant differences between participants were found, with large variation in positive (F (36,236.96) = 9.043, p <.001) and negative affect (F (36, 176.15) = 8.782, p <.001).

Figure 4

Estimated Marginal Means of Positive and Negative Affect per Participant.



For total mood no significant variation over time was found (F (20, 427.38) = 1.082, p = .365). Lowest mood scores were measured in the morning, while until Friday evening (point 9) the highest mood was measured in the evening (Appendix G). In general mood rose to its highest point on Saturday afternoon and dropped lowest point on Monday morning. From this point on, the highest level of mood throughout the day was captured in the afternoons of the following week. The EMMs indicated for positive (F (20, 415.91) = 1.639, p = .041) and negative affect (F (20, 431.92) = 1.119, p = .326) insignificant variation over time (Appendix G).

3.3 Associations Between Daily Sedentary Time, Mood and Neuroticism

For research question one no significant relationship between daily sedentary time and mood was found (B = 0.048, SE =0.053, F (1, 337.34) = 0.825, p = .364). Thus, there is no change in mood as daily sedentary time increases by one unit. Furthermore, the 95% CI [-0.056, 0.152] indicated a very small variation of the individual within-person correlations. The absence of the relationship between daily sedentary time and mood can also be seen in the visualization of the EMMs of daily sedentary time and mood per participant (Figure 5) and over time (Figure 6).

Figure 5

Estimated Marginal Means of Mood and Total Sedentary Time in Hours per Participant.

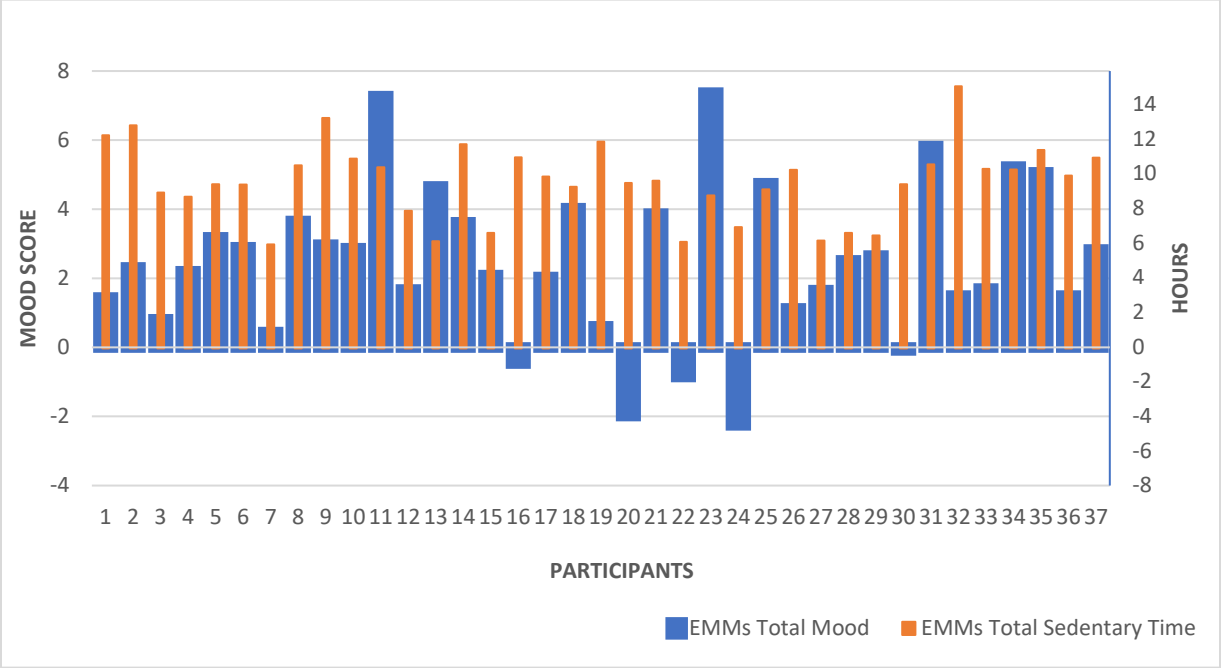
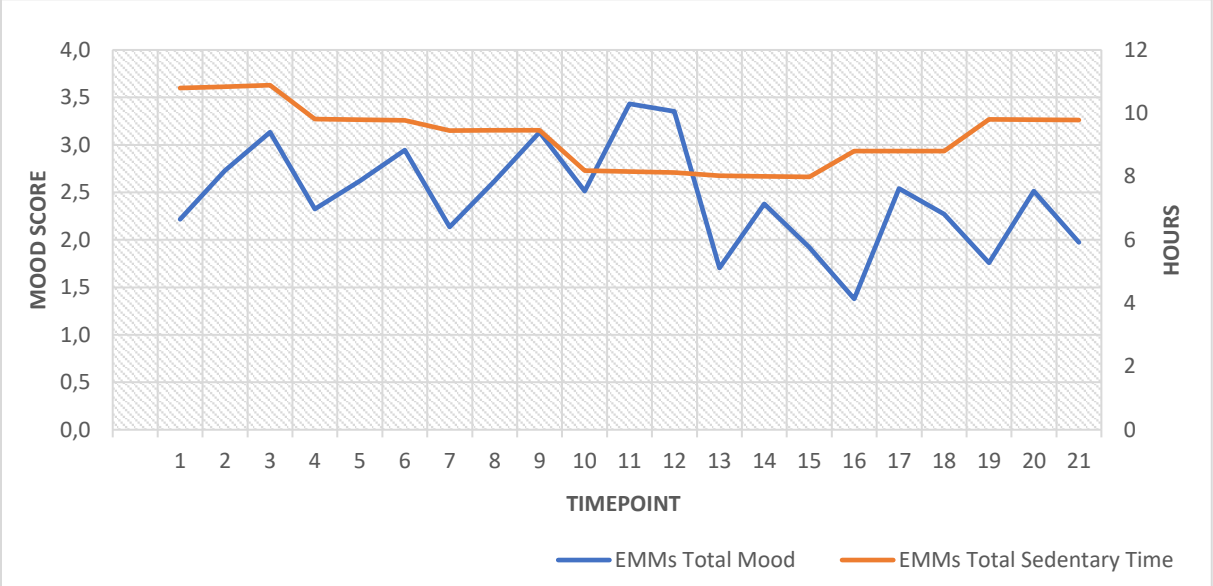


Figure 6

Estimated Marginal Means of Mood and Total Sedentary Time in Hours per Timepoint.



Research question two focused on daily passive sedentary time and negative affect. No significant relation was found, with an average within-person correlation of B = -0.0005 (SE = 0.053, F (1,464.3) = 0.223, p = .637). The 95% CI [0.002, 0.005] indicates almost non variation of individual within person correlations. Also, the visualization per participant and over time

(Figures 7 & 8) displays no relation, as there is no pattern to be identified. Thus, daily passive sedentary time does not seem to predict negative affect within this sample.

Figure 7

Estimated Marginal Means of Negative Affect and Passive Sedentary Time per Participant.

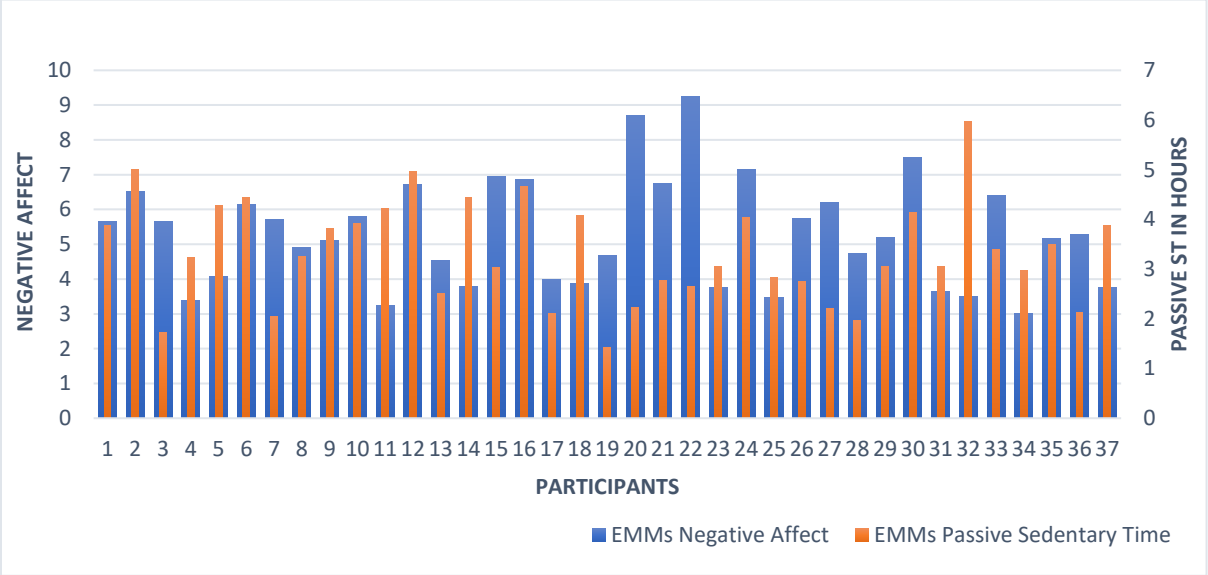
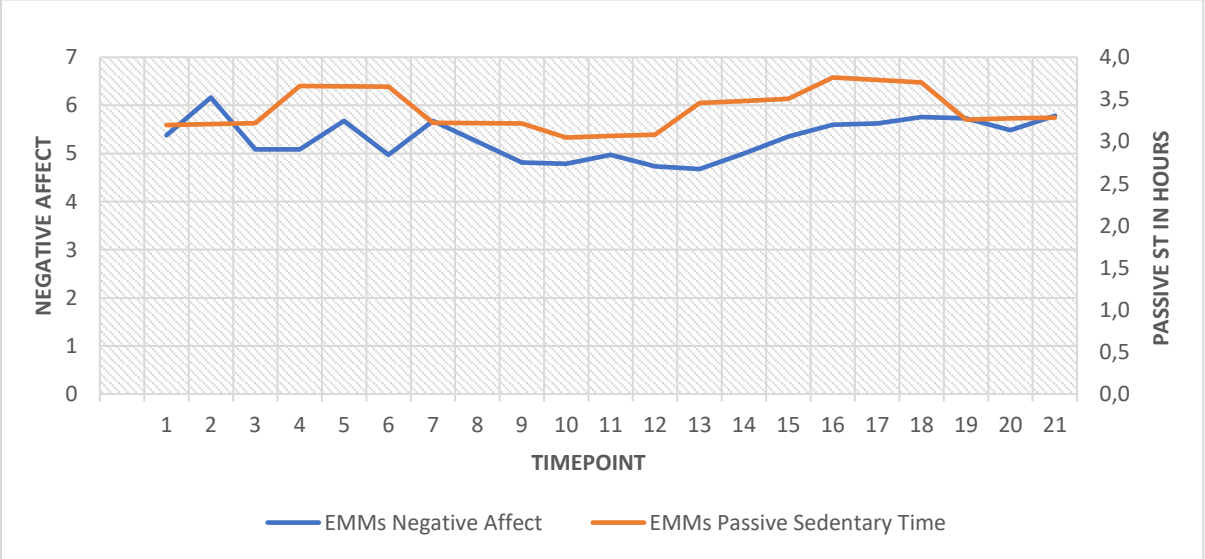


Figure 8

Estimated Marginal Means of Negative Affect and Passive Sedentary Time Over Time.



Lastly, a moderation effect on the relationship between sedentary time and mood was analysed (Table 3). Likewise, this led to insignificant main effects as well as interaction effect of trait neuroticism. The main effect of sedentary time stayed insignificant as examined within the first analysis (B = 0.154, SE = 0.186, F (1,312.16) = 0.687, p = .408). There is no association

between daily sedentary time and mood. Even though neuroticism has the smallest p-value examined, the association between neuroticism and mood was insignificant as well with an average within-person correlation of B = -1.262 (SE = .676, F (1,285.34) =3.486, p = .063). Additionally, was the 95% CI [-2.593,0.068] the widest within this analysis. This illustrates large variation in individual within-person correlations. Furthermore, no significance was found for the interaction effect of neuroticism (B = -0.043, SE = .068, F (1,325.21) = .402, p = .527). These findings demonstrate no effect of neuroticism on either mood nor the association between daily sedentary time and mood.

Table 3

Overview of Results from all Analyses Presented in Unstandardized Values.

Parameter	Estimate	Std. Error	df	t	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Analysis 1[a]							
Intercept	1.999	0.529	291.503	3.778	p<.000	0.958	3.042
ST	0.048	0.053	337.338	0.908	.364	-0.056	0.152
Analysis 2[b]							
Intercept	5.416	0.258	298.517	21.019	p<.000	4.909	5.923
Passive ST	-0.0005	0.001	464.298	-0.472	.637	-0.003	0.002
Analysis 3[a]							
Intercept	5.463	1.856	274.922	2.942	.004	1.808	9.117
ST	0.154	0.186	312.162	0.829	.408	-0.211	0.519
Neuroticism	-1.262	0.676	285.343	-1.867	.063	-2.593	0.068
Interaction effect of Neuroticism& ST	-0.043	0.068	325.209	-0.634	.527	-0.178	0.091

Note. [a] Dependent Variable = Mood, [b] Dependent Variable = Negative Affect, Abbreviation ST = Sedentary Time

4. Discussion

4.1. Main Findings

In general, this study focused on investigating the association between daily sedentary behaviour and mood, as well as the moderating impact of trait neuroticism. There was no significant overall relation found between daily sedentary behaviour and mood, as well as no moderating effect of neuroticism. However, the descriptive statistics brought interesting insights already. The sample was highly sedentary and displayed mostly mentally active sedentary behaviour. Besides, the sample experienced more positive than negative affect and scored mostly moderately on the neuroticism scale.

The amount of sedentary time within this sample is similar to previous studies. Although, the self-report studies in Castro et al. (2020) meta-analysis recoded slightly lower amounts. Furthermore, the visualisations present a difference between weekdays and weekend, similar to McVeigh et al. (2016) and Prince et al. (2020).

The visualizations of mood per participant do appear quite mixed for each participant with some exceptions. It seems as if there is no clear pattern. Exceptions, such as participants 11 and 23, display very high positive and very low negative affect, as well as a low neuroticism score. This might indicate that these participants are less prone to be as much affected by negative events than those scoring high in neuroticism, which would be in line with Costa and McCrae (1980) and Eysenck (1974) findings. Based only on the visualizations, it does not seem as if the sedentary type, active or passive, can be used to explain these mood exceptions.

For the first research question, the overall association between daily sedentary behaviour and state mood was examined. Against the expectations and previous research (DeMello et al., 2018; Endrighi et al., 2016; Giurgiu et al., 2019; Hamer et al., 2014; Huang et al., 2020), no significant association between these two constructs was found. There is no evidence of daily sedentary behaviour predicting mood within individuals of this sample. Only one study was found concluding that sedentary time does not necessarily cause negative affect and therefore influence mood (Aggio et al., 2017). Similar to the current study, their sample consisted of students, who might showcase different sedentary behaviours than adults (Aggio et al., 2017). Another potential reason for non-significant results, similarly mentioned by Aggio et al. (2017), is the fact that mood can be influenced and manipulated by several factors, which are not necessarily related to sedentary behaviour (Lischetzke, 2014). Such might be listening to music, eating food, hormones and the amount and quality of social contact (Bolger & Eckenrode, 1991; Davydov et al., 2005; Ottley, 2000; Vittengl & Holt, 1998).

Another factor influencing mood, might be the weekly mood cycle. Similarly to this study, Larsen and Kasimatis (1990) observed mood increasing towards the weekend and drastically decreasing from Sunday to Monday, the lowest point of the week. Csikszentmihalyi and Hunter (2014), explained this effect by the social structure of time. Moving towards the weekend, leisure time and freedom from work or school, increases mood. The same might be the reason for fluctuation within one day (Csikszentmihalyi & Hunter, 2014). On Sunday mood decreases again, which might be because the start of the new week and obligations are forthcoming (Csikszentmihalyi & Hunter, 2014). Although the lowest point of mood was found on Monday, no drastic change compared to the other weekdays can be seen. This is in line with Stone (2012) findings, which suggest fluctuations between weekdays and weekend-days, but rather stable mood throughout Monday to Friday.

Next to that, personality seems to play a role in how one is experiencing mood. As mentioned in the introduction, people scoring high in neuroticism tend to experience negative moods more strongly than people scoring low in neuroticism. Furthermore, Larsen and Kasimatis (1990) discovered that extraverted people possess a more positive baseline mood compared to introverted people. These findings are also mentioned in Hoerger and Quirk (2010) report in which neuroticism is linked to poorer baseline mood than extraversion. Thus, participants most likely have different baseline moods and are affected by different mood manipulations during their daily life. Furthermore, Brandstätter (1983) found that situations, social interactions and their subsequent emotions are related to personality. Since, the sample is quite homogenous regarding the study programme, it might be that their personality types are similar as well (Pike, 2006). Based on Holland (1997) *'Theory of Vocational Choice'*, individuals search for jobs fitting to their personality. This indicates, the sample might consist of similar personality types. All these factors might lead to non-significant results and no association between sedentary behaviour and mood within this sample.

The same explanation can be used for research question two as it was expected to find an increase in negative affect when mentally passive sedentary time increases. Similar, to research question one, the findings suggest no association between passive sedentary time and negative affect. Looking at the visualizations, one can see that participants who scored higher times of passive than active sedentary behaviour did not necessarily score higher on negative affect, indicating that there is no relationship to be found within this sample. This might be influenced by the same elements as the outcome of research question one. Elements, such as music or social contact, which was the third largest sedentary behaviour, might neutralize the effect of sedentary behaviour found in previous research. Important to note is the large amount

of sedentary behaviour research based on screen time behaviour, not considering for example social interactions (Allen et al., 2017; Chau et al., 2013; Huang et al., 2020).

Since there is no proof of an association between sedentary behaviour and mood, it is not surprising that research question three led to another non-significant result. It was expected that high neuroticism scores strengthen the relationship between sedentary behaviour and mood. Although the second main effect of neuroticism on mood was insignificant, it showed the lowest p-value in the moderation analysis. This might indicate a small trend of a negative effect on mood, which would fit to previous findings (Costa & McCrae, 1980; Eysenck, 1974; Hoerger & Quirk, 2010; Larsen & Kasimatis, 1990).

While some research suggests neuroticism is related to sedentary behaviour as well as mood others display a bidirectional relationship between these constructs. A paper of Kelly et al. (2020) displays findings which suggest that physical health is influencing neuroticism as well, seemingly more often than the other way around. Such findings not only appear for physical health, but also mental health since evidence of a bidirectional relationship between neuroticism and depressive symptoms, was found (Hakulinen et al., 2015; Neeleman et al., 2004). Additionally, the literature provided for the substantiation of the moderation model did focus on neuroticism as a moderator of relationships excluding health behaviour. They focused on concepts such as well-being or violence and depression. This might indicate a flawed moderation model, which could lead to these insignificant results.

4.2 Strengths and Limitations

Even though the findings are not in line with previous research, this study holds advantages compared to others. First, the topic of sedentary behaviour is quite newly researched to such an extent, for example by including within-person data. Additionally, the focus on mood and neuroticism as additional variables in the relationship with sedentary behaviour is rare to non-existent. There are studies focusing on both concepts separately in relation to sedentary behaviour, but none were found taking mood as well as personality into account. Furthermore, the good amount of research on sedentary time, focuses primarily on adults or elderly people. Thus, using young adults as a target group brings insight into a large group within our society. One of the most prominent differences between this study and previous work, is most likely the inclusion of mentally active and passive sedentary behaviour. Some preceding researchers measured sedentary time as being equal to screen time or the lack of physical activity (Hoare et al., 2016; Saunders et al., 2020), which does not differentiate between behaviours. Screen time includes, working but also watching Netflix, two activities which demand different

amounts of mental activity.

Many studies focusing on sedentary behaviour are conducted as cross-sectional studies, which can be prone to memory bias and lead to less extensive data. By using the experience sampling method, it was possible to retrieve real life data over a larger timespan. This makes it possible to analyse certain associations over time or within certain individuals, while avoiding memory biases or biases due to a laboratory setting. Sending out multiple measurements a day and prompting these measurements randomly, reduces the timespan participants need to remember, while it increases ecological validity.

In contrast to strengths there are limitations as well. Within this study, a rather homogenous sample, consisting of mainly female, German, psychology students, was analysed. This might take away variety in the sample and would be advisable to change within a replication. For example, by including general young adults, not only university students. A more heterogenous sample would be beneficial as more differences between participants might occur. For example, sedentary time or mood might be affected by the study load of the study programme. By including a larger variety of study programmes, results might differ.

Next to that, the sample size shrunk by eliminating everyone with a response rate below 70% (van Berkel et al., 2017). Even though this was done to ensure more precise data and was not below the recommended minimum, the information of 17 participants was lost by not setting the cut-off point at 50%.Furthermore, the study duration of nine days laid below the average in ESM studies, but still at least 518 data points were collected (van Berkel et al., 2017). Conducting a data collection of two instead of one week, would offer the possibility to compare these weeks. Even though, technically two weeks were included within this study, they were not complete. Leaving it open if, for example, Monday or Tuesday affected the Wednesday measurement. Additionally, the inclusion of different periods would allow comparisons between these. It might be that all participants simply had a good week right before the holidays but would have a different one mid-semester.

When taking a closer look at the results of sedentary behaviour it appears as if participants did not understand the item prompt. A surprisingly large number of participants had to be excluded, because they entered sedentary times above 24 hours per day, which is not possible. After excluding them, some of the participants left indicated a very high amount of sedentary time. Presumably, this happened by entering the time double. For example, sedentary time while studying and as active PC usage. This might indicate the item prompt should be explaining what to enter clearer or a check of some kind should occur.

Lastly, the differentiation between mentally active and passive sedentary behaviour is

based on only very few studies (Hallgren et al., 2020; Hallgren et al., 2018). This made it difficult to categorise the items from the PAST-U questionnaire in mentally active and passive activity. Therefore, the items might not have been completely mutually exclusive, which the previous argument supports. Furthermore, items were adapted which might have led to a change in validity.

4.2 Further Research

Since the results turned out to be insignificant, contradicting to the majority of previous research, it is recommended to replicate this study under consideration of its limitations. Starting by using a more heterogenous sample, to get a better insight into the general young population with a variation in e.g. study programs, which was the original focus of this study.

Looking at the measurement tool it is advisable to further elaborate on how to fill in the PAST-U questionnaire to avoid misleading results. More advantageously would be the usage of an actigraph to measure sedentary time, in an even more state-like way. This would avoid memory bias and offers the possibility to link sedentary behaviour to a specific time of the day. However, there would be the need of an additional measurement or item to elaborate on the type of activity a person is engaging in. Taking Giurgiu et al. (2019) study as an example, an idea might be to trigger a questionnaire asking for the sedentary activity, after the accelerometer measured a certain duration of sedentary behaviour. Thus, memory bias would be reduced to a minimum and a purer within-person analysis would be possible.

Similar applies to the mood measurements. It might be advisable to conduct more than three state mood measurements per day, especially when using actigraphs. This allows sedentary time to be directly linked to state mood and to identify effects in a small timeframe (Giurgiu et al., 2019). Additionally, this should reduce recall bias as well.

5. Conclusion

No significant association between sedentary behaviour and mood or neuroticism was found. Nevertheless, the high amount of sedentary time in students should be noted because previous research did find detrimental health outcomes, which could affect them in the long run. Furthermore, this study served as a first try to incorporate a personality trait as a moderator of the relationship between sedentary behaviour and mood. Still, further research of different models, longer study periods and more heterogeneous samples is needed to see if there is an association as previous research suggested. Especially, since the distinction between mentally active and passive sedentary tasks is new, further improvement of their measurement might be beneficial.

References

Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. (2013). Sampling: why and how of it? *Indian Journal of Medical Specialities, 4*(2). https://doi.org/10.7713/ijms.2013.0032

Aggio, D., Wallace, K., Boreham, N., Shankar, A., Steptoe, A., & Hamer, M. (2017). Objectively Measured Daily Physical Activity and Postural Changes as Related to Positive and Negative Affect Using Ambulatory Monitoring Assessments. *Psychosomatic Medicine, 79*(7), 792-797. https://doi.org/10.1097/psy.0000000000000485

Allen, M. S., Walter, E. E., & McDermott, M. S. (2017). Personality and sedentary behavior: A systematic review and meta-analysis. *Health Psychol, 36*(3), 255-263. https://doi.org/10.1037/hea0000429

APA Dictionary of Psychology. (2022). Retrieved 9 January 2022 from https://dictionary.apa.org/personality-trait

Biddle, S. J. H., Bennie, J. A., De Cocker, K., Dunstan, D., Gardiner, P. A., Healy, G. N., Lynch, B., Owen, N., Brakenridge, C., Brown, W., Buman, M., Clark, B., Dohrn, I. M., Duncan, M., Gilson, N., Kolbe-Alexander, T., Pavey, T., Reid, N., Vandelanotte, C., Vergeer, I., & Vincent, G. E. (2019, Nov 27). Controversies in the Science of Sedentary Behaviour and Health: Insights, Perspectives and Future directions from the 2018 Queensland Sedentary Behaviour Think Tank. *Int J Environ Res Public Health, 16*(23). https://doi.org/10.3390/ijerph16234762

Bolger, N., & Eckenrode, J. (1991). Social relationships, personality, and anxiety during a major stressful event. https://doi.org/10.1037/0022-3514.61.3.440. *Journal of Personality and Social Psychology, 61*(3), 440-449. https://doi.org/https://doi.org/10.1037/0022-3514.61.3.440

Boothkewley, S., & Vickers, R. R. (1994). Associations between Major Domains of Personality and Health Behavior. *Journal of Personality, 62*(3), 282-298. https://doi.org/https://doi.org/10.1111/j.1467-6494.1994.tb00298.x

Brandstätter, H. (1983). Emotional Responses to Other Persons in Everyday Life Situations. *Journal of Personality and Social Psychology, 45*(4), 871-883. https://doi.org/10.1037/0022-3514.45.4.871

Castro, O., Bennie, J., Vergeer, I., Bosselut, G., & Biddle, S. J. H. (2020). How Sedentary Are University Students? A Systematic Review and Meta-Analysis. *Prevention Science, 21*(3), 332-343. https://doi.org/10.1007/s11121-020-01093-8

Chau, J. Y., Grunseit, A. C., Chey, T., Stamatakis, E., Brown, W. J., Matthews, C. E., Bauman, A. E., & van der Ploeg, H. P. (2013). Daily sitting time and all-cause

mortality: a meta-analysis. *PLoS One*, *8*(11). https://doi.org/10.1371/journal.pone.0080000

Clark, B. K., Pavey, T. G., Lim, R. F., Gomersall, S. R., & Brown, W. J. (2016). Past-day recall of sedentary time: Validity of a self-reported measure of sedentary time in a university population. *Journal of Science and Medicine in Sport*, *19*(3), 237-241. https://doi.org/https://doi.org/10.1016/j.jsams.2015.02.001

Conner, T. S., & Lehman, B. J. (2012). Getting started: Launching a study in daily life. In M. R. M. T. S. Conner (Ed.), *Handbook of research methods for studying daily life.* (pp. 89-107). The Guilford Press.

Costa, P. T., & McCrae, R. R. (1980). Influence of extraversion and neuroticism on subjective well-being: Happy and unhappy people. *Journal of Personality and Social Psychology*, *38*(4), 668-678. https://doi.org/10.1037/0022-3514.38.4.668

Csikszentmihalyi, M., & Hunter, J. (2014). Happiness in Everyday Life: The Uses of Experience Sampling. In (pp. 89-101). Springer Netherlands. https://doi.org/10.1007/978-94-017-9088-8_6

Csikszentmihalyi, M., & Larson, R. (2014). Validity and Reliability of the Experience-Sampling Method. In (pp. 35-54). Springer Netherlands. https://doi.org/10.1007/978-94-017-9088-8_3

Davydov, D. M., Shapiro, D., Goldstein, I. B., & Chicz-Demet, A. (2005). Moods in everyday situations: effects of menstrual cycle, work, and stress hormones. *Journal of Psychosomatic Research*, *58*(4), 343-349. https://doi.org/10.1016/j.jpsychores.2004.11.003

Degroote, L., DeSmet, A., De Bourdeaudhuij, I., Van Dyck, D., & Crombez, G. (2020). Content validity and methodological considerations in ecological momentary assessment studies on physical activity and sedentary behaviour: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *17*(1). https://doi.org/10.1186/s12966-020-00932-9

DeMello, M. M., Pinto, B. M., Dunsiger, S. I., Shook, R. P., Burgess, S., Hand, G. A., & Blair, S. N. (2018). Reciprocal relationship between sedentary behavior and mood in young adults over one-year duration. *Mental Health and Physical Activity*, *14*, 157-162. https://doi.org/10.1016/j.mhpa.2017.12.001

Diamond, R., & Byrd, E. (2020, 2020/12/01/). Standing up for health – improving mental wellbeing during COVID-19 isolation by reducing sedentary behaviour. *Journal of Affective Disorders*, *277*, 232-234. https://doi.org/https://doi.org/10.1016/j.jad.2020.07.137

Diener, E. (1984). Subjective well-being. *Psychological Bulletin, 95*(3), 542-575. https://doi.org/10.1037/0033-2909.95.3.542

Elavsky, S., Kishida, M., & Mogle, J. A. (2016). Concurrent and lagged relations between momentary affect and sedentary behavior in middle-aged women. *Menopause, 23*(8), 919-923. https://doi.org/10.1097/gme.0000000000000645

Endrighi, R., Steptoe, A., & Hamer, M. (2016). The effect of experimentally induced sedentariness on mood and psychobiological responses to mental stress. *British Journal of Psychiatry, 208*(3), 245-251. https://doi.org/10.1192/bjp.bp.114.150755

Eysenck, M. W. (1974). Extraversion, arousal, and retrieval from semantic memory. *Journal of Personality, 42*(2), 319-331. https://doi.org/10.1111/j.1467-6494.1974.tb00677.x

Fadda, D., & Scalas, L. F. (2016). Neuroticism as a Moderator of Direct and Mediated Relationships Between Introversion-Extraversion and Well-Being. *Europe's journal of psychology, 12*(1), 49-67. https://doi.org/10.5964/ejop.v12i1.985

Friedman, H. S. (2019). Neuroticism and health as individuals age. *Personal Disord, 10*(1), 25-32. https://doi.org/10.1037/per0000274

Furnham, A., & Cheng, H. (2019). The Big-Five personality factors, mental health, and social-demographic indicators as independent predictors of gratification delay. *Personality and Individual Differences, 150*. https://doi.org/10.1016/j.paid.2019.109533

Gerlach, G., Herpertz, S., & Loeber, S. (2015). Personality traits and obesity: a systematic review. *Obes Rev, 16*(1), 32-63. https://doi.org/10.1111/obr.12235

Giurgiu, M., Koch, E., Ottenbacher, J., Plotnikoff, R., Ebner-Priemer, U., & Reichert, M. (2019). Sedentary behavior in everyday life relates negatively to mood: An Ambulatory Assessment study. *Scandinavian Journal of Medicine & Science in Sports, 29*. https://doi.org/10.1111/sms.13448

Grøntved, A. (2011). Television Viewing and Risk of Type 2 Diabetes, Cardiovascular Disease, and All-Cause Mortality. *JAMA, 305*(23), 2448. https://doi.org/10.1001/jama.2011.812

Groth-Marnat, G. W. A. J. (2016). *Handbook of psychological assessment*. John Wiley & Sons, Inc.

Hakulinen, C., Elovainio, M., Pulkki-Raback, L., Virtanen, M., Kivimaki, M., & Jokela, M. (2015). Personality and Depressive Symptoms: Individual Participant Meta-Analysis

of 10 Cohort Studies. *Depress Anxiety*, *32*(7), 461-470. https://doi.org/10.1002/da.22376

Hallgren, M., Dunstan, D. W., & Owen, N. (2020). Passive Versus Mentally Active Sedentary Behaviors and Depression. *Exerc Sport Sci Rev*, *48*(1), 20-27. https://doi.org/10.1249/JES.0000000000000211

Hallgren, M., Owen, N., Stubbs, B., Zeebari, Z., Vancampfort, D., Schuch, F., Bellocco, R., Dunstan, D., & Trolle Lagerros, Y. (2018). Passive and mentally-active sedentary behaviors and incident major depressive disorder: A 13-year cohort study. *Journal of affective disorders.*, *241*, 579-585. https://doi.org/10.1016/j.jad.2018.08.020

Hamer, M., Coombs, N., & Stamatakis, E. (2014). Associations between objectively assessed and self-reported sedentary time with mental health in adults: an analysis of data from the Health Survey for England. *BMJ Open*, *4*(3), e004580. https://doi.org/10.1136/bmjopen-2013-004580

Hansen, F. (2021). *The Influence of Context and Mental Activeness on the Relationship between Sedentary Behaviour and Mood: An Experience Sampling Study.* (Publication Number 87587) University of Twente]. http://essay.utwente.nl/87587/

Hill, P. L., Mroczek, D. K., & Young, R. K. (2014). Personality Traits as Potential Moderators of Well-Being. In (pp. 245-259). https://doi.org/10.1016/b978-0-12-411478-4.00012-6

Ho, M. Y., Cheung, F. M., You, J., Kam, C., Zhang, X., & Kliewer, W. (2013). The moderating role of emotional stability in the relationship between exposure to violence and anxiety and depression. *Personality and Individual Differences*, *55*(6), 634-639. https://doi.org/https://doi.org/10.1016/j.paid.2013.05.004

Hoare, E., Milton, K., Foster, C., & Allender, S. (2016). The associations between sedentary behaviour and mental health among adolescents: a systematic review. *Int J Behav Nutr Phys Act*, *13*(1), 108. https://doi.org/10.1186/s12966-016-0432-4

Hoerger, M., & Quirk, S. W. (2010). Affective forecasting and the Big Five. *Personality and Individual Differences*, *49*(8), 972-976. https://doi.org/10.1016/j.paid.2010.08.007

Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments, 3rd ed*. Psychological Assessment Resources.

Huang, Y., Li, L., Gan, Y., Wang, C., Jiang, H., Cao, S., & Lu, Z. (2020). Sedentary behaviors and risk of depression: a meta-analysis of prospective studies. *Transl Psychiatry*, *10*(1), 26. https://doi.org/10.1038/s41398-020-0715-z

John, O. P., & Srivastava, S. (1999). *The Big-Five trait taxonomy: History, measurement, and theoretical perspectives* (Vol. 2). University of California Berkeley.

Kelly, D. P., Weigard, A., & Beltz, A. M. (2020). How are you doing? The person-specificity of daily links between neuroticism and physical health. *J Psychosom Res, 137*, 110194. https://doi.org/10.1016/j.jpsychores.2020.110194

Kercher, K. (1992). Assessing Subjective Well-Being in the Old-Old: The PANAS as a Measure of Orthogonal Dimensions of Positive and Negative Affect. *Research on Aging, 14*(2), 131-168. https://doi.org/10.1177/0164027592142001

Larsen, R. J., & Kasimatis, M. (1990). Individual differences in entrainment of mood to the weekly calendar. *Journal of Personality and Social Psychology, 58*(1), 164–171. https://doi.org/10.1037/0022-3514.58.1.164

Lischetzke, T. (2014). Mood. In (pp. 4115-4119). Springer Netherlands. https://doi.org/10.1007/978-94-007-0753-5_1842

López-Valenciano, A., Mayo, X., Liguori, G., Copeland, R. J., Lamb, M., & Jimenez, A. (2020). Changes in sedentary behaviour in European Union adults between 2002 and 2017. *BMC Public Health, 20*(1), 1206. https://doi.org/10.1186/s12889-020-09293-1

Lyubomirsky, S., & Lepper, H. S. (1999). A Measure of Subjective Happiness: Preliminary Reliability and Construct Validation. *Social Indicators Research, 46*(2), 137-155. https://doi.org/10.1023/A:1006824100041

Marciano, L., Camerini, A.-L., & Schulz, P. J. (2020). Neuroticism in the digital age: A meta-analysis. *Computers in Human Behavior Reports, 2*. https://doi.org/https://doi.org/10.1016/j.chbr.2020.100026

McVeigh, J. A., Winkler, E. A. H., Howie, E. K., Tremblay, M. S., Smith, A., Abbott, R. A., Eastwood, P. R., Healy, G. N., & Straker, L. M. (2016). Objectively measured patterns of sedentary time and physical activity in young adults of the Raine study cohort. *International Journal of Behavioral Nutrition and Physical Activity, 13*(1). https://doi.org/10.1186/s12966-016-0363-0

Mertens, E. C. A., Deković, M., Van Londen, M., & Reitz, E. (2022). Personality as a moderator of intervention effects: Examining differential susceptibility. *Personality and Individual Differences, 186*, 111323. https://doi.org/https://doi.org/10.1016/j.paid.2021.111323

Merz, E. L., & Roesch, S. C. (2011). Modeling trait and state variation using multilevel factor analysis with PANAS daily diary data. *J Res Pers, 45*(1), 2-9. https://doi.org/10.1016/j.jrp.2010.11.003

Moulin, M. S. (2016). *An Assessment of Sedentary Time Among Undergraduate Students at an Urban Canadian University*. (Publication Number 3568) The University of Western Ontario]. Electronic Thesis and Dissertation Repository. http://ir.lib.uwo.ca/etd/3568

Neeleman, J., Bijl, R., & Ormel, J. (2004). Neuroticism, a central link between somatic and psychiatric morbidity: path analysis of prospective data. *Psychol Med, 34*(3), 521-531. https://doi.org/10.1017/s0033291703001193

Ottley, C. (2000). Food and mood. *Mental Health Practice, 4*(4), 32–39. https://doi.org/10.7748/mhp2000.12.4.4.32.c1684

Owen, N., Sugiyama, T., Eakin, E. E., Gardiner, P. A., Tremblay, M. S., & Sallis, J. F. (2011). Adults' sedentary behavior determinants and interventions. *Am J Prev Med, 41*(2), 189-196. https://doi.org/10.1016/j.amepre.2011.05.013

Park, J. H., Moon, J. H., Kim, H. J., Kong, M. H., & Oh, Y. H. (2020). Sedentary Lifestyle: Overview of Updated Evidence of Potential Health Risks. *Korean Journal of Family Medicine, 41*(6), 365-373. https://doi.org/10.4082/kjfm.20.0165

Patterson, R., McNamara, E., Tainio, M., De Sá, T. H., Smith, A. D., Sharp, S. J., Edwards, P., Woodcock, J., Brage, S., & Wijndaele, K. (2018). Sedentary behaviour and risk of all-cause, cardiovascular and cancer mortality, and incident type 2 diabetes: a systematic review and dose response meta-analysis. *European Journal of Epidemiology, 33*(9), 811-829. https://doi.org/10.1007/s10654-018-0380-1

Pike, G. R. (2006). Vocational Preferences and College Expectations: An Extension of Holland's Principle of Self-Selection. *Research in Higher Education, 47*(5), 591-612. https://doi.org/10.1007/s11162-005-9008-x

Prince, S. A., Cardilli, L., Reed, J. L., Saunders, T. J., Kite, C., Douillette, K., Fournier, K., & Buckley, J. P. (2020). A comparison of self-reported and device measured sedentary behaviour in adults: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 17*(1). https://doi.org/10.1186/s12966-020-00938-3

Rammstedt, B., & John, O. P. (2007). Measuring personality in one minute or less: A 10-item short version of the Big Five Inventory in English and German. *Journal of Research in Personality, 41*(1), 203-212. https://doi.org/10.1016/j.jrp.2006.02.001

Richter, M. (2021). *The association between Sedentary Time, Physical Activity and Mood : an experience sampling study* (Publication Number 56604) University of Twente]. http://essay.utwente.nl/87531/

Saunders, T. J., McIsaac, T., Douillette, K., Gaulton, N., Hunter, S., Rhodes, R. E., Prince, S. A., Carson, V., Chaput, J. P., Chastin, S., Giangregorio, L., Janssen, I., Katzmarzyk, P. T., Kho, M. E., Poitras, V. J., Powell, K. E., Ross, R., Ross-White, A., Tremblay, M. S., & Healy, G. N. (2020). Sedentary behaviour and health in adults: an overview of systematic reviews. *Appl Physiol Nutr Metab*, *45*(10), S197-S217. https://doi.org/10.1139/apnm-2020-0272

SEMrush. (2020). *Most popular streaming services worldwide from November 2019 to March 2020, by number of monthly visits (in millions).* Retrieved October 06 from https://www.statista.com/statistics/187011/svod-video-platforms-traffic/

Shiffman, S., Stone, A. A., & Hufford, M. R. (2008). Ecological Momentary Assessment. *Annual Review of Clinical Psychology*, *4*(1), 1-32. https://doi.org/10.1146/annurev.clinpsy.3.022806.091415

Smith, P. F. (2012). A note on the advantages of using linear mixed model analysis with maximal likelihood estimation over repeated measures ANOVAs in psychopharmacology: comment on Clark et al. (2012). *Journal of Psychopharmacology*, *26*(12), 1605-1607. https://doi.org/10.1177/0269881112463471

Stephan, Y., Terracciano, A., Luchetti, M., Aschwanden, D., Lee, J. H., Sesker, A. A., Strickhouser, J. E., & Sutin, A. R. (2020). Physical Activity and Sedentary Behavior During COVID-19: Trajectory and Moderation by Personality. *Social Psychological and Personality Science*, *12*(6), 1103-1109. https://doi.org/10.1177/1948550620962945

Stockwell, S., Trott, M., Tully, M., Shin, J., Barnett, Y., Butler, L., McDermott, D., Schuch, F., & Smith, L. (2021). Changes in physical activity and sedentary behaviours from before to during the COVID-19 pandemic lockdown: a systematic review. *BMJ Open Sport Exerc Med*, *7*(1), e000960. https://doi.org/10.1136/bmjsem-2020-000960

Stone, A., Shiffman, S., Atienza, A., & Nebeling, L. (2007). *The science of real-time data capture: Self-reports in health research*. Oxford University Press.

Stone, A. A., Schneider, S., & Harter, J. K. (2012). Day-of-week mood patterns in the United States: On the existence of "Blue Monday", "Thank God it's Friday" and weekend effects. *The Journal of Positive Psychology*, *7*(4), 306–314. https://doi.org/10.1080/17439760.2012.6919

Sutin, A. R., Stephan, Y., Luchetti, M., Artese, A., Oshio, A., & Terracciano, A. (2016). The five-factor model of personality and physical inactivity: A meta-analysis of 16 samples. *Journal of Research in Personality*, *63*, 22-28. https://doi.org/10.1016/j.jrp.2016.05.001

Thivel, D., Tremblay, A., Genin, P. M., Panahi, S., Rivière, D., & Duclos, M. (2018). Physical Activity, Inactivity, and Sedentary Behaviors: Definitions and Implications in Occupational Health. *Frontiers in public health, 6*, 288-288. https://doi.org/10.3389/fpubh.2018.00288

Thompson, E. R. (2007). Development and Validation of an Internationally Reliable Short-Form of the Positive and Negative Affect Schedule (PANAS). *Journal of Cross-Cultural Psychology, 38*(2), 227-242. https://doi.org/10.1177/0022022106297301

Tremblay, M. S., Aubert, S., Barnes, J. D., Saunders, T. J., Carson, V., Latimer-Cheung, A. E., Chastin, S. F. M., Altenburg, T. M., & Chinapaw, M. J. M. (2017). Sedentary Behavior Research Network (SBRN) – Terminology Consensus Project process and outcome. *International Journal of Behavioral Nutrition and Physical Activity, 14*(1). https://doi.org/10.1186/s12966-017-0525-8

Ussery, E. N., Fulton, PhD J. E., Galuska, PhD D. A., Katzmarzyk, PhD P. T., Carlson, PhD S. A. (2018). Joint Prevalence of Sitting Time and Leisure-Time Physical Activity Among US Adults, 2015-2016. *JAMA, 320*(19), 2036-2038. https://doi.org/10.1001/jama.2018.14165

van Berkel, N., Ferreira, D., & Kostakos, V. (2017). The Experience Sampling Method on Mobile Devices. *ACM Computing Surveys, 50*(6), 1-40. https://doi.org/10.1145/3123988

van der Ploeg, H. P., & Hillsdon, M. (2017). Is sedentary behaviour just physical inactivity by another name? *Int J Behav Nutr Phys Act, 14*(1), 142. https://doi.org/10.1186/s12966-017-0601-0

Vittengl, J. R., & Holt, C. S. (1998). A Time-Series Diary Study of Mood and Social Interaction. *Motivation and Emotion, 22*(3), 255-275. https://doi.org/10.1023/a:1022388123550

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *J Pers Soc Psychol, 54*(6), 1063-1070. https://doi.org/10.1037//0022-3514.54.6.1063

Watson, D., & Tellegen, A. (1985). Toward a Consensual Structure of Mood. *Psychological Bulletin, 98*(2), 219-235.

Wheeler, L., & Reis, H. T. (1991). Self-Recording of Everyday Life Events: Origins, Types, and Uses. *Journal of Personality, 59*(3), 339-354. https://doi.org/https://doi.org/10.1111/j.1467-6494.1991.tb00252.x

Wilmot, E. G., Edwardson, C. L., Achana, F. A., Davies, M. J., Gorely, T., Gray, L. J., Khunti, K., Yates, T., & Biddle, S. J. (2012). Sedentary time in adults and the association with diabetes, cardiovascular disease and death: systematic review and meta-analysis. *Diabetologia, 55*(11), 2895-2905. https://doi.org/10.1007/s00125-012-2677-z

Woltjes, S. (2019). *Ecological Momentary Assessment Versus Cross-Sectional Survey* Wageningen University & Research Centre].

World Health Organization. (2020). *WHO Guidelines on Physical Activity and Sedentary Behaviour* (9789240015128 9240015124). http://www.ncbi.nlm.nih.gov/books/NBK566045/

Zhang, F. (2020). Neuroticism. In B. J. Carducci, Nave, C. S., Mio, J. S., Riggio, R. E. (Ed.), *The Wiley Encyclopedia of Personality and Individual Differences: Models and Theories* (Vol. 1, pp. 281-284). John Wiley & Sons Ltd. https://doi.org/https://doi.org/10.1002/9781118970843.ch229

Zweig, D., & Webster, J. (2003). Personality as a moderator of monitoring acceptance. *Computers in Human Behavior, 19*(4), 479-493. https://doi.org/https://doi.org/10.1016/S0747-5632(02)00075-4

Appendix A. Informed Consent

Informed Consent

Thank you for participating in our study on sitting behaviour! Please read the following information thoroughly.

The goal of this research is to explore the relationship between sitting behaviour and mental health-related constructs. With your participation in this research, you will help us contribute to the scientific knowledge of sitting behaviour and its relationship to mental health.

You are eligible to participate in this study if you are at least 18 years old, proficient in English, and enrolled at a university or university of applied sciences.

The study will be conducted over a period of nine days. At the start of the study, you will be asked to fill out a baseline questionnaire with questions about demographics and personality traits. This questionnaire will take about ten minutes to fill out. After that, you will receive three short questionnaires daily via the Ethica App. Please make sure that the notifications on your device for Ethica are turned on.

Participation in this study is not expected to pose any risks. One possible consequence is an increased awareness of your daily mood, behaviour, academic pressure, and feelings. For this reason, please consider your participation in this study carefully if you are sensitive to these topics. This might be especially relevant for you if you are diagnosed with or suspected to have a mood and/or anxiety disorder.

Your participation in this study is entirely voluntary. If you wish to withdraw from this research, you can do so at any time without giving a reason. All your answers will be treated confidentially. That is, all personal data will be anonymized and will not be published and/or given to a third party. Hence, the data will be used for this study only. The study has been approved by the Ethics Committee of the University of Twente. If you have any questions or concerns before, during or after your participation, do not hesitate to contact the researchers:

Josie Vorhauer (j.vorhauer@student.utwente.nl)

Lina Skupin (l.a.skupin@student.utwente.nl)

Helena Zablotny (h.k.zablotny@student.utwente.nl)

Lina Rath (l.rath@student.utwente.nl)

(Supervisor) Gerko Schaap (g.schaap@utwente.nl)

I hereby declare that I have fully read and understand the text above and I am willing to participate in this study. By ticking ‘Yes’, I actively consent to participate in this study and the processing of my data.

Appendix B. A List of the Baseline Questionnaire Items Relevant for This Report

Welcome to the **first survey**! This survey will assess some baseline information about you. It will take about **10 minutes** to complete.
Please read the questions carefully and answer honestly.
Thank you for agreeing to participate in this study!

Q1: How old are you?

Q2: What gender do you identify with?

Q3: What is your nationality?

Q4: Which study programme are you enrolled in?

In the second part of this survey, you will be asked questions related to your personality.
Please indicate in how far you agree with the given statements.

Q1: I see myself as someone who is depressed, blue.

Q2: I see myself as someone who is relaxed, handles stress well.

Q3: I see myself as someone who can be tense.

Q4: I see myself as someone who worries a lot.

Q5: I see myself as someone who is emotionally stable, not easily upset

Q6: I see myself as someone who can be moody.

Q7: I see myself as someone who remains calm in tense situations.

Q8: I see myself as someone who gets nervous easily.

You've made it! This was the first survey.

A little tip for you: Fill out the questionnaires as soon as you can. This way you won't receive any further notifications :) Thank you for participating!

Appendix C. The Adapted PAST-U Questionnaire

PAST-U: Past-day Adults' Sedentary Time - University

I am going to ask you about different times when you may be sitting or lying down: when studying, working, travelling, watching TV, using the computer, and doing other activities. For each of these, only count the time this was your main activity. For example, if you watched TV and ate dinner at the same time, this might be TV or meal time, but not both. Your answers can be given in hours and minutes. Try to report only the time you spent sitting or lying down and do not take into account the time you spent getting up for breaks (e.g. coffee, bathroom).

Sitting for study

ST 1. **How long** were you **sitting** while studying yesterday? (include the time at university, during lectures, tutorials, meetings, group discussions, self-study, study from home, etc.)

Sitting for work

ST 2. **How long** were you **sitting** at your workplace or working from home in a paid position yesterday? (Examples: babysitting, sitting at the reception, minding a stall/shop, data entry/administrative paper work, tutoring, etc.)

Sitting for Transport

ST 3a. Thinking again of yesterday, please estimate the **total** time that you spent **sitting** to travel from one place to another driving yourself. Please **include sitting and waiting** for transport. Do **not** include any time you were standing up while travelling or waiting.

ST 3b. Thinking again of yesterday, please estimate the **total** time that you spent **sitting** to travel from one place to another not driving yourself/ using public transportation. Please **include sitting and waiting** for transport. Do **not** include any time you were standing up while travelling or waiting.

Television Viewing

ST 4a. Please estimate the **total time** you spent sitting or lying down to watch TV or DVDs? This includes if you watch TV in bed. This does not include Video-on-Demand watching.

ST 4b. Please estimate the total you spent sitting or lying down to play games on the TV, such as PlayStation/Xbox yesterday? This includes if you watch TV in bed.

Computer, Internet, Electronic Games

ST 5a. Please estimate the total time yesterday that you spent sitting or lying down and using the computer actively. (For example, include time spent playing games, reading, online shopping on your smartphone/tablet/computer).

ST 5b. Please estimate the total time yesterday that you spent sitting or lying down and using the computer passively. (For example, including time spent watching Video On Demand (e.g. YouTube, Netflix), scrolling through social media.

Sitting for reading

ST 6. Please estimate the total time yesterday that you spent sitting or lying down while reading **during your leisure time**. Include reading in bed but do not include time spent reading for paid work or for study.

Sitting for eating

S7. Please estimate the total time yesterday that you spent sitting down for eating and drinking, including meals and snack breaks.

Sitting for socializing

ST8. Please estimate the total time yesterday that you spent sitting down to socialize with friends or family, regardless of location (at university, at home or in a public place). Include time spent on the phone (e.g. calling, chatting, texting etc.)

Sitting/lying for other purposes

ST 9. We are interested in any other sitting or lying down that you may have done that you have not already told us. For example this could include; hobbies such as doing art and craft, playing board games; listening to music or for religious purposes. Please name only one main activity.

ST 10. Again, thinking of yesterday, please estimate the **total time** that you spent sitting or lying down **NOT** including time that you have told us about in the previous answers.

Appendix D. A List of the Adapted I-PANAS-SF Items

Q1: To what extend do you feel determined right now?

Q2: To what extend do you feel attentive right now?

Q3: To what extend do you feel active right now?

Q4: To what extend do you feel nervous right now?

Q5: To what extend do you feel afraid right now?

Q6: To what extend do you feel upset right now?

Appendix E. Reliabilities of Adapted PAST-U and PANAS Item

Reliabilities of adapted PAST-U Items

Item	Spearman's Rho	p-value
ST_studying	.664	*p* <.001
ST_working	.759	*p* <.001
ST_driving_active	.713	*p* <.001
ST_driving_passive	.428	.029
ST_tv	.565	.003
ST_videogames	.605	.001
ST_PC_active	.491	.011
ST_PC_passive	.566	.003
ST_reading	.605	.001
ST_eating	.353	.077
ST_socializing	.769	*p* <.001
ST_creative	.865	*p* <.001
ST_other	.510	.008

Note: Sedentary Time/Sedentary Behaviour (ST)

Reliabilities of the PANAS Items.

Item	Spearman's Rho	p-value
PA_determined	.616	*p* <.001
PA_attentive	.675	*p* <.001
PA_active	.660	*p* <.001
NA_nervous	.722	*p* <.001
NA_afraid	.758	*p* <.001
NA_upset	.585	*p* <.001

Note: Positive Affect (PA) and Negative Affect (NA)

Appendix F. Table of Descriptive Statistics

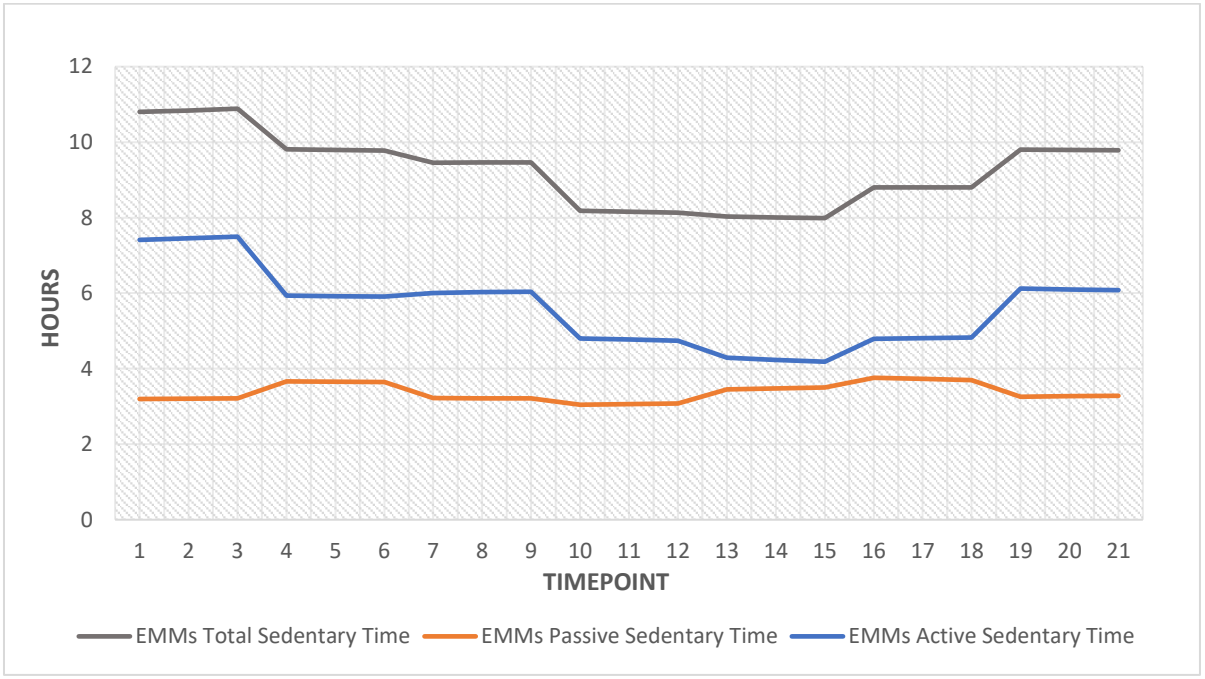
Table of Descriptive Statistics

Variable	M	SD	Minimum	Maximum
Daily Sedentary Time [b]	9.27	3.26	1.75	23.00
Active ST [b]	5.62	3.02	0.00	16.75
Passive ST [b]	3.39	1.85	0.50	12.50
Other ST	0.27	0.51	0.00	3.75
State Mood	2.46	3.59	-12.00	12.00
State PA	7.77	2.79	3.00	15.00
State NA	5.31	2.48	3.00	15.00

Note. [b] in hours, Abbreviation ST = Sedentary Time, PA = Positive Affect, NA = Negative Affect

Appendix G. Additional Visualisations Over Time

EMMs of Daily, Active and Passive Sedentary Behaviour Over Time.



EMMs of Total Mood, Positive and Negative Affect Over Time.