

Making the urban fringe more attractive for running and cycling purposes

A quantitative study of the relationship between the built environment and physical activity

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1. Abstract

Society has become more and more urbanized over the years, while city-life has proven to negatively affect mental health. Physical activity, like running and cycling, has, on the other hand, proven to be beneficial for the mental health of people. Therefore it is important that urban dwellers are being stimulated to sport more. Because cities have become crowded, it makes sense to get people to sport more outside city limits. The urban fringe might be perfect for this. That leads to the central research question in this study: How can the built environment in the urban fringe in the Netherlands be made more attractive for urban-based runners and cyclists? An online survey was placed in Facebook groups and spread through running and cycling associations to gather the needed data. Descriptive statistics and Chi Square tests were used for data analysis. The results indicate that the urban fringe is already used a lot by urban-based runners and cyclists in the Netherlands. Factors that are seen as important when runners and cyclists choose a location to sport in include: traffic, busyness, proximity, accessibility, aesthetics, greenery, amenities like availability of cycling and walking paths, safety, and maintenance. Factors related to the built environment in the urban fringe are rated as fairly good by the respondents. This might be an explanation for the fact that the urban fringe is already used quite often for running and cycling purposes. The study concludes that in order to make the urban fringe in the Netherlands more attractive for running and cycling purposes, the following factors that are related to the built environment have to be improved: safety, accessibility, level of maintenance, greenery, traffic, aesthetics and availability of cycling and walking paths. Interventions in the urban fringe that might achieve this, could be improving the aesthetics and greenery by planting more trees or improving safety, improving accessibility and separating traffic and sportspeople by installing more dedicated walking and cycling paths.

2. Introduction

2.1. Background

Over the years people have become more and more urban-based. Right now more than half of the world's population is living in urban areas (United Nations, 2014). In Europe, this percentage is even higher. All in all, it can be said that because of urbanization, urban areas have become busier with traffic, more polluted and noisier. Several studies claim that living in urban areas impacts people negatively on a mental level.

Lederborg et al. (2011) report the following in their study on the effects of city living and urban upbringing: cities have both health risks and benefits. Mental health is, however, negatively impacted. The prevalence of mood and anxiety disorders is higher in urban dwellers. People who are born and raised in urban areas have more risk to develop schizophrenia.

Studies on the effects of physical activity on mental health generally conclude that physical activity is beneficial for the mental health of individuals and for their quality of life in general. Taylor et al. (1985), for example, state that exercise and physical activity improves self-confidence, self-concept and cognition. This may improve mental health and even prevent mental disorders.

These findings in the existing literature highlight the importance of physical activity and exercise for urban populations. Cities are becoming more and more crowded through the ongoing process of urbanization. This might be discouraging urban residents to conduct sports activities such as running and cycling within the city. Therefore it makes sense to get people to sport in less crowded areas. One idea to do this is to make places in the urban fringe, just outside the city, more attractive for runners and cyclists. This is the idea that is explored in this thesis. The urban fringe is by definition an area that is not urban, nor rural. The population density ratios are intermediate between urban- and rural areas. Traffic density and air pollution are therefore likely to be less in the urban fringe, as compared to the city. Therefore, getting people to sport more in the urban fringe is beneficial for the quality of life of individuals and for public health in general.

2.2. Research questions and -objectives

The aim of this research is to find out how the built environment in urban fringe in the Netherlands can be made more attractive for running and cycling. Furthermore this thesis

aims to provide insight on how the built environment in the urban fringe is influencing the levels of physical activity.

The main research question that will be answered in this thesis is as follows: **How can the built environment in the urban fringe in the Netherlands be made more attractive for urban-based runners and cyclists?** To answer this central question, there is a need to split the research problem up into secondary research topics and -questions. To begin with, this thesis explores how the built environment can affect levels of physical activity, according to existing scientific literature on this topic. The answer to this secondary research question will serve as the theoretical framework on which the rest of the research is based. Further secondary research topics will be covered with the use of primary data that is collected through a survey. The answers to these questions can be found in the '*Results*' section.

Secondly, there is a need to find out to what extent runners and cyclists already use the urban fringe as a place to sport in. Thirdly, this study covers the question of how important certain factors (*access, aesthetics, greenery, amenities, safety, maintenance, proximity, traffic, familiarity, features and busyness*) are when it comes to making a choice for a place to sport in. This question is essential for this study because if one aims to increase the usage of the urban fringe for sports activities, there is a need for understanding to what extent urban dwellers find certain factors important in their choice for a place to run or cycle in.

Fourthly, the survey aims to find out how factors related to the built environment (*access, aesthetics, greenery, features, amenities, safety, traffic and maintenance*) in the urban fringe is perceived by the runners and cyclists who actually sport here regularly. Of course, the urban fringe does not exist, places that can be classified as urban fringe can still vary in their exact geographic pattern between locales (Sharp & Clark, 2008). Still, it is valuable for this study to get a general view of how runners and cyclists perceive certain aspects of the urban fringe. The fifth secondary research question that is covered in this thesis is whether or not runners and cyclists would actually sport more in the urban fringe if the built environment there was to be improved.

Finally, it is interesting to find out if there are differences between cyclists and runners regarding the factors that they find important in their choice for a place to sport in, and regarding their perception of the built environment in the urban fringe. When the data from the surveys is analyzed and the answers to the secondary research questions are known, a well-supported answer to the main research question can be formulated.

In short, these are the secondary research questions that are answered in this study: (1) how does the built environment affect levels of physical activity, according to existing scientific literature on this topic? (2) To what extent do runners and cyclists already use the urban fringe as a place to sport in? (3) To what extent are certain factors (*access, aesthetics,*

greenery, amenities, safety, maintenance, proximity, traffic, familiarity, features and busyness) important, when a choice for a place to sport in, is to be made? (4) How are factors that are related to the built environment (*access, aesthetics, greenery, features, amenities, safety, traffic and maintenance*) in the urban fringe perceived, by the runners and cyclists who actually sport here regularly? (5) Would runners and cyclists sport more in the urban fringe if factors related to the built environment there were to be improved? (6) What are the differences in the results between cyclists and runners?

2.3. Key concepts

In this thesis, the concepts 'urban fringe' and 'built environment' are often mentioned and discussed. To help the reader understand what this study is about, these concepts are defined in this section.

The rural-urban fringe or urban fringe in the Netherlands is the place which is central in this study. Therefore it is essential that this concept is clearly defined. In this thesis, the following definition of urban fringe is used:

'Location beyond the limits of the legal city, in the 'agricultural hinterland,' exhibiting characteristics of mixed land use, with no consistent pattern of farm and nonfarm dwellings. The residents are involved in rural and urban occupations. The area is unincorporated, relatively lax zoning regulations exist, and few, if any, municipal services are provided. The area shows potentialities for population growth and increasing density ratios. Present density ratios are intermediate between urban and rural.' (Kurtz & Eicher, 1958, p. 36-37).

Another important concept in this thesis is the built environment. This concept is important to clarify beforehand because this study explores the relationship between sports activities and the built environment. The following definition of the built environment will be used throughout this study: *"Broadly defined, the built environment is the human-made space in which people live, work, and recreate on a day-to-day basis. It includes the buildings and spaces we create or modify."* (Oleru and Roof, 2008)

2.4. Structure of the thesis

In this chapter the subject, research questions and most important concepts in this study were introduced. In chapter 3 the theoretical framework, on which this study builds, is discussed. Chapter 4 consists of a discussion in which the methodology for the collection of primary data in this research is argued. The quality of the gathered data is also reflected upon in this chapter. In chapter 5 the results of the data analysis and the answers to most of the secondary research questions are presented. The conclusion of the study, which includes an answer to the main research question and a reflection on the study, can be found in chapter 6.

3. Theories and relevance

3.1. Academic relevance

In the *'Background'* section, the societal relevance of this study was already discussed. This chapter starts by explaining the academic relevance of this research.

From literature reviews such as Koohsari et al. (2015) and McCormack et al. (2010) and evidence reviews such as Kaczynski & Henderson (2007), it becomes evident that a lot of research has been done on the relationship between the built environment and physical activity. The built environment can inhibit and facilitate participation in physical activity (Sallis et al., 2012). The literature on this subject agrees with the statement that the built environment can influence levels of physical activity. More specifically, there is research that shows the relationships between physical activity and the features and amenities of public green spaces such as parks (which are part of the built environment). Places in the rural-urban fringe could also be identified as public green space, which makes some of the current research very relevant to the central research question in this study. In the literature, there is some evidence that non-park public open space (such as places in the urban fringe) might be important for physical activity (Brownson et al., 2001).

Koohsari et al. (2015) propose a research agenda in the field that studies the relationships between public open space, urban design and physical activity (active living research). In the conclusion of this article Koohsari et al. (2015) identify research gaps in the field where the relationship between the built environment and physical activity are studied. Koohsari et al. (2015) propose the need for having a better understanding of how individual public open space attributes are associated with physical activity.

The primary data that is collected in this study amounts to closing the research gap that Koohsari et al. (2015) discuss because, in the survey, respondents are asked to what extent they find certain characteristics of places important in their choice for a location to run or cycle in. Furthermore, this study adds to the existing literature in this field by placing the relationships between the built environment and physical activity in the context of the urban fringe. Moreover, the relation between the built environment and physical activity has never been researched for different forms of physical activity, like running and cycling. It is, of course, a possibility that runners find different aspects of the built environment stimulating for physical activity than cyclists do.

3.2. Theoretical framework

The theoretical foundation of this study consists of the relationship between the built environment and levels of physical activity, which is explored and researched in other literature. Sallis et al. (2012) provide an ecological model of four domains that influence physical activity (figure 1). The choice to use this model is made because it is from a fairly recent study.

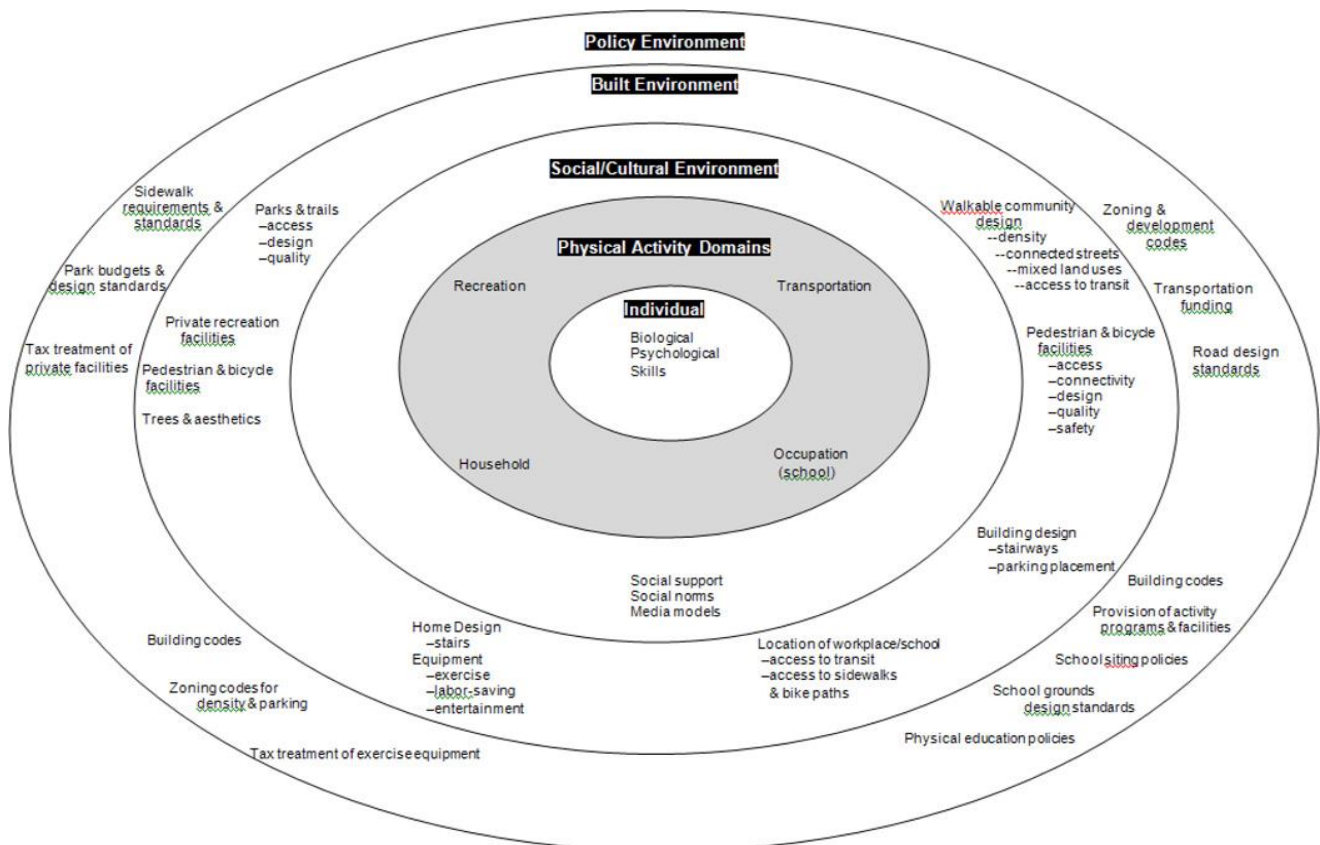


Figure 1. Model of the domains that influence physical activity (Sallis et al., 2012)

In this study, there will be a focus on the upper-left part of the model because running and cycling for sport can be defined as recreational physical activities. Furthermore, in this study, only the domain of the built environment will be used. If the concepts that are not relevant for this study are filtered out of the model provided by Sallis et al. (2012), the concepts that are relevant for studying the relationship between the built environment and physical activity, remain. In the case of public open space, access is an important determinant of recreational physical activity. Furthermore, availability of biking and pedestrian facilities (amenities), aesthetics and trees (greenery) seem to be important (Sallis et al., 2012).

From other literature, more characteristics of the built environment that could potentially influence the attractivity of the urban fringe for recreational physical activity usage are

discernible. McCormack et al. (2010) review 21 qualitative studies on the relation between amenities of the built environment and physical activity of urban residents. Their findings are in line with earlier quantitative research, showing that attributes including safety, aesthetics, amenities, maintenance and proximity are important for encouraging the use of public open space. Furthermore, McCormack et al. (2010) stress that perception of these attributes by people is also of great importance. The article suggests that the mentioned attributes of public open spaces and the perception of these attributes are equally important for promoting physical activity. Proximity is, however, not really relatable to the built environment, but still possibly an important determinant of Physical activity. That's why proximity, but also familiarity (with the place) and busyness (amount of other users), are taken into account in this study, although they are not incorporated in the conceptual model (Figure 2). Familiarity and busyness are concepts, added by the researcher, which are possibly important factors for sportspeople when making a choice for a location to run or cycle in. The researcher came up with some other possible determinants of physical activity, related to the built environment: (the amount of) traffic and features (such as pre-determined routes, availability of benches and water taps).

3.3. Conceptual model

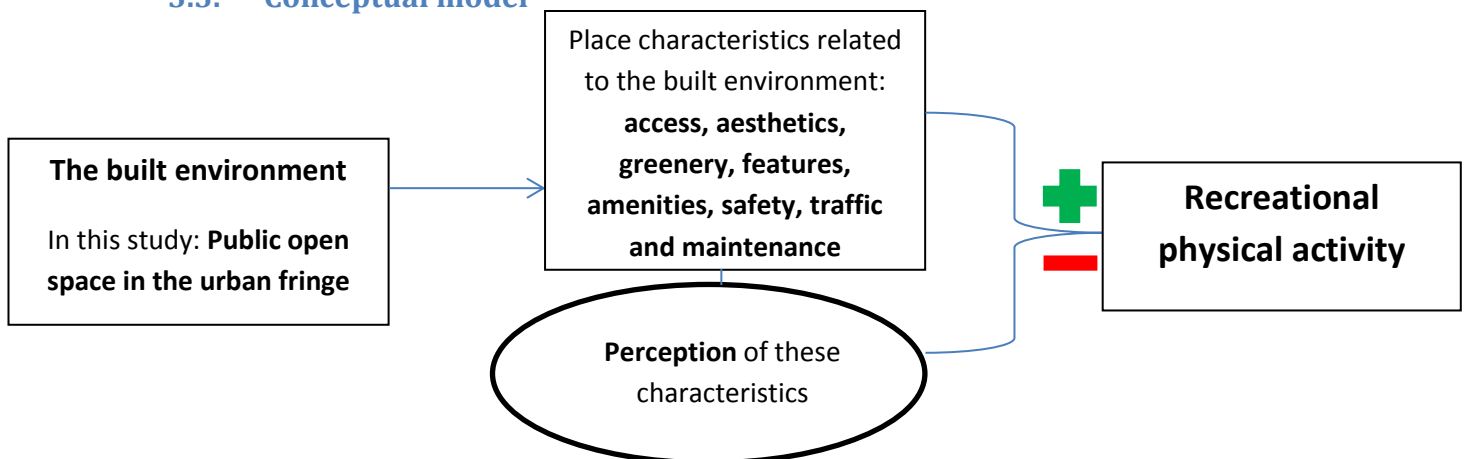


Figure 2. Conceptual model of the relation between the built environment and physical activity

Figure 2 explains the relation between factors related to the built environment and physical activity in public open space. Places have certain characteristics that are related to the built environment which, together with the perception of these characteristics, can positively or negatively affect the levels of physical activity in these areas.

This model will be tested in this study, by asking respondents in a survey to what extent they find certain factors important in their choice for a place to run or cycle in.

The survey also covers the perception part of the model, by asking respondents to rate certain characteristics that are relatable to the built environment in the urban fringe (*access, traffic, aesthetics, greenery, amenities, safety etc.*).

n.b. Proximity is within this study interpreted as the proximity of a place to sport in, to a respondent's home.

4. Methodology

4.1. A quantitative research method

The main research question of this study is answered by data from a survey. The survey can be found in 'Appendix A'. The choice for a quantitative research method was made because of the fact that with a survey, a lot more respondents can be heard than with interviews. Therefore the results of this research project are more representative of the total population of urban-based runners and cyclists than would be the case if qualitative research methods were used. Furthermore, with the survey, a complete and general picture of how the built environment in the urban fringe affects the willingness of people to run or cycle there, is painted. This complete picture is needed because it is impossible to find out how the built environment in the urban fringe can be made more attractive for usage by runners and cyclists if the researched sample is not representative of the population. The downside of using a quantitative method in this study is that it does not obtain a deeper understanding the reasons why runners and cyclists choose for certain answers in the survey (Clifford et al., 2010).

4.2. Modus operandi

In this study, two groups of people are being researched: runners and cyclists. All the respondents had to be urban dwellers. The aim of the primary data collection was to get 50 respondents in both of the groups. As stated earlier, the two different groups are implemented in the research because of the interest in finding differences or similarities in what different sportspeople find important factors, when they choose a place to sport in. A visual representation of the geographical area, in which the research was carried out, can be found in 'Appendix B'

Data was collected via an online survey. The link to the survey was placed in various Facebook groups which consisted of runners or cyclists. Furthermore, sports associations were contacted and asked if they would spread the link to the survey among their members. Data was collected in the period from 10-05-2017 till 24-05-2017. During this period 181 sportspeople clicked on the link to the survey. 129 respondents qualified as part of the target group by answering the first two questions with 'yes'. When the data was corrected for respondents who did not complete the whole survey, 116 valid cases remained. Of these 116 respondents, 75 are runners and 41 are cyclists.

Figure 3 provides an overview of the secondary research questions and the questions asked to the respondents in the survey, and the linkages between those two. In question 8 and 9 of

the survey, 5-point Likert-scales were used. When respondents are asked about their opinions, which is the case in question 8 and -9, a Likert-scale is seen as a solid research tool (Clifford et al., 2010). By using a five-point scale, respondents are given a neutral option. This works well in surveys because respondents are not forced in a certain direction (Clifford et al., 2010).

Research question	Answered using survey question...
(2) To what extent do runners and cyclists already use the urban fringe as a place to sport in?	6 [Where do you run/cycle regularly?] & 7 [Where do you run/cycle most often?]
(3) To what extent are certain factors (access, aesthetics, greenery, amenities [availability of cycle/walking paths], safety, maintenance, proximity, features, traffic, familiarity and busyness) important, when a choice for a place to sport in, is to be made?	8 [How important do you find the following factors when making a choice for a location to run/cycle in? <i>access, aesthetics, greenery, amenities, safety, maintenance, proximity, traffic, familiarity, features and busyness</i>]
(4) How are factors related to the built environment in the urban fringe perceived, by the runners and cyclists who actually sport here regularly?	9 [How do you rate the following characteristics of the place in the urban fringe, where you run/cycle regularly? <i>access, aesthetics, greenery, features, amenities, safety, traffic and maintenance</i>]
(5) Would runners and cyclists sport more in the urban fringe if the built environment there was to be improved?	10 [Would you sport more often in the urban fringe if the characteristics, listed in question 9, were to be improved?] & 11 [If answered no, why not?]
(6) What are the differences in the results between cyclists and runners?	5 [which sport do you perform regularly; at least once per week?] in combination with either 6, 7, 8, 9 or 10

Figure 3. Overview of the research- and survey questions and the linkages between the two. The complete survey that was used can be found in 'Appendix A'.

4.3. Quality of the data

Of course, with an online survey, it can be hard to control that the people who respond are actually part of the researched population. Therefore, two control questions were implemented in the survey. If the first and second questions of the survey are answered with yes, the respondent qualifies to fill out the rest of the survey. This ensures that all the respondents that are included in the results of this study are actually urban residents who run or cycle regularly (at least once per week). One of the benefits of using an online survey is that the sample is random and unbiased. Due to the fact that the researcher does not decide which specific person he approaches. A downside of this method is that potential respondents who don't have access to the internet are excluded. This is, however, not considered to be an issue in this research since 94.4% of the Dutch population had access to

the internet in 2016 (CBS, 2016). The sample is to a certain extent representative of the population because, in the Facebook groups, urban-based runners and cyclists from cities all over the Netherlands could respond to the survey. The number of respondents that participated is quite low for a quantitative study, with only 116 valid cases. This is due to the limited time and resources that the researcher had at his disposal. It should be noted that for the sample to be fully representative of the population, the number of respondents should be much higher. The difference in the number of respondents in each group (75 runners and 41 cyclists) is caused by the fact that, for the researcher, it was harder to find cyclists online. If there was more time at hand, the distribution of runners and cyclists in the sample would be more even.

Another problem that could potentially endanger the quality of the data is the possibility that the respondents would not fully understand the concept of the urban fringe, which is essential in this study. A definition of the urban fringe and an example was therefore added to each page of the online survey. The definition is an adaptation of the one posed by Kurtz and Eicher (1958), which is used earlier in this thesis:

The urban fringe is the area that bridges the city and the countryside. It is situated beyond the limits of the legal city, in the 'rural hinterland', exhibiting characteristics of mixed land use, with no consistent pattern of farm and nonfarm dwellings. The residents are involved in rural and urban occupations. The area shows potentialities for population growth, due to its proximity to the city. Places in the urban fringe could, for example, be relatively green areas just outside city limits.

Lastly, the design of the online survey made sure that only sportspeople who were familiar with the urban fringe would answer survey question 9 and 10. Only respondents who answered in survey question that they regularly sport in the urban fringe, could see and answer question 9 and 10 (Figure 3).

4.4. Analysis methodology

Secondary research questions 2, 3, 4 and 5 (Figure 3) are answered by analyzing descriptive statistics. Research question 6 (Figure 3) is answered by looking for significant differences in the data between runners and cyclists. Because the data contains mostly nominal and ordinal variables, Chi-square tests are used for analyzing the differences between the groups. The Chi-square test is preferred over a Fisher's exact test because the latter requires variables with two categories each (Van Geloven and Holman, 2016). The five categories in the Likert-scales of survey question 8 and 9 have been recoded into three categories so that the variables met the requirements to do a Chi-square test.

5. Results

In this chapter, the results of the quantitative study are presented and discussed in relation to the theoretical framework. Secondary research questions 2, 3, 4, 5 and 6 (Figure 3) are answered here. Every subsection underneath the 'research sample' subsection represents questions 2, 3, 4 and 5 respectively. Secondary research question 6 is answered throughout the 'results' chapter by constantly comparing the two groups.

5.1. Research sample

As stated earlier, this study contains 116 respondents, of which 75 are runners and 41 are cyclists. All respondents are urban dwellers. In the sample both genders are equally represented; 48.3% of the respondents is female and 51.7% of the respondents is male. In the group of runners, the percentage of female respondents is slightly higher. While in the group of cyclists the percentage of males is much higher. This can be seen in Figure 4.

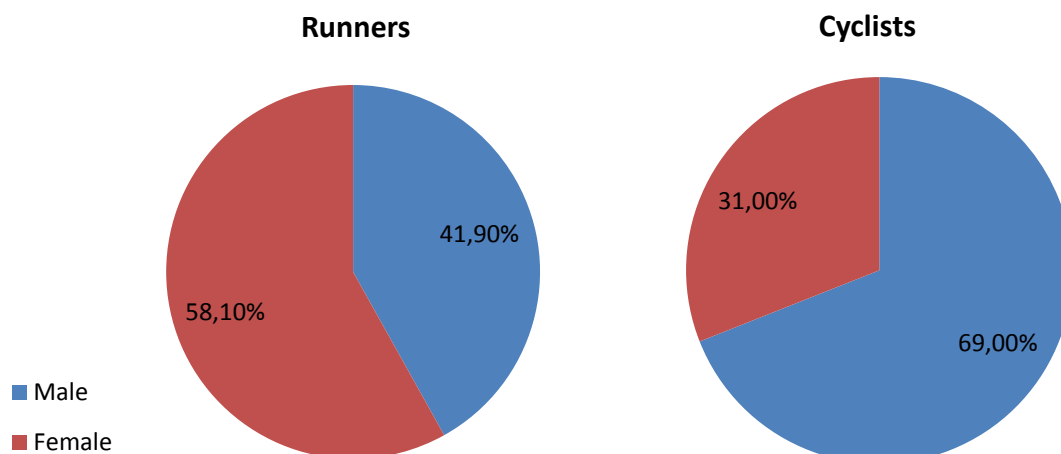


Figure 4. Sex distribution in the runners and cyclists groups

The uneven sex distribution in the runner's group is a coincidence, as it would probably be even if there were more respondents. The uneven sex distribution in the cyclist's group can be explained by the fact that in the Netherlands cycling is much more popular among men than it is among women (Mulier Instituut, 2016). The age of the respondents ranges from 20 to 66 and the age distribution is normal. The mean age of the respondents in the sample is around 39 years.

5.2. Sporting in the urban fringe

One objective of the survey was to find out to what extent the urban fringe is already used by sportspeople. The results show that a lot of running and cycling is already being done. 81% of the cyclists in the sample answered that they regularly sport in the urban fringe, as compared to 78.4% of the runners. Not much of a difference between the two groups here. The distribution of answers to the question 'where do run/cycle most often?' can be seen in figure 5.

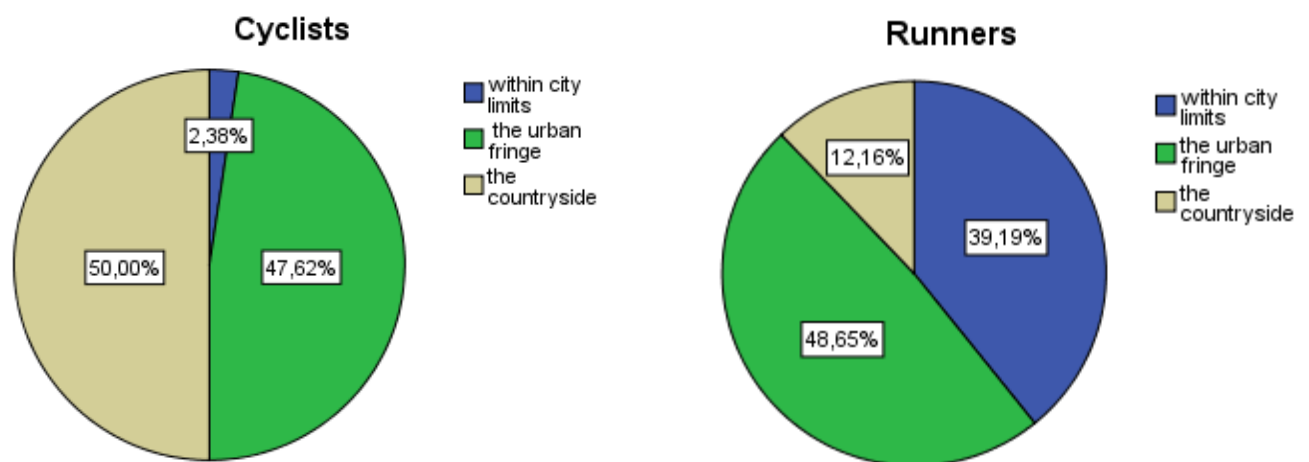


Figure 5. Where do you run/cycle most often?

Surprisingly, the percentage of urban-based cyclists and runners who sport most often in the urban fringe is almost the same; 47.6% and 48.7% respectively. As expected, the city with its parks is used a lot as well by urban-based runners. For cyclists it makes no real sense to stay within city limits due to obstacles like traffic lights, hence the low percentage in that category. The countryside is more suitable for cycling and that shows in the data. The countryside further away from the homes of urban dwellers, that's why it is not often used by runners. Runners simply cannot cover the same distances as cyclists in a reasonable amount of time.

The high percentages of runners and cyclists who sport regularly, or even most frequently, in the urban fringe show that the urban fringe is to a certain extent already attractive for urban-based sportspeople. The question, however, remains if the built environment could be improved in a way that the urban fringe becomes more attractive for runners and cyclists.

5.3. Factors determining physical activity

Here the answers to survey question 8 are analyzed: *How important do you find the following factors when making a choice for a location to run/cycle in? (access, aesthetics, greenery, amenities, safety, maintenance, proximity, traffic, familiarity, features and busyness)*. Respondents could choose an option from a five-point Likert-scale going from 1; very unimportant to 5; very important. The results of this question are displayed in figure 6 and figure 7, on the next page. The columns read from left to right: very unimportant, reasonably unimportant, neutral, reasonably important and very important. The rows read from top to bottom: proximity, safety, accessibility, level of maintenance, greenery, familiarity, traffic, features, busyness and availability of cycling/walking paths (amenities).

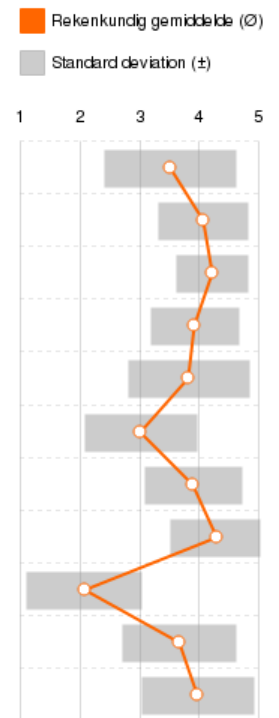
From these results, it is evident that factors that were mentioned in the literature as important determinants of physical activity in a place are also considered to be important by the respondents. McCormack et al. (2010) stated that factors like *safety, aesthetics, amenities, maintenance* and *proximity* are important for encouraging physical activity in public open spaces; such as parks and places in the urban fringe. Sallis et al. (2012) add that *access, aesthetics and trees (greenery) and availability of biking and pedestrian facilities* are important determinants of physical activity. The results of this study confirm that these factors are indeed important when people are making a choice for a location to sport in. On average all these characteristics scored higher than 3 on the Likert-scale, which indicates that they are all important to a certain extent.

For the cyclists, the most important factor was the *'amount of traffic'* with an average of 4.29 on the Likert-scale. Runners found this an important factor as well, averaging 4.19. The group of runners found, however, *'proximity'* more important when choosing a place to run in. *'Proximity'*, as in proximity to the home of the respondent, scored on average 4.26 on the Likert scale for runners. Because cyclists can cover bigger distances more easily, *'proximity'* is less important for them.

In both groups, the availability of features such as set out routes, water taps and benches was seen as the most unimportant factor when choosing a place to run or cycle in with averages of 2.07 and 2.97 for cyclists and runners respectively. Also, *'familiarity'* was seen as relatively unimportant. The hypothesis of the researcher that those factors might be important when sportspeople are making a choice for a certain location to run or cycle in is therefore rejected.

However, the two other factors that the researcher proposed as potentially important proved to be so. The *'amount of traffic'* and *'busyness'* (number of other users) have proven

	neutraal (niet belangrijk of belangrijk)										Ø	±
	Zeer onbelangrijk (1)		redelijk onbelangrijk (2)		belangrijk (3)		redelijk belangrijk (4)		Zeer belangrijk (5)			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%		
Nabijheid (De omgeving is...	2x	4,76	5x	11,90	13x	30,95	13x	30,95	9x	21,43	3,52	1,11
Veiligheid	-	-	1x	2,38	7x	16,67	22x	52,38	12x	28,57	4,07	0,75
Toegankelijkheid	-	-	-	-	4x	9,76	24x	58,54	13x	31,71	4,22	0,61
Niveau van onderhoud	-	-	1x	2,38	10x	23,81	22x	52,38	9x	21,43	3,93	0,75
Groenvoorziening (aanwe...	1x	2,38	3x	7,14	11x	26,19	14x	33,33	13x	30,95	3,83	1,03
Bekendheid (de mate waa...	2x	4,76	10x	23,81	17x	40,48	11x	26,19	2x	4,76	3,02	0,95
Esthetiek (Een, voor het oo...	-	-	2x	4,76	10x	23,81	20x	47,62	10x	23,81	3,90	0,82
Verkeer (de mate van verk...	-	-	2x	4,76	2x	4,76	20x	47,62	18x	42,86	4,29	0,77
Aanwezigheid van feature...	14x	33,33	15x	35,71	9x	21,43	4x	9,52	-	-	2,07	0,97
Drukke (aantal andere geb...	-	-	6x	14,29	10x	23,81	18x	42,86	8x	19,05	3,67	0,95
Aanwezigheid van fiets- en...	1x	2,38	2x	4,76	7x	16,67	19x	45,24	13x	30,95	3,98	0,95



to be reasonably important factors when runners and cyclists have to choose a location to sport in.

Figure 6. Results of survey question 8, cyclists

	neutraal (niet belangrijk of belangrijk)										Ø	±
	Zeer onbelangrijk (1)		redelijk onbelangrijk (2)		belangrijk (3)		redelijk belangrijk (4)		Zeer belangrijk (5)			
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%		
Nabijheid (De omgeving is...	3x	4,05	1x	1,35	4x	5,41	32x	43,24	34x	45,95	4,26	0,94
Veiligheid	2x	2,70	7x	9,46	17x	22,97	29x	39,19	19x	25,68	3,76	1,03
Toegankelijkheid	1x	1,35	3x	4,05	10x	13,51	43x	58,11	17x	22,97	3,97	0,81
Niveau van onderhoud	-	-	13x	17,81	23x	31,51	27x	36,99	10x	13,70	3,47	0,94
Groenvoorziening (aanwe...	2x	2,70	2x	2,70	11x	14,86	34x	45,95	25x	33,78	4,05	0,92
Bekendheid (de mate waa...	7x	9,46	19x	25,68	22x	29,73	21x	28,38	5x	6,76	2,97	1,10
Esthetiek (Een, voor het oo...	3x	4,05	6x	8,11	17x	22,97	36x	48,65	12x	16,22	3,65	0,99
Verkeer (de mate van verk...	1x	1,35	4x	5,41	5x	6,76	34x	45,95	30x	40,54	4,19	0,89
Aanwezigheid van feature...	19x	25,68	26x	35,14	17x	22,97	7x	9,46	5x	6,76	2,36	1,17
Drukke (aantal andere geb...	4x	5,41	11x	14,86	26x	35,14	27x	36,49	6x	8,11	3,27	1,00
Aanwezigheid van fiets- en...	2x	2,70	4x	5,41	11x	14,86	32x	43,24	25x	33,78	4,00	0,98

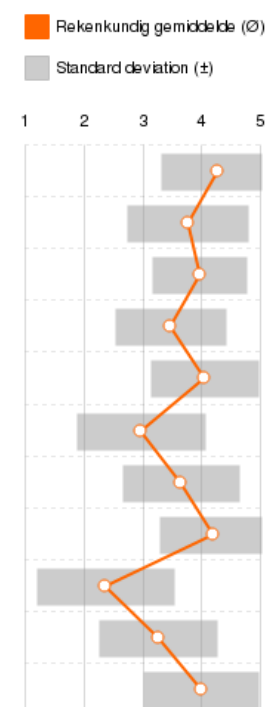


Figure 7. Results of survey question 8, runners

Chi-square tests were carried out to find out if there are significant differences between the groups based on the variables of survey question 8. The results of these tests are shown in figure 8.

Variables	P
Proximity	0,0001
Safety	0,107
Accessibility	0,248
Level of maintenance	0,017
Greenery	0,189
Familiarity	0,494
Aesthetics	0,422
Traffic	0,818
Availability of features	0,553
Busyness	0,200
Availability of cycling/walking trails	0,965

P is significant when, $P < 0.05$

Figure 8. Results of the Pearson Chi-Square tests for each variable from survey question 8

The results imply that the differences between runners and cyclists found in the variables of survey question 8, can mostly be explained by coincidence. Except for the variables '*proximity*' and '*level of maintenance*'. On these two variables, the groups differ significantly. Runners find '*proximity*' significantly more important when making a choice for a location to sport in, than cyclists do. The other way around: cyclists find the level of maintenance significantly more important.

The significant difference between the groups for the variable '*proximity*' is easily explained. Runners cannot cover the distances that cyclists do, in a reasonable amount of time and effort. Therefore, runners find '*proximity*' significantly more important than cyclists do, when they have to make a choice for a location to sport in. The significant difference between cyclists and runners for the variable '*level of maintenance*' might be explained by the desire of the cyclists to ride on smooth and well-maintained cycling paths. This is important for cyclists from a safety as well as a comfort perspective (Bicycle Network, 2017).

'*Proximity*' is in this study not related to the built environment, so there are no significant differences between runners and cyclists in to what extent they find factors related to the built environment important when they have to make a choice for a location to sport in. Except for the variable '*level of maintenance*'.

5.4. Perception of factors related to the built environment, in the urban fringe

In this section the data of survey question 9 is analyzed: *How do you rate the following characteristics of the place in the urban fringe, where you run/cycle regularly? (access, aesthetics, greenery, features, amenities, safety, traffic and maintenance)*. Respondents could choose an option from a five-point Likert-scale going from 1; very bad to 5; very good. The results of this question are displayed in figure 10 and figure 11, on the next page. The columns read from left to right: very bad, bad, neutral, good, very good. The rows read from top to bottom: safety, accessibility, level of maintenance, greenery, features, traffic aesthetics and availability of cycling and walking paths (amenities).

All variables, except one, are rated as reasonably good on average. With average scores around 4 in both the groups. The only exception is the *'availability of features like predetermined routes, water taps and benches'*; this variable is rated as quite bad in the urban fringe. But because this characteristic was also seen as unimportant in survey question 8, improving the quality or quantity of these features in the urban fringe will most likely not raise the amount of sport activity.

The fact that almost all variables are generally rated as fairly good in the urban fringe is most likely the cause that the urban fringe is already being used quite a lot by runners and cyclists. However, it seems that improvements still can be made.

As can be seen in figure 9, the data from survey question 9 has been analyzed with the use of Chi-square tests, to see if there are significant differences in how runners and cyclists rate factors related to the built environment in the urban fringe. The results indicate that there are no significant differences between the groups regarding this question. The differences between the groups that can be seen in the data are based on coincidence.

Variables	P
Safety	0,964
Accessibility	0,906
Level of maintenance	0,904
Greenery	0,488
Availability of features	0,978
Traffic	0,446
Aesthetics	0,614
Availability of cycling/walking trails	0,574

P is significant when, $P < 0.05$

Figure 9. Results of the Pearson Chi-Square tests for each variable from survey question 9

	Zeer slecht (1)		Slecht (2)		neutraal (niet goed of slecht) (3)		Goed (4)		Zeer goed (5)		Ø	±
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%		
Veiligheid	-	-	1x	2,94	9x	26,47	22x	64,71	2x	5,88	3,74	0,62
Toegankelijkheid	-	-	1x	2,94	3x	8,82	26x	76,47	4x	11,76	3,97	0,58
Niveau van onderhoud	-	-	1x	2,94	9x	26,47	22x	64,71	2x	5,88	3,74	0,62
Groenvoorziening (de aan...	-	-	-	-	8x	23,53	20x	58,82	6x	17,65	3,94	0,65
Aanwezigheid van feature...	4x	11,76	9x	26,47	18x	52,94	3x	8,82	-	-	2,59	0,82
Verkeer (minder verkeer is...	-	-	1x	2,94	11x	32,35	22x	64,71	-	-	3,62	0,55
Esthetiek (een, voor het oo...	-	-	-	-	7x	20,59	21x	61,76	6x	17,65	3,97	0,63
Aanwezigheid van fiets- en...	-	-	3x	8,82	5x	14,71	22x	64,71	4x	11,76	3,79	0,77

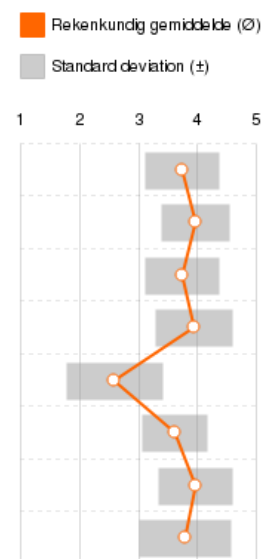


Figure 10. Results of survey question 9, cyclists

	Zeer slecht (1)		Slecht (2)		neutraal (niet goed of slecht) (3)		Goed (4)		Zeer goed (5)		Ø	±
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%		
Veiligheid	-	-	2x	3,45	14x	24,14	36x	62,07	6x	10,34	3,79	0,67
Toegankelijkheid	-	-	1x	1,72	6x	10,34	37x	63,79	14x	24,14	4,10	0,64
Niveau van onderhoud	-	-	2x	3,45	13x	22,41	35x	60,34	8x	13,79	3,84	0,70
Groenvoorziening (de aan...	-	-	1x	1,72	9x	15,52	26x	44,83	22x	37,93	4,19	0,76
Aanwezigheid van feature...	7x	12,07	14x	24,14	32x	55,17	5x	8,62	-	-	2,60	0,82
Verkeer (minder verkeer is...	-	-	5x	8,62	14x	24,14	29x	50,00	10x	17,24	3,76	0,84
Esthetiek (een, voor het oo...	-	-	1x	1,72	15x	25,86	28x	48,28	14x	24,14	3,95	0,76
Aanwezigheid van fiets- en...	-	-	2x	3,45	9x	15,52	35x	60,34	12x	20,69	3,98	0,71

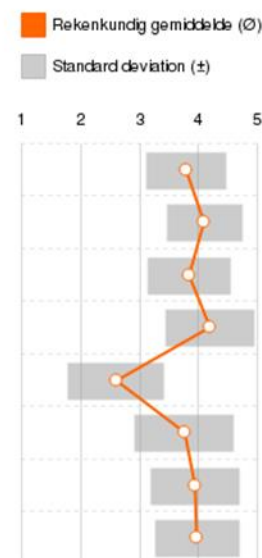


Figure 11. Results of survey question 9, runners

5.5. Increasing running and cycling in the urban fringe

The last question that needed to be answered was: *Would urban-based runners and cyclists actually sport more in the urban fringe if factors related to the built environment were to be improved?* The respondents were asked if they would sport more in the urban fringe if the variables from survey question 9 would be improved. The results, shown in figure 12, show that around 50% of the respondents in both the groups would sport more in the urban fringe if the factors related to the built environment were to be improved.

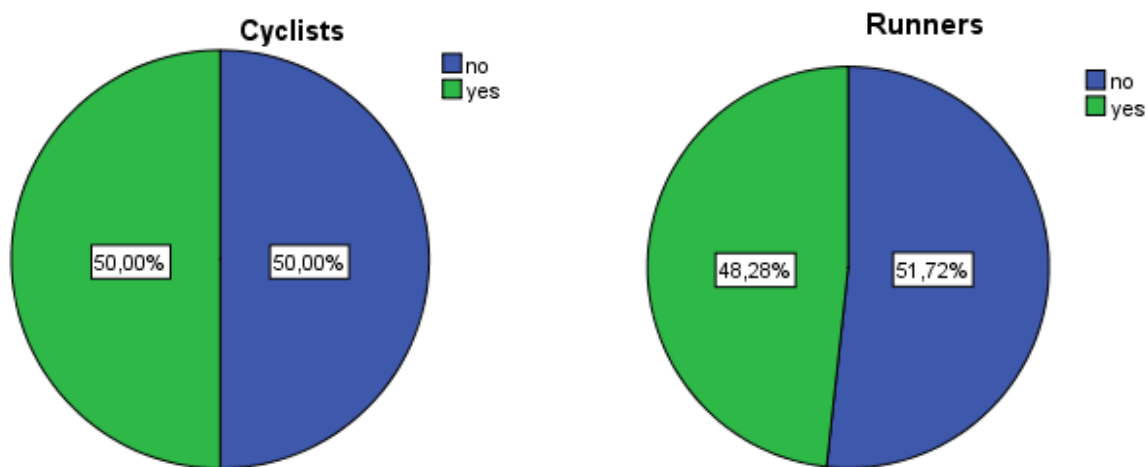


Figure 12. Would you sport more in the urban fringe if the factors from question 9, were to be improved?

The answers of the respondents to survey question 11 (*If you answered 'no' to the previous question, why not?*) provides an explanation of the other 50% of runners and cyclists who declared that they would not sport more in the urban fringe if the factors related to the built environment were to be improved. Reasons for not sporting more in the urban fringe that were frequently mentioned mostly consist of either of these two options: the respondent already runs or cycles as much as he/she possibly can (without risking injury), or the respondent finds the urban fringe already very attractive to run or cycle in.

6. Conclusion

The results of the quantitative research carried out in this study indicated that the urban fringe is already being used quite a lot by urban-based cyclists and runners. Around 80% of urban-based runners and cyclists in the Netherlands sport regularly in the urban fringe. Around 48% of urban-based cyclists and runners in the Netherlands even said that the urban fringe is the location where they sport most often. This is most probably caused by the fact that runners and cyclists perceive characteristics related to the built environment in the urban fringe as fairly positive. These characteristics include *safety, accessibility, level of maintenance, greenery, traffic, aesthetics* and *availability of cycling and walking paths*. The results of the survey show that runners and cyclists do not see the urban fringe as the perfect sport environment. 50% of urban-based runners and cyclists in the Netherlands would sport more in the urban fringe if the mentioned characteristics would be improved.

Furthermore, this study explored what urban based runners and cyclists in the Netherlands find important factors when they have to choose a location to sport in. The results confirmed findings in earlier research, showing that: *'proximity', 'accessibility', 'aesthetics', 'greenery', 'amenities like availability of cycling and walking paths', 'safety',* and *'maintenance'* are important determinants of physical activity in public open space such as places in the urban fringe. This study proposed four other possible determinants of physical activity in the urban fringe: the *amount of traffic, busyness (amount of other users), familiarity* and *availability of features like predetermined routes, water taps and benches*. Urban-based runners and cyclists in the Netherlands find *'traffic'* and *'busyness'* important when they are choosing a location to sport in. This indicates that *'traffic'* and *'busyness'* might be important determinants of physical activity. Further research is, however, needed to confirm this.

Not many differences were found in the data between runners and cyclists. Urban based runners in the Netherlands find proximity more important than cyclists do, regarding their choice for a location to sport in. Cyclists find, in the same regard, level of maintenance of the environment more important.

The results presented in this study indicate that the following factors that are related to the built environment are the most important when an urban-based runner or a cyclist in the Netherlands has to choose a location to sport in: *safety, accessibility, level of maintenance, greenery, traffic, aesthetics* and *availability of cycling and walking paths*. If policy makers improve these characteristics in the urban fringe in the Netherlands it is likely that the urban fringe will become more attractive for usage by urban-based runners and cyclists. Interventions in the urban fringe that might achieve this, could be improving the aesthetics

by planting more trees or improving safety, improving accessibility and separating traffic and sportspeople by installing more dedicated walking and cycling paths.

If other scholars also aim to do research about the relation between the built environment and physical activity in the urban fringe, it would be a good idea to take a more qualitative approach. This study aims to say something about places in the urban fringe in general. This is good for basic understanding of the built environment in the Dutch urban fringe and its relation with physical activity. Every place in the urban fringe is, however, different. Therefore, deeper knowledge of specific places is needed if one aims to design meaningful and effective policies regarding the promotion of physical activity through the built environment. That is something that is missing in this study.

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8. Appendices

8.1. Appendix A: survey



rijksuniversiteit
groningen

Enquête relatie tussen plaatsen en sporten

Beste respondent,

Als onderdeel van het schrijven van mijn bachelor thesis doe ik onderzoek naar de motivatie van hardlopers en wielrenners/fietsers om op bepaalde plekken te sporten. Het gaat hier om hardlopers en fietsers die in steden wonen. In het bijzonder ben ik benieuwd of stedelingen sport beoefenen in de **Urban Fringe***, en waarom ze dit wel of niet doen. Uiteindelijk wil ik te weten komen hoe plaatsen in de Urban Fringe aantrekkelijker gemaakt kunnen worden voor gebruik door hardlopers en fietsers.

Voor de duidelijkheid: deze enquête is alleen bedoeld voor hardlopende- of fietsende inwoners van steden.

Uw anonimiteit wordt gegarandeerd bij uw deelname aan dit onderzoek. U kunt het invullen van de enquête ten alle tijden beëindigen. Voor vragen en opmerkingen kunt u mij per email bereiken via l.j.schaafsma@student.rug.nl.

Hartelijk dank voor uw bijdrage aan dit onderzoek!

-Luuk Schaafsma

***De urban fringe is het gebied dat de brug vormt tussen stad en platteland. Het ligt buiten de officiële grenzen van de stad, in het ‘rurale achterland’. In de urban fringe komt gemixt landgebruik voor, met geen eenduidig patroon van boerenbedrijven en gewone woonhuizen. De inwoners werken gedeeltelijk op het platteland en gedeeltelijk in de stad. De urban fringe heeft vaak het potentieel om in populatie te stijgen door de nabijheid van de stad. Denk bij plekken in de urban fringe bijvoorbeeld aan relatief groene gebieden net buiten de bebouwde kom van steden.**

1. Woont u in een stad?
 - Ja
 - Nee

2. Loopt u regelmatig hard? Of doet u regelmatig aan fietsen/wielrennen/mountainbiken? (regelmatig betekend hier minimaal 1 keer per week). Let op: Met fietsen wordt hier recreatief/sportief fietsen bedoeld. Fietstochten met als doel om van A naar B te komen zijn hier niet van toepassing.
 - Ja
 - Nee

3. Wat is uw geslacht?
 - Man
 - Vrouw

4. Wat is uw leeftijd? (in hele jaren)
..... jaar oud

5. Welke sport beoefend u regelmatig? (minimaal 1 keer per week). Als u beide sporten minimaal 1 keer per week beoefend, vink dan de sport aan die u het meest doet.
 - Hardlopen
 - Wielrennen/fietsen

6. Waar beoefend u deze sport? U mag hier meerdere opties aanvinken.
 - In de stad/stadspark
 - In de Urban Fringe (zie inleiding voor uitleg)
 - Op het platteland

7. Waar beoefend u deze sport **het vaakst**? U mag hier slechts één optie aanvinken.
 - In de stad/stadspark
 - In de Urban Fringe (zie inleiding voor uitleg)
 - Op het platteland

8. Hoe belangrijk vindt u de volgende factoren bij uw keuze voor een bepaalde omgeving om in te sporten? (aankruisen wat van toepassing is)

	zeer onbelangrijk	redelijk onbelangrijk	neutraal	redelijk belangrijk	zeer belangrijk
Nabijheid (relatief dichtbij uw woning)					
Veiligheid					
Toegankelijkheid					
Niveau van onderhoud					
Groenvoorziening (de aanwezigheid bomen, planten, struiken, gras etc.)					
Bekendheid (u kent de omgeving goed)					
Esthetiek (Een mooie omgeving)					
verkeer (er is weinig verkeer in de betreffende omgeving)					
Aanwezigheid van features zoals drinkfonteinen, aangegeven routes, bankjes en toiletten.					
Drukke (aantal andere gebruikers)					
Aanwezigheid van fiets- en wandelpaden					

Vul vraag 9, 10 en 11 alleen in als u bij vraag 4 heeft aangegeven dat u wel eens in de Urban Fringe hardloopt of fietst.

9. Hoe waardeert u de volgende karakteristieken van de plaats/omgeving in de Urban Fringe, waar u regelmatig sport? (aankruisen wat van toepassing is)

	Zeer slecht	Slecht	Neutraal (niet goed of slecht)	goed	Zeer goed
Veiligheid					
Toegankelijkheid					
Niveau van onderhoud					
Groenvoorziening (de aanwezigheid van bomen, planten, gras etc.)					
Aanwezigheid van features zoals drinkfonteinen, aangegeven routes, bankjes en toiletten.					
Verkeer (minder verkeer is beter)					
Esthetiek (een, voor het oog, mooie omgeving)					
Aanwezigheid van fiets en wandelpaden					

10. Zou u vaker in de Urban Fringe sporten als de karakteristieken van vraag 9 voor die specifieke plek/omgeving verbeterd zouden worden?

- Ja
- Nee

11. Indien 'nee', waarom niet?

.....

.....

.....

Dit is het einde van de enquête. Nogmaals hartelijk dank voor uw bijdrage!

8.2. Appendix B: Map of the research area

