

# Preliminary findings on the interrelationship between green spaces, social support, and happiness in students at the University of Groningen

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## Abstract

This study explores the interconnections between the use of green spaces, social support, and happiness. The student mental health crisis has made this topic increasingly relevant as many search for ways to improve the well-being of those enrolled in higher education. The conceptual model of this research anticipated a positive correlation between green space use, social support, and happiness level. This research relies on social support theory and the concept of biophilia to show how interactions with other people and nature both impact human happiness. Using a Maptionnaire survey to gather data from 29 students at the University of Groningen, this study analyzed the descriptive statistics and created a correlation matrix to determine the relationship between the measured variables. The results of the study lend some support to the conceptual model proposed. However, the results were found to be statistically insignificant, likely due to the relatively low number of participants for a quantitative study. This study highlights the importance of green spaces for the potential to facilitate social support and enhance mental well-being in students. Based on the results of the survey, this study proposes opportunities for the University of Groningen and other similar institutions to preserve local green spaces and the services they provide.

**Keywords:** Green Spaces, Social Support, Happiness, Student Well-Being, Spatial Science

**Word count:** 7315

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I have many people to thank for their support during the months that it took to research, analyze, and write this thesis. I want to thank the students who participated in the survey and contributed to the expansion of knowledge relating to the importance of green spaces in urban planning: a topic about which I am extremely passionate.

I want to express my gratitude to Christina Prell, for her continuous support and feedback throughout the research and writing of my thesis. Christina always met any discouragement or ‘writing blocks’ on my part with new ideas and advice on ways to improve the article by creating a more well-rounded story.

Finally, I want to show appreciation to my parents and sisters for providing me with much-needed emotional support during this taxing process. I am grateful for the countless Facetime calls that took place over the course of this period in my life.

I am elated to submit this thesis, knowing that my time as a Research Master’s student at the University of Groningen has sadly come to an end. I am grateful for the experiences I have had during these two years since I began in 2022 and excited to go into the world to use the knowledge and skills that I have gained.

## 1. Introduction

Green spaces have long been known to have a positive impact on happiness and well-being. Many studies have shown how green spaces play a vital role in the happiness and well-being of students, particularly in psychological recovery and attention recovery [1]. Concerns about student mental health have been heightened as a result of the increase in student anxiety and loneliness over recent years [2, 3]. Given the global crisis in student mental health, promoting green space use and protecting urban natural areas could play a role in supporting well-being. Green spaces have even been associated with lower antidepressant prescription rates in the Netherlands [4]. 60% of university students are experiencing mental health conditions, with many of them receiving no kind of treatment [5, 6]. Particularly in the aftermath of the global pandemic, which significantly altered the social lives and mental health of students worldwide [3, 7], understanding the role of green spaces and social support systems is crucial for understanding student well-being.

Green spaces facilitate social interaction by offering an area for communities to gather [8, 9, 10, 11, 12], improve mental health through exposure to nature and open spaces [13, 14, 15, 16, 17], and improve physical health by providing a space for residents to exercise amidst urban nature [18, 19, 20, 21, 22, 23, 24]. The services provided by green spaces generally contribute to the happiness of a neighbourhood. For students, green spaces also play a vital role in their academic success. Schools with higher “greenness,” or vegetated areas, have been associated with a higher level of academic success for individual students [25]. Campus green spaces have also been shown to have a significant positive impact on the mental well-being of college and University students [1].

This pilot study tests a conceptual model that connects a person’s social relationships, use of greenspaces, and level of happiness. Where many studies have connected green spaces with mental well-being and social ties with happiness, this study brings these three concepts together. As of writing this article, we have not come across a study that attempts to connect these variables. This study aims to find strategies that will enhance student well-being by identifying the correlation of green space use and social ties on happiness among students at the University of Groningen.

By understanding how students value and use green spaces as well as their self-reported levels of happiness, this study highlights the role of accessible green spaces and social support in mental health. This research will contribute to the academic understanding of green spaces, social support, and mental well-being by providing preliminary insights that are specific to the experiences of students.

## 2. Literature Review

*“Intricacy is related to the variety of reasons for which people come to neighbourhood parks. Even the same person comes for different reasons at different times; sometimes to sit tiredly, sometimes to play or to watch a game, sometimes to read or work, sometimes to show off, sometimes to fall in love, sometimes to keep an appointment, sometimes to savour the hustle of the city from a retreat, sometimes in the hope of finding acquaintances, sometimes to get closer to a bit of nature, sometimes to keep a child occupied, sometimes simply to see what offers, and almost always to be entertained by the sight of other people.”*

- Jane Jacobs, 1961, on the importance of green spaces.

Green spaces play an integral role in the development of an urban environment and the social network of a neighbourhood, as Canadian urbanist and activist Jane Jacobs poetically explains in her critical novel *The Death and Life of Great American Cities* (1961). Green spaces provide the space to relax, socialize, and exercise; all of which have a positive impact on an individual’s mental health and happiness. Based on pre-existing literature, this research seeks to understand the connection between social ties, the use of green spaces, and how these factors impact the self-reported happiness levels of students at the University of Groningen. Students have unique experiences of stress and loneliness that can be exacerbated by poor social support [26] and the absence of exposure to nature [27, 28]. Understanding these challenges is critical for finding a solution that promotes student well-being and happiness, as well as academic success. Social support systems are known to mitigate the effects of stress and loneliness [29, 30, 31]. Similarly, access to nature through the use of urban green spaces has also been shown to positively impact mental health and well-being [32, 33, 34]. This study poses three research questions.

1. What is the correlation between the use of green spaces, social support, and happiness levels among students?

2. How do students interact with green spaces?
3. Are students who visit greenspaces more often happier?

This research is based on the vast empirical knowledge of scientific studies which correlate green spaces with mental well-being and social support with happiness. We further propose the correlation between green spaces and social ties, and seek to understand how this possible correlation may impact the happiness of students. As of this writing, we are unaware to the best of our knowledge any study that has attempted to link these three bodies of literature in the way we demonstrate here.

## **2.1 Defining Green Space**

Green space plays an important role in the fabric of a city. Whilst there is no one definition or set of characteristics that can be used to define a green space, a combination of criteria from many authors can illustrate the concept of 'green space'. Green space can be "any land that is partly or completely covered with vegetation, such as parks, community, allotment or residential gardens, urban forests, or street trees" [35]. Some define green space based on how they are used by the public, such as for recreation or exercise [36, 37], while others define green space based on physical qualities such as the size, maintenance, or aesthetics of the space [35, 38, 39, 40]. In this study, we define green space as any public urban space that prominently features nature and can be used recreationally. This loose definition was provided to participants in this study, along with examples of green spaces in Groningen such as Noorderplantsoen, Stadspark, and Nieuwe Kerk. Therefore, the exact interpretation of what defines a green space was left to the subjectivity of each participant.

## **2.2 Social Support Theory**

Social support was defined by Cobb in 1976 as "information leading the subject to believe that he is cared for and loved, esteemed, and a member of a network of mutual obligations" [41]. Many authors have since built on the foundation of the theory and researched the mechanisms through which social support influences health and well-being. The concept of social support originally theorized that strengthening social support could have a positive impact on human health [42, 43]. We further

address the importance of support *received* compared to support *given*, as a reciprocal support system is stronger than relationships that are “asymmetrically committed” [44, 45]. One author found that strong social support systems improve psychological well-being, as social relationships act as buffers for stress [46]. This can be directly applied to students, who face high amounts of stress in their academic lives. Another explained how social support is linked with academic achievement among university-level students [47]. This study draws on Social Support Theory to posit that increased social support may correlate with increased levels of happiness in students at the University of Groningen.

### **2.3 Green Spaces and Social Support**

Green spaces have been known to improve mental health and wellbeing both by providing the space for humans to interact with nature as well as providing the opportunity for social interaction [48]. Urban green spaces also act as a catalyst for social cohesion and this further promotes psychological well-being [8]. Social ties and social support can influence how a person uses a green space [49], how they value urban nature [50], and how often they visit a green space [51].

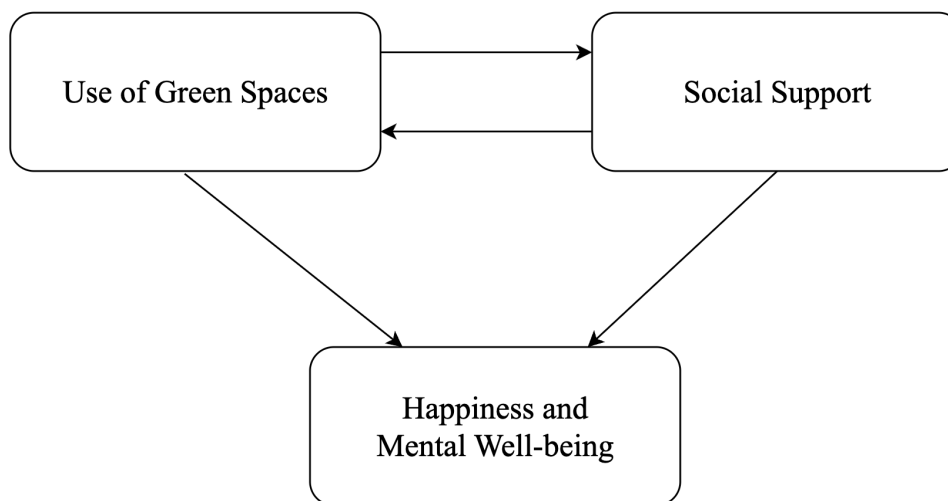
### **2.4 Biophilia: The Desire for Connection with Nature**

The concept of biophilia, from the ancient Greek *bio*, meaning life, and *philia*, meaning love, explains how humans desire to emotionally interact with and be surrounded by nature [52]. There is a vast body of research supporting biophilia as a hypothesis, showing the importance of urban green spaces for mental health, well-being and happiness. Many scholars have determined that the characteristics of urban green spaces contribute to the happiness and mental well-being of an urban community [53, 54]. A study in Cali, Colombia found that being surrounded by “greenness” was significantly correlated with happiness [55]. Similarly, another study confirmed that natural amenities like urban forests and parks contribute to the quality of life of urban residents [56]. On average, people have been found to be happier outdoors in ‘green’ or natural environments than in urban environments [57]. The resounding assertion from many academics concludes that spending time in green spaces,

whether interacting with others, exercising, or simply relaxing, has a positive influence on a person's mental health and happiness.

## 2.5 Conceptual Model

The conceptual model proposed for this study (Fig. 1) displays the dynamic interrelationship between the use of green spaces, social ties, and happiness. This study hypothesizes that social ties and access to green spaces impact the happiness and well-being of students. We also hypothesize that social ties and the use of green spaces have a reciprocal relationship, both impacting each other and further impacting the happiness and well-being of students.



**Figure 1:** Conceptual model created by authors.

This conceptual model is based on a review of the existing literature surrounding green space accessibility, social support, and happiness. Drawing from this literature, the conceptual model hypothesizes that access to and use of green spaces are intertwined with social ties, and both green spaces and social support influence individual happiness and mental well-being. In recent studies, results indicated a correlation between access to urban nature and a person's happiness and mental well-being [58, 59, 60]. For example, people who had less green space in their living environment tended to have more feelings of loneliness and had a perceived shortage of social support [49]. After reviewing the available literature, it is apparent that empirical evidence lends support to our proposed



conceptual model that green spaces, social support, and happiness may have a complex and interconnected relationship.

### **3. Methodology**

#### **3.1 Study Scope and Area**

This study took place from August 2023 to January 2024 in the city of Groningen, Netherlands. Participants include students at the University of Groningen, primarily students in the Faculty of Spatial Science. The focus of this study is on the interconnections between the variables of green space access and usage, social support, and happiness. Using a map-based questionnaire to collect participant data, this study captures current student experiences to highlight the value of green spaces and social support for student mental well-being.

Green spaces are well distributed throughout Groningen, Netherlands to the extent that the city has been named “the greenest city in the Netherlands” [61]. The Gemeente Groningen (Municipality of Groningen) has been invested in creating a city that is “green, healthy, social, and sustainable” [62]. To achieve this goal, the city conducted surveys to highlight areas that display the opportunity to create both social meeting places and green spaces. The city acknowledges that issues such as flooding and extreme heat have created the need for green and blue spaces to mitigate these negative effects of climate change [62].

In 2020, the research centre *Humankind* conducted a study to quantify the “greenness” of the seven most populated cities of the Netherlands, particularly looking at street greenness. The streets in Groningen ranked the highest in “greenness” with an average greenness value of 54% [63]. Tilburg (Population 228 000), a comparable city with a similar population to Groningen (Population 238 000), was found to have an average street greenness of 44% [63]. As a ‘university town’, where a higher proportion of the population are students, the importance of green spaces in Groningen cannot be overstated.

#### **3.2 Participant Sampling**

Participants were gathered using convenience and snowball sampling because these sampling techniques were determined to be optimal for finding participants given the short time frame of this

study [64]. We contacted teachers at the University of Groningen to send the survey to students in their classes and contacted student colleagues to fill out the survey. The study population included 29 students at the University of Groningen primarily due to our access to students. Participants ranged in age from 19 to 30 years old and consisted of 14 Bachelor students and 15 Master students. Of the 29 participants, a majority were in the Faculty of Spatial Sciences at RUG, with the exception of two students from the Faculty of Arts and one student from the Faculty of Economics and Business.

### **3.3 Ethical Considerations**

Ethical considerations are critical in any study, as Hay (2021) explains that ethics “protect the rights of individuals, communities, and environments involved in, or affected by our research” [65]. As such, we ensured that the GDPR guidelines were followed throughout each process of our research. The software used for this study, Maptionnaire, is fully GDPR compliant (for more details see: <https://www.maptionnaire.com/features#security>). At the beginning of the survey (see Appendix), participants were given information about the study and what would be done with the results. The consent section further explained their rights and whom to contact if they had any questions, concerns, or complaints about the study.

The survey was completely confidential and anonymous. The identity of each participant was hidden from the researchers and no identifying characteristics, such as names or email addresses, were asked for or included in the survey. The participants were automatically given ID codes by the program to follow the answers of each individual without any identifying information. When a map answer was required from the participant, such as the location of their current residence, we asked that they choose a location within 200 metres as opposed to the exact location. This was to ensure privacy for the participants. The results were downloaded as a spreadsheet from Maptionnaire and will be deleted within three months after the completion and acceptance of this article.

### **3.4 Data Collection: Maptionnaire Survey**

This study used the map-based survey software Maptionnaire to gather data from students at the University of Groningen. Quantitative surveys are ideal for quickly gathering and analyzing large

amounts of data [66]. We determined that Maptionnaire was the optimal software to use in this study because it allows for spatial data collection and allows the respondents to map their responses, providing a visual representation of their answers. We further found that Maptionnaire's integrated tools allowed for an efficient data analysis process.

We created a survey to ask participants about the green spaces they visit and how they enjoy those green spaces. The survey also asked questions about participants' relationships with those from whom they receive social and academic support. Finally, the survey asked participants to self-report their happiness levels based on the five questions of the Mental Health Inventory (MHI-5). The three variables used in this study are explained further in the following sections.

#### *Measuring Interaction with Green Spaces*

To understand how students interact with green spaces, the survey asked participants to identify the green space nearest to them and the green space they use most frequently. Participants were then asked to outline how often they use green spaces to relax, socialize, and exercise to understand the context in which students value green spaces. These three 'uses' were based on several articles that described the many ways in which people interact with green spaces [67, 68, 69, 70, 71, 72, 73]. We then condensed these many uses into the three simpler categories of relaxing, socializing, and exercising. We also asked participants about their daily commutes to their classes, based on findings about the importance of accounting for 'green' commuting in community planning [74]. Participants selected their method of transport and whether they travel through a green space during their daily commute. The goal of this was to understand how they might interact daily with green spaces (or not) and whether these interactions were deliberate or coincidental.

#### *Measuring Social Ties and Support*

We based our survey questions for this section on the five measures of social support, proposed in 1985 by Tardy et al. [75]. These include Direction (whether support is given and received), Disposition (availability of support), Description/Evaluation (satisfaction with support), Content (whether the support was emotional, instrumental, etc. in nature), and Network (the social

dimension or nature of the relationship) [75]. The Maptionnaire survey asked multiple questions about the emotional and academic support participants receive from a person of their choice. The goal of this section was to understand whether a participant receives support for any emotional issues or situations that they encounter, as well as whether they receive support surrounding their academic life. The survey also asked whether the participants' chosen academic and emotional support persons sought support from them in return. This was to understand whether the support relationships were reciprocal or simply one-sided.

### *Measuring Happiness*

The final section of the Maptionnaire survey asked questions to determine the participants' self-reported levels of happiness and mental well-being. The five questions of the Mental Health Inventory (MHI-5) questionnaire were used, as this is the “gold standard” criteria for measuring depressive states and happiness [76, 77]. These questions were answered by selecting one of six options on an ordinal scale including “All of the time,” “Most of the time,” “A good bit of the time,” “Some of the time,” “A little of the time,” or “None of the time.” For questions in which “All of the time” was a positive indicator of happiness, a score of 6 was given. In contrast, for those questions in which “All of the time” was indicative of unhappiness, a score of 1 was given, as shown below:

**Table 1:** MHI-5 questions and the score given per question based on the multiple-choice answer

<b>During the past month, how much of the time have you...</b>						
<b>Multiple Choice Answer</b>	Been a happy person?	Felt calm and peaceful?	Been a very nervous person?	Felt downhearted and blue?	Felt so down in the dumps that nothing could cheer you up?	
All of the time	6	6	1	1	1	
Most of the time	5	5	2	2	2	
A good bit of the time	4	4	3	3	3	
Some of	3	3	4	4	4	

the time					
A little of the time	2	2	5	5	5
None of the time	1	1	6	6	6

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The scores of each question were added up to create a total score, with the maximum possible score of 30. The scores were then divided by 30 to make the result a percentage. A higher percentage indicates a higher level of happiness and a lower level of depressive states.

### 3.5 Data Transformations

For the descriptive statistics analysis, we first transformed the data to create larger categories. Given the small sample size for this study ( $N = 29$ ). In particular, we collapsed data results from the ordinal-scaled items to form larger categories. Those with the highest relative MHI-5 scores, ranging from 73.3% to 90% were placed into one category ( $n = 10$ ). Those with the middle relative MHI-5 scores, ranging from 60% to 70%, were placed into another category ( $n = 10$ ). Finally, those with the lowest relative MHI-5 scores, ranging from 46.7% to 56.7%, were placed into another category ( $n = 9$ ). The data resulting from these transformations were used for generating pie charts for the responses to each question.

For the correlation matrix, the responses to all questions were turned into dummy variables (values of either 0 or 1). For example, if a participant answered “Yes”, they visited a green space to socialize in the past month, that answer was transformed into a “1” and if they answered “No”, that answer was transformed into a “0”. This was to allow for the correlation matrix to be performed and calculate the Pearson correlation coefficient between each variable with all other variables.

### 3.6 Analyses

To explore bivariate relationships between the data, a correlation matrix was created to examine the Pearson correlation between each variable with all other variables. The variables consisted of each

answer given by the participants, and therefore the matrix consisted of 43 variables in total. The results of these analyses were found to be statistically insignificant and as such, we do not rely on these results as evidence for our research questions.

We performed several measures to analyze the descriptive statistics of the transformed data, including creating pie charts and comparing grouped data to each other. The participants were separated into groups of those with the highest ( $n = 10$ ), moderate ( $n = 10$ ), and lowest ( $n = 9$ ) MHI-5 scores. This was to account for the low sample population by comparing the groups to each other as opposed to relying solely on statistical analysis to highlight patterns in the data. The responses of each group were charted and analyzed for similarities and differences. We discuss the results of the analysis for descriptive statistics in the following section.

## 4. Results

In this section, we introduce the preliminary findings of our analyses that aim to answer the research questions we posted for this study. Due to the small sample size, none of the results from the correlation matrix were found to be statistically significant, as indicated by p-values ranging from 0.16 to 0.5. Therefore, we will discuss only results from the descriptive statistics to understand how green space use, social support, and happiness are interconnected.

The table below displays a baseline of the demographic data collected from the students who participated in this study. The participants were categorized based on their scores from the MHI-5 questions and grouped with those of the highest, moderate, and lowest levels of happiness.

*Table 2: Demographic qualities of data collected from participants.*

	<b>Highest Happiness (n = 10)</b>	<b>Moderate Happiness (n = 10)</b>	<b>Lowest Happiness (n = 9)</b>
<b>Age</b>			
Mean	24.2	23.4	23.1
Min	20	19	19
Max	29	29	30
<b>Gender</b>			
Female	5	5	6
Male	5	5	3
Non-binary	1	0	0
<b>MHI-5 Score (%)</b>			
Mean	81.7	63.3	53.3
Min	73.3	60	46.7
Max	90	70	56.7

There appears to be no connection between happiness level (MHI-5 Score) and the distances that participants travel to reach the green space they visit most often, their self-reported nearest green

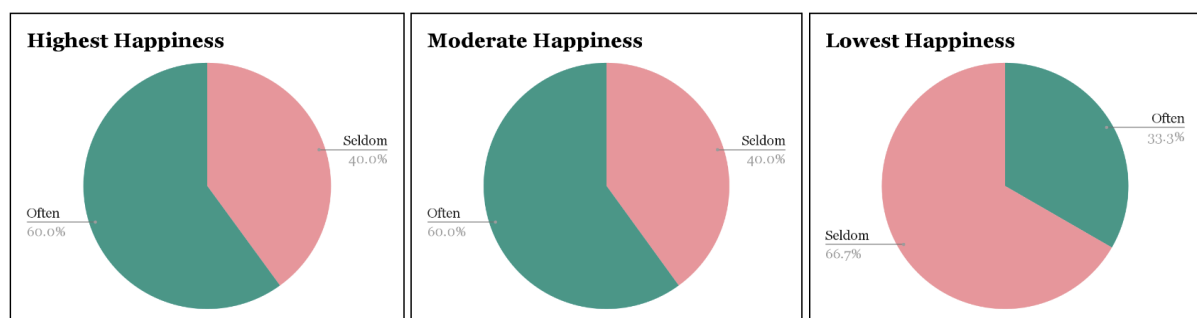


space, and their daily commute to university classes (Table 3). However, those with the middle MHI-5 scores seem to travel a significantly higher distance than those with the highest and lowest scores.

**Table 3:** Travelling distances mapped by participants

Average Distance (metres)	Highest Happiness (n = 10)	Moderate Happiness (n = 10)	Lowest Happiness (n = 9)
To the nearest (self-reported) green space	669	1217	846
To the nearest (actual) green space	188	159	285
To favourite green space	1558	2061	1501
Daily commute to University	3301	3940	2847

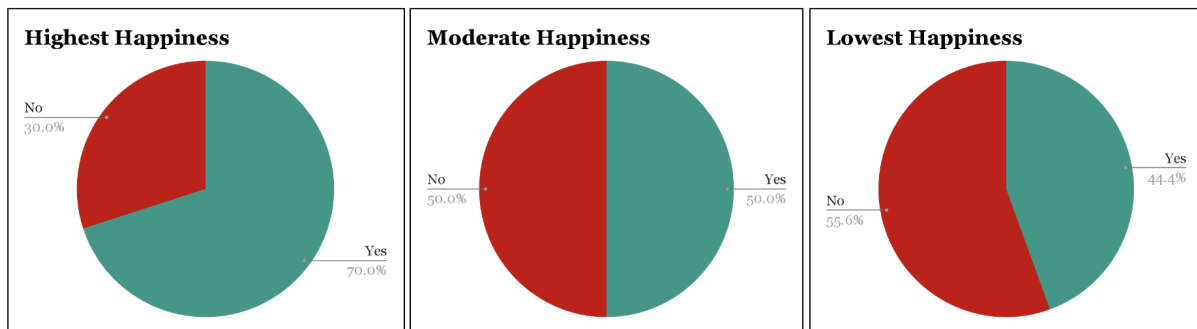
We compared the charts of the responses from the highest, middle, and lowest MHI-5 scoring groups to determine whether there was a difference between responses from the relative happiest, medium, and unhappiest participants. We found that the highest and middle-scoring participants visited their favourite green space more often than those with the lowest happiness scores, as shown in Figure 2 below:



**Figure 2:** How often do participants visit or use their favourite green space?

These charts indicate a possible correlation between happiness level and frequency of green space use, suggesting that those who visit a green space more often may be happier. This finding is reinforced by multiple studies [58, 59, 78] and lends support to our conceptual model.

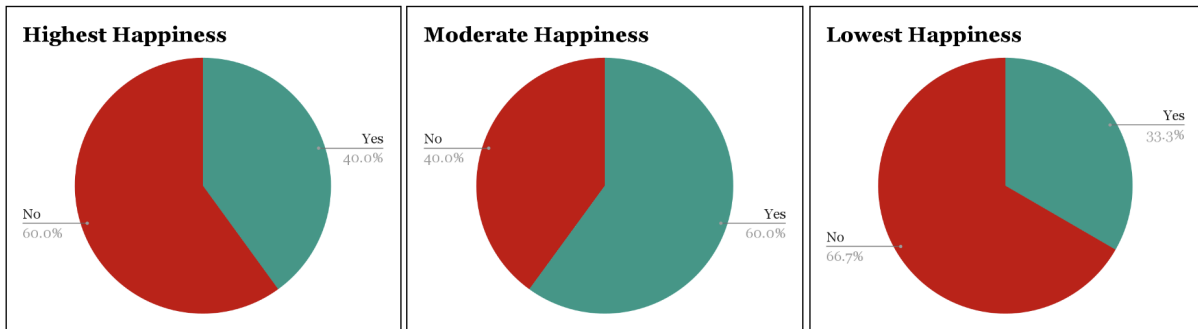
When analyzing how students of different happiness levels interact with green spaces, we found that a majority (70%) of those with the highest MHI-5 scores visited a green space to socialize within the month before they took the survey.



**Figure 3:** *During the past month, did participants use any green space to socialize?*

These students were, on average, more happy than those who did not visit a green space and those who visited a green space to exercise or relax. 50% of the medium-scoring participants and only 44% of the lowest-scoring participants had visited a green space to socialize. These charts (Fig. 3) display the relationship between happiness, socializing, and green spaces, indicating that a higher proportion of the happier students visited a green space to socialize. This finding suggests a possible correlation between socializing in green spaces and happiness, providing some answers to our first research question about the relationship between green spaces, social support, and levels of happiness.

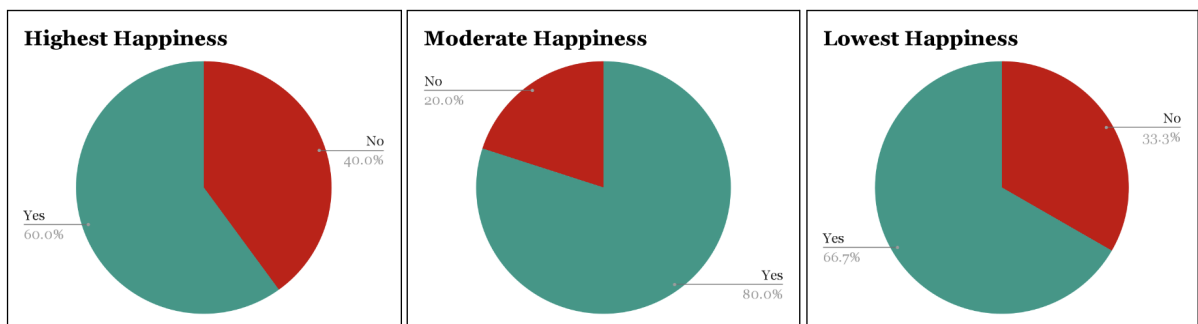
We found that the highest number of students with medium MHI-5 scores, or 60%, had visited a green space to exercise in the month before they took the survey, as seen in Figure 4.



**Figure 4:** During the past month, did participants use any green space to exercise?

Only 40% of the students with the highest scores exercised in a green space, comparable with 33% of those with the lowest scores. This could indicate that those with moderate happiness levels may prioritize exercising in green spaces as a strategy to boost mental health and happiness. Students with higher levels of happiness may already have different means of exercising, while students with lower levels of happiness may have time constraints or other barriers that limit their interactions with green spaces for exercise.

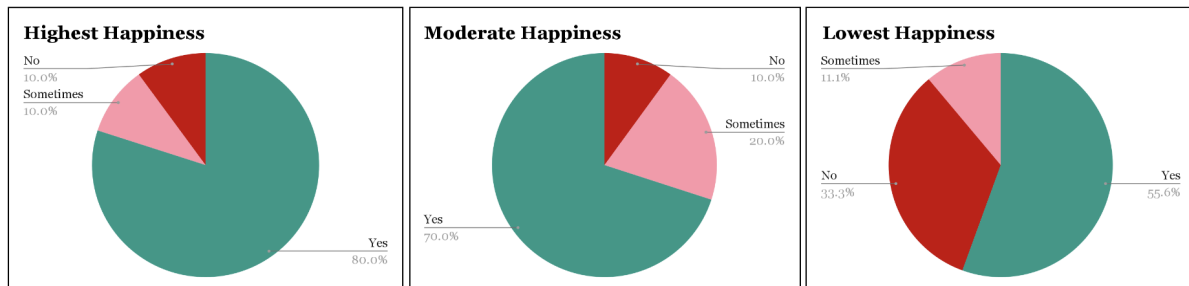
Similar to their use of green spaces for exercising, we found that a higher proportion of those with medium levels of happiness used a green space to relax in the month before they took the survey, followed by the lowest-scoring then highest-scoring participants (Fig. 5).



**Figure 5:** During the past month, did participants use any green space to relax?

Students with the lowest MHI-5 scores may seek solace in green spaces to cope with emotional or academic stress. Those students with the highest scores who did not relax in a green space may have alternative sources of relaxation and stress relief.

When determining how students interact with green spaces daily, we asked participants whether they pass through a green space on their commute to campus or other university facilities around Groningen (Fig. 6).

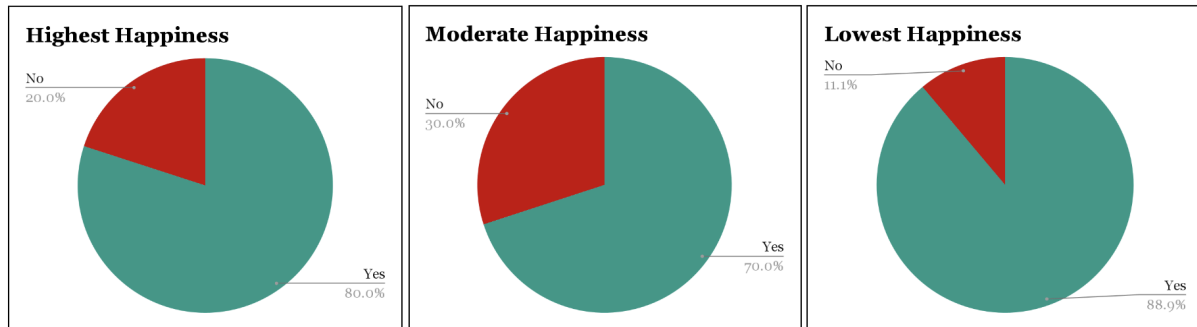


**Figure 6:** During their daily commute to campus, do participants travel through a green space?

We found that the highest proportion (80%) of the happiest participants travel through a green space daily, compared to 70% of medium-happiness participants and 55.6% of the unhappiest participants. With more of the highest-scoring students travelling through green spaces than the lowest-scoring students, this displays the merit of short-term interactions with urban nature [79].

All of the students who participated in this study had reached out to someone for emotional support in the month before they completed the survey. There was a low, and once again insignificant, negative correlation between happiness and using a family member for emotional support ( $r = -0.25$ ,  $p = 0.40$ ). This could suggest that those who reach out to their family for emotional support may not receive sufficient support from friends, which would account for the increased feelings of unhappiness of these participants [80]. There was a low, insignificant, negative correlation between MHI-5 score and whether the participant marked the location of their emotional support person ( $r = -0.28$ ,  $p = 0.39$ ). It could be inferred that if participants did not mark the location of their emotional support person, they may not have a close relationship to know where this person lives, and therefore do not have the depth of emotional support that could ensure their happiness and mental well-being.

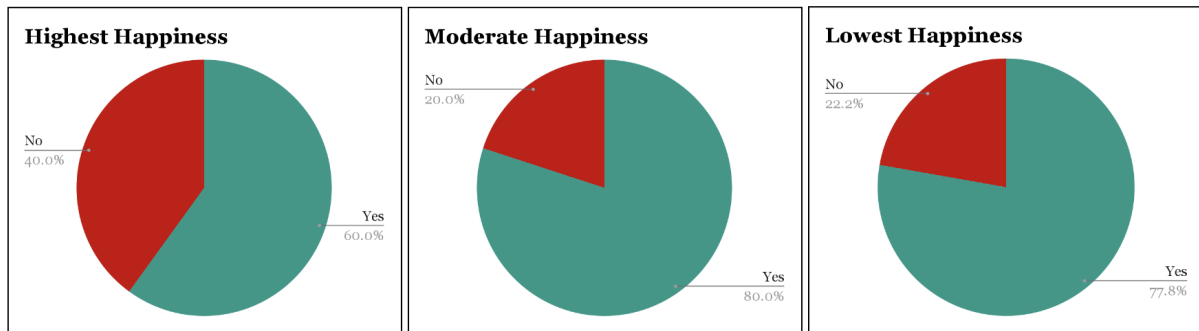
We found that emotional support was reciprocated most amongst the unhappiest participants, followed by the happiest participants, and finally, the medium happiness participants, as displayed in Fig. 7.



**Figure 7:** Did participants' emotional support person reach out to them for emotional support in return?

This could indicate that happier students feel that they receive sufficient support and may reach out less often than unhappier students, who may reach out more and are more likely to cause their emotional support person to reach out for support in return. We also found that those who sought emotional support in the month before they took the survey were also further away from the green space they visit most often, as indicated by the moderate, albeit insignificant, negative correlation ( $r = -0.66$ ,  $p = 0.26$ ) between the two variables. This could indicate that those who are further from their favourite green space are unhappier and may therefore reach out more for emotional support, which could in turn increase the likelihood of a reciprocal emotional support relationship. However, we cannot infer much from the correlation matrix results as they were all found to be insignificant and therefore we rely on results from the descriptive statistics.

Regarding academic support, we found that the lowest proportion of the happiest participants sought support in an academic context compared to the medium and unhappiest participants (Fig. 8).



**Figure 8:** *In the past month, did participants ever turn to someone for academic support?*

The participants with the highest MHI-5 scores may have more academic success and less academic stress, therefore not requiring the same volume of support in their academic lives.

The results we acquired from this study, although statistically insignificant, paint a larger picture of the association between green spaces, social support, and happiness. We explore the implications of these results in the following section.

## 5. Discussion

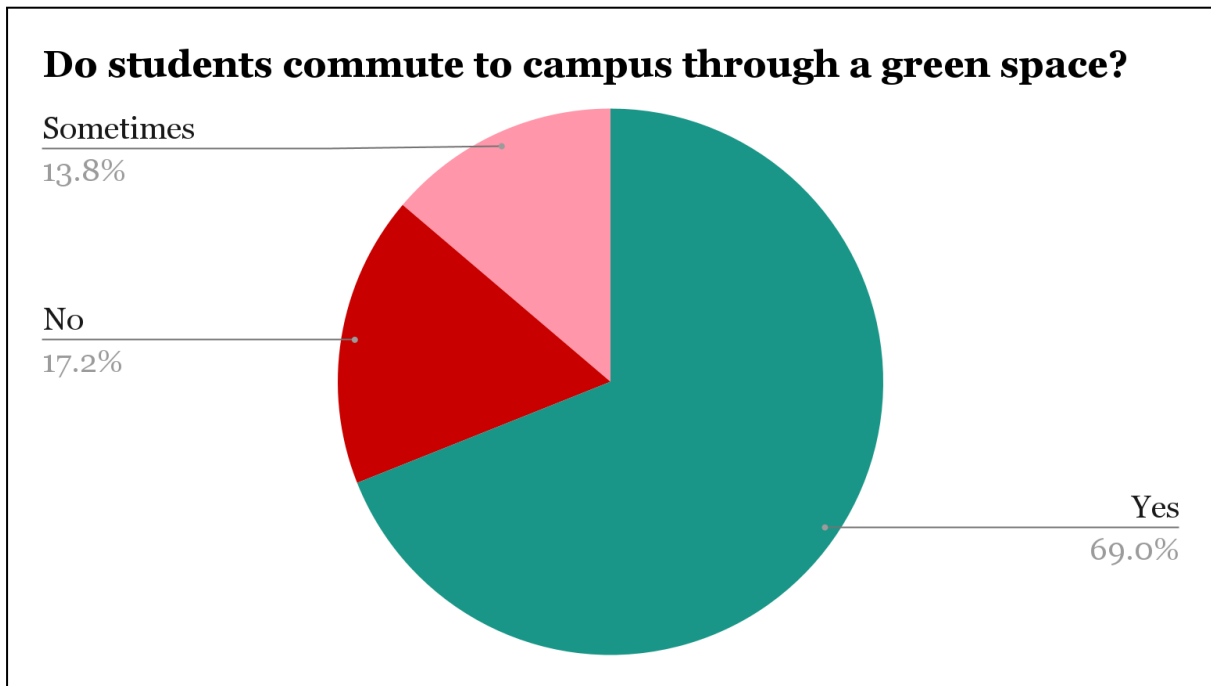
At the beginning of this research, we asked three questions to narrow the scope of our study. In this section, we discuss how our results compare to other works and interpret the implications of our study for the University of Groningen and, more generally, the field of urban planning.

### 5.1 Main Findings

For our primary research question, we asked ‘*What is the correlation between the use of green spaces, social support, and happiness levels among students?*’ We expected to find results that would demonstrate a correlation between the use of green spaces, social support, and happiness, indicating that an increase in one variable would correlate with an increase in the other two. Based on a review of other available literature, we expected that the happiest students visited a green space the most often, those with relatively medium happiness, and finally the unhappiest [81]. We were, of course, largely unable to come to this conclusion due to the insignificance of the correlation matrix results. Some of the findings in the descriptive statistics and charts hint at possible support for our conceptual model, such as the finding that the highest- and middle-scoring participants visit their favourite green space more often than the lowest-scoring participants (Fig. 2). Similarly, another result that we expected to discover was the finding that the group with the most participants passing through a green space on their daily commute to campus was those with the highest scores, followed by the medium and lowest scores respectively.

Our secondary research question asked ‘*How do students interact with green spaces?*’ The preliminary results of this study indicate that students value urban nature as spaces for socialization, even more than for exercise or relaxation purposes. We suspect that the considerably low number of students who used a green space to exercise within the month before they took the survey could likely be explained by poor weather conditions, as this survey took place between November 2023 and January 2024 in Groningen, Netherlands, where the weather is often rainy and relatively cold. In the spring and summer months, during which the weather is far more desirable, this number will likely

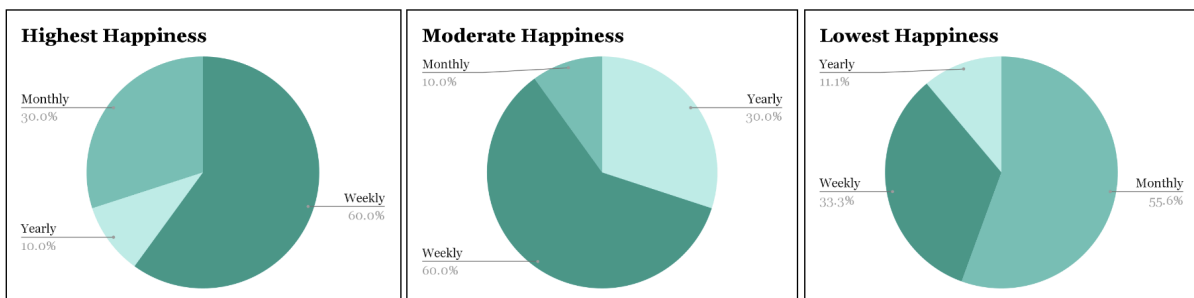
increase. Despite the poor weather, however, a majority of the students who participated in this study stated that they travel through a green space on their daily commute to classes or campus (Fig. 9).



**Figure 9:** During their daily commute to classes or campus, do students travel through a green space?

Whilst this is merely a short-term interaction with green spaces, encountering nature on a daily commute to work (or university, in this case) has proven benefits in reducing a person's depressive mood and increasing their level of happiness [82].

Finally, we asked 'Are students who visit green spaces more often happier?' The students with the highest levels of happiness were found to visit their favourite green space most often, as seen in Fig. 10.





**Figure 10:** *Frequency of green space use vs MHI-score category of participants.*

Those with medium levels of happiness visited their favourite green space less frequently, and the group of students with the lowest levels of happiness visited their favourite green space the least often compared to the rest of the participants. This result is supported by similar works which discuss how the frequency of green space visits is correlated with mental health and states of happiness [51, 54].

## **5.2 Opportunities for Change**

Throughout this study, we have discussed the importance of green spaces and social support for the mental well-being and happiness of students. The results of this study exhibit the necessity of green spaces for both happiness and socialization. This study has implications for the University of Groningen and can provide insight into opportunities for change to improve the mental wellness and quality of life of students at other institutions of education. Conducting a survey among students at the University of Groningen was a starting point to increase student involvement in matters that impact them directly, such as the urban design of their campus. Students can provide valuable insights and ideas for opportunities to improve the campus and other university buildings around campus. The University of Groningen could further the work of this study and create focus groups to seek these ideas from students that can guide planners in designing an inclusive campus that integrates green spaces and vegetation.

Earlier in this article, we reference Jane Jacobs and her explanation of the wide variety of applications for green spaces in an urban setting and the importance of green spaces in the network of a community. To promote social cohesion and student mental health, policies can be put in place to preserve and enhance such green spaces. The university can prioritize initiatives that aim to foster social cohesion amongst students and faculty by implementing one or multiple of the following, drawing on examples from other universities or municipalities.

### *Policies in Sustainability*

Whilst the University of Groningen currently has policies and campaigns in sustainability, such as the recent removal of single-use cups from coffee machines around campus and their other

buildings, there are always ways in which the school could improve. The University could introduce more water conservation or recycling measures, such as collecting rainwater like the University of Twente [83]. They could compost food waste like the Erasmus University Rotterdam, which has reduced food waste by 85 - 90% [84]. These are just some examples of the measures that the university could take to enhance the health of the green spaces that students enjoy.

### *Increasing Campus Greening*

Seeking additional student input would be valuable in the commission to introduce more vegetation to campus. The university could plant community gardens filled with vegetables, native plants, or pollinating flowers, as Erasmus University [85], Radboud [86], Tilburg [87], and the University of Leiden [88] have done, to increase social interaction and sense of community among students [89]. Green path walkways could be implemented, increasing students' interaction with urban nature as they commute from one building to another, similar to 'De Groene Loper', or "The Green Walk on the Eindhoven University of Technology campus [90]. Increasing the number of trees on campus would also help by providing shade and reducing energy usage during the summer [91, 92, 93].

### *Community Building*

Combining social interaction with time spent in green spaces could strengthen students' sense of belonging and improve mental health [94]. Facilitated activities such as campus cleanup [95], outdoor activity days [96], or even outdoor nature excursions [97] could help to improve students' connection with nature and introduce more opportunities for social support into their lives. These activities could also be student-led to foster a sense of leadership and involvement amongst the student body and enhance their campus community experience, as the University of Leiden has done [88].

### 5.3 Limitations

#### *Timing of Survey*

The data collection for this study took place during November and December of 2023. An issue with some of the questions in the survey is that they relied on details from the participants that occurred in the past month. For example, the question “During the past month, how often did you use any green space to exercise?” might have had more interesting results if the question had been asked during the spring or summer seasons. People are likely to exercise outdoors during warmer months with sunnier weather as opposed to the autumn and winter months [98] when it is relatively cold and rainy in Groningen. During this time, people who exercise are more likely to do so indoors [98]. The reasoning for phrasing this question to seek data from the past month was to standardize the period of time that the participants would reflect upon during this survey.

#### *Participant Sampling*

The sample size of this study was a limiting factor, as data was collected from only 29 participants [99]. For a quantitative study such as this, it would have been ideal to collect data from at least 50 participants to obtain meaningful results. Still, the time constraints of this study did not allow for an extended period of participant gathering. To combat this issue, we combined data from the participants with the highest, moderate, and lowest relative MHI-5 scores so that we could compare the data by these three levels of happiness as opposed to comparing all 29 of the participants to each other. Having such a small sample size allowed us to zoom into participants and acquire deeper preliminary findings. However, all of the findings that we gained from this study were found to be statistically insignificant largely due to the small sample population.

Sampling bias is also a limitation when it comes to the results of this study. We obtained data from students who were primarily in the Faculty of Spatial Science at the University of Groningen. The students of this faculty learn and discuss topics relevant to this study such as urban planning policies, green space allocation, and even the impacts of green spaces on humans. These students who participated in the study may already have preconceived notions of what a green space means to them,

or the benefits of green spaces on mental health and happiness, which may have had an impact on their answers to the questionnaire.

### *Reliance on Self-Reported Data*

The questions included in the Maptionnaire survey led the participants to reflect upon their feelings and patterns of the past month. As the survey relied on self-reported data, there is a likelihood of error in both how the participants described their feelings and patterns, as well as how they interpreted the questions. For example, one question asked, “Which green space is nearest to where you currently live?”. As seen in the figure below, multiple participants selected that the green space nearest them was quite far away, often missing multiple green spaces much closer to their location.

**Figure 11:** *Map of Groningen displaying the location of participants and their self-reported ‘nearest’ green spaces. Pink indicates the highest MHI-5 scores. Orange indicates medium MHI-5 scores. Blue indicates the lowest MHI-5 scores.*

These discrepancies bring into question not only how the participants interpreted this question, but also how they define ‘green space’. Perhaps those who selected a green space further away than the one that was truly nearest to them assumed that a green space must be explicitly wild or untouched by humans [100]. Perhaps some decided that green spaces must cover a certain area [35] and therefore they selected the larger green space further away from their home, as opposed to the smaller one nearby. It must be noted that before this question, they were given the following description of how ‘green space’ is defined in this study:

*“The term “green space” can include any public urban space that features nature and can be used recreationally. In Groningen, green spaces could include Noorderplantsoen, Stadspark, or even Nieuwe Kerk.”*

The unreliability of the data mapped by participants led to its own challenges which compelled us to largely abandon any maps that we had hoped to analyze using GIS. We were able to gain data

involving the commuting distance, distance to the nearest green space, and distance to the favourite green space of each participant, as seen in Table 3. However, the analyses of these results were inconclusive and displayed no correlation to happiness or any other measured variable.

A similar mistake was made when one participant selected, “No,” in the past month, they did not ever turn to someone for emotional support or advice. In the following question, however, when asked to define who this emotional support person was to them, they selected “Family member” and “Romantic Partner” likely signifying that they were referring to a spouse or long-term partner. In this scenario, the participant likely selected the wrong answer and meant to express that “Yes” in the past month they did indeed turn to someone for emotional support.

## **6. Conclusion**

### **6.1 Key Findings and Implications**

Throughout this study, we explored the interconnection between green spaces, social support, and happiness. We found in our preliminary results that, whilst statistically insignificant, lend some support to our hypothesis that social ties and the use of green spaces both impact the happiness and mental well-being of students. We observed that students value green spaces for exercise and relaxation purposes, and even more for socialization. Although this article brings forth only the preliminary findings of this study, the data gathered will contribute to the scientific literature in environmental psychology and spatial planning. This study displays the importance of green spaces and social support on the mental health and happiness of students. Our preliminary results display how green spaces are vital for the facilitation of social interaction, and how socialization within a green space has a positive correlation with student happiness. Even simple interactions with urban nature, such as commuting to campus or other classes through a green space, are positively associated with improved mental health.

The implications of our study extend beyond academic purposes, as we offer opportunities for change at the University of Groningen and other similar institutions of higher education. By prioritizing policies and initiatives that aim to preserve and enhance green spaces, universities can strengthen social cohesion, thereby further improving student mental well-being and happiness. It is critical to acknowledge that the limitations of our study have influenced the validity and generalizability of our findings. Despite these challenges, the study we conducted indeed contributes valuable insights into the discourse on green spaces and social ties and the correlation of these variables on student happiness.

### **6.2 Future Research**

The applications of this study, whilst statistically insignificant, can still carry some value in future research. The primary limitation of this study was the low sample population and this could be

combated by broadening the search for participants. As this study examined only the preliminary results from the participants we were able to gather, this research could be furthered by analyzing results from an increased sample population. Another opportunity for future research could involve exploring more qualitative research methods, such as focus groups or in-depth interviews with students to determine what they value about green spaces and how the green spaces near campus or other parts of Groningen could be improved. These qualitative research methods could also help researchers to gain a deeper understanding of the social support that these students receive and provide as well as the happiness levels of the students and the factors that impact their mental well-being.

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## Appendix: Maptionnaire Survey Questions

### *Section 1: Introduction and Consent*

Thank you for taking part in this study. The goal of this research is to study the relationship between social relationships and urban nature and to see how these factors can impact mental health and happiness in students. You should be able to complete this questionnaire in about 10 minutes. There are no right or wrong answers to any of the questions. On the next page will be information about this study as well as a place to mark consent. Please read this before continuing to the survey questions.

**To take this questionnaire you must be at least 18 years old. Please enter your age.**

*Value cannot be below 18*

*Value cannot be above 120*

#### 1. Purpose of Research and Data Processing

This research aims to study the relationship between a person's proximity to nature, their social ties, and their level of happiness. The results of this questionnaire will contribute to the Master's thesis of Madison Ketelaars, which will be publicly available in the University of Groningen thesis archive. The data that will be collected includes locational data (as mapped in this questionnaire), accessibility to and use of green spaces, self-reported levels of happiness measured by the MHI-5 questionnaire, and information regarding the social ties of the participants. The data collected in this survey will be confidential and protected according to the University of Groningen guidelines which state that "Personal data shall be kept in a form which permits identification of data subjects for no longer than is necessary for the purposes for which the personal data are processed" [GDPR Art. 5]. No sensitive information, such as names or addresses, will be collected in this survey. Any identifiable information of the participant will be removed from the final report. If specific quotes from the participant are included in the final report, this information will be pseudonymized under a randomly selected fake name. There are no known risks of participating in this study.

#### 2. Rights of the Participants

Participants have the right to ask questions at any time. All questions can be directed to Madison Ketelaars (m.a.ketelaars@student.rug.nl). Participation in this research is entirely voluntary and participants may withdraw at any time without prejudice now or in the future. If any participant wishes to withdraw their participation from this study at any time for any reason, they may contact Madison Ketelaars to do so. Participants have the right to lodge a complaint with a supervisory authority at any time. Complaints can be made to Mr. A. R. Deenan (contact details in section 4).

#### 3. Who can access the data

The data collected from this survey will be stored for up to 6 months after the completion of the project. The persons who will have access to the data collected by this survey include the following: Master's Thesis Researcher: Madison Ketelaars m.a.ketelaars@student.rug.nl Thesis Supervisor: Christina Prell c.l.prell@rug.nl

#### 4. For Complaints or Comments

Participants have the right to complain to the Data Protection Officer (Functionaris Gegevensbescherming) at any time during or after completing the survey. Mr. A.R. (Arjen) Deenen (a.r.deenen@rug.nl) University of Groningen Postal address: P.O. Box 72 9700 AB Groningen An. Central Privacy Desk E-mail: privacy@rug.nl

I have read and understand this information. I voluntarily agree to participate in this study.

### Section 2: Introductory Questions

**Which gender do you identify with?**

- Male
- Female
- Non-binary
- Prefer not to say

**In which country or countries do you hold nationality?**

*Map response: Place point(s) in country*

**In which neighbourhood do you currently live?**

*Map response: Place point in neighbourhood*

**Which level of education are you completing at RUG?**

- Bachelor
- Master
- Research Master
- PhD
- Exchange semester
- Other

**Which faculty are you in at the University of Groningen?**

*Written answer*

### Section 3: Use of Green Spaces

The goal of this section is to determine how you use and value green spaces. The term "green space" can include any public urban space that features nature and can be used recreationally. In Groningen, green spaces could include Noorderplantsoen, Stadspark, or even Nieuwe Kerk.

**Which green space is nearest to where you currently live?**

*Map response: Select green space or park*

**Which green space do you visit most often?**

*Map response: Select green space or park*

**What is the main method of transport you use to reach this green space?**

- Walking
- Cycling (or using an electric bicycle)
- Driving in a car
- Driving on a moped, scooter, or similar motorized vehicle
- Train
- Other public transport
- Other

**How often do you visit or use this green space?**

- Daily

- A couple times per week
- Once a week
- Once a month
- A couple times per year
- Never

**During the past month, how often did you use any green space to socialize?**

- Daily
- A couple times per week
- Once a week
- Once or twice
- Never

**During the past month, how often did you use any green space to exercise?**

- Daily
- A couple times per week
- Once a week
- Once or twice
- Never

**During the past month, how often did you use any green space to relax?**

- Daily
- A couple times per week
- Once a week
- Once or twice
- Never

#### *Section 4: Daily Commute*

The goal of this section is to understand the route you take to the Zernike campus or other University of Groningen buildings.

**What is the approximate route of your daily commute to school? For privacy, omit the beginning 200 metres of your commute.**

*Map response: Draw route*

**What is the method of transport you take during your commute? (Select as many as necessary)**

- Walking
- Cycling (or using an electric bicycle)
- Driving in a car
- Driving on a moped, scooter, or similar motorized vehicle
- Train
- Other public transport
- Other

**During your daily commute, do you travel through a green space?**

- Yes
- No
- Sometimes

**If you travel through a green space during your commute, is this the most direct route or do you go out of your way to pass through the green space?**

- It is the most direct route.
- I go out of my way to pass through a green space.
- I do not pass through a green space.

#### *Section 5: Emotional Support and Advice*

Emotional support includes reaching out to someone when you have a bad day and you need to vent, sharing your deep personal feelings with someone, asking someone for advice about your romantic relationship, or something similar. This section aims to understand the support you receive in your personal life.

**In the past month, did you ever turn to someone for emotional support or advice?**

- Yes
- No

**Who is this person to you? Select as many that apply. If you thought of multiple people, describe just one of them.**

- Family member
- Friend
- Colleague
- Romantic partner
- Neighbour
- Acquaintance
- University staff member
- Other

**Where does this person live? Provide the general area. If you do not know, then leave this question blank.**

*Map response: Place point in neighbourhood*

**In the past month, did this person reach out to you for emotional support or advice?**

- Yes
- No

**In the past month, how often did you interact with this person? This includes all face-to-face interactions, texting, phone calls, etc.**

- Multiple times each day
- Daily
- A few times per week
- A few times during the month
- Just once during the month

**Through which media did you interact with this person to receive emotional support? Select all that apply.**

- WhatsApp, iMessage, or another SMS app
- Instagram, Facebook, or another social media service
- Phone call
- Video chat
- Face-to-face or physical interaction

- Other

*Section 6: Support in an Academic Context*

Academic support includes any type of support or advice that you receive from someone relating to your studies at the university. For example, reaching out to a friend to study together for an upcoming exam, or having a classmate write notes for you in a lecture that you missed. This section aims to understand the support you receive in your academic life.

**In the past month, did you ever turn to someone for academic support?**

- Yes  
 No

**Who is this person to you? Select as many that apply. If you thought of multiple people, describe just one of them.**

- Family member  
 Friend  
 Colleague  
 Romantic partner  
 Neighbour  
 Acquaintance  
 University staff member  
 Other

**Is this the same person that you described in the previous section?**

- Yes  
 No

**Where does this person live? Provide the general area. If you do not know, then leave this question blank.**

*Map response: Place point in neighbourhood*

**In the past month, did this person reach out to you for academic support?**

- Yes  
 No

**In the past month, how often did you interact with this person? This includes all face-to-face interactions, texting, phone calls, etc.**

- Multiple times each day  
 Daily  
 A few times per week  
 A few times during the month  
 Just once during the month

**Through which media did you interact with this person to receive academic support? Select all that apply.**

- WhatsApp, iMessage, or another SMS app  
 Instagram, Facebook, or another social media service  
 Phone call  
 Video chat

- Face-to-face or physical interaction
- Other

### *Section 7: Level of Happiness*

This section measures your level of happiness based on your feelings during the past month. There is no right or wrong answer to any of these questions.

**During the past month, how much of the time were you a happy person?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**During the past month, how much of the time have you felt calm and peaceful?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**During the past month, how much of the time have you been a very nervous person?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**During the past month, how much of the time have you felt downhearted or blue?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

**During the past month, how much of the time have you felt so down in the dumps that nothing could cheer you up?**

- All of the time
- Most of the time
- A good bit of the time
- Some of the time
- A little of the time
- None of the time

You have completed this survey. Thank you again for taking part in this research. If you have any questions, please contact Madison Ketelaars at [m.a.ketelaars@student.rug.nl](mailto:m.a.ketelaars@student.rug.nl).



## **Reflection**

I am proud to present my Master's Thesis and excited to express that I enjoyed this research process. In this section I will reflect upon what I think I did well and what I would have improved, had I done the process again. My favourite aspect of this thesis was that I was able to write it in a way that could be submitted to an academic journal for possible publication: something that has been a goal of mine for years.

## **Overcoming Challenges**

At the start of the thesis process, the primary obstacle was that I was completing the thesis during a different semester than other people in my class due to the fact that I started in February instead of September. I met many roadblocks when trying to get information about how to write a thesis (as I had never written one before), and about the outline and expectations of a Research Master's thesis. I think that this difficulty is likely another issue associated with me starting a thesis in September as opposed to January or February like most of the other people in my class did. This obstacle set me back quite a bit and as a result, it took me longer to complete my thesis. However, despite these obstacles I still managed to make do by looking at previous theses completed at the University of Groningen as well as looking at research articles that were published in PLoS One, the journal to which my advisor and I had decided to submit this work. Gaining inspiration and guidance from these articles helped me to organize my own work in a way that would be most accepted by the scientific community.

Another obstacle is unfortunately one of my own making: Procrastination. I am a procrastinator and without hard deadlines, I often find it difficult to get work done in a timely manner. To combat this, I discussed with my advisor about creating smaller deadlines that would help me to make goals for each week to finish the thesis. This worked quite well and also allowed me to improve my time management skills and overcome my tendency to procrastinate.

### **Areas for Improvement**

There are multiple things that I wish I had done differently throughout this process. Regarding my procrastination habit, I wish that I told my advisor earlier so that we could have worked out the weekly deadline system earlier in the process. I think that I unfortunately wasted some time by not acting earlier.

I also would have liked to create a Maptionnaire survey (and overall thesis) that was more GIS-centered. I found that the ways in which I asked mapped questions to participants were not as clear as they should have been, and therefore I should have been more thoughtful with the questions that I included in the survey. I also should have asked more questions that involved mapping in order to create more opportunities for me to create maps for this thesis.

Finally, I wish that I started the whole process earlier so that I could start recruiting participants earlier in the school year. This might have helped me to find more participants as well as would have created a better picture of how students use green spaces in nicer weather, such as September or October, as opposed to November and December.

### **Highlighting Successes**

I thoroughly enjoyed the research process and problem-solving that came with this quantitative research project. I rarely do quantitative research so this was a refreshing way to conduct research for my thesis. Despite the fact that I have less experience conducting quantitative research compared to qualitative research and despite the statistically insignificant results that I received, I think that I did a fine job with the analysis and interpretation of results. Of course, I would have liked to find interesting significant results, but I think that I did a good job working around this issue. I still found a way to make the thesis meaningful by analyzing and interpreting the descriptive statistics and managed to tell the story that I set out to tell: Green spaces and social support are important factors of student mental well-being.