



ESTONIAN UNIVERSITY OF LIFE SCIENCES  
Institute of Agricultural and Environmental Sciences

**Angela Hõrak**

**THE CYCLE-ABILITY OF TARTU**  
**TARTU LINNA RATTASÕIDU SOBIVUS**

Master's thesis

Curriculum in Landscape Architecture

Supervisor: Professor Simon Bell, *PhD*

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<p>Today, many cities around the world want to increase the share of sustainable transport, especially cycling. Increasing the use of bikes in the city makes people healthier, improves the environment, and creates new healthy habits. To create bike-friendly cities you need a well-thought-out and safe cityscape. The aim of this research was to look at the use of bicycles in the city of Tartu, the main routes used, numbers over time, and the views and perceptions of the users old and new. In order to achieve the goal, several observations were carried out at different times and locations in Tartu, interviews with various experts were conducted and an online questionnaire asking about people's cycling habits was also done. The obtained results can be useful in improving the cityscape of Tartu, so that in the future the development of bicycle traffic would become one of the important points in the construction and design of roads. This would make the infrastructure of the city of Tartu safer and more efficient for all road users.</p>			
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Autor: Angela Hõrak		Õppekava: Maastikuarhitektuur	
Pealkiri: Tartu linna rattasõidu sobivus			
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<p>Paljud maailma linnad tänapäeval soovivad suurendada säästva transpordi osakaalu, eriti just jalgrattaga liikumise osas. Jalgrattaga liikumine soodustab inimestel head tervist, muudab keskkonna paremaks ning loob uusi tervislike harjumusi. Et muuta linn jalgratta sõbralikuks on vaja hästi läbimõeldud ja turvalist linnapilti. Antud uurimistöö eesmärgiks oli uurida jalgrataste kasutamist Tartu linnas, peamisi kasutatavaid marsruute, palju inimesi üldse rattaga ringi liigub ning inimeste vaateid ja arusaamu rattakultuurist Tartus üldiselt. Eesmärgi saavutamiseks viidi läbi erinevatel aegadel ja erinevates kohtades mitu vaatlust, tehti intervjuud erinevate ekspertidega ning lisaks viidi läbi ka veebiküsimustik, milles uuriti inimeste enda rattakasutuse kohta. Saadud tulemused võivad olla kasuks Tartu linnapildi parandamisel, et tulevikus oleks teede ehitamisel ja projekteerimisel üheks oluliseks punktiks ka jalgrattaliikluse arendamine. Läbi selle muutuks Tartu linna infrastruktuur ohutumaks ja tõhusamaks kõigile liiklejatele.</p>			
Märksõnad: jalgrattasõit, jalgratta jagamine, hea linna infrastruktuur, jalgratturite ohutus			

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## INTRODUCTION

In the last few centuries, the way we use public transport is transformed from horseback riding to the widespread use of different motorised vehicles. The use of cars in the city has increased rapidly over the years and will definitely continue to grow at a faster pace in the upcoming years. Unfortunately, today mobility growth poses considerable challenges to city planners around the world, as it entails problems of congestion, air pollution, and accidents. Many cities in the world have thus desired to increase the share of sustainable transport, specifically travel by bicycle (Gössling, 2013).

If we increase the number of cyclists in general, it can be an important step towards a more sustainable and liveable future. If cycling and walking in the city are easy and safe, it makes the city more people-friendly. Cities should be mainly designed for people, and planning practitioners should be able to understand citizens' needs. Increasing the use of bikes in the city will create a well-structured and safe space, full of green areas and a welcoming environment for people to enjoy their life to the fullest. Cycling also brings personal health benefits and increases people's well-being (Civitas, 2016).

In Tartu, the development of light traffic roads has been one of the most important priorities for a long time. In the last decade, many bicycle parking, light traffic/ and bicycle roads have been built all over Tartu. It is also seen in the cityscape that overall bicycle using has been increased over the years. The aim of the movement study made in Tartu 2018 was to give various answers to the following questions: who, how, on what purpose, when, how long and how much are moving around in the city of Tartu and its neighbouring areas. Also, what are the key factors influencing people's choice of transportation. Feedback was collected from 1089 people living in the area at the time (Tartu Movement Study, 2018).

This study revealed that most people living in Tartu would prefer to cycle between their usual destinations, if possible (if there were no obstacles). People usually travel daily (4-7x per week) on foot or by car. 21% of Tartu residents used a bicycle on a daily basis and were generally satisfied with the use of bicycles in the city. There were the most cyclists among the residents of Variku, Maarjamõisa and Vaksali. According to the respondents of the city of Tartu, the main obstacles to bicycle movement were, additionally to weather conditions, traffic hazard and the lack of suitable light traffic routes. Compared to the residents of the vicinity of Tartu, residents of Tartu city were also distinguished by the fact that a fairly large percentage of

respondents in the city of Tartu revealed insufficient bicycle storage facilities at the destinations, which makes them fear that the bike might be stolen at any minute. Also, some of the transport nodes are quite unsafe, and accidents are easy to happen there.

As a conclusion of the study, the respondents in the city of Tartu could significantly use bicycles as the preferred mode of moving on the following terms:

- a well-developed network of light traffic routes in the city of Tartu;
- better and safer bicycle storage options, both in destinations and in transport nodes;
- better bicycle safety for road users in traffic.

The efforts made by the city of Tartu, to develop light traffic roads and developing bicycle traffic, are a major priority to the city. Based on this study, it is necessary to extend the network of light traffic routes further. That is exactly what Tartu has done in the following years.

On 8 June 2019, Tartu opened its first bike-sharing system, comprised of 750 bikes in 69 bike share stations across the city. A total of 500 of these bikes are electric and the remaining 250 of them are regular bikes. Each bike station has an information board with detailed instructions on how to use the bike. The bikes can be picked up from any station and be returned to any available station. Electric bikes are in use until temperatures fall below freezing. In cold weather, only regular bikes are in use (Tartu Smart Bike). Tartu Smart Bike-share system gives the city a very modern and integrated public transportation network because it is part of the city's public transportation network. All users will be able to combine bicycle riding with bus rides. To unlock the bicycle, the user can use a bus card or mobile app. For the Tartu Smart Bike mobile app, a user must create a bike share account and connect it to a credit card. This system is being supplied by the Canadian company Bewegen Technologies Inc, which won the public procurement organised in the spring of 2018 (Tark Tartu).

Tartu Smart Bike share communicates with the bike share system in real-time, giving information about bikes locations and solving all problems that occur quickly. Software that is installed in the bikes collects data daily for statistics about bike rides, speed, distances and other needed information (Bike Share 2020). Smart Bikes also play an important role for Tartu city to develop environmentally-friendly mobility, where it can reduce the number of cars in the city, encourage users to get some physical activity and maintain the phenomena in Tartu, which

is “15 minutes to anywhere”. In addition, using a Smart Bike is a lifestyle choice valued highly by all citizens and visitors of the city (Tartu Postimees, 2020).

The aim of this paper is to look at the use of bicycles in the city of Tartu, the main routes used, numbers over time and the views and perceptions of the users old and new. This thesis is organized into four sections: the literature review, where the theoretical background of cycling, in general, is described; methodology and information about the study area; results and data collected; and finally, a discussion where main findings are brought out.



# **1. LITERATURE REVIEW**

This chapter reviews the theoretical background of cycling in general. Firstly, it is concentrated on cycling safety, what are the main safety precautions and what safe infrastructure in the city looks like for cyclists. Secondly, two examples of world-leading cycling cities are brought out to find out what those cities look like and why cycling is so popular there. Lastly, a brief history of bike-sharing systems is described.

## **1.1 Cycling safety**

In recent decades, traffic has got safer and is keep getting safer. However, in Europe, cyclist deaths and injuries have not been decreasing at the same rates as those for other road users because most safety improvements have focused on the protection of motorized vehicle owners (Civitas, 2016).

Most researches have shown that different characteristics, including built and social environments such as roads, land use, traffic, and time of day, are associated with changes in bicyclist safety. For example, wide roads with improved street lighting and suitable pavement conditions show a lower risk of tragically ended bicycle accidents (Moore, 2011; Reynolds, 2009).

On the opposite, rural environments, night time cycling, high levels of traffic flow, (Chen, 2017), roads with poor network design and connectivity, presence of large vehicles (Moore, 2011), and industrial land use have a higher risk of tragically ending bicycle accident (Reynolds, 2009).

### **1.1.1 Using helmets**

Road traffic injuries are a major public health problem and a leading cause of death and injury all over the world. Each year nearly 1.4 million people die as a result of road crashes, and millions more are injured or disabled (WHO 2020). Motorcycle and bicycle riders are at an increased risk of being involved in some sort of an accident. This is because they very often share the traffic space with others, like fast-moving cars, buses, and/or trucks, and also because they are less visible from all of them. In addition, their lack of physical protection makes them particularly vulnerable to being injured if they are involved in a collision (World Health Organization).

Wearing a helmet is one of the most effective ways of reducing head injuries and fatally-ties resulting from motorcycle and bicycle crashes. Motorcyclists who do not wear helmets are at a much higher risk of sustaining head injuries and dying from these injuries (Joseph, 2014).

In Europe, most countries do not require cyclists to use helmets. Although research has shown that helmets lead to 1.72 times fewer head injuries (SWOV, 2012), most countries do not require helmets to be used because they fear a decrease in the amount of cycling. It is a known fact that helmets do not prevent accidents, but only have an effect on the seriousness of an accident. (Joseph, 2014).

For children, some European countries, for example, Estonia, Sweden, France, and Austria have helmet policies, mostly because their risk of falling and getting hurt is higher than adults (Civitas, 2016).

### **1.1.2 Cycling at night**

Cycling at night-time is more dangerous than cycling in daylight, with 40% of cyclist fatalities occurring at night time (Jaermark, 1991). Bicyclists often expect drivers to give them the right of way but drivers fail to do so. In many instances, this occurs because drivers do not see the bicyclist, either because they do not scan the road appropriately or because bicyclists are insufficiently conspicuous to drivers at night (Wood, 2012). Many factors affect conspicuity, including object contrast, movement, illumination, background ‘clutter’ and road conditions, also the cognitive process of the driver and his/her responses in detection and recognition (Kwan, 2004).

The use of bicycle lights is one widely adopted approach for improving cyclist visibility and is now a legal requirement when cycling on roads at night in many countries. Another practical and solid approach to improving the conspicuousness of cyclists is the use of high-visibility clothing (Wood, 2010). By adding ankle and knee markings to a bicyclist who is already wearing typical reflective clothing at night time, provides a more powerful conspicuity enhancement (Wood, 2012). However, while bicyclists are generally well-informed regarding the need to wear high visibility clothing, such as reflective clothing, few bicyclists use such aids on a regular basis (Wood, 2009).

### **1.1.3 Safe infrastructure**

Not only the size of a city, its area, population density, and the number of citizens can affect the options of using bikes and other modes of individual transportation but also safety and efficiency (Makarova, 2020). To ensure the safety of cyclists, a safe, well maintained, and well-connected infrastructure free of obstacles is needed. Interactions with other traffic determine how the infrastructure should be designed. Even careful consideration should be given to whether cyclists and pedestrians should share the same infrastructure or not (Civitas, 2016). Several studies showed the positive impacts of cycle paths on the level of cycling activity, implying that installing cycling infrastructure could encourage people to cycle more (Buehler and Pucher, 2012, Hong, 2019).

Segregated cycle lanes, textured surfaces, painted bike lanes, traffic-calmed streets, and green routes are one of the best measures to provide safe cycling infrastructure. It has also been established, that developing new cycling infrastructure inside the city area will be more effective than introducing new cycling facilities outside the developed areas (Hong, 2019). The infrastructure that works best for everyone is simple, safe, and connected. That kind of infrastructure also allows bicycles to be a competitive mode of transportation for people of all ages and abilities (Thoem, 2020).

## **1.2 Cycling in Europe**

The large capital cities in Europe, like Amsterdam and Copenhagen, are viewed as examples of world-leading cycling cities, and many other smaller European cities have substantial proportions of people cycling regularly (Civitas, 2016). These cities are role models for many other major cities in Europe and around the world.

### **1.2.1 Cycling in Amsterdam**

The Netherlands is the world leader in cycling (Pucher and Buehler, 2008). This country has many small cities that have high cycling rates, but on top of them all is capital city Amsterdam. As in many other European cities, cycling in Amsterdam came to be a popular means of transport at the turn of the 20th century, rapidly becoming the preferred mode of transport to move around the city during the 1920s and 1930s. Cycling retained its popularity in 1950 until people started to prioritize motorized traffic devices, which led to a rapid decline in cyclist

numbers. Unlike in other European cities, however, cycling never disappeared from Amsterdam (Carstensen and Ebert, 2012).

This strong political and social support for cycling was reflected in the constant expansion of cycling infrastructure, accompanied by aggressive strategies to calm traffic and reduce parking to prevent car use. Especially from the 1990s onwards, cycling use in Amsterdam has grown remarkably, even if it continues to be lower than at the start of the 20th century. Meanwhile, individual car ownership has gradually decreased, and bike ownership has hit new highs. But urban cycling policy in the past few decades has been largely reactive: more than seeking to promote cycling use, its function has been to accommodate the rising number of cyclists in the city (Nello-Deaking and Nikolaeva, 2020).

However, cycling rates are uneven through Amsterdam, varying from 21% in suburban neighbourhoods to above 50% near the city centre (Nello-Deaking and Harms, 2019). This difference is partially attributable to differences in population density, which can vary largely between suburbs and central neighbourhoods. Also, residents with a non-Dutch background also tend to cycle significantly less than those with a native Dutch background (Nello-Deaking and Nikolaeva, 2020).

The city of Amsterdam has greatly restricted car access to the city centre over the years. Many streets are one way for cars, and others are reserved for pedestrians and cyclists and are completely off-limits to cars. Since the 1970s, the city has also reduced the amount of car parking in the city centre in hopes that parking costs and less parking space would invite people to use bikes more (Buehler and Pucher, 2010).

### **1.2.2 Cycling in Copenhagen**

In Denmark's capital city Copenhagen, cycling represents a serious means of transport. Bikes are used by everyone and for everything. (Gössling, 2013). As well in The Netherlands, the bicycle was the major transport mode in Copenhagen in the 20th century (Carstensen and Ebert, 2012). This trend continued throughout the 1960s when car use expanded and rapidly exceeded the use of bicycles, but many Copenhageners continued to cycle (Gössling, 2013). In the 1970s big energy crisis hit the Western world, which was harder for Denmark than for most countries.

Because of that crisis the government there was forced to introduce car-free Sundays to conserve oil reserves in-country (Carstensen and Ebert, 2012). This led to massive demonstrations in Copenhagen and other major cities, where people demanded better infrastructure and safety for the city's cyclists. Since then Copenhagen has published many bicycle strategy plans, which provide comprehensive visions for the development of cycling in the city (Gössling, 2013).

Copenhagen has now declared itself as the City of Cyclists. These days most Copenhageners choose the bicycle because it's the easiest and fastest way to navigate around Copenhagen. This is the result of many years of political and administrative focus on improving the conditions for cycling in Copenhagen to become the "world's best city for bicycling" (Gössling, 2013).

A crucial element in Copenhagen is the comprehensive network of dedicated bicycle infrastructure with separated tracks and safe intersection design. Copenhagen roads and bicycle facilities can and must always be designed to be safe, easily passable, and comfortable, and provide cyclists with a sense of security (City of Copenhagen, 2013). Copenhagen has simple and yet also safe infrastructure throughout the city. Simple cycling infrastructure there appears in four basic typologies: traffic-calmed streets, painted bike lanes, separated cycle tracks, and green routes get you where you need to go. To make cycling safe in Copenhagen, the streets are designed to prioritize the more vulnerable road users, pedestrians, and cyclists, over cars and trucks (Thoem, 2020).

Since Copenhagen started to improve its urban infrastructure, cycling has given the city several social, environmental, health, and economic values. Over the years, the city has witnessed a significant reduction in carbon emissions as well as ecological footprint. City attention and focus on cycling campaigns and infrastructure around Copenhagen have increased cyclists' safety over the years and reduced their overall traveling time by a substantial amount (Future Distributed, 2020).

### **1.3 History of bike sharing systems**

Over the years, there have been four generations of bicycle-sharing systems. The first generation of bike-sharing, known as the "White Bikes" (or Free Bike Systems), developed in 1965 in Amsterdam. These bicycles were unlocked and publicly free to use. This program survived only for a short time, pointing to the whole reality of problems such as theft and vandalism. The second generation of bicycle sharing was originally opened in Denmark in 1991. However, both of these first programs were very small (DeMaio, 2009).

It was not until 1995 that the first large-scale second-generation bicycle sharing program, called City Bikes, was launched in Copenhagen, with many improvements over previous generations. Copenhagen bicycles were specially designed for practical use by all and could be collected and returned at specific locations throughout the city centre where the coin-operated machines were located (Hesselgren, 2020).

The first 3rd generation bicycle sharing program was established in 1996 at the University of Portsmouth (Bike about) in England, where students could use a magnetic stripe card to rent a bicycle. This and the following bike-sharing systems made of various technological improvements, including electronically lockable bicycle locks, telecom systems, smart cards, mobile phones with access, and on board computers (DeMaio, 2009).

The last generation of bicycle-sharing systems is still in the process of development. This generation includes movable docking stations, solar-powered docking stations, electric bikes, and real-time system data (Lozano, 2018).

The 4th generation of bike-sharing started with the introduction of Ofo in 2014 in China (Yang, 2017). With the development of new techniques, it was now possible to develop a new bike-sharing system without docking stations. The innovation was influenced by the introduction of mobile payments on smartphones and the development of smart locks, including GPS and wireless mobile communication. These locks make it possible to track bicycles through cities and to unlock bicycles from a distance (Lozano, 2018).

## **2. METHODOLOGY AND DATA COLLECTION**

### **2.1 Methodology**

The aim of this master thesis is to look at the use of bicycles in the city of Tartu, the main routes used, numbers over time and the views and perceptions of the users old and new. This chapter explains the research methods used in this work. In addition, to understand what study area looks like, a small portion of information about Tartu city, in general, is brought out.

In order to achieve the result of the work, several different observations were made at different times and a questionnaire was conducted on the Internet, where the residents of Tartu were asked about their own cycling habits. Due to the questions/concerns identified in the questionnaire and observations, a couple of interviews with experts were also conducted.

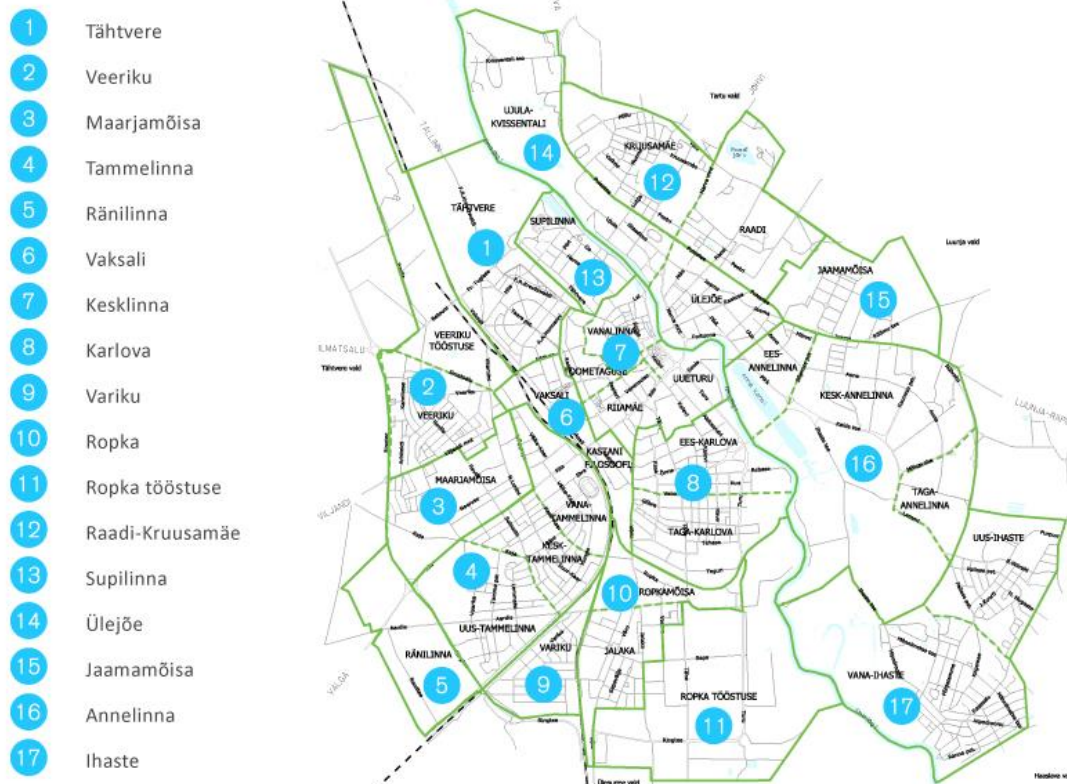
### **2.2. Tartu**

Tartu, with its population of around 100 000 (Statistikaamet), is the second-largest city in Estonia and also holds the title of the oldest city in the Baltic countries in general. Tartu is located on the banks of the river Emajõgi (Mother River), which connects the two largest lakes of Estonia, Peipsi and Võrtsjärv. This city is usually considered to be the intellectual capital of the country because it is home to the nation's oldest and most renowned university, the University of Tartu. Because of that, the large number of young people makes the town more vibrant and full in the winter time than in summer, where many are on holidays elsewhere (Chernov, 2012).

The motto of Tartu is: "Tartu - heade mõtete linn" ("*Tartu - a city of good ideas*").

#### **2.2.1 Structure of the city**

Tartu is divided into 17 neighbourhoods, which carry no administrative purposes. Their names and borders are defined (Figure 1). The oldest inhabited districts are Kesklinn, Supilinn and Ülejõe. Annelinn is the largest in terms of both population and area. Older districts are located around the historical centre of Tartu - former suburbs that formed by the river and trade routes. Further afield are the younger districts that developed in the 20th century. On the right bank of the river Emajõgi, upstream from the city centre, there is Supilinn, downstream Karlova and Ropka industrial districts, up the slopes of the ancient valley are Tähtvere, Vaksali, Ropka.



**Figure 1.** Map of Tartu 17 neighbourhoods (map from Tartu Statistiline ülevaade 2014)

The districts of Veeriku, Maarjamõisa, Tammelinna, Ränilinn and Variku, were built behind the railway in the 19th century. On the left bank there are Ülejõgi, Annelinn and Ihaste, on the valley slopes Raadi-Kruusamäe and Jaamamõisa.

The right bank of the river (Supilinn, Veeriku, Karlova) makes up about 56% of the territory of the city of Tartu and the left bank (Ülejõe, Annelinn) about 44% (Tartu 2021).

### 2.3 Observations

In the course of the research, different observations were carried out in Tartu at different times: one more general observation in the summer months (June, July and August), another observation in October 2020 and a third winter observation in February 2021. The first observation during the summer time focused on different times of the month and when people were mostly around the city. In addition, the number of people using the Tartu Smart Bike system was observed.

The second observation was much more thorough and was conducted in October 2020. It was done at 4 different locations in Tartu at two different times: daytime from 12:00 to 14:00 and



in the evening from 17:00 to 19:00. The observations examined whether people ride their own bike or a rented one, who were the people who mostly cycled (gender, young /old) and whether they cycled alone or with someone else. In addition, it was looked at whether people wear a helmet, where they usually prefer to ride and how safe are the roads (behaviour between cars and bikes, how well are streets lighted at evening time).

The third and final observation was carried out at exactly the same locations as the second observation. The only difference was that it was made while the snow was on the ground. The main goal was to observe whether and where people are driving in snow. In addition, It was also researched whether the roads are clean enough and what are the conditions for cycling in the winter time.

For both the second and third observation, they were carried out 15 minutes at each selected location.

### **2.3.1 Site selection**

For more thorough observations in October 2020 and February 2021, four different areas in the city of Tartu were chosen – Tartu University buildings near Sanatooriumi Park (Figure 2 first picture), Tartu Train Station and Vaksali street (Figure 2 second picture), Keskpark in the city centre (Figure 2 third picture) and Ülejõe park next to river Emajõgi (Figure 2 fourth picture). One of the bases of the selection was to find areas where different kind of people (young/ old or students/full-time workers) moved around a lot.

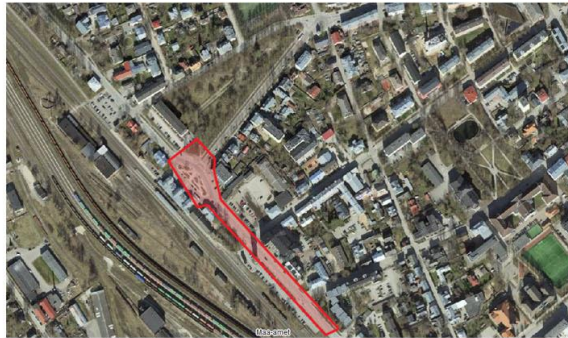
The first location was chosen because of the university building complex. In addition to that, there is one high school in this area. In all probability, lots of students and teachers move around in this area. The second location has a very common road for people to pass by every day, it has newly improved bicycle road that has improved the city a lot. The third location is chosen because of the Tartu Smart Bike system. It has the most used bike station in the city. The last location includes a widely used park in the centre of Tartu and a beautiful riverside along with it.



1. Tartu University buildings near Sanatooriumi park



3. Keskpark in city centre



2. Tartu Train Station and Vaksali street



4. Ülejõe park next to river Emajõgi

**Figure 2.** Chosen areas for observations – on the left locations one and two, on the right locations three and four (base maps: Maa-amet 2020).

### 2.3.2 Observation analysis methods

An MS Office Excel table was used to analyse the selected sites, which was compiled to gather the most necessary information (Appendix 1). The table was designed to gather more general information about the selected locations under consideration such as the date, time, and weather. The following questions were directed specifically to the place where the survey was carried out. They asked how much the bikes were there at that moment, the gender of the cyclists and whether they used their bike or a rented bike. It was also possible to take notes at the end of the table. In general, it was noted where people prefer to drive: either on the sidewalk or on the driveway; what was the lighting like in the evening; whether helmets were used and other details that were noticed.

## **2.4 Questionnaire**

One of the most important methods used was the questionnaire. The main purpose of the questionnaire was to find out who are the ones who cycle around most, how often they do it and what people think are the strengths and weaknesses of the city of Tartu in relation to the use of a bicycle in the city.

The questionnaire was opened to the respondents on 05.11.2020 and closed on 12.11.2020, it was open for 7 days. A total of 115 people responded to the questionnaire.

### **2.4.1 Preparing the questions**

The questions were chosen based on factors that make the city a bicycle-friendly city. The main ideas of the questions were to find out who are those people who use bikes around the city, what they like, what they do not like about it in the city of Tartu and the views and perceptions of the users old and new. The questionnaire had a total of 15 questions. 11 of the questions had multiple-choice answers, 2 questions were simple “yes” or “no” questions, and 2 were open questions. The questionnaire had two language versions, English and Estonian (Appendix 2).

### **2.4.2 Finding the people**

The questionnaire had been shared mostly through social media (Facebook) and via email. It was distributed in the form of Google Forms. The questionnaire was intended for mostly residents or students in the city of Tartu.

At the beginning of the questionnaire, various socio-demographic data were asked, such as gender, age, if they work or study (Figure 3). More than a few questions were about people's own cycling habits and the feelings they have when cycling around the city.

		<b>How many people</b>	<b>Percentage %</b>
<b>Gender</b>	Male	34	29,6%
	Female	81	70,4%
<b>Age</b>	< 17	11	9,6%
	18-25	80	69,6%
	26-39	12	10,4%
	40-51	6	5,2%
	52-67	6	5,2%
	68 +	0	0%
<b>Student/worker</b>	Student	64	55,7%
	Full-time worker	24	29.6%
	Part-time worker	7	6%
	Pensioner	1	0,9%
	Unemployed	3	2,6%
	Homemaker	2	1,7%
	Other	4	3,4%

**Figure 3.** Socio - demographic data of the respondents

Most of the respondents who completed my survey were women, which means the majority of my results are based on a female opinion. The main age group who answered this questionnaire were 18-25-year-olds and most of them were students.

## **2.5 Interviews**

In order to find answers and/or solutions for issues and/or concerns raised, two small online interviews were conducted, one in October 2020 and another in April 2021.

### **2.5.1 Finding people and interviewing them**

Two different interviews were conducted - one with the people behind the Tartu Smart Bike system and the other with Tartu mobility expert Aksel Part. The interviewees were selected based on what questions/concerns had arisen and who could best justify them. Both interviews were conducted online by e-mail. A total of four main questions were asked from both interviewees. Due to the willingness to cooperate, both interviewees were kindly ready to answer the questions and gave answers only after a few days.

### **2.5.2 Preparing the questions**

The first interview was done in October 2020 with mobility expert Aksel Part. The questions were prepared from questions/concerns raised from the first observations done in the summer of 2020 and in October 2020. Questions were about:

1. Is Tartu a bike-friendly city
2. Different districts and their impact on cycling
3. Bike vs car users
4. Future for cyclists in Tartu

The second interview focused on people's questions/concerns from the questionnaire and also observations done. The people behind the Tartu Smart Bike-share system were asked questions about:

1. Maintenance of bike stations
2. Electric bikes and their popularity
3. Winter time cycling
4. Future plans

## **3. RESULTS AND DATA COLLECTED**

### **3.1 Results of observations**

#### **3.1.1 Observation in Tartu, summer 2020**

The first observation took place in Tartu in the summer of 2020. It was a comprehensive observation to find out what cycling culture in Tartu looks like in general. It was mostly observed that at what times and what kind of bicycle people ride around. Before those first observations, six questions were written down to which would like an answer. These six questions and the answers to them are as follows:

#### **1. Do people use more of their own bikes or rented ones?**

In a couple of years, the number of cyclists in Tartu has grown exponentially, and all this is also shown by the observations made in the summer of 2020. Thanks to the new Tartu city bike-sharing system, which has been so well received by the residents, cycling has become a matter of course. During the summer observation, it became clear that people like to use their bikes as much as rented bikes. On closer inspection, it seems that rented bikes are used more to get from point A to point B, but people's bikes are used more just to ride around the city. Rented bikes have become popular among young people who we can see riding around the city with friends.

#### **2. Where do they prefer to drive (on car roads, light traffic roads or pedestrian roads)?**

It seems that people prefer to ride in places where a special area for cyclists has been provided. For example, the recently completed light traffic road on Vaksali Street and also the bicycle road on Keskk Street is really popular among cyclists. However, if no special cycle path has been created, people prefer to ride on sidewalks rather than on car roads. It seems a little safer to drive between people than between cars. But there were also those who drove on the streets and in the middle of cars.

Some of the rules for cycling in the city from Estonian law are:

- A cyclist under the age of 10 and without a driving license may ride alone on sidewalks, cycle and pedestrian paths and outdoor yards.

- On the road, you must ride a bicycle near its right edge. The only exception is to move to the left or to reverse.

### 3. What are the most popular roads?

Most people could be seen moving around in the city centre and Karlova district. The most popular rental bike parking places in the city are Uueturu, Soola and Pirogovi plats, so the city centre is very busy all the time. In the city centre, people can be seen riding on University Street, Rüütli Street and in the areas along the river Emajõgi. I also noticed that quite a few people cycle near Lõunakeskus and that the rental bike parking was always very full of bikes.

### 4. What time of day are rented bikes used the most?

As the observation showed that people like to ride with rented bikes as much as their bikes in the summer, then the following table was compiled on the use of rented bikes (Figure 4) Tartu city bicycle rental is available for everyone from 5:00 in the morning until 1:00 in the early morning. The bikes were used most intensively in the afternoon and the evening, between 14:00 and 20:00. At that time most people could be seen using their bikes as much as rented ones. It was also difficult to find a bike in the rented bicycle parking lot at that time because so many were driving around the city with them. The least use of the rented bikes was early in the morning, between 5:00 and 8:00. As the summer of 2020 was relatively warm, people could also be seen driving moderately between 22:00 and 1:00.

time of day	JUNE	JULY	AUGUST
5:00 - 8:00	low	low	low
8:00-10:00	medium	medium	medium
10:00-12:00	medium	medium	medium
12:00-14:00	medium	high	medium
14:00-16:00	high	high	high
16:00-18:00	high	high	high
18:00-20:00	high	high	high
20:00-22:00	medium	high	high
22:00-1:00	low	medium	medium
low	few people or no people at all		
medium	people drive around		
high	lots of people driving around the city		

**Figure 4.** Rented bike users per time of the day.

## **5. Do people wear helmets?**

The Estonian Traffic Act states that the use of helmets is mandatory until the age of 16. The observation revealed that most people, unfortunately, do not wear helmets, including people under the age of 16. While driving around the city, very few helmet wearers could be seen, and those who did were more elderly or kindergarteners.

## **6. Does it feel safe to drive around the city?**

For me, Tartu is quite a bike-friendly city and I feel safe to drive around here more than for example in Tallinn. Yes, there are a few places that I wish they would have thought more about for bikes, but overall you can see that people feel safe and happy when they drive around the city. The first thing I notice is that they feel safe driving around the city because they don't wear a helmet, and many people dare to drive among the cars. As Tartu is a relatively small and compact city, there is no fast traffic here and people are used to the fact that many lots of residents ride bicycles. Especially now that a Tartu bike rental system has come out and people are very happy to use them all year round.

The quality of the roads and their lighting in the dark can also be dangerous for cyclists. Although Tartu has worked hard to make the main traffic routes good and enough lighting, unfortunately, some streets and roads require renovation. I would like to see better lighting in the areas along the river Emajõgi, as they are quite busy all the time. The quality of roads could be improved in places where there are currently room for pedestrians and cars only. If possible, either give a piece of the road to the cyclists or widen the sidewalk so that the cyclists feel comfortable and safe.



### 3.1.2 Observtions in october 2020

The first more thorough observation was carried out on the 19th of October 2020. It was a daytime observation from 12:00 to 14:00. A total of 4 different places in Tartu were visited, the surroundings were observed for 15 minutes in each place.

A starting point for this days observation was Tartu University buildings near Sanatooriumi park.

DATE:	Monday 19th October 2020
TIME:	12:00 – 12:15
BIKES USED:	
Own bikes	2 people
Rented	1 person
GENDER:	
Male	2 men
Female	1 female
How many people:	In total of 3 people were seen
Notes:	- Rainy cold weather (4°C) - bike stations near university buildings were full of bikes - mostly students with bikes



Location 1. (Author, 2020)

After the first point, observation was carried on near Tartu Train Station and Vaksali street.

DATE:	Monday 19th October 2020
TIME:	12:30 – 12:45
BIKES USED:	
Own bikes	8 people
Rented	2 people
GENDER:	
Male	8 men
Female	2 women
How many people:	In total of 10 people were seen
Notes:	<ul style="list-style-type: none"><li>- Rainy cold weather (4°C)</li><li>- Women used only their own bike</li><li>- Old people preferred to drive on a sidewalk, and younger people on a light traffic road.</li></ul>



Location 2. (Author, 2020)

The third location of the day was Keskpark in the city centre.

<b>DATE:</b>	Monday 19th October 2020
<b>TIME:</b>	13:20 – 13:35
<b>BIKES USED:</b>	
Own bikes	4 people
Rented	10 people
<b>GENDER:</b>	
Male	10 men
Female	4 women
How many people:	In total of 14 people were seen
<b>Notes:</b>	- Cloudy cold weather (4°C) - Lots of Wolt/Bolt food bikes - You could see that bikes are used by both young and old people. Lots of families with small children



Location 3. (Author, 2020)



The last location of the first observation day was Ülejõe park next to river Emajõgi.

<b>DATE:</b>	Monday 19th October 2020
<b>TIME:</b>	13:45 – 14:00
<b>BIKES USED:</b>	
Own bikes	7 people
Rented	7 people
<b>GENDER:</b>	
Male	9 men
Female	5 women
How many people:	In total of 14 people were seen
<b>Notes:</b>	<ul style="list-style-type: none"><li>- Cloudy cold weather (4°C)</li><li>- 3/14 people were using helmets</li><li>- Most bike users seemed to be students/younger people</li></ul>



Location 4. (Author, 2020)

**Conclusion of day 1:** This time of the day, most people cycled around the downtown area. For the most part, people preferred to ride on sidewalks. The exception was the light traffic road on Vaksali Street, which seemed to be very popular because a lot of people drove there. In general, the roads were in good condition in these locations and there was room to ride bicycles as well as pedestrians to walk. There were also many different food delivery bikes moving around near the city centre. As there are many restaurants and cafes in this area, this is a normal thing.

The Tartu Smart Bike bicycle stations near the Keskpark park were very full at that time, and it was difficult for people to return the bikes there. Fortunately, there are many different bike stations nearby, and everyone was still able to park their bikes properly.



Sanatooriumi park and Tartu University buildings



Tartu Train Station and Vaksali street



Keskpark in city centre



Ülejõe park next to river Emajõgi

**The second** more thorough observation was carried out on the 27th of October 2020. It was an evening observation from 16:45 to 19:00. A total of 4 different places in Tartu were visited, the surroundings were observed for 15 minutes in each place.

Just like in the first observation, a starting point for this observation was Tartu University buildings near Sanatooriumi park.

DATE:	Tuesday 27th October 2020
TIME:	16:45 – 17:00
BIKES USED:	
Own bikes	8 people
Rented	4 people
GENDER:	
Male	9 men
Female	3 women
How many people:	In total of 12 people were seen
Notes:	<ul style="list-style-type: none"><li>- Really windy weather (9°C)</li><li>- Good lighting on streets and sidewalks</li><li>- People preferred to cycle more on car roads than on sidewalks</li></ul>



Location 1 (Author, 2020).



After the first point, observation was carried on near Tartu Train Station and Vaksali street.

DATE:	Tuesday 27th October 2020
TIME:	17:15 – 17:30
BIKES USED:	
Own bikes	9 people
Rented	3 people
GENDER:	
Male	6 men
Female	6 woman
How many people:	In total of 12 people were seen
Notes:	<ul style="list-style-type: none"><li>- Really windy weather (10°C)</li><li>- Like in daytime observation, old people preferred to drive on a sidewalk and younger people on a light traffic road</li><li>- This area has good street lighting at night time. New bike lines are well seen in the dark and this street overall feels place to be.</li></ul>



Location 2 (Author, 2020).

The third location of the day was Keskpark in the city centre.

DATE:	Tuesday 27th October 2020
TIME:	17:55 – 18:10
BIKES USED:	
Own bikes	18 people
Rented	7 people
GENDER:	
Male	16 men
Female	9 woman
How many people:	In total of 25 people were seen
Notes:	<ul style="list-style-type: none"><li>- Windy weather (9°C)</li><li>- Lots of Wolt/Bolt food bikes</li><li>- Some places had good street lighting, in other places there was unfortunately too dark</li><li>- You could see that bikes are used by both young and old people.</li></ul> Lots of families with small children

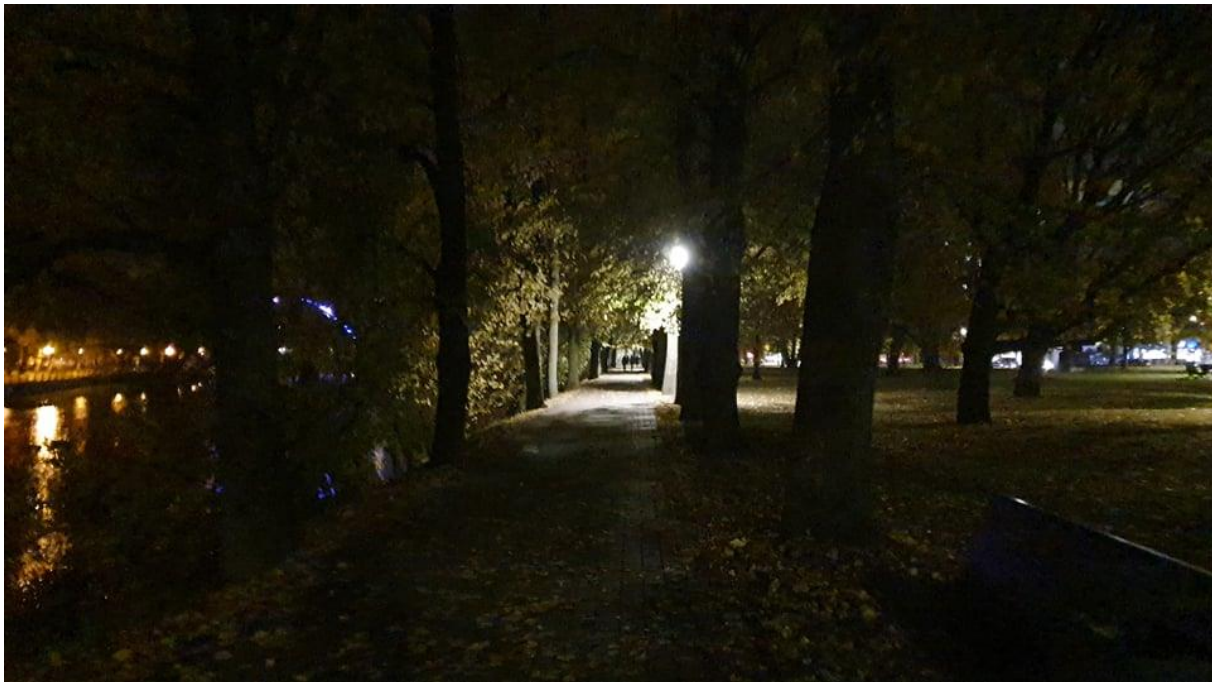


Location 3 (Author, 2020).



The last location of the second observation was Ülejõe park next to river Emajõgi.

DATE:	Tuesday 27th October 2020
TIME:	18:45 – 19:00
BIKES USED:	
Own bikes	20 people
Rented	12 people
GENDER:	
Male	29 men
Female	3 woman
How many people:	In total of 32 people were seen
Notes:	<ul style="list-style-type: none"><li>- Really windy weather (9°C)</li><li>- Ülejõe park was a little too dark, not enough lights</li><li>- Even though this park is really dark, lots of people used it for walking, running and cycling</li><li>- Most people walked/cycled by the riverside and by the car road, the area inside the park was not used at all</li></ul>



Location 4 (Author, 2020).

**Conclusion of day 2:** The evening observation showed that people use bicycles quite a lot at such times. The numbers doubled compared to the observations made during the daytime. Exactly half of the locations allowed people to ride a bike without worries, but the other half was a bit disappointing. Location number 1 (Sanatooriumi park and Tartu University buildings) and location number 2 (Tartu Train Station and Vaksali street) were well lit, where the street light was placed in exactly the right places, lighting the road long ahead. In locations 3 and 4, however, there were problems with street lighting. In the case of location 3 (Keskpark in the city centre), this is not considered a big problem, because there were different buildings around that area that, in addition to street lighting, also helped to make roads lighter. The biggest surprise, however, was the lighting of location 4 (Ülejõe park next to river Emajõgi). The roads were relatively dark and strange.

Although there were a lot of people there, the location still made me feel a little unsafe. As there are no buildings on the side of the river Emajõgi, there was especially little light. The cyclists drove carefully because they did not see long ahead and there were a lot of people walking.



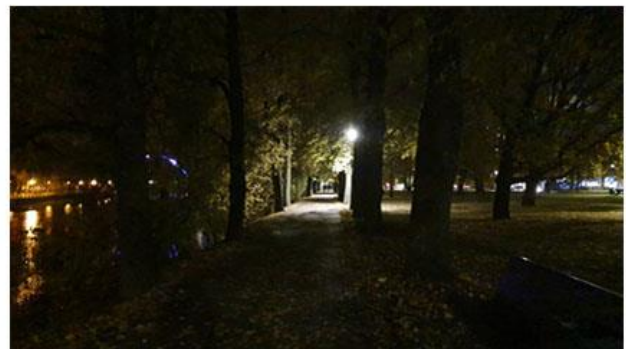
Sanatooriumi park and Tartu University buildings



Tartu Train Station and Vaksali street



Keskpark in city centre



Ülejõe park next to river Emajõgi

### 3.1.3 Winter observation in February 2021

The last observation was carried out on the 3rd of February 2021. It was a winter observation, from 13:00 to 15:00. A total of 4 different places in Tartu were visited, the surroundings were observed for 15 minutes in each place.

Like observations done in October of 2020, a starting point for this observation was Tartu University buildings near Sanatooriumi park.

DATE:	Wednesday 3rd February 2021
TIME:	13:00 – 13:15
BIKES USED:	
Own bikes	2 people
Rented	-
GENDER:	
Male	1 men
Female	1 woman
How many people:	In total of 2 people were seen
Notes:	<ul style="list-style-type: none"><li>- Cold winter weather (-6°C)</li><li>- Only a few people cycled, but there were lots of bikes in bike stations and around the university buildings.</li><li>- The ones who did cycle did it on car roads, because of the snow there was not much space on sidewalks.</li></ul>



Location 1 (Author, 2021).



After the first point, observation was carried on near Tartu Train Station and Vaksali street.

DATE:	Wednesday 3rd February 2021
TIME:	13:30 – 13:45
BIKES USED:	
Own bikes	1 person
Rented	-
GENDER:	
Male	-
Female	1 woman
How many people:	In total of 1 people were seen
Notes:	- Cold winter weather (-6°C) - People prefer to drive on a sidewalk because there was no room on the bike line (because of the snow. It was not cleaned well, only car roads were clear of snow)



Location 2 (Author, 2021).

The third location of the day was Keskpark in the city centre.

<b>DATE:</b>	Wednesday 3rd February 2021
<b>TIME:</b>	14:15 – 14:30
<b>BIKES USED:</b>	
Own bikes	4 people
Rented	-
<b>GENDER:</b>	
Male	4 men
Female	-
How many people:	In total of 4 people were seen
<b>Notes:</b>	- Cold winter weather (-6°C) - All of the people who used the bikes were Wolt/Bolt food bikes

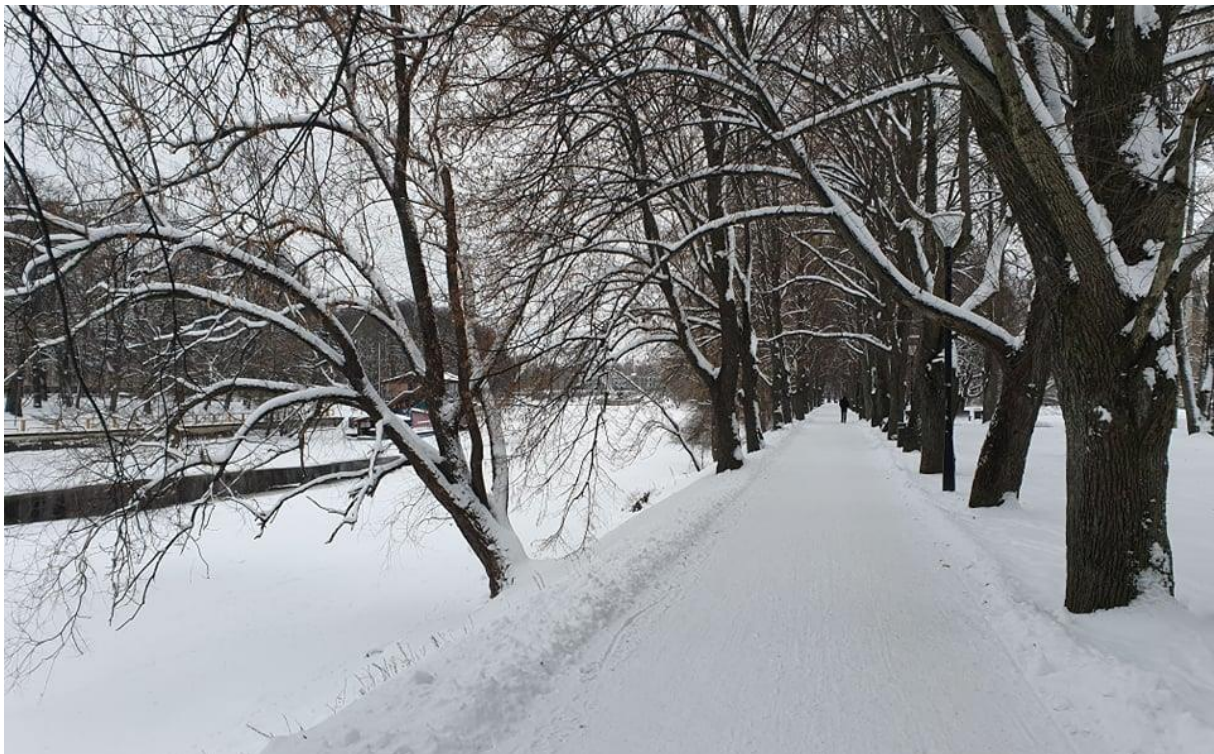


Location 3 (Author, 2021).



The last location of the winter observation was Ülejõe park next to river Emajõgi.

<b>DATE:</b>	Wednesday 3rd February 2021
<b>TIME:</b>	14:45 – 15:00
<b>BIKES USED:</b>	
Own bikes	3 people
Rented	-
<b>GENDER:</b>	
Male	2 men
Female	1 woman
How many people:	In total of 3 people were seen
<b>Notes:</b>	- Cold winter weather (-6°C) - Sidewalks were beautifully cleared of snow and there was plenty of room to walk/cycle



Location 4 (Author, 2021).

**Conclusion of day 3:** As expected, people ride a bike less with snow than they would without snow. Although Tartu has a lot of functional bike stations and space to ride, unfortunately, they do not pay much attention to keeping snow roads in good condition. Tartu focuses only on giving the person some space to walk and not on the cyclist who would like to drive there as well. However, roads should be cleaned more widely so that they can also be used while cycling.

Although the bikes of Tartu Smart Bike can also be used in winter (not electric ones, they are only in summer), then turning this observation no people who had used a rented bike could be caught. People used only their own bikes. However, while driving / walking, I have noticed their use on a few occasions.



Sanatooriumi park and Tartu University buildings



Tartu Train Station and Vaksali street



Keskpark in city centre



Ülejõe park next to river Emajõgi

### 3.2 Questionnaire answers

The questionnaire was opened to the respondents on 05.11.2020 and closed on 12.11.2020, it was open for 7 days. A total of 115 people responded to the questionnaire.

The questionnaire started with various socio-demographic questions to find out who were the main group of people. People were asked to answer such questions as what is their gender, how old are they, do they work or study (Figure 5).

		<b>How many people</b>	<b>Percentage %</b>
<b>Gender</b>	Male	34	29,6%
	Female	81	70,4%
<b>Age</b>	< 17	11	9,6%
	18-25	80	69,6%
	26-39	12	10,4%
	40-51	6	5,2%
	52-67	6	5,2%
	68 +	0	0%
<b>Student/worker</b>	Student	64	55,7%
	Full-time worker	24	29.6%
	Part-time worker	7	6%
	Pensioner	1	0,9%
	Unemployed	3	2,6%
	Homemaker	2	1,7%
	Other	4	3,4%

**Figure 5.** Socio - demographic data of the respondents

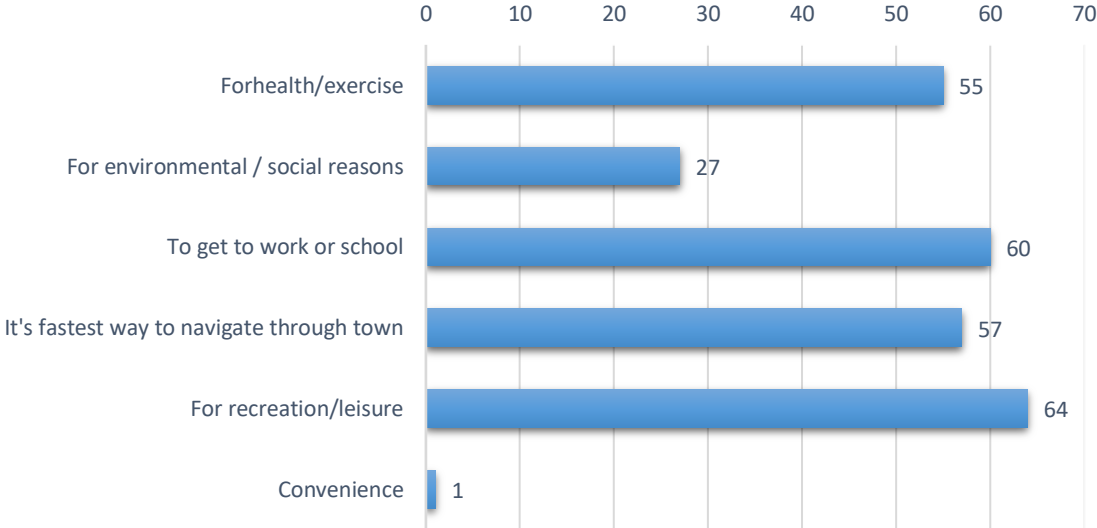
The survey showed that 70.4% of the respondents who completed my survey were female and 29.6% were men, which means the majority of my results are based on a female opinion. The main age group that answered this questionnaire were 18-25-year-olds, which accounted for 69.9% of the total respondents. They were followed by 26-39-year-olds and under 17-year-olds, then accounting for 10.4 and 9.6%. People were then asked if they were students or employees. More than half of the respondents answered that they are students - in total they were 55.7%. This was followed by full-time employees with 29.6% and part-time employees with 6%. Among the respondents there were also unemployed 2.6% of people, homemakers



1.7% and one pensioner, who accounted for 0.9% of the total. 3.4% of respondents chose others as their answer because they either did not want to answer this question or they could not find a suitable option.

The following questions examined the respondents own cycling habits in Tartu. The first question was about how often they ride a bicycle. 33.9% of respondents say they cycle a few times a year, 28.7% ride a few times a month and almost as much 27.8% of people use a bike a few times a week. The smallest percentage 9.6% - were people who said they ride a bicycle daily.

The next question examined what exactly are the main reasons why people use a bike and move around with it. Several different suitable options could be selected for this question (Figure 6). In addition, it was possible to add reasons next to the given ones in the table. The most popular answer was the reason for spending for recreation/leisure, which was chosen by 55.7% of the respondents. The fact that people use bike to go to work or school also plays a big role in the use of the bicycle - 52.2% said that. 49.6% of respondents think that it is the fastest way to move from one point to another in the city. Also, 47.8% of people prefer to ride a bike because it improves their health and makes them move more. The lowest percentage of 23.5% said they cycle due to environmental and/or social reasons. One person added that they use the bike for convenience.

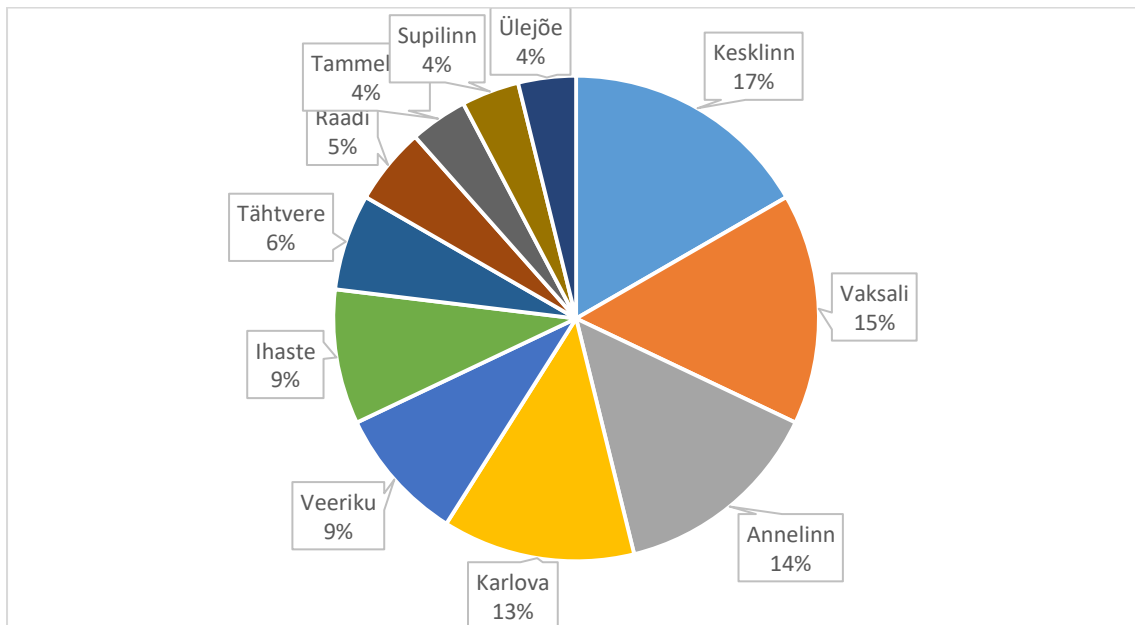


**Figure 6.** What is the main reason you ride a bicycle?

When asked if people usually prefer to use their own bicycle or the Tartu city rented bicycle, people answered in two ways. 55.7% of the respondents use their bike to get around the city. But a surprisingly high percentage - 44.3% of people use the new rental bikes offered by the Tartu bicycle sharing system. Examining more precisely who are the people who use their own bikes and who are the ones who prefer to use rented bikes, it is found out that man at the age of 18-25 are the ones who use the rented bikes the most. Overall in all age groups, females prefer to use their own bikes over the rented ones.

The 7th question was about people's favourite districts/streets in Tartu, where they like to cycle most and why. A total of 97 out of 115 people answered this question. There were also 18 people who did not answer this question for one or another reason.

Out of 97 people, 78 people mentioned their favourite districts (Figure 7), 12 people pointed out their favourite street (s), and 7 people did not have a favourite district/street and they just gave a description of what a good street/district for them would look like.



**Figure 7.** Favorite districts in Tartu for cyclists.

Kesklinn (17%) - The city centre of Tartu and the most popular district among the respondents. Regarding the district, it was pointed out that it is good to cycle there because it is easy to move from point A to point B. In addition, good roads and a lot of space were brought out by the river Emajõgi.

Vaksali (15%) - Second favourite district. People said that there are new and logical traffic roads that are wide and well lit. In addition, you can cycle there without having to stop all the time, and the road surface is good enough. People especially enjoy the roads on Vaksali street and the newly renovated Vanemuise street.

Annelinn (14%) – This district was also a very popular choice. According to the respondent, there is a good atmosphere, a lot of space to cycle and many people also live in this area. A new light traffic road and a road around Eeden shopping centre was brought up a lot.

Karlova (13%) - Many people like to drive in the Karlova district because there are not so many cars but if there are, they drive slowly (most streets with a 30km / h limit) and the atmosphere is good and calm. In addition, it was pointed out that the district is beautiful and the people there enjoy cycling and that is why it is good to ride there. Võru street was brought out several times separately.

Veeriku (9%) - Respondents claim that proper cycling roads have been built in the Veeriku district and that there are many bicycle parking lots. The area is also considered to be good and peaceful. Good streets to cycle on are Ilmatsalu street and also a small section of Näituse street from Veeriku Selver to the railway.

Ihaste (9%) - The only elements that people brought out of the Ihaste district were comfortable roads and well-constructed light traffic roads.

Tähtvere (6%) - People say about the Tähtvere district that there are quiet streets with only a few cars. In addition, there are health trails where it is good to ride a bike.

Raadi (5%) - The surroundings of the Raadi manor park and the Estonian National Museum (ERM) have left the best impression on the people living in the Raadi district. There are wide roads, and there is quite a calm ride around.

Tammelinn (4%) - A quiet district, where, like the Karlova district, people cycle around the streets a lot.

Supilinn (4%) - Quiet streets with less traffic. The area along the Emajõgi River, where the roads are well maintained and in good condition, was especially highlighted.

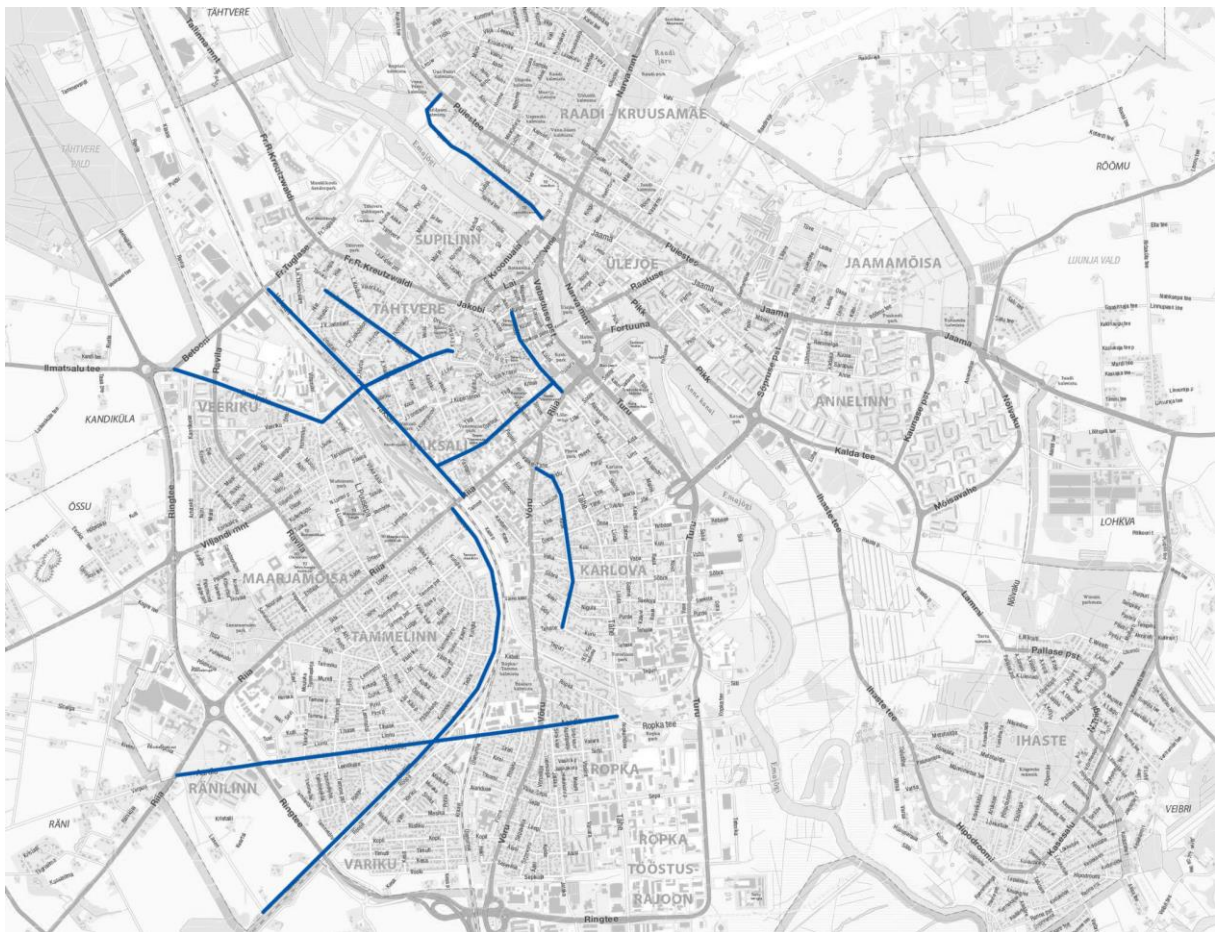
Ülejõe (4%) - The area along the Emajõgi River, where you can drive for a long time without having to stop all the time.

There are a total of 17 districts in Tartu, of which 11 districts were brought out by respondents. The 6 districts that people never mentioned are: Jaamamõisa, Maarjamõisa, Ropka, Ropka-tööstusrajoon, Ränilinn and Variku.

As a result, it can be assumed that either light traffic roads/sidewalks are not well developed in these districts or there is no opinion at all because people do not cycle there much. In addition, there are fewer bicycle parks in these districts than in others

If the cycle circulation is developed better in these districts, then the traffic in Tartu as a whole would be better. In addition, it would also attract people living/working in these districts to use more bicycles, which in turn would reduce car traffic in the city.

As mentioned before, 12 people pointed out their favourite street (s) in Tartu. A total of 10 streets were pointed out: Taara puiestee, Aardla, Näituse, Vaksali (the most popular answer), Kesk, Vanemuise, Raudtee, Ilmatsalu, Ülikooli and Ujula Street (Figure 8).



**Figure 8.** Favorite streets to cycle in Tartu, marked with blue (base map: tartu.maps.arcgis.com).

Examining the characteristics of the five different streets that were brought out it is clear that all these streets have been built in the last ten years and great emphasis has been placed on light traffic roads. People prefer streets that have roads that are separated from cars as well as from pedestrians.

- **VAKSALI STREET**

**Description of the street:**

In 2017 Vaksali street was renovated, which changed the car parks and light traffic roads wider and bigger. In addition to light traffic roads, almost one and a half meters of space was built for cyclists on both sides of Vaksali Street, where they can ride without worries. Bike lines are separated from car lines by granite curbs that are dug into the asphalt. The same granite curbs also separate the bike path from the sidewalk. In addition, there is a beauty and separation strip stacked between cubes with a side length of eight centimetres between the sidewalk and the car line.



Google  
(Google maps, 2019)



- **ÜLIKOOLI STREET**

**Description of the street:**

For a long time, the section between the town hall and Barclay Park in the direction of the town hall was impassable to pass for cyclists. The sign promised, but in reality, it was not possible to drive there. In 2019, however, this section of the road was been renovated. The street is now covered with an Old Town suitable block of stone, and instead of the former roadside parking lots, a wide, pedestrian-friendly sidewalk was built, which is tiled with granite tiles. The speeds of vehicles are determined by the thresholds built into the street section. It is forbidden to stop vehicles on the completed bicycle and footpath.



(Author, 2021)

- **NÄITUSE STREET**

**Description of the street:**

The section of Näituse Street has also been made comfortable for both cyclists and pedestrians. On one side of the street, the car road is separated from the light traffic road by a small green strip, and on the other side of the street, there is a small strip separated from the car road for cycling only. Road markings for the street have been made in this regard. The light traffic road separated by a green strip is also divided into two by road markings - one side is for pedestrians and the other side is for cyclists.



Google  
(Google maps, 2019)

- **KESK STREET**

**Description of the street:**

Very good work has also been done on the construction of Kesk Street. Bicycle paths on both sides of the chestnut alleys and sidewalks in front of the houses are built. There is a car road between the sidewalk and the bike path. The cycle path starts from Riiamäe and reaches the Võru-Aardla cross through Kesk Street.

Cyclists do not have to see at each intersection whether cars need to be given way. The traffic organization has been changed so that Kesk Street - and thus its cycle paths - are the main road with respect to the intersecting streets, with the exception of Vaba and Sõbra, where traffic still follows the right-hand rule.



(Google maps, 2014)



- **VANEMUISE STREET**

**Description of the street:**

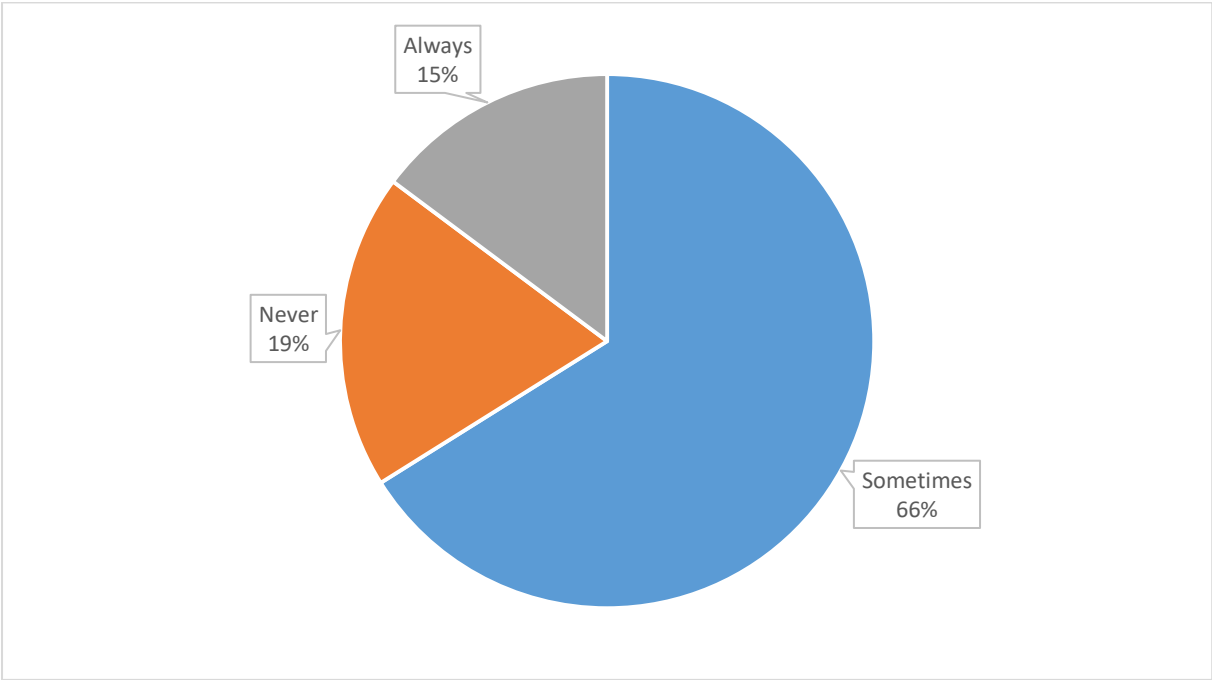
On Vanemuise street there has preferred pedestrian and bicycle traffic. Spacious bicycle lanes have been built on both sides of the street on the same level as the road. The traffic flow has been reduced - all traffic from Vanemuise Street to Pepler Street to Ülikooli Street has been changed to one-way. Behind the one-way street, turning is the desire to reduce the number of cars in the city centre.



(Author, 2021)

Those 7 people, who did not have a favourite district/street, just described what a good street/district for them would look like. They prefer wide streets, separated from car roads and well maintained. If the situation is even better it is considered that even sidewalks and cycling roads could be separate from each other. The main reason for that was that people do not want to "fight" with cars and pedestrians for their place. One person said that they cannot describe what they like or would like because they ride a bicycle out of necessity and not of their own will.

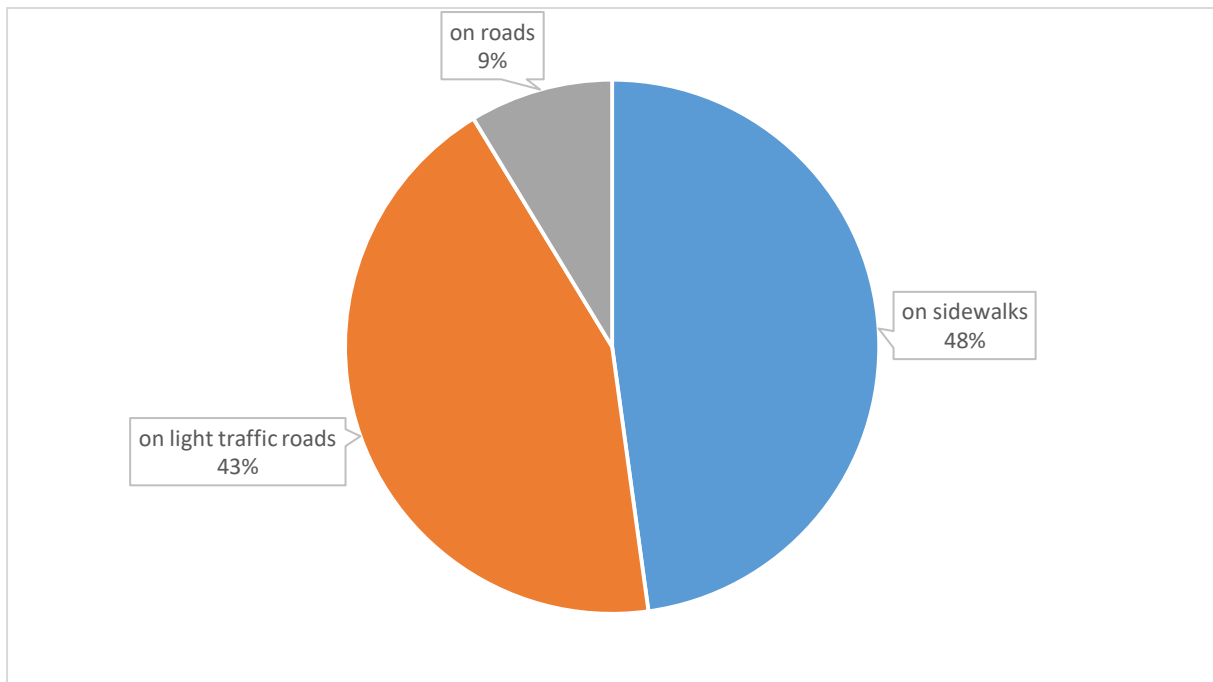
8th question was wondering how often people cycle with others. The answers are showing that people prefer sometimes to ride with others. 19 % of people say that they like to cycle alone at all times and 15 % of the cycle always alone (Figure 9). All this shows that cycling in Tartu is not only for people to get one point to another but also a way to spend some time with friends and/or acquaintances.



**Figure 9.** Cycling with others.

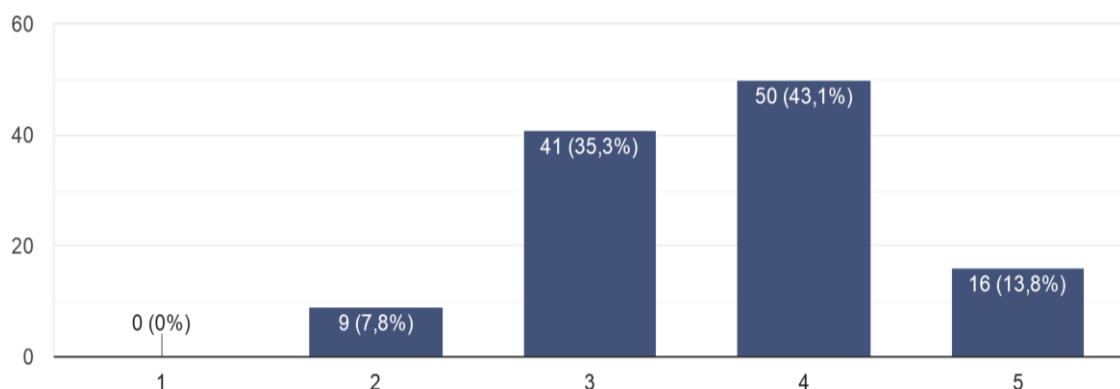
If we look at the overall picture of the city it is to be seen that people cycle almost everywhere. One of the questions was whether people prefer to drive on roads, on sidewalks or light traffic roads (Figure 10). A large proportion of people, 48%, prefer to drive just on sidewalks and almost as many respondents, 43%, prefer to drive on light traffic roads. When receiving the feedback, it became clear that since there are few light traffic roads in Tartu, everyone has to cycle on sidewalks. However, if more light traffic roads were added and they were as good, then most people would drive on light traffic roads.

9% of respondents were those who said they usually drive on roads. 50% of them were men and the other 50% were women. In terms of age, those people who prefer to drive on roads are younger people, aged 18-25. It turns out that younger people are bolder and have the will and courage to drive in the middle of cars.



**Figure 10.** Cycling with others.

Questions number ten was on human safety: On a scale from 1 (Not safe at all) to 5 (Very safe), how safe do you feel cycling in Tartu? (Figure 11). Since the majority of respondents answered on a scale of one to five as four - 43.1%, it can be assumed that people feel somewhat safe. People who answered three on a scale of one to five, 35.3%, feel neutral. For them, the city is not dangerous, but it is also not completely safe. 7.8% of the respondents think that it is relatively dangerous to move around Tartu, but no person answered that it is very dangerous to move around here and they do not have a sense of security. 13.8% of people feel very safe when driving around Tartu.



**Figure 11.** How safe do you feel if cycling in Tartu?

Examining more closely whether women or men feel safe, it is found out that of the sixteen respondents who answered that Tartu is very safe, half were men and half women (8 women and 8 men). However, when examining who does not feel safe, it turned out that most women are those who do not feel safe. Seven of the nine respondents were women and only two were men.

The next two questions were yes / no questions. First, it was investigated whether the respondents also use a helmet when riding a bicycle. 1 person decided not to answer this question for some reason. As many as 94.7% of the respondents answered that they do not wear a helmet. It can be concluded that whether they feel safe enough when driving around, or whether wearing helmets is not as self-evident as it should be. However, six people, three women and three male, or 5.3% of the respondents, dared to say that they were wearing a helmet. Those six people were all at the age of 26 or older. Although in Tartu it is mandatory for people under 16 to wear a helmet, it seems that older people wear a helmet more.

The answers to the 12th question, whether people consider Tartu to be a bicycle-friendly city, were overwhelmingly answered yes - as much as 72.2%. People who find that Tartu is not a bicycle-friendly city were 27.8%. Unfortunately, this percentage is still high and there should be many changes made to the city to improve it.

The next question, however, answers exactly what should be done in Tartu to make people move more and what would make it a more bicycle-friendly city. Again, people were given answer answers and could choose multiple answers at once. In addition, they were able to state their own reasons.

Ninety people, that means 78.3% of those who answered the question, would like to see bike paths separated from car roads. However, 60.9% want better road conditions and 51.3% want to see cycle paths that run through different green areas. 43.5% said they wish to see better road behaviour by car users and cyclists. 41.7% think that bike lanes and roads, in general, are poorly lighted at night time and they could be better much better. A small percentage 37.4%, would also be people who want to see an improved bicycle parking all over Tartu. As Tartu is known as a city on the banks of the river Emajõgi, 35.7% of the respondents would like to see more bike paths along the riverside.

People added reasons like:

1. Clean bike paths with no leafs
2. More careful pedestrian behaviour
3. Better connections between different places in Tartu, like a drive from Tähtvere to the University of Life Sciences.
4. More bike parking stations
5. If electric bikes are more accessible (referred to Tartu city bike system bikes)
6. A better network of light traffic routes, especially at intersections
7. It is still dangerous to drive on bikes (highways) in places with heavy traffic. The city government tends to develop cycle paths where it is convenient to do them (space is limited), but not where there is the greatest need (areas with more traffic, where space is scarce).
8. More electric bikes. As long as a person is not sure that he has transport to get home, the bicycle cycle in Tartu will not replace cars. In addition, electric bikes could be available in winter as well
9. If they lived in the city
10. The need for this

The various answers added by people show that there is still much that can be done to improve the cycling culture in our city. Most of these proposals are easy to deal with and would add new bicycle users to the city.

As there is much happening in the world at the moment, and our lives and circumstances have changed a lot, people's habits in their daily lives have also changed. It is much preferred to be outdoors and exercise a lot. The next question asked the residents of Tartu whether Covid-19 has also changed their cycling habits and whether they are cycling more or less due to this situation. 73% of respondents stated that they ride the bike exactly as much as before and that this pandemic, which is happening all over the world, has not affected them in this regard. However, 15.7% of people ride a bike less than before because of this situation. Fortunately, there are also those who have started using the bike more, in total 11.3% of the respondents said that today they really have started using bikes more.

The 15th and also the last question was for people who wanted to add a comment to the whole topic of the questionnaire. There were a total of 12 different questions/ways of thinking that people had when filling in this questionnaire (Figure 12).

<i>Cyclists MUST monitor traffic and cars while riding in the city and not focus on their "rights". In traffic, all parties must treat each other with respect."</i>
<i>"There could always be bikes in the parking spots, some bike spots are constantly empty, e.g. in the park bike park."</i>
<i>"Question about Tartu and bike-friendliness - compared to what? It is pleasing to say that the matter is being dealt with, sad that it has not come very far. Larger intersections in Tartu are practically all designed only for cars. Bicycle paths are mostly built where there is already calm traffic or wide sidewalks."</i>
<i>"Cyclists must always ride on light traffic routes and not climb on highways."</i>
<i>" Tartu may be better for cycling than Tallinn, but in logical places, you still run out of bike paths."</i>
<i>"Separate bike paths would be needed."</i>
<i>"More electric bikes are needed, too often there are none in parking lots."</i>
<i>" I use the bike as a means of transport and drive where it is possible and safest - even this safest is not always a very good option. Tartu is full of illogical roads, too high curbs, uncomfortable and broken paving. Traffic culture leaves much to be desired - pedestrians walk along the cycle path separated by a line. Cyclists often ride on a one-way bike path in the opposite direction, and so on."</i>
<i>"I cycle because it consumes calories, saving nature."</i>
<i>"Pedestrians could be more considered for bikes on sidewalks."</i>
<i>"As a driver, cyclists are annoying and dangerous, because there are no separate roads for them in Tartu + the cyclists themselves are also very careless."</i>

**Figure 12.** Questions/comments at the end of the questionnaire

## **3.3 Interviews**

### **3.3.1 Interview with mobility expert**

The first interview was done on the 30th of October 2020 with Tartu mobility expert Aksel Part. A total of four different kinds of questions were asked regarding the Tartu city cycling movement. The questions were mainly formed from the questions that arose during the observations, and most of them also overlap with the concerns/questions that emerged from the questionnaire. This interview provides answers and shares thoughts on both of the methods used.

First, the general opinion was asked as to whether Tartu is a bicycle-friendly city and what changes should be made to further improve this situation in the city. However, Aksel Part stated that due to its compactness, Tartu is naturally a good city for cycling, but as a whole, he does not consider Tartu to be a bicycle-friendly city at the moment. He cited the fact that the city government does not currently have structures to promote cycling - the measures are fragmented and incomplete. This means that good things are done from time to time (such as this bike-sharing system or Vaksali Street cycle paths), but they are not part of a comprehensive and consistent strategy to promote cycling. The Tartu cycling strategy is currently being adopted, which is quite good in itself, but it will probably take a long time to incorporate this document into the daily activities of the city government. The lack of consistent work is evident in all aspects of cycling policy: cycling infrastructure is largely very poorly designed (with the exception of Vaksali Street), winter infrastructure maintenance is insufficient, the speed and convenience of car traffic is still a priority in the construction of shared infrastructure, communication measures are essentially non-existent and the collection and use of data on cycling are insufficient. In order to improve the situation, in his opinion, it would be necessary to create internal structures (agencies/departments) of the city government, which would deal with the promotion of bicycle traffic on a daily basis. In addition, stronger political will would be needed to bring about the changes in modal shift targeted in the strategic documents, but this is a process that can only take place slowly with changes in public opinion.

It was also talked about the different districts and streets that are the most dangerous for cyclists and the safest. In terms of districts, the mobility expert could not point out specific ones, he rather said that the problem is in standard city-wide solutions and also on larger roads more generally it is much more dangerous to drive than on small ones.



As it can be seen that over time the use of bicycles has become more popular in Tartu, it was asked Aksel what he thought would make Tartu city residents use fewer cars and bicycles even more than they do now. He briefly stated that, in general, cycling simply needs to be made faster and more comfortable than driving. This requires constant work by the city government and more attention to the construction of streets and the creation of new roads.

Finally, the mobility expert was asked how he likes to see the future of Tartu as a bicycle city. Aksel Part stated that he would like to see a bicycle culture where it is normal to do daily movements (to work, school, shop) by foot or bicycle because this is the fastest, most comfortable and logical way to move around in Tartu for all age groups (both 8- and For 80-year-olds). This requires, among other things, a significant slowdown in car traffic and the construction of suitable cycling infrastructure in line with international best practice. The use of bicycles could also be high in winter, mainly due to the very good maintenance of the infrastructure.

### **3.3.2 Interview with Tartu Smart Bike**

The second interview was done on the 5th of April 2021 with people behind the Tartu Smart Bike-share system. A total of four different kinds of questions were asked regarding the city bike-share system. The exact questions asked and answers got are as followed:

**Question 1** - *The questionnaire revealed that during the summer time it is difficult for people to find electric bicycles in stations. Most parking lots are either completely empty of bikes or fully loaded with them. How is this problem being addressed?*

**Answer** - Bike system circulation technicians use a program based on artificial intelligence that gives clear work instructions on where and when to move them. For example where there are too many bikes and should be reduced or where more bikes are needed. It is a self-learning program that also monitors the frequency of parking lots and operates accordingly. Thanks to this program, the quality and efficiency of the service we offer will improve. This bike parking help system is available from 07:00 in the morning until 23:00.

**Question 2** - *Electric bikes are preferred to use considerably more than regular bikes. Are there any plans to add them to Tartu this summer? How long does an electric bike battery last on average without having to be recharged in the meantime?*

**Answer** - We are aware that electric bicycles are preferred. But the total number of our bikes will not grow this season. According to the data issued by the manufacturer, the battery can withstand about 50 km, but in reality up to 35 km. The user cannot remove a bike with less than 50% battery life from the parking lot.

**Question 3** - *In winter time, only regular bikes are in use - do you also somehow maintain bicycle stations in winter (for example clean them of snow, check that the bikes are intact, etc) or do something else that make it more comfortable for people to use these bikes in winter time?*

**Answer** - During the winter time, in addition to the usual work, our technicians also perform cleaning of parking lots from snow and leaves. In addition, maintenance is carried out: checks are made and the function is checked. The condition of the wheels is also checked on an ongoing basis, including in winter.

**Question 4** - *Has such a bicycle circulation system in Tartu justified itself, and can we see similar systems in other Estonian cities in the future?*

**Answer** - In Tartu, bicycle cycling has been very popular and has certainly justified itself. In the light of such a large investment, the worst situation would have been where bike stations and bicycles are present and no one is using them. The use in Tartu is huge.

We are aware that the city of Viljandi is actively engaged in cycling and also the system covering the island in Hiiumaa will be operational this year. However, it is not known in detail about the progress of these projects.

## **4. DISCUSSION**

This chapter briefly summarizes and analyses the results of the observations and the questionnaire. A more in-depth analysis is presented in the results chapter. My conclusions and comments are presented at the end.

### **4.1 Observations**

A total of 3 different observations were made: observation during the day, observation during the dark and observation during the snow. In general, observations showed that more bicycle paths would need to be added to the city, and those that exist themselves are in relatively good condition. However, more attention should be paid to the lighting of cycle paths and sidewalks in the dark and road maintenance in general.

Interesting finds found out turning observations: women preferred to ride their bikes more than men who preferred to ride city bikes. Older people still preferred to ride on the sidewalk, even though when there were separate cycle paths. Helmets were used by very few people, mostly children. Due to the great increase in the service of food couriers in recent years, many of these riders can also be seen in the street scene. Often the sidewalks are narrow for pedestrians as well as cyclists, more bike lanes along the car road are needed.

### **4.2 Questionnaire**

Based on the questionnaire, it was found that people prefer to use both their bike (56%) and the city bike (44%) relatively equally. However, problems have arisen due to the great use of city bikes - there are either not enough bikes or the bike stations are so full of bikes that it is more difficult to return the bike.

People mainly preferred streets/districts with good cycle paths and good connections to different parts of the city. There are quite a lot of them in the city of Tartu, but there are also many places where there are no logical and simple solutions on light traffic roads and also at intersections. Such illogical and inconvenient solutions often drive cyclists to the roads, making accidents quicker to happen. This is also shown by the safety question asked in the questionnaire, which shows that it is relatively unsafe for people to move between cars. The feeling of safety in the city was mainly between four and three on a 5-point scale (1-Not safe at all, 5 -Very safe). This shows that people feel relatively safe, but the situation could be improved.

In general, Tartu is considered to be a bicycle-friendly city (72% of respondents said so) and due to the compactness of the city, people like to use a bicycle to get from point A to point B.

#### **4.3 Problems and concerns raised**

Comparing different data it is seen that Tartu has a lot of potential for becoming a bike-friendly city of Estonia. People are enjoying more and more cycling and this has improved the cityscape and peoples well-being in general. Although, the city still has a long way to go to become a very good bike city and satisfy both cyclists and other road users. The main concerns in the city are: lighting on roads at night-time, road maintenance in winter but also at other times (leaf cleaning in autumn, various road maintenance), insufficient logical connections between light traffic roads and intersections, a feeling of insecurity between cars and minor problems with the city's bike-sharing system during peak hours.

## CONCLUSION

The aim of this research was to look at the use of bicycles in the city of Tartu, the main routes used, numbers over time and the views and perceptions of the users old and new. In order to achieve the goal, several observations were carried out at different times and locations in Tartu and an online questionnaire asking about peoples cycling habits was conducted. Due to the questions/concerns identified in the questionnaire and from observations, a couple of interviews with experts were also conducted.

Comparing different data sets, it is clear that bikes have been used more and over the years. In Tartu, the city's bicycle circulation system, which has become very popular in a short time and has attracted even the least bicycle-friendly people, has greatly contributed to this. The cityscape shows that the bicycle is used by both younger and older residents, and both the city bikes and peoples own bikes are relatively equally preferred.

One of the biggest problems in Tartu is cycling infrastructure because the city is full of many different illogical connections and the cycle paths are not well thought out. Most cycle paths simply end off, making cycling relatively difficult and inconvenient. Although the new bicycle circulation system in Tartu has fully justified itself and has worked out great so far, it still also has minor problems. In general, there is a problem in finding free bikes, as demand is high and there are problems with street maintenance. However, all these problems could be solved if the city government paid more attention to the promotion of the bicycle cycle and did everything necessary to improve this system. It would be necessary to create internal structures (agencies/departments) of the city government, which would deal with the promotion of bicycle traffic on a daily basis. As the city already has a clear direction and goal for the future, it should not be a problem to create such a new field/branch for the city government.

The following similar researches could focus on those aspects and design solutions that would help to change the cityscape in real life and make the city of Tartu better for cyclist. For this to happen, even more, thorough observations and experiments should be carried out to see which solution is best suited to the city of Tartu.

## KOKKUVÕTE

Selle uurimistöö eesmärk oli uurida jalgrataste kasutamist Tartu linnas, peamisi kasutatavaid marsruute, palju inimesi üldse rattaga ringi liigub ning kasutajate vaateid ja arusaamu rattakultuurist Tartus üldiselt. Eesmärgi saavutamiseks viidi Tartus läbi erinevatel aegadel ja erinevates kohtades mitu vaatlust ning viidi läbi ka veebiküsimustik, milles uuriti inimeste enda rattakasutuse kohta. Küsimustikust ja vaatlustest esile kerkinud küsimuste / murede lahendamiseks viidi läbi ka paar intervjuud erinevate ekspertidega.

Erinevaid andmekogumeid võrreldes on selge, et rattaid on aastate jooksul järjest rohkem kasutama hakatud. Tartus on sellele palju kaasa aidanud lühikese ajaga väga populaarseks saanud linna jalgrattasüsteem, mis on meelitanud ka kõige vähem jalgrattasõbralikke inimesi seda kasutama. Linnapildis võib näha, et jalgratast kasutavad nii nooremad kui ka vanemad elanikud ning suhteliselt võrdselt eelistatakse nii linna rattaid kui ka enda isiklike rattaid.

Üheks suurimaks probleemiks on eelkõige Tartu linna infrastruktuur, sest linn on täis palju erinevaid ebaloogilisi ühendusi ning rattateed pole piisavalt hästi läbi mõeldud. Suurem osa rattateedest lõppevad lihtsalt ära ning see muudab liikumise rattaga suhteliselt keeruliseks ja ebamugavaks. Kuigi Tartu linna uus rattaringluse süsteem on ennast täiesti ära õigustanud, siis on ka sellega pisemaid probleeme tekkinud. Üldiselt ollakse hädas sobivate rataste leidmisega, kuna nõudlus on suur, lisaks on probleeme inimeste arvates tänavate hooldamisega. Kõiki neid probleeme saaks aga lahendada sellega, kui linnavalitsus suunaks rohkem tähelepanu just rattaringluse edendamisele ning teeks selleks kõik vajaliku, et see süsteem järjest paremaks muuta. Selleks tuleks kokku panna erinevad inimesed ja moodustada üks eraldiseisev allüksus, kes kõige selle lahendamisega igapäevaselt tegelema hakkaksid. Kuna linnal on kindel suund ja eesmärk täiesti selgelt välja kujunenud, siis ei tohiks olla probleemi sellise uue allüksuse/haru loomisel.

Järgmised sarnased uurimistööd võiksid keskenduda just nendele aspektidele ja toimivatele liikluslahendustele, mis aitaksid linnapilti ka reaalses elus muuta ning Tartu linna paremaks teha. Selleks tuleks viia läbi veel põhjalikumad vaatlused ning katsed, et näha milline lahendus sobib Tartu linnale kõige paremini.



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(17.11.2020)

## **APPENDIXES**



**Appendix 1.** Table to collect observation data

<b>DATE:</b>		
<b>TIME:</b>		
<b>WEATHER:</b>		
<b>BIKES USED:</b>	<i>Own bike</i>	<i>Rented bike</i>
<b>GENDER:</b>	<i>Male</i>	<i>Female</i>
<b>How many people in total:</b>		
<b>NOTES:</b>		

## Appendix 2. Online questionnaire form

# Rattaringlus Tartu linnas / The cycle-ability of Tartu

### [EST]

Tere! Olen Eesti Maatülikooli maastikuarhitektuuri eriala tudeng Angela Hõrak ning kirjutan hetkel oma magistritööd teemal: 'Rattaringlus Tartu linnas'. Nimelt uurin Tartu linna elanike arvamusi ja seisukohti jalgrattakultuurist Tartus. Oleksin väga tänulik kui aitaksite kaasa minu lõputöö valmimisele ja leiaksite 3 minutit, et vastata mõnele küsimusele :)

### [ENG]

Hello! I am Angela Hõrak, Landscape Architecture student at Estonian University of Life and Science. I am currently writing my master's thesis on: 'The cycle-ability of Tartu' and for that I am collecting information about people's cycling habits in the city of Tartu. I would be very grateful if you could take 3 minutes to answer some questions :)

\* Kohustuslik / required

### 1. Sugu / Gender \*

Naine / Female

Mees / Male

### 2. Vanus / Age \*

<17

18 - 25

26 - 39

40 - 51

52 - 67

68 +

### 3. Ma olen ... / I am ... \*

Õpilane / *Student*

Täiskohaga töötaja / *Full-time worker*

Osalise tööajaga töötaja / *Part-time worker*

Pensionär / *Pensioner*

Töötu / *Unemployed*

Kodune / *Homemaker*

Muu / *Other*

### 4. Kui tihti sõidate rattaga? / How frequently do you ride a bike? \*

Igapäev / *everyday*

Mõned korrad nädalas / *several times a week*

Mõned korrad kuus / *several times a month*

Mõned korrad aastas / *several times a year*

**5. Mis on peamine põhjus, miks jalgrattaga sõidate? [vali sobivad vastused] / What is the main reason you ride a bicycle? [check all that apply] \***

Tervis/Liikumine / *For health/exercise*

Keskkonnakaitselistel ja/või sotsiaalsetel põhjustel / *for environmental / social reasons*

Töole või kooli sõitmiseks / *To get to work or school*

See on kiireim viis linnas ringi liikumiseks / *It's fastest way to navigate through town*

Vaba aja veetmine/puhkus / *For recreation/leisure*

Muu/ *Other* :

**6. Kas kasutate tavaliselt oma isikliku ratast või Tartu rattaringlusest renditud ratast? / Do you usually use your own bike or Tartu Bike Share bike? \***

Isikliku ratast / *own bike*

renditud ratast / *Tartu Smart Bike Share bike*

**7. Milline on Teie lemmik linnaosa / tänav Tartus, kus Teile kõige rohkem rattaga sõita meeldib? Miks? / What is your favorite district / street in Tartu where you like to ride the most? Why?**

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**8. Rattaga sõites, kui tihti sõidate kellegagi koos? / How often do you ride with others? \***

Sõidan alati üksinda / *Never*

Mõnikord / *Sometimes*

Sõidan alati kellegagi koos / *Always*

**9. Kas tavaliselt sõidate rattaga: sõiduteedel, kõnniteedel või kergliiklusteedel? / Where do you usually cycle: on roads, on sidewalks or on light traffic roads? \***

Sõiduteedel / *on roads*

Kõnniteedel / *on sidewalks*

Kergliiklusteedel / *on light traffic roads*

**10. Skaalal 1 (ebaturvaline) kuni 5 (väga turvaline), kui turvaliselt ennast tunnete Tartus rattaga ringi sõites? / On a scale from 1 (Not safe at all) to 5 (Very safe), how safe do you feel cycling in Tartu? \***

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**11. Kas kasutate rattaga sõitmisel kiivrit? / Do you usually wear a helmet when you cycle? \***

Jah / *Yes*

Ei / *No*

**12. Kas peate Tartut rattasõbralikuks linnaks? / Do you consider Tartu as a bike-friendly city? \***

Jah / *Yes*

Ei / *No*

**13. Mis paneks Teid ratast rohkem kasutama? [vali sobivad vastused] / What would help you start cycling or cycle more? [check all that apply] \***

Paremas korras teed / *better road conditions*

Rattateed mis on autoteedest eraldatud / *bike paths separated from car roads*

Paremini valgustatud teed / *more lights on paths*

Rohkem rattateid, mis kulgeksid läbi rohealade / *more bike paths that would run through green spaces*

Rohkem rattateid, mis kulgeksid mööda Emajõe / *more bike paths along the riverside*

Rohkem ratta parklaid / *improved bicycle parking*

Autojuhtide parem käitumine teedel / *Better road behavior by car users*

Muu / *Other* :

**14. Kas kasutate jalgratast rohkem või vähem seoses tekkinud Covid-19 olukorraga? Do you cycle more or less as a result of the Covid-19 situation? \***

Rohkem / *More*

Vähem / *Less*

Kasutan sama palju kui varem / *Same as before*

**15. Kas soovite antud teema kohta midagi lisada? / Any comments you would like to add?**

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**Appendix 3.** Lihtlitsents lõputöö salvestamiseks ja üldsusele kättesaadavaks tegemiseks ning juhendaja(te) kinnitus lõputöö kaitsmisele lubamise kohta

Mina, Angela Hõrak,

Sünniaeg 04.10.1995,

1. annan Eesti Maaülikoolile tasuta loa (lihtlitsentsi) enda loodud lõputöö  
The cycle-ability of Tartu,

mille juhendaja on Simon Bell,

- 1.1. salvestamiseks säilitamise eesmärgil,
- 1.2. digiarhiivi DSpace lisamiseks ja
- 1.3. veebikeskkonnas üldsusele kättesaadavaks tegemiseks

kuni autoriõiguse kehtivuse tähtaja lõppemiseni;

2. olen teadlik, et punktis 1 nimetatud õigused jäävad alles ka autorile;

3. kinnitan, et lihtlitsentsi andmisega ei rikuta teiste isikute intellektuaalomandi ega isikuandmete kaitse seadusest tulenevaid õigusi.

Lõputöö autor */allkirjastatud digitaalselt/*

allkiri

Tartu, 24.05.2021

**Juhendaja(te) kinnitus lõputöö kaitsmisele lubamise kohta**

Luban lõputöö kaitsmisele.

Simon Bell

*/allkirjastatud digitaalselt/*

*(juhendaja nimi ja allkiri)*

*/digiallkirjas/*

*(kuupäev)*