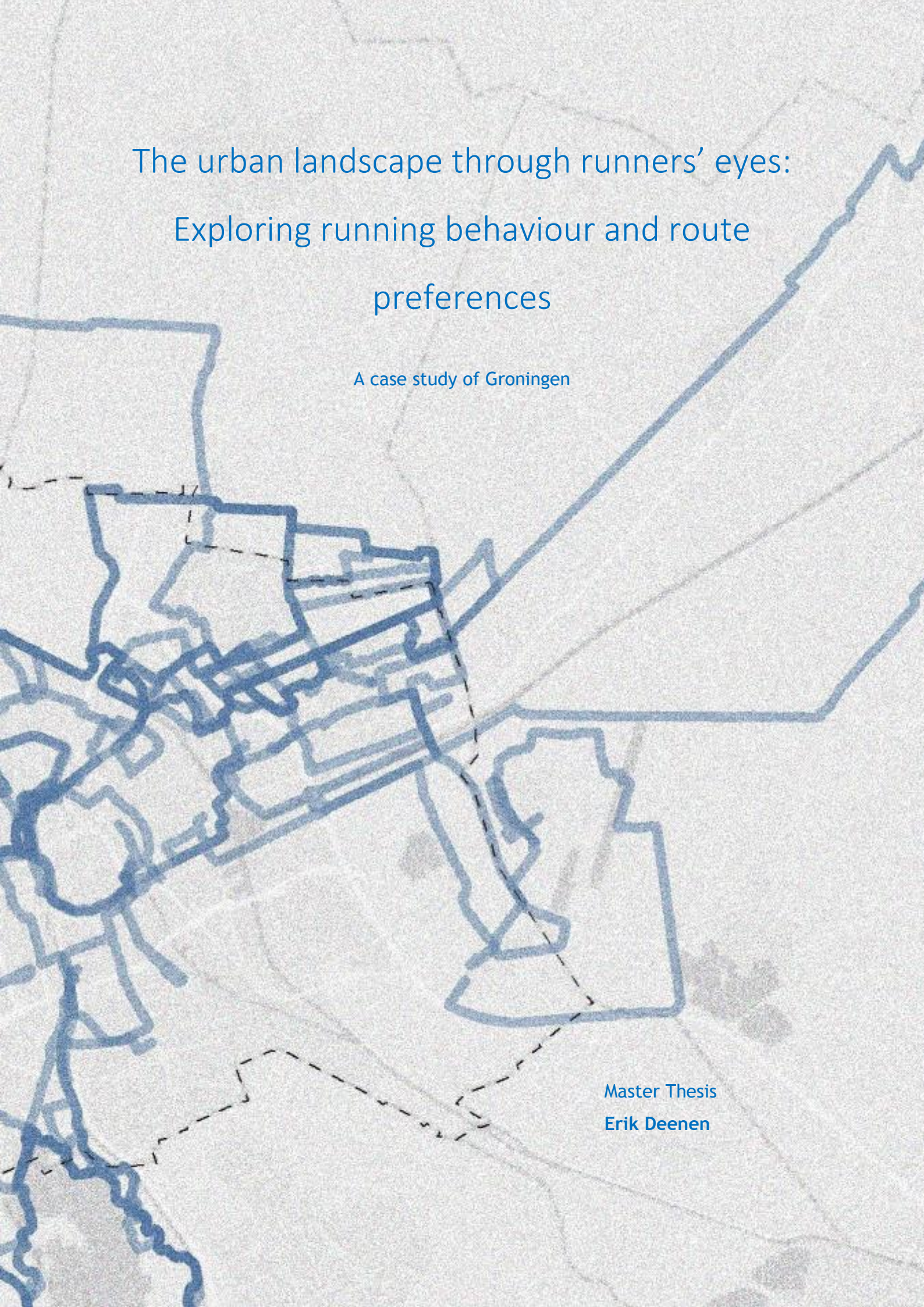
The urban landscape through runners' eyes: Exploring running behaviour and route preferences

A case study of Groningen



Master Thesis

Erik Deenen

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Research Master in Regional Studies

University of Groningen

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Foreword

In the first week of June 2016, the University Medical Centre of Groningen was the venue for the international conference *Building the Future of Health*. In an environment where *curing* people is the daily practice, researchers and other experts from varying disciplines gathered and agreed that *prevention* of diseases deserves more attention. Behaviour and lifestyle were identified as critical factors when it comes to health promotion. Among these lifestyle factors, physical activity in general, and sports in particular, can significantly increase people's resistance against physical and mental illnesses.

This Master Thesis on running behaviour and experiences fits within the research agenda towards understanding the relationships between human behaviour, health, and the physical environment. The research agenda supports city governments into developing policies to improve the health levels of their citizens by luring them into a healthy lifestyle. Vancouver, for example, chose a different path than most car-dominated North-American cities and evolved an appropriate architecture and urban design - so-called *Vancouverism* - that had a real impact on the quality and lifestyle of its citizens. Kopenhagen and Valencia have incorporated sports and physical activity into their urban planning policies, and invested in public facilities such as playgrounds and running route networks. And last but not least, the city of Groningen has recognized the role that public spaces plays in activating its citizens, and aims at better integrating sports, health and planning policies.

I hope this study will support policy makers in Groningen to further improve the running experiences of the thousands of runners in the city. It was good to see that, while working on this thesis, a number of new marked running routes appeared throughout the city.

Groningen, 21 June 2016

Acknowledgements

I would like to thank my supervisor, Gerd Weitkamp, for his supportive but critical feedback sessions, my research master friends, Dexter, Angelica, Patrick, Fanny, Fieke and Laura, for having a great time together in Groningen, and finally, my friends at Loopgroep Groningen, for making me enjoy every mile of running.

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“Lack of activity destroys the good condition of every human being while movement and methodical physical exercise save it and preserve it.”

Plato

Abstract

Sedentary lifestyles are a major threat to public health in many Western countries, as they are causing an increase in cardiovascular diseases, disability, mental issues such as depression, and consequently, increasing death rates and health care costs. Therefore, researchers and policy makers worldwide have emphasized the need to increase levels of physical activity. Because the physical environment of people plays an important role in guiding (healthy) behaviour, urban planners are increasingly interested in creating health promotive environments. Running, being an 'easy' and increasingly popular sport in Western countries, can be identified as one opportunity to tackle the ill-effects of sedentary lifestyles. Although some studies have dealt with the conditions of a running friendly environment, more insight is needed into the more specific elements (i.e. affordances) of the built, natural, and social environment that may influence the running experience and running behaviour. This study therefore aims at providing insights into the interactions between runners and the (urban) physical environment, and how these interactions influence the perception, behaviour and route choices of runners.

It will do so by studying the links between the physical environment and running behaviour in the city Groningen and discovering general patterns that explain the behaviour. A social-ecological model is used to theoretically understand the dynamic links between the individual runner and his/her social and physical environment and provides a framework for the study. The research is further designed as a mixed methods study, consisting of a survey among 157 Groningen runners, GPS data collection from 35 runners and three run-along interviews. The three methods were conducted sequentially, allowing to enrich the data from previous steps and both find out where runners in Groningen run, how they perceive the physical environment of Groningen while running and how this influences their route choices, running experiences and behaviour.

Firstly, to find out where runners in Groningen run, GPS-tracks of running routes were collected and analysed using GIS. The GPS data show a varied pattern of routes throughout the city and surrounding landscape. The home location and intended distance of the runner play a major role in determining the scope of the route: most runners often start their run from home, and then the range of areas they can pass by is limited by their intended distance. Although urban parks provide good conditions for running, they are often too small for the common 5-10 km runs. Therefore, many runners link multiple green areas or run outside the city limits.

Secondly, runners were asked about their experiences. The results show a mixed picture of positive and negative experiences. Although experiences are very personal, some significant differences have been found for males vs. females and for specific neighbourhoods in Groningen. Firstly, women have a less positive running experience than men due to feelings of (social) insecurity. And secondly, respondents from central neighbourhoods report a less positive running experience than

respondents from peripheral neighbourhoods at the outskirts of the city, as there is more nuisance from interaction with people and traffic, and the environment is deemed less inviting to go for a run due to a lack of nature and physical challenge.

Running routes are determined by a varied array of criteria: presence of greenery, the quality of paving, presence of street lighting, sense of safety, momentum and spatiality are the most relevant. Most runners also tend to avoid environments with high levels of arousal, and seek tranquil and traffic-calmed spaces. Runners (women especially) tend to avoid unsafe areas without street lighting when it is dark, which makes that insufficient street lighting and sense of safety can significantly limit route options. The other criteria are less decisive, as runners tend to be pragmatic and are able find their way through barriers, even though traffic situations and uneven paving can be rather obtrusive to a smooth running experience.

The main conclusions of this study are that Groningen generally provides a good running environment for most runners, offering many route options in a varied urban and natural landscape. The differences found for men versus women and for runners from central versus peripheral neighbourhoods are in line with what could be expected from theory. Although the physical environment is important for the running experience, runners are pragmatic and adaptive when it comes to finding their way in the city, as long as the baseline conditions of sufficient lighting, momentum, sense of safety, good paving and greenery are met. Runners prefer variety along the route and the ability to choose from multiple route options, indicating that the connectivity between running areas and granularity of the path network is important.

Further research is recommended to better understand how individual runners interact with their environment, and where they do and do not run over a longer time period. Secondly, the use of more detailed topographic data will enhance the spatial analysis of running routes and understanding of environmental affordances. Policies are recommended towards improving the running route network in Groningen. However, it needs to be stressed that physical measures alone may not be sufficient to lure more people into regular running to achieve a healthier lifestyle.

Chapter 1. Introduction and background

Key points:

- *In many developed countries, sedentary lifestyles are a major threat to public health and life expectancies;*
- *Public health policies are aiming at increasing the level of physical activity by addressing both individual and social and environmental changes;*
- *Running is one possible way of tackling the ill-effects of increasing sedentary lifestyles and increasing the level of physical activity;*
- *Running is an increasingly popular sport in Western countries including the Netherlands;*
- *The role of the (physical) environment in running behaviour and experience is not yet fully understood, although there exists adequate evidence that the environment plays a role in supporting an active lifestyle.*
- *This study aims at providing insights into the interactions between runners and the urban environment on a spatial level, and how these interactions influence the perception, behaviour and route choices of runners.*

The introduction provides an overview of the research on health behaviour and the (physical) environment, narrowing down from general trends towards specific interventions. The chapter concludes with presenting the objective and research questions.

1.1 Running in numbers

Running has become an increasingly popular sport since the 1960s in many Western countries, including the Netherlands (Bottenburg, et al., 2010). Before, hardly anyone could be seen running in public, as running was perceived as a waste of energy and runners were “laughed and jeered at” (Bottenburg, et al., 2010, p. 7). Two ‘running waves’ have been identified in the past decades as periods in which the number of runners increased significantly. The first ‘running boom’ occurred in

the 1970s and early 1980s with a rise in for example the number of marathons organised worldwide and the number of people participating in these marathons, and a second wave can be seen from the late 1990s onwards (Fig. 1). In the early 2000s, the number of road running practitioners increased in almost all European countries (Fig. 2). The third running wave has also been identified in the Netherlands in recent years, especially within older age cohorts (30-50) and among women (NOS, 2015).

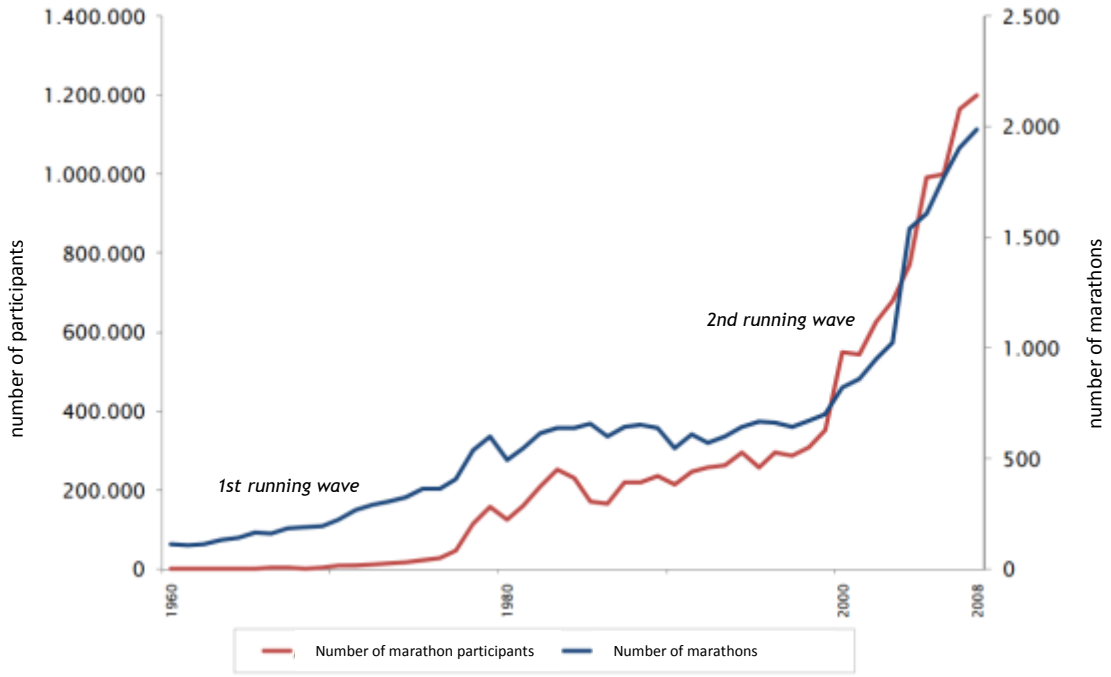


Fig. 1. Number of marathons and marathon participants worldwide.

(Bottenburg, et al., 2010)

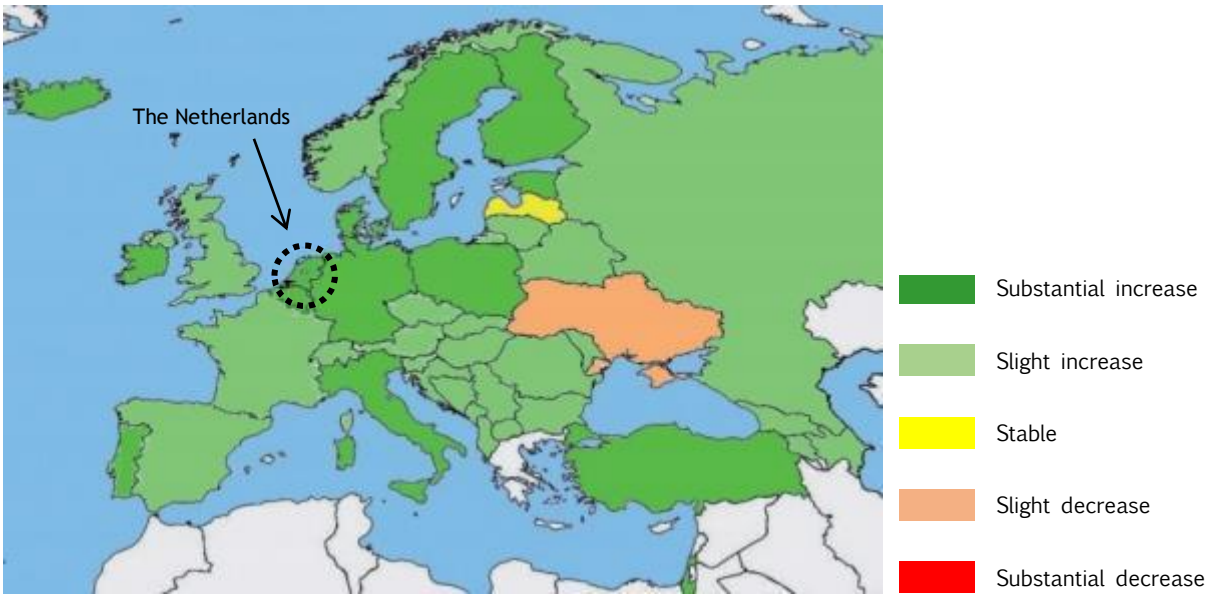


Fig. 2. Growth in road running practitioners in Europe 2000-2009.

(Bottenburg, et al., 2010, p. 10)

Today, running is the second most practiced sport in the Netherlands, with on average 12.2% of the sporting population between 20-79 years participating in running activities in 2012 (Tiessen-Raaphorst, 2015). When analysing these figures in more detail, it appears that this group of runners is overrepresented by middle-aged (20-49 years), highly educated and relatively healthy people when compared to other sports such as fitness and swimming. Other studies of the Dutch sporting population show the individualisation of sport, the preference for sporting in in unorganised or informal groups, and for sporting outdoors in public space rather than in commercial or public indoor sports accommodations (Tiessen-Raaphorst, 2015). These preferences correspond to the popularity of running, which is a highly 'unbounded' form of sport that can be practices alone and without professional training. Fig. 3 shows the spatial distribution of the percentage of households in which running is practiced for 2014, indicating that Groningen has a relatively high share of runners among its residents. Fig. 4 shows the yearly hours of running by sex and by age cohort from 2006-2012, indicating that the share of women and older age cohorts in the running population has increased in recent years. These trends could be explained by processes of emancipation and ageing.

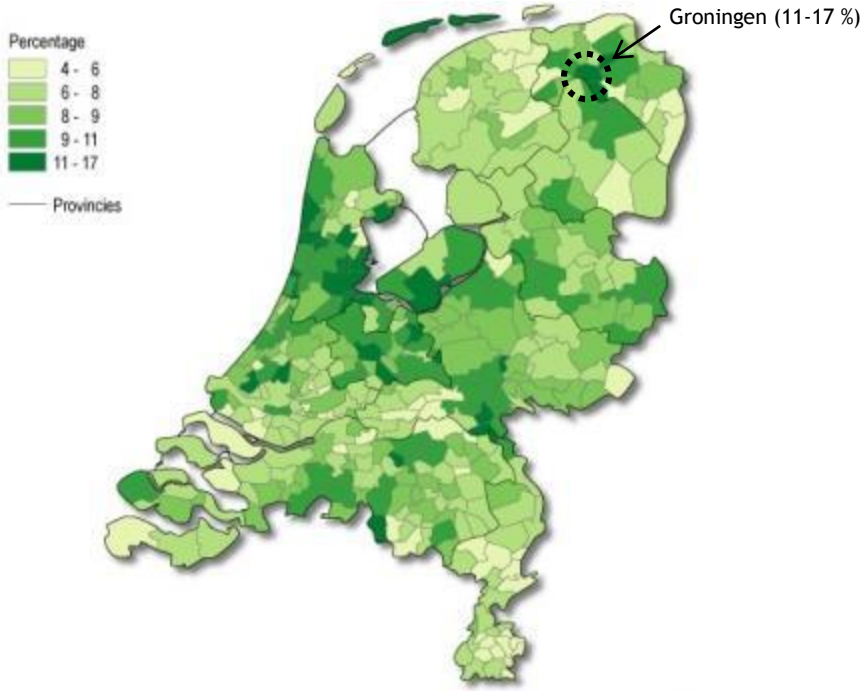


Fig. 3. Percentage of households in Dutch municipalities in which running is practiced (2014).
(Giesbers, 2014)

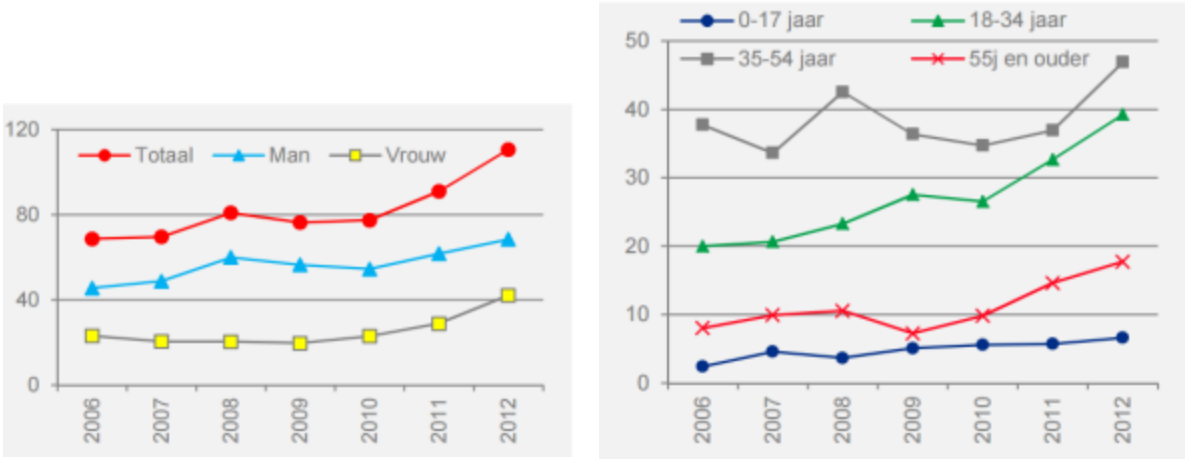


Fig. 4. Yearly hours of running in the Netherlands, by sex (left) and by age cohort (x 1.000.000).

(VeiligheidNL, 2014)

1.2 Why do people run: physical activity and (public) health

From a (public) health perspective, distance running is an effective strategy to increase the general health levels and quality of life of the populations of many developed countries. For example, in the UK "distance running, 'jogging' and recreational walking are explained as integral positive contributors towards achieving government objectives linked to tackling obesity levels, healthy living, physical and mental health and well-being, and increased leisure participation and recreational activity" (Shipway & Holloway, 2010, p. 270). A study on running in the Netherlands into the reasons to start and keep running indicates that both physical and mental health-related themes are important motivations for running (Fig. 5).

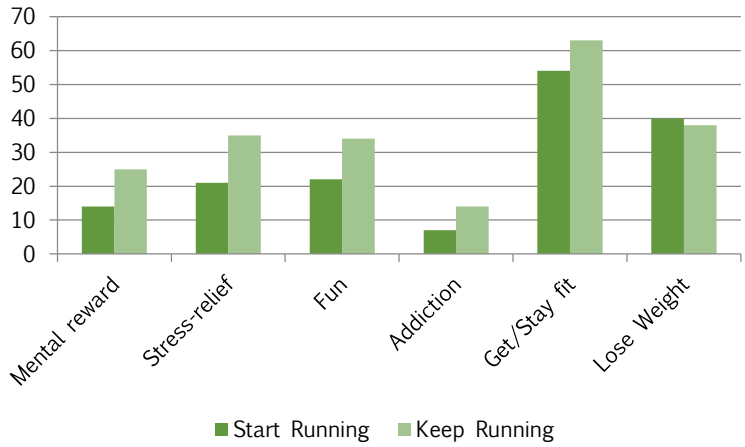


Fig. 5. Reasons to start running and reasons to keep running in the Netherlands (%).

(Asics, 2009)

The daily experiences of runners provide further explanations for the positive influences of running on people's lives. Shipway & Holloway (2010) have conducted a two-year qualitative research into the motivations and experiences of runners in the UK. They describe how running helps many people

to cope with problems and stresses of everyday life and thereby works as an antidepressant. "Distance running can be a useful method for mood control, providing a calming and relaxing activity to assist with dealing with some of the more stressful challenges of everyday life. From a public health perspective, the strongest evidence for the positive effects of exercise on mental health is for self-esteem" (Shipway & Holloway, 2010, p. 274). Running assists people to reinforce their identity and enhance their physical capital and attractiveness. "The thin and fit running body" has a symbolic value, and represents a group of leisure participants who are dedicated, controlled, disciplined, culturally and economically invested in health and are self-responsible (Shipway & Holloway, 2010, p. 275). In another qualitative study, runners reported a significantly better mood on running days in contrast to non-running days (Szabo, et al., 1998).

However, despite all these benefits of running, there are potential negative consequences that cannot be ignored. There exists a thin line between commitment to running, characterised by extreme pleasure and '*runners' euphoria*', and negative addiction to running, characterized by gradual deterioration of the addict's professional and personal life (Zarauz Sancho & Ruiz-Juan, 2011). When the line is crossed, runners have become dependent on regular training, and can start experiencing negative effects such as anxiety and irritability after not running 24-36 hours. To be able to measure the level of dedication to running, Carmack & Martens developed the Commitment to Running scale (Szabo, et al., 1998). This is a 12-item survey with statements such as 'Running is vitally important to me' and 'Running is drudgery' that can be marked on a 1-5 Likert scale. This results in a theoretical score between 12 (minimum) and 60 (maximum).

For policy makers concerned with public health, the increase in running is a positive trend, despite negative consequences in the form of negative addiction and injuries (Rijksinstituut voor Volksgezondheid en Milieu, 2014). These public health[1] professionals are concerned with the provision of the conditions in which people can live healthy lives, and have shifted their attention from monitoring infectious diseases towards prevention of diseases through healthy lifestyles as lifestyle diseases due to unhealthy behaviour were increasing in Western societies. The Ottawa Charter for Health Promotion (WHO, 1986) initiated a "new era" in public health, by:

- Enabling people to take their health destiny in their own hands;
- Focusing on health promotion instead of disease prevention;
- Making people able to take their own responsibility into putting pressures on politicians and themselves (i.e. changing behaviour and norms) (WHO, 1986).

These goals are supported by evidence that the improved health situation in European cities in the nineteenth and twentieth century was not merely a result of advanced medical care, but of economic, social and environmental changes as well (Kenzer, 1999). This way of thinking was a

[1] Public health refers to all organized measures (whether public or private) to prevent disease, promote health, and prolong life among the population as a whole (World Health Organisation, 2015).

clear shift from the 20th century curative focus in medicine, and links to the general societal trend towards healthy lifestyles as identified by Cook (2013):

> *"Running as exercise stemmed from the need to live a healthier and fitter lifestyle in the 1960s. A discourse that has particular resonance with older runners as (…) fitness running developed as a counter to the ill-effects of increasingly sedentary lifestyles. This remains a significant impetus today as runners and governments seek to tackle obesity levels and promote healthy living and physical well-being."*

Regular (vigorous or moderate) physical activity such as distance running and other sports, and less intensive physical activities such as walking and cycling for transportation as well, are important contributors to our mental and physical wellbeing (Haskell et al. 2007; Das & Horton, 2012). Therefore, medical researchers have established guidelines for minimum levels of physical activity. Hallal et al. (2012) report three distinct public health recommendations for physical activity:

- 150 minutes per week of moderate-intensity physical activity, such as brisk walking for adults of all ages, socioeconomic groups and ethnicities;
- For children and adolescents, 60 minutes per day of vigorous or moderate intensity physical activity will result in immediate and future health benefits;
- Lastly, muscular strengthening physical activities are recommended for health improvement.

Despite the evidence, 31% of the adult world population does not meet these physical activity standards and there is a global trend of decreasing levels of physical activity (Das & Horton, 2012). Similarly, in the Netherlands, more than one third of the adult population and more than half of the elderly population does not meet the Dutch norms for physical activity, and merely one fifth of the youth meet these recommendations (Hildebrandt, et al., 2013). These sedentary lifestyles result in an increase of cardiovascular diseases, disability, mental issues such as depression, and consequently, increasing death rates. About 1 in 25 deaths worldwide are a result of inactivity (Barton & Pretty, 2010). The illnesses resulting from inactivity put a financial burden on our health care system as well: "As ageing populations will put additional pressure on health services, it is becoming increasingly urgent that all sectors of the population undertake and sustain healthy behaviours as early in life as possible" (Barton & Pretty, 2010, p. 3947). This is a reason why, in recent years, there has been a renewed emphasis on broadening the scope of (public) health policies in order to stimulate behavioural changes in society.

The medical journal *The Lancet* published a special issue on physical inactivity in 2012, in which the severe consequences of sedentary lifestyles are described. The front page and introduction present a clear main message for policy makers:

> *"In view of the prevalence, global reach, and health effect of physical inactivity, the issue should be appropriately described as pandemic, with far-reaching health, economic, environmental, and social consequences." (Das & Horton, 2012, front page).*

The issue describes the relationship between human beings and their environment, and how human wellbeing could be improved by strengthening that relationship. Physical activity is placed in the context of our daily lives. "It is not about running on a treadmill, whilst staring at a mirror and listening to your iPod. It is about using the body that we have in the way it was designed, which is to walk often, run sometimes, and move in ways where we physically exert ourselves regularly whether that is at work, at home, in transport to and from places, or during leisure time in our daily lives." (Das & Horton, 2012, p. 2). The issue further shows that efforts beyond the health sector are needed — through social and environmental interventions — in order to achieve greater uptake of this healthier behaviour in people's lives.

In line with *The Lancet* special issue, Bleich and Sturm (2009) refer to sedentary lifestyles as a 'market failure', because despite the short-term benefits (e.g. ease of travelling by car) socially undesirable economic and health outcomes will follow in the long term (e.g. negative externalities such as increased health care costs): "There is nothing wrong if people want to be sedentary, but there is a problem if people are sedentary because market failures discourage physical activity" (p. 306). Therefore, government interventions and investments are deemed necessary in order to encourage regular physical activity and tempt people to make different behavioural decisions. Making the urban environment more suitable for physical activity is one possible strategy. Communication about the health effects of certain behaviours and how to change behaviour is important as well: "In the broader case of obesity, experts generally view obesity as an environmental problem while the news media has predominately identified obesity as a personal responsibility, although this has shifted over time" (Bleich & Sturm, 2009, p. 307). In order to fundamentally change these perceptions of active versus sedentary lifestyles, behavioural economists have called for a 'cultural shift' towards altering habitual behaviour and social norms (Zimmerman, 2009). Through changing the 'anchor points' in people's social and physical environment, people will be enabled and stimulated to take different behavioural decisions and physical activity could become an inevitable part of life rather than a matter of daily choice (Barton & Pretty, 2010).

In this regard, spatial planning policies can play an important role in creating physical activity 'friendly' neighbourhoods. Evidence shows that promoting moderate level physical activity, such as walking and running, results in longer-term changes in behaviour than interventions which require specialist facilities, such as gyms (Thompson, 2013). The links between spatial planning and public health will be further outlined in the following sections.

1.3 Health and the urban environment

The previous section identified that environmental aspects are relevant for enabling healthy behaviour. This section will further describe the (historical) links between health and the urban environment. The European Healthy Cities Network (EHCN) is one example of the efforts to put the

health of citizens on the agenda of multiple policy sectors and to link health to the broader concept of sustainable development (Tsouros & Green, 2009). Moreover, there are clear historical links between urban planning practice and the need to build healthier cities, as for example the building codes ensuring enough light and fresh air within houses (e.g. the Dutch *Woningwet*) and major public works such as the development of urban sewer systems and public parks (see Wagenaar, 2013). However, during the twentieth century, urban planners have also facilitated the increasing dependency on non-active transportation (such as cars), currently so common in Western countries, thereby unknowingly putting public health levels at risk again, not only by increasing air pollution and traffic casualties, but by promoting sedentary lifestyles as well (Barton, et al., 2009). At the same time, the health care system became more and more pharmaceutically oriented and disconnected from preventive social and environmental interventions (curing vs. prevention).

The (scientific) interest of urban planners into the role of the physical environment in providing healthy living conditions returned in the 1990s with research into identifying and understanding *salutogenic environments*, that is, environments that support healthy behaviours and responses. Active transportation and recreational physical activity were identified as important drivers for public health. It was hypothesised that creating salutogenic environments "may have more permanent and population-wide effects than other forms of public health interventions targeted at individuals" (Thompson, 2013, p. 80). Barton & Pretty concluded that "simple prescriptions are unlikely to be adopted by whole populations unless supported by shifts in urban design, transport policy, support for social care, parenting, and patients' expectations of their doctors" (p. 3953). Furthermore, providing salutogenic environments is relevant from a sustainable development perspective, as the need to balance economic, social and environmental interests requires addressing health inequalities within and between communities:

> *"If the environment has an influence on people's health, and if we can identify the key features of the environment that make a significant difference then it is necessary to consider equity of access to health-supportive environments in order to address health inequalities" (Thompson, 2013, p. 80).*

The ability to be physically active in the living environment is an important aspect of salutogenic environments. The link between physical activity behaviour and the physical environment has been widely studied from the 1990s onward (Sallis, 2009). Urban planning literature provides insights on transportation (behaviour) and the organisation and design of the physical environment, while environmental psychology and behavioural sciences focus on the individual perception of this environment and how this influences experience and subsequent behaviour. Table 1 summarises the main domains and their contributions to the study of physical activity friendly environments, and the potential relevance for research into running. It shows that both social and physical measures are required.

Table 1. Historical contributions of various disciplines to contemporary measures of physical activity environments.

Domain	Health, behavioural science, exercise science fields	City planning, transportation, urban design, geography fields	Leisure studies, parks, and recreation fields
Settings of interest	Recreation facilities, schools, worksites	Design of communities	Park and recreation facilities
Physical activity behaviours of interest	Recreational or leisure time physical activity	Walking and cycling for transportation	Recreational or leisure time physical activity
Key concepts	Physical activity in specific settings, social environment, access to recreation facilities, home equipment, neighbourhood attributes (function, safety, aesthetics, and destinations)	Walkability, often defined by 3Ds of residential density, land-use diversity, and pedestrian-oriented design	Constraints to leisure; biophysical, social, managerial aspects of recreation facilities
Potential relevance for running	How to 'tempt' more people to start running as a leisure activity	How to design running friendly cities	How to offer and maintain suitable facilities for runners

Adapted from: Sallis (2009), p. S87

The following two sections will explore the literature on physical activity in the physical environment from urban planning and environmental psychology/behavioural perspectives, and explores their relevance for running as well.

1.4 Insights from urban planning

Urban planning literature focuses on the characteristics of urban space and how people use this space. Because distance running is an activity that mainly takes place in the public domain of cities rather than enclosed sports facilities, this literature is important for understanding running behaviour and experiences.

Ettema (2015) conducted a survey among 1581 beginning runners in the Netherlands, and found that a comfortable surface and not having to stop for other traffic are the most important conditions for creating attractive routes. Other elements of a good running environment are the ability to maintain momentum (i.e. continuity of the routes), enhance performance and avoiding injury and annoyances from interactions with the social environment (e.g. encounters with pedestrians) (Allen-Collinson 2008; Ettema, 2015). Other research indicates that running in green, incentive rich environments distracts people from the feelings of effort and fatigue, thus enabling them to run longer (Duijvesteijn, et al., 2010; Gladwell, et al., 2013).

A literature review by Heath et al. (2006) on the role of urban design, land use and transport policies for increasing physical activity found that urban design and policies on both community-scale and street-scale are effective in promoting physical activity. On a community-scale, characteristics such as the connectivity of streets and sidewalks, the preservation of green space in cities and aesthetic qualities of public space are relevant. Also, regulations regarding the organization of public space, air quality and traffic safety could promote physical activity in an urban area. However, it should be noted that changing community-scale characteristics of an urban area is a time-consuming process with many interdependencies and barriers, including:

- changing how cities are built given that the urban landscape changes relatively slowly;
- zoning regulations that preclude mixed-use neighbourhoods;
- cost of remodelling/retrofitting existing communities;
- lack of effective communication between different professional groups (i.e., urban planners, architects, transportation engineers, public health professionals, etc.);
- changing behavioural norms directed towards urban design, lifestyle, and physical activity patterns (Heath, et al., 2006, p. S61).

Concluding, urban planning interventions cannot be seen in isolation from long-term societal trends. Fig. 6 shows a community-scale urban planning proposal for Groningen, with a strategically oriented long-term intervention to improve the attractiveness of active transportation.

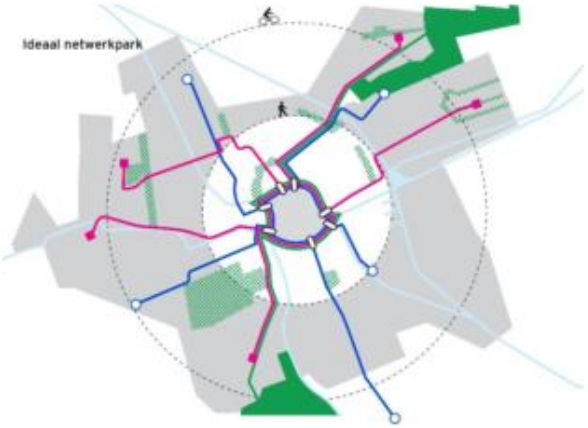


Fig. 6. Conceptual design to link green spaces and active transportation networks in Groningen.
(Matthijs Dijkstra Landschapsarchitecten, 2013)

Street-scale interventions act on a smaller scale than community-scale interventions and offer more short-term possibilities towards increasing the physical activity friendliness of an urban area. Heath et al. found effective interventions related to access, aesthetics and safety, including improved street lighting, creating safer street crossings, ensuring sidewalk continuity, traffic calming measures, or landscaping to enhance the aesthetics of the street area (Heath, et al., 2006, p. S62).

Fig. 7 shows an example of a relatively simple intervention to create running routes in the city of Groningen.

Fig. 7. Route indicators from Hoogkerk 4 miles' track in Groningen, a simple measure to increase the running-friendliness of the environment.

(Kasemier, 2016)

In transportation literature there have been published many studies on the links between the urban environment and modes of active transportation, mostly walking and cycling (see for example Lee & Vernez Moudon, 2004). The *New Urbanism* movement is especially keen on creating pedestrian-oriented urban environments (King, et al., 2002). The literature points out that density and diversity, the characteristics of the street network, and the spatial qualities of an area are important for its walking and cycling 'friendliness'. Because running is a significantly different activity than walking or cycling, for example in terms of speed, physical intensity and spaciousness, these activities cannot be compared unreservedly (Ettema, 2015). However, it can be assumed that certain characteristics correspond, such as the role of spatial quality and the density of the street network.

Another important distinction that should be made here is that between transportation or recreational purposes of the (walking or cycling) activity (Ettema, 2015). It can be assumed that running resembles recreational walking more than walking for transportation, as it is carried out as an activity in its own right. Characteristics that stimulate recreational walking are for example aesthetics, variation in functions and quality of infrastructure and these may also stimulate running. "However, running may also bear similarity to transportation walking in the sense that runners want to keep moving without interactions with other traffic" (Ettema, 2015, p. 5). The walking experience (and presumably running experience as well) is further positively affected by liveliness, perceived safety, and the opportunities for restoration offered by a green environment.

Leisure and recreation studies are relevant for the current study of running behaviour, as they focus on behaviour that people pursue in their 'unobligated' time and the role of park and recreation

organisations (i.e. municipal public agencies) in facilitating and maintaining recreational facilities. People are physically active 'by choice' in their leisure time, because it makes them 'feel good' and enhances their quality of life. The century-old aim of the park and recreation field is to facilitate leisure activities and involve more people in 'active play' through better management of recreation facilities (Sallis, et al., 2006). From the sixteenth century onwards, many European cities have developed green areas, green boulevards and parks for their visual connection, recreational value, and associated improvement of urban spaces and public sanitation ('lungs of the city', see Ignatieva, et al., 2010). In recent years, interest in the benefits of natural environments and time spent outdoors has increased again, to counteract the fact that we increasingly live in cities and have disconnected from nature (Thompson Coon, et al., 2011, p. 1761). Green areas are deemed relevant for ecological purposes as well, provided they are connected into an urban green network and are designed properly. Integration of both social and ecological needs is possible with careful design; this offers opportunities for creating a diverse and challenging running environment as well (Fig. 8). As Zhang et al. (2015) concluded in a comparative analysis of urban green areas, "the provision of urban green spaces should not only consider the amount of green spaces but also their accessibility and usability" (p. 14358).

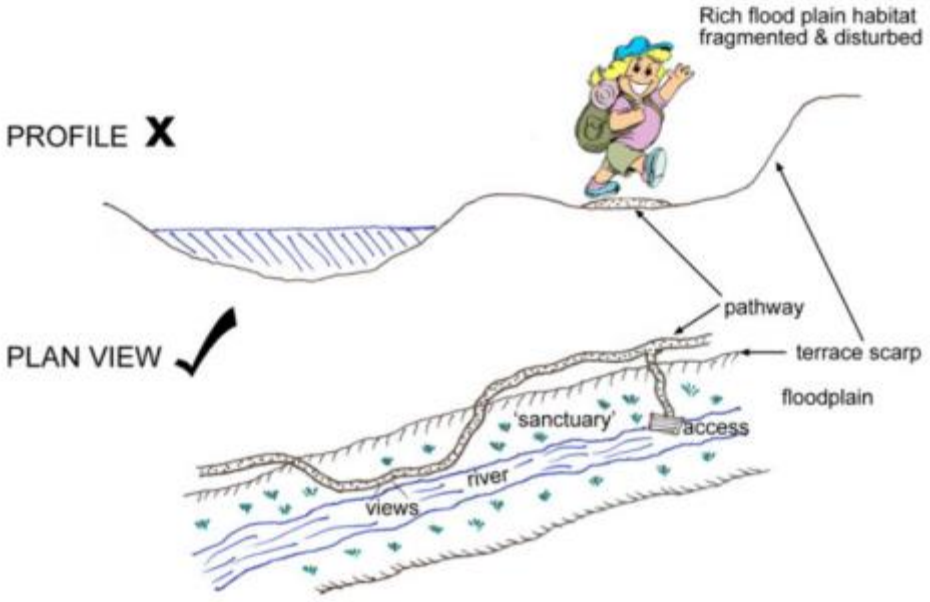


Fig. 8. Landscape design is relevant for access to and aesthetics of urban green areas.

The profile (top) shows a pathway parallel to the river, not only fragmenting the natural habitat in the area, but also creating a straightforward route. By contrast, the meandering pathway (bottom) provided explicit views and water access points, while representative ecological values across the riparian gradient are preserved in sanctuary segments. The second pathway will provide the runner with more variety.

(Ignatieva, et al., 2010, p. 23)

In line with the increased attention towards walking and cycling for transportation and active leisure, there is a growing interest in 'active living' and 'healthy ageing'. This is a transdisciplinary research agenda to achieve population-wide increases in healthy lifestyles and physical activity,

targeting not only individuals, but social environments, physical environments and policies as well (Sallis, et al., 2006). The active living concept assumes that interventions will be most effective when they operate on multiple levels, and trigger multiple anchor points in people's lives. These levels can be described and analysed using social-ecological models. "According to (social-, ed.) ecological models, the most powerful interventions should (a) ensure safe, attractive, and convenient places for physical activity, (b) implement motivational and educational programs to encourage use of those places, and (c) use mass media and community organization to change social norms and culture" (Sallis, et al., 2006, p. 299). By contrast, interventions targeted at individuals or small groups seem to have limited effects on a population-wide level. The social-ecological perspective will be further explained in the theoretical framework of this report.

According to Shipway & Holloway (2010), urban governments have a responsibility to give higher priority to interventions to promote improved physical and psychological well-being, healthy ageing and the reduction of obesity, and therefore provide access to leisure opportunities such as walking paths or cycle lanes. The city of Groningen has established a policy framework for stimulating physical activity in public space, *De bewegende Stad* (The active city) (Gemeente Groningen, 2014). Its key ambitions are to improve the visibility and accessibility of sporting facilities, to integrate active living measures into all spatial planning activities and to create an attractive public space for multiple social groups (elderly, children). Urban designers Vincent Kompier and Daniel Casas Valle conducted an international review of the spatial interventions to integrate sport into public urban space (Kompier & Vasas Valle, 2012). They recommend to give more emphasis to sport in spatial planning policies and to find mutual interests with other policy fields. An example is the public park *Superkilen* in Copenhagen, which integrated social cohesion objectives with recreational and spatial planning policies (Fig. 9). In Groningen, the marked running routes are another example of these sport promoting policies, and new routes were opened this year. The Hunze Fitmijl was developed in close cooperation with local residents and was accompanied by a playground for children and outdoor fitness equipment (Jong & Verver, 2015).

Fig. 9. Superkilen park in Copenhagen.
(Baan, 2012)

1.5 Insights from environmental psychology and behavioural sciences

Besides urban planning literature, environmental psychology and behavioural sciences provide us with clues how the physical environment can support active and healthy lifestyles. Although most of the insights will be covered in the theoretical framework (chapter 2), this section will introduce *green exercise* and well-being. Green exercise can be defined as activity in the presence of nature (e.g. urban green space, waterside, forest; see Gladwell, et al., 2013). A multistudy analysis by Barton & Pretty (2010) found significant positive health effects on both self-esteem and mood from green exercise for people that are currently sedentary, non-active or mentally unwell. Even a short-duration physical activity in green space will contribute to immediate mental health benefits (Barton & Pretty, 2010). Moreover, people seem to clearly experience these benefits as well: "A consistent finding in well over 100 studies of recreation experiences in wilderness and urban nature areas has been that stress mitigation is one of the most important verbally expressed perceived benefits" (Ulrich, et al., 1991, p. 203). This is also one important reason for people to start and keep running (Asics, 2009).

However, the relative contributions of both 'green' and 'exercise' aspects to overall well-being are still largely unknown. For example, Bodin & Hartig (2003) found no significant differences in restorative effects from running in both a park and in an urban environment. However, when comparing physical exercise *indoors* and exercise in natural environments, the latter has been associated with greater enjoyment and satisfaction, and with greater feelings of revitalisation and positive engagement (Thompson Coon, et al., 2011). All in all, as Ulrich et al. (1991) concluded, recreation experiences are very complex, and overall stress recovery is influenced by a multitude of facets such as viewing nature, physical exercise and achieving sense of control through 'temporary escape'.

From a behavioural (change) perspective, evidence suggests that policy programs aimed at stimulating indoor sports are less effective in the long term than policies to stimulate physical activity in outdoor environments (Duijvesteijn, et al., 2010). The enjoyment associated with outdoor activity may bring about long-term positive behavioural changes, and explains the interest of policy makers into programs such as the Green Gym attempting "to motivate people to spend more time being active in natural environments thereby improving their physical and psychological health" (Thompson Coon, et al., 2011, p. 1761).

1.6 Objective and research questions

Although there has been done research on running specifically, Ettema (2015) identifies gaps in knowledge that need to be tackled to be able to more specifically design spatial interventions towards a runner-friendly urban environment. "More insight is needed into the more specific elements of the built, natural, and social environment that may influence the running experience and running behaviour" (p. 18). Ettema suggests that GPS tracking would enable researchers to link

runners' experiences to detailed elements in the landscape. Secondly, the use of qualitative research methods is recommended to better understand running experiences. Concluding, what seems to be missing is both spatial data on running behaviour and personal accounts of running experiences.

To address these gaps, this study aims at providing insights into the interactions between runners and the urban environment on a spatial level, and how these interactions influence the perception, behaviour and route choices of runners. It will do so by studying the links between the physical environment and running behaviour in Groningen and linking this to (personal) experiences of running. These insights are valuable for creating an urban environment that promotes public health and well-being through facilitating and encouraging physical activity. Therefore, the insights from this study of Groningen can be useful to formulate policy recommendations towards developing runner-friendly and health promotive urban environments.

The main question of this study is: *How does the physical environment influence the running experience, behaviour and route choice of runners in the city of Groningen?* The research will be further structured following 2 sub-questions.

1. *Where do runners in Groningen run?*

The first sub-question deals with the actual routes that runners use, and the physical characteristics of these routes and their surrounding areas. In the words of Cook (2013): "the brute facts of movement" (p. 4). This part of the research will for example give insight into which areas and routes are popular for running, and whether this popularity is related to certain physical characteristics such as greenery or road surface.

2. *How do runners perceive and experience the physical environment of Groningen while running?*

The second question deals with the perception of the environment and experiences while running in Groningen. Firstly, we will look at the (stated) preferences of runners and whether the running environment of Groningen accommodates for these preferences. And secondly, the experiences from runners will be studied, by looking at the actual running experience and negotiation with space.

It should be noted that this research covers only a small part of the total 'physical activity agenda', which ranges from active transportation, to physical activity at work, to active play by children and sports and many other related themes. The results from this research can therefore not be generalized unconditionally to all forms of physical activity in public space and their public health effects. However, it can be argued that contributions to a runner-friendly environment could positively influence general active living objectives as well.

Chapter 2. Theoretical framework

Key points:

- *Multiple academic disciplines provide theories that are relevant for the study of the physical environment and running behaviour. Therefore, a multidisciplinary approach is recommended, which combines insights from for example environmental psychology, behavioural sciences and planning;*
- *Social-ecological models describe the dynamic interrelationships between the individual and its environment;*
- *These models are employed to analyse the healthfulness (i.e. impact on health behaviour) of the (social and physical) environment;*
- *The way people perceive and respond to their environment is personal, but there is evidence that certain elements (affordances) support or elicit specific behaviours. Running is for example positively influenced by greenery and good quality infrastructure.*

Theories from multiple academic disciplines are relevant for describing and understanding the links between the physical environment and the running experience and behaviour. Environmental psychology, for example, addresses stress resulting from urban lifestyles and how physical exercise and certain environmental characteristics can help recovering from that stress. Social-ecological models are used to analyse the multiple and interdependent levels of influence on behaviour, from genetic heritage characteristics to spatial planning policies. To address these interdependencies, research into health promotive environments requires a multidisciplinary approach and is rooted in the fields of medicine and public health, urban planning and behavioural and social sciences (Stokols, 1992). These studies focus on the transactions between environmental qualities, behavioural patterns and health outcomes. In doing so, they address the added value of community-wide prevention strategies for individual medicine-based curative strategies.

This chapter will address relevant theories and synthesizes these in a multilevel social-ecological model for running behaviour (Fig. 16).

2.1 The social-ecological perspective on health behaviour and the physical environment

The introduction on physical activity and public health has outlined that environmental factors play an important role in the behaviour of individuals. To gain more insight into the dynamic interrelations between personal and social-environmental factors, researchers employ social-ecological models. These models originate from theoretical work by Uri Bronfenbrenner, who developed the ecological systems theory to explain the relationship between human development and "the changing environments in which it (*the growing human organism*) actually lives and grows" (Bronfenbrenner, 1977, p. 513). With the theory, Bronfenbrenner addressed the shortcomings of the prevailing scientific method of (psychological) experiments that are "elegantly designed but often limited in scope" (Bronfenbrenner, 1977, p. 513). For him, there was a clear gap arising between research following rigorous scientific methods for the sake of science alone, versus conducting socially relevant research. Since, the role of *context* (also referred to as *system* or *environment*) in human functioning has become embedded in the fields of environmental psychology and environmental behaviour research, in order to holistically describe human functioning in real-life (social) situations (Wapner & Demick, 2002).

Researchers explore these person-in-environment systems and the associated transactions of the person with the environment (i.e. experience and action) to find causalities. It is assumed that a particular person or phenomenon is embedded in and influenced by a surrounding set of events and cannot be studied in isolation. In other words, both the person and his/her environment are comprised of mutually defining psychological, physical, interpersonal and sociocultural aspects (Wapner & Demick, 2002). This connects to the notion that "lived realities are multi-dimensional" and require a contextual and evolving theory of inquiry, both quantitative and qualitative (Mason, 2002, in Franz, et al., 2013, p. 371).

The transactions within person-in-environment systems are characterized by complex cycles of mutual influences: the individual exerts an influence over his or her environment, and, at the same time, the environment exerts an influence on the individual (Thompson, 2013). For example, in relation to human health, although physical and social features of an environment directly influence the person's health, the behaviour of the person in turn modifies the healthfulness of this environment (e.g. an urban park not only results in cleaner air, but it can stimulate physical activity as well, thereby supporting healthy behaviour). Furthermore, human environments should be analysed as nested ecological systems, in which multiple levels of influence (i.e. socio-economic, cultural, physical) interact with each other (see Fig. 10). Therefore, "efforts to promote human well-being must take into account the interdependencies that exist among immediate and more

distant environments" (Stokols, 1992, p. 8). For example, certain public policies can be employed to change the health care system from curative to preventive, but these are on their turn subject to other macro trends in space and time such as economic developments and climate conditions.

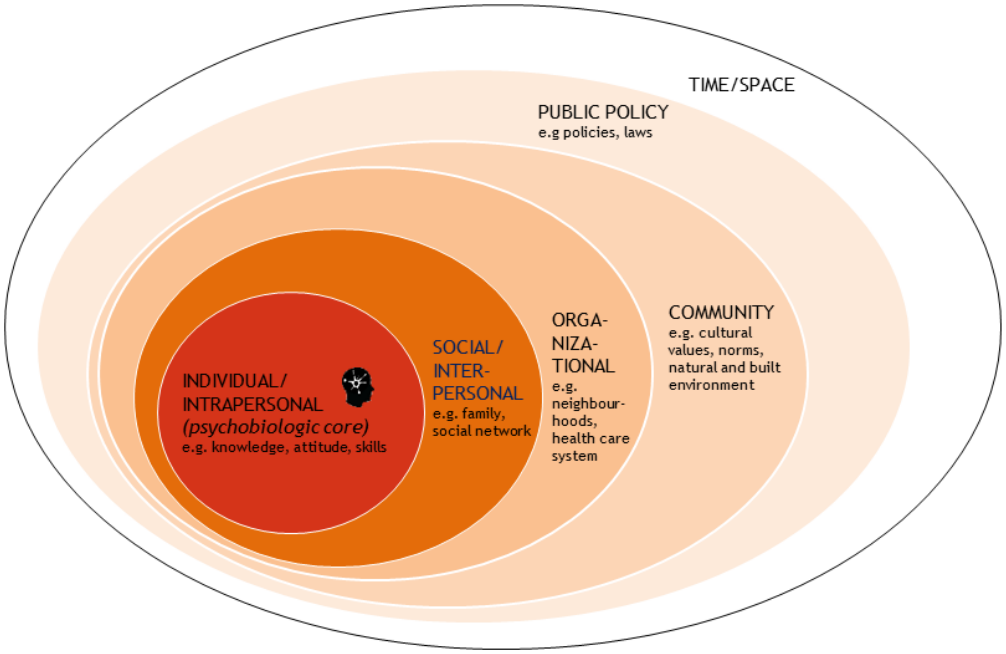


Fig. 10. Basic Bronfenbrenner social-ecological model (ecological systems theory).

(Adapted from Booth, et al., 2001, p. S24 & Sallis et al., 2006, p. 301)

2.2 Health promotive environments

Based on the theories of social ecology, Daniel Stokols (1992) developed a theory on health promotive environments (also referred to as *salutogenic environments*). He did four core assumptions about the healthfulness of person-in-environment systems. These are:

1. The healthfulness of a situation and well-being of its participants are influenced by the physical (e.g. geography, technology) and social environment (e.g. culture, economics). The health status of an individual is influenced by intrapersonal attributes (e.g. genetic heritage, psychological dispositions, behavioural patterns). Therefore, efforts to promote human well-being should be based on the dynamic interplay between these factors;
2. Behaviour has multiple levels of influences. Therefore, analyses of health promotion should address the multidimensional and complex nature of human environments. These environments can be described in terms of their physical and social components, in terms of their objective or perceived qualities, and their scale or immediacy to people (e.g. proximal vs. distant);
3. The participants in the environment can be studied at varying levels (e.g., immediate-local conditions within one's home or workplace; meso-scale influences at the neighbourhood level; and more distal or global features of whole communities such as the design of transit

systems, land use zoning laws, pervasive cultural values, and widespread economic or political conditions). Intervention programs for health promotion should be targeted at these multiple levels as well. Health promotion theorists and practitioners should strive to identify, from among myriad contextual variables, those "high-leverage" factors that exert the greatest influence on individuals' physical activity patterns at each environmental scale;

4. The social-ecological perspective incorporates concepts from systems theory to understand the dynamic interrelations between people and their environments. Therefore, interventions to promote physical activity should be "composite" or synergistic — that is, they should address multiple high-leverage environmental conditions situated at micro, meso and macro levels of the environment and engage several sectors of society (adapted from Stokols, 1991 & King et al., 2002).

To operationalise these assumptions, Stokols developed a table with criteria of a health promotive environment, subdivided in physical health, mental & emotional well-being and social cohesion (Table 2).

Table 2. Some dimensions and criteria of health-promotive environments.

Facets of healthfulness	Environmental resources	Behavioural, physiological and psychological outcomes
Physical health	Injury-resistant design; ergonomically sound design; physical comfort	Physiologic health, absence of illness symptoms and injury, perceived comfort
Mental & emotional well-being	Environmental controllability and predictability; environmental novelty and challenge; low distraction; aesthetic qualities; symbolic and spiritual elements	Sense of personal competence, challenge, and fulfilment; minimal experience of emotional distress; feelings of attachment to one's physical and social milieu
Social cohesion at organisational and community levels	Availability of social support networks; participatory design and management processes; health-promotive media and programming	High levels of social contact and cooperation; commitment to and satisfaction with organisation and community; high levels of perceived quality of life; prevalence of health-promotive, injury-preventive, and environmentally protective behaviour

Adapted from Stokols, 1992, p. 9

For running environments, the facets of healthfulness could for example be represented by:

- Physical health: 'Comfortable' and safe routes without hazards, barriers or interruptions;
- Mental & emotional well-being: Good balance between predictability and challenge along a route; pleasant momentum/flow, feeling of 'being away' while running;
- Social cohesion: Involving runners in urban planning; making running 'visible' in public space; integration of health, sports and planning policies.

These social-ecological models can clearly be distinguished from behavioural models that solely emphasize individual characteristics and interventions such as educational programs to change the health behaviour of people. Although both approaches are relevant, the effectiveness of individual approaches can be maximized through creating supportive environments and policies (WHO, 1986). "A central conclusion of ecological models is that it usually takes the combination of both individual-level and environmental/policy-level interventions to achieve substantial changes in health behaviours. (…) Educating people to make healthful choices when environments are not supportive can produce weak and short-term effects, which are common" (Sallis, et al., 2008, p. 467).

2.3 Affordances of the physical environment

To better understand the complementarity of the individual and his/her environment, psychologist J.J. Gibson developed the theory of affordances. Gibson developed his theory of affordances in a 1977 publication, in which he defined an affordance as a possibility for motoric action provided to an animal by the environment. Affordances are as "arrows pushing the observer toward or away from the object", indicating possible functions an object or environment might serve for the perceiver (Gibson, 1979, p. 138; Kaplan, 1979). For example, an object such as a door handle 'invites' the observer to push it down to open a door. To define it more precisely, Lier (2004) defined an affordance as a relationship between an organism or body and an object or physical environment that, through a collection of stimuli, affords the opportunity for that organism to perform an action. An affordance is not a property of either individual (physical, cognitive and emotional) characteristics or its physical environment alone, but is both objectively real and psychologically significant (Ward Thompson, 2013). Gibson illustrated his theory with a description of a hypothetical terrestrial surface:

> *"If a terrestrial surface is nearly horizontal (instead of slanted), nearly flat (instead of convex or concave), and sufficiently extended (relative to the size of the animal), then the surface affords support. It is a surface of support, and we call it a substratum, ground, floor. It is stand-on-able, permitting an upright posture for quadrupeds and bipeds. It is therefore walk-on-able and run-over-able. It is not sink-into-able like a surface of water or swamp, that is, not for heavy terrestrial animals" (…) "Note that the four properties listed - horizontal, flat, extended, and rigid - would be physical properties of a surface if they were measured with the scales and standard units used in physics. As an affordance of support for a species or animal, however, they have to measured relative to the animal. They are unique for that animal. They are not just abstract physical properties. They have unity relative to the posture and behaviour of the animal being considered. So an affordance cannot be measured as we measure in physics" (Gibson, 1979, pp. 127-128).*

When placing affordances into the social-ecological model, they can be understood as a mediating factor between the individual's behaviour and his or her physical environment. More specifically, affordances link individual perception of the environment to the experiences one has (had) with the

perceived elements, enabling them to adapt or adjust behaviour. In this sense, an affordance is neither an objective property nor a subjective property. As Gibson wrote:

> *"An affordance cuts across the dichotomy of subjective-objective and helps us to understand its inadequacy. It is equally a fact of the environment and a fact of behaviour. It is both physical and psychological, yet neither. An affordance points both ways, to the environment and to the observer" (Gibson, 1979, p. 129).*

Thus, affordances share characteristics of both objective, 'real' elements and of values and meanings, which are often supposed to be subjective, phenomenal, and mental. For runners, not only the presence of physical elements in the environment such as certain paths, sidewalks and trails are relevant, but also whether they are deemed suitable for running. Moreover, although there might be some basic conditions that are necessary for running, the specific affordances can be different for every individual runner dependent on his/her preferences and skills: "The value of something was assumed to change as the need of the observer changes" (Gibson, 1979, p. 138). Running 10 km/h or 15 km/h results in different perceptions of the environment and requires different conditions that afford a pleasant running experience.

On the other hand, people tend to be adaptive in relation to their physical environment, and are able to change their behaviour in response to environmental changes. An environment with different objects and spaces affords multiple behaviours (Atmodiwirjo, 2014). This is illustrated by a child moving along a path, which could be undertaken by different possibilities: walking, running, or crawling (Fig. 11). The actual behaviour of the child is not only a consequence his or her capabilities or preferences, but also related to the primary spatial properties/affordances along the path (Atmodiwirjo, 2014). The concept of affordances has been beautifully elaborated in the 'landscape of affordances', designed by RAAAF in 2015 (Fig. 12). In this respect, we can also imagine a runner adapting his speed or running technique in response to for example the road surface and objects near the route.

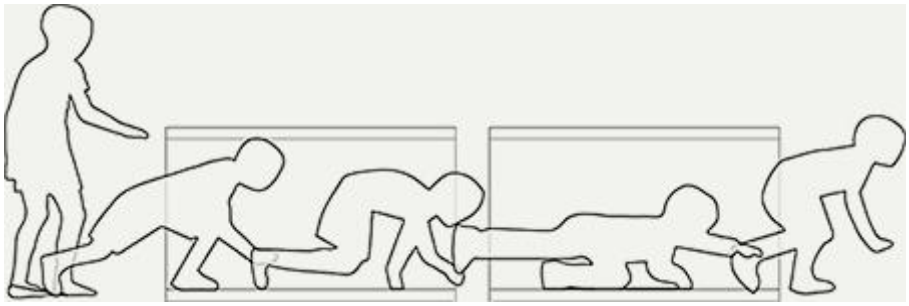


Fig. 11. Walking or crawling: adaptive action in response to the physical environment.
(Atmodiwirjo, 2014)

Fig. 12. ‘The end of sitting’. Interior design of a landscape that affords different modes of working. (Architect Magazine/RAAAF, 2015)

Related to, but broader than the concept of affordances is the notion of behaviour settings (Sallis, 2009; Ward Thompson, 2013). Behaviour settings are both social and environmental structures in which specific recurring patterns of activity can be observed. In other words, certain physical environments (and their socio-cultural context) can elicit certain types of behaviour that are rather predictable, partly as a result of the affordances that are available in that environment, such as a public open grassfield above a certain size attracting informal footbal players. “Such behaviour would not be found in similar sized lawns in front of corporate buildings, or in very small and subdivided grassy plots in a public park” (Ward Thompson, 2013, p. 82).

2.4 Environmental support for outdoor activity

Personal construct theory offers another way to understand the link between individuals and their (physical) environment. This theory describes how the personal constructs that people develop throughout their lives, support them to understand the world and its meaning, predict what to expect from their environment, and modify their predictions in the light of experience (Ward Thompson, 2013). The personal constructs, together with the affordances of the environment, determine how suitable the environment is deemed for certain behaviours (i.e. environmental support). Environmental supportiveness was defined by Ward Thompson (2013): “the extent to which the environment helps or hinders physical activity, and allows for notions of positive attractors in the landscape or environment (such as good quality paving and tree lined walks) as well as limitations (such as dog fouling) which inhibit or prevent activity” (p.83).

Runners strongly depend on their constructs of the environment in order to be able to anticipate environmental circumstances, for example different road surfaces or the height of sidewalks. On the other hand, opposite of the accommodation of planned actions, the environment could also elicit certain unplanned behaviours. Certain landscapes have qualities that lure people to become more active rather than less (Ward Thompson, 2013):

> *"Environmental supportiveness thus builds on the idea of aesthetics and affordances that can elicit activities, drawing people into perhaps unplanned behaviour because the environment makes doing so easy and enjoyable" (Ward Thompson, 2013, p. 83).*

Concluding, the behaviour settings, constructs and available affordances determine the *choice architecture* of the environment, both for enabling planned behaviour or eliciting unplanned behaviour (Ward Thompson, 2013). In order to better understand how the choice architecture influences behaviour, the next sections will explore the role of perception in making sense of our environment.

2.5 Perception of the environment

The way people respond to their environment is ultimately determined by their individual perception. In line with affordance theory, perception is understood as not merely dealing with information from the physical environment, but also with what we are looking for, needing or expecting from the environment (Kaplan, 1979). Kaplan refers to this process as an intuitive form of judgement, in which people anticipate the experiences they would have, the ease of moving through the environment, and how they would function in the environment they are viewing (Kaplan, 1979). In the landscape perception model as developed by Jacobs (2011), this judgement is referred to as the 'mental process', which is influenced by biological, cultural and individual factors (Fig. 13). This complex mental process mediates the transition from physical landscape (objective) to psychological landscape (subjective).

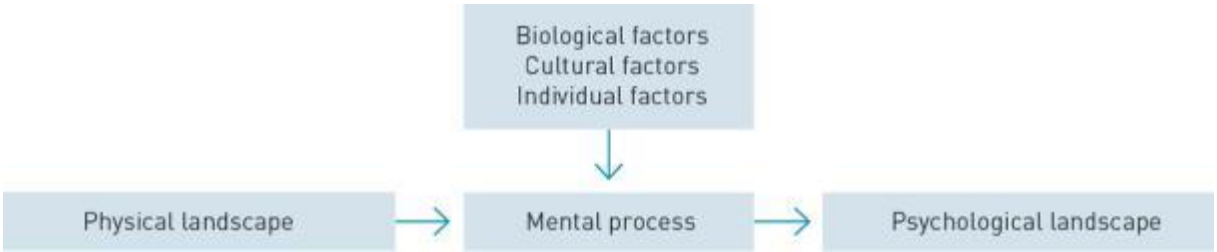


Fig. 13. Landscape perception model.

(Jacobs, 2011, p. 42)

Table 3 shows the landscape preference matrix, consisting of four factors that determine our understanding of a landscape: coherence, legibility, complexity and mystery. People prefer landscapes that score high values on all factors, which would provide the best opportunities for our

survival. This is especially true for half-open, green landscapes, as further explained in the next section.

Table 3. Psychology of landscape perception.

Level of interpretation	Making sense/understanding	Involvement
The visual array ('picture plane') *Immediate*	Coherence *The extent to which the scene seems to 'hang together', facilitates understanding of a scene*	Complexity *Information richness of the scene, makes a scene interesting*
Three-dimensional space *Prediction*	Legibility *The predicted navigability of the scene upon further exploration (being able to find one's way back), facilitates understanding of a scene* *Such scenes offer visual access, but with distinct and varied objects to provide notable landmarks*	Mystery *The promise of the scene offering additional information upon further exploration, raises expectations that there is more to learn about the scene* *Such scenes include winding paths, meandering streams, and brightly lit areas partially obscured by some foliage*

Adapted from Kaplan, 1979, p. 245; Kaplan, 1987; Kahn, 1997: p.4; Jacobs, 2011

2.6 Psychological benefits of a green environment

A considerable body of work has been published about the stresses associated with living in cities and the positive effects of natural and green environments for stress recovery and increasing mental well-being (Ulrich et al., 1991; Kahn, 1997; Bodin & Hartig, 2003; Ward Thompson, 2013). Landscape architect Frederick Law Olmstead intuitively argued that viewing nature "employs the mind without fatigue and yet exercises it; tranquilizes it and yet enlivens it; and thus, through the influence of the mind over the body, gives the effect of refreshing rest and reinvigoration to the whole system" (Law Olmstead, F., 1865, in Ulrich et al., 1991).

This basic notion has later been supplemented by more solid theoretical work, such as cultural, psycho-evolutionary and arousal theories (Ulrich, et al., 1991). Ulrich's psycho-evolutionary framework, for example, adds a broad range of emotional, physiological and cognitive responses, such as recovery and restoration, to the mere aesthetic preferences for natural settings (Ulrich, et al., 1991). In other words, green space makes people feel more relaxed and vitalized.

E.O. Wilson's biophilia hypothesis suggests there is a genetically based, unconscious and instinctive bond between human beings and other living organisms as a result of biological evolution (Kahn, 1997). "Given people's strong tendency to connect with nature, it seems appropriate to distinguish "green space attachment" as a special form of place attachment that is highly significant to people" (Zhang, et al., 2015, p. 14345). Interestingly, certain landscapes and landscape elements

that were beneficial to our survival continue to cause particular emotional responses: “when given the option, humans choose landscapes such as prominences near water from which parkland can be viewed that fit patterns laid down deep in human history on the savannas of East Africa” (Jacobs, 2011; Kahn, 1997, pp. 1-2). Appleton’s prospect-refuge theory is related to this, in stating that landscapes that provide both opportunity (prospect) and safety (refuge) are preferable over others. This is confirmed by empirical evidence that half-open landscapes are preferred over open or closed landscapes (Jacobs, 2011).

Arousal theory further explains why certain natural landscapes are preferred over others. The ‘optimal’ landscape has a mixture of arousal-increasing and arousal-decreasing properties (arousal being the general level of excitement or activation). Combined, these stimuli “make it cognitively difficult to understand the situation, but at the same time make it possible to resolve the problem” (Jacobs, 2011, p. 43). In other words, stimuli have an optimal level of arousal: the individuals’ physical and emotional well-being are enhanced when environments are personally controllable and predictable; however, when the environment is too predictable and controllable, it will be classified as boring and unchallenging and constrains opportunities for development (Stokols, 1992; Ettema & Smajic, 2015). These insights are often used in the design of public parks, exemplified by the English landscape garden (Fig. 14).

Fig. 14. Stourhead, an English landscape garden.

(Jolley, 2010)

Linked to biophilia and arousal theory, Kaplan (1995) developed the attention restoration theory, in which four aspects were identified as key to recovering from mental stress: being away, fascination, extent/sense of coherence and compatibility. Natural settings provide these conditions quite well, as exemplified by Kaplan (1995):

1. **Being away/novelty**. Natural settings are often the preferred destinations for extended restorative opportunities. The seaside, the mountains, lakes, streams, forests, and meadows are all idyllic places for 'getting away'. Yet for many people in the urban context, the opportunity for getting away to such destinations is not an option. However, the sense of being away does not require that the setting be distant. Natural environments that are easily accessible thus offer an important resource for resting one's directed attention;
2. **Fascination**. Nature is certainly well-endowed with fascinating objects, as well as offering many processes that people find engrossing. Many of the fascinations afforded by the natural setting qualify as 'soft' fascinations: clouds, sunsets, snow patterns, the motion of the leaves in the breeze - these readily hold the attention, but in an undramatic fashion. Attending to these patterns is effortless, and they leave ample opportunity for thinking about other things;
3. **Extent/Sense of coherence**. The environment must have extent. It must, in other words, be rich enough and coherent enough so that it constitutes a whole other world. In the distant wilderness, extent comes easily. But extent need not entail large tracts of land. Even a relatively small area can provide a sense of extent. Trails and paths can be designed so that small areas seem much larger. Miniaturization provides another device for providing a feeling of being in a whole different world, though the area is in itself not extensive. Japanese gardens sometimes combine both of these devices in giving the sense of scope as well as connectedness. Extent also functions at a more conceptual level. For example, settings that include historic artefacts can promote a sense of being connected to past eras and past environments and thus to a larger world;
4. **Compatibility**. There should be compatibility between the environment and one's purposes and inclinations. In other words, the setting must fit what one is trying to do and what one would like to do. The natural environment is experienced as particularly high in compatibility. It is as if there were a special resonance between the natural setting and human inclinations. For many people, functioning in the natural setting seems to require less effort than functioning in more 'civilized' settings, even though they have much greater familiarity with the latter (adapted from Kaplan, 1995, p. 174).

Some studies have found evidence that physical exercise in natural environments is more beneficial than exercise in urban environments. Field experiments have pointed to enhanced emotional, attentional, and physiological restoration in people who walked in natural versus urban environments (Bodin & Hartig, 2003).

The psychological benefits of running are related to the actual (environmental) experiences *during* a run. Cook (2013) investigated the running experience by applying the human-geographical concept of 'mobility', which consists of the triumvirate of movement, meaning and experience (Fig. 15). Running is referred to as a constant 'negotiation with space', in which movement, meaning and experience can be subdivided in six facets:

1. **Motive force**. Why does a person move?
2. **Speed**. Can the desired speeds be reached?
3. **Rhythm**. Recurring patterns of movement and rest, continuity
4. **Route**. What route is taken, habitual routes, predictable or not?
5. **Experience**. How does it feel?
6. **Friction**. What are barriers to mobility?

After making the choice to go running (i.e. have established 'motive force'), the actual environmental experience of running is determined by the dynamic process between the ('brute') facts of movement and experiences of the 'running body' in the environment (Fig. 15). The constant 'negotiation' with space is insightfully studied with Cook's (2013) mobile video ethnography research (see Methodology section of this report). Similarly, Allen-Collinson (2008) described the corporeal experience of running as a dynamic process between the running body, its environment and the knowledge of routes and training objectives the runner has:

> *"When ascending a slope or pitch, for example, the quadriceps muscles must work harder, stride-length shortens, the body is angled into the slope, breathing rate increases… Simultaneously we are identifying and checking the best line. The knowledge is truly knowing in action, the know-how being in the action (Allen-Collinson, 2008, p. 45).*

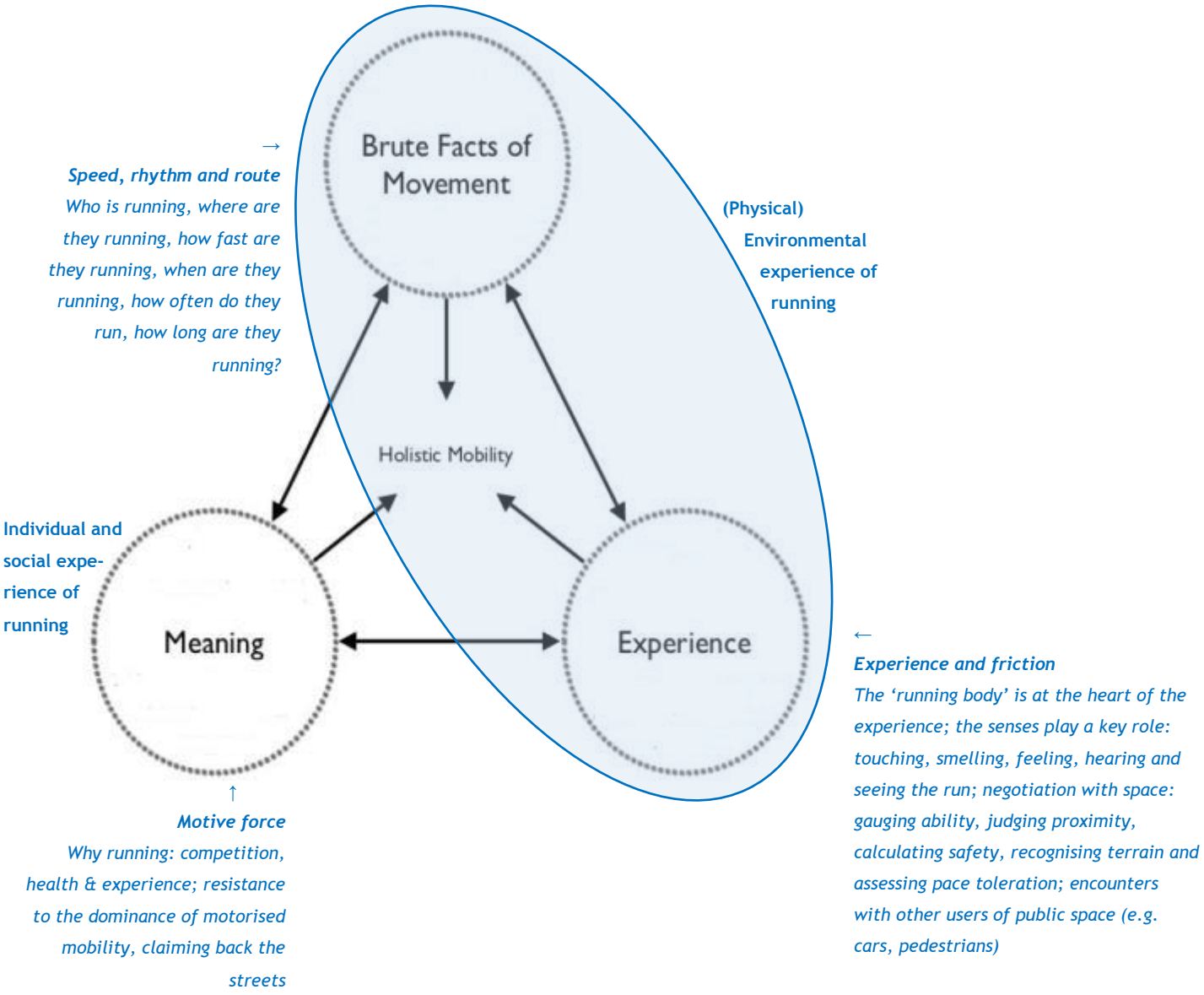


Fig. 15. Holistic Mobility Framework.

(Adapted from Cook, 2013, p. 4)

2.7 Conceptual model

Based on the social-ecological theories on (health) behaviour and related theories, Fig. 16 shows a model to structure and visualise the multiple influencing aspects of running behaviour. On the one hand, the behaviour is influenced by the individual runner and the conditions he or she sets to the environment (choice-determining factors or *constructs*), and on the other hand by the physical environment and whether it affords running activities (choice-enabling factors or *choice architecture*).

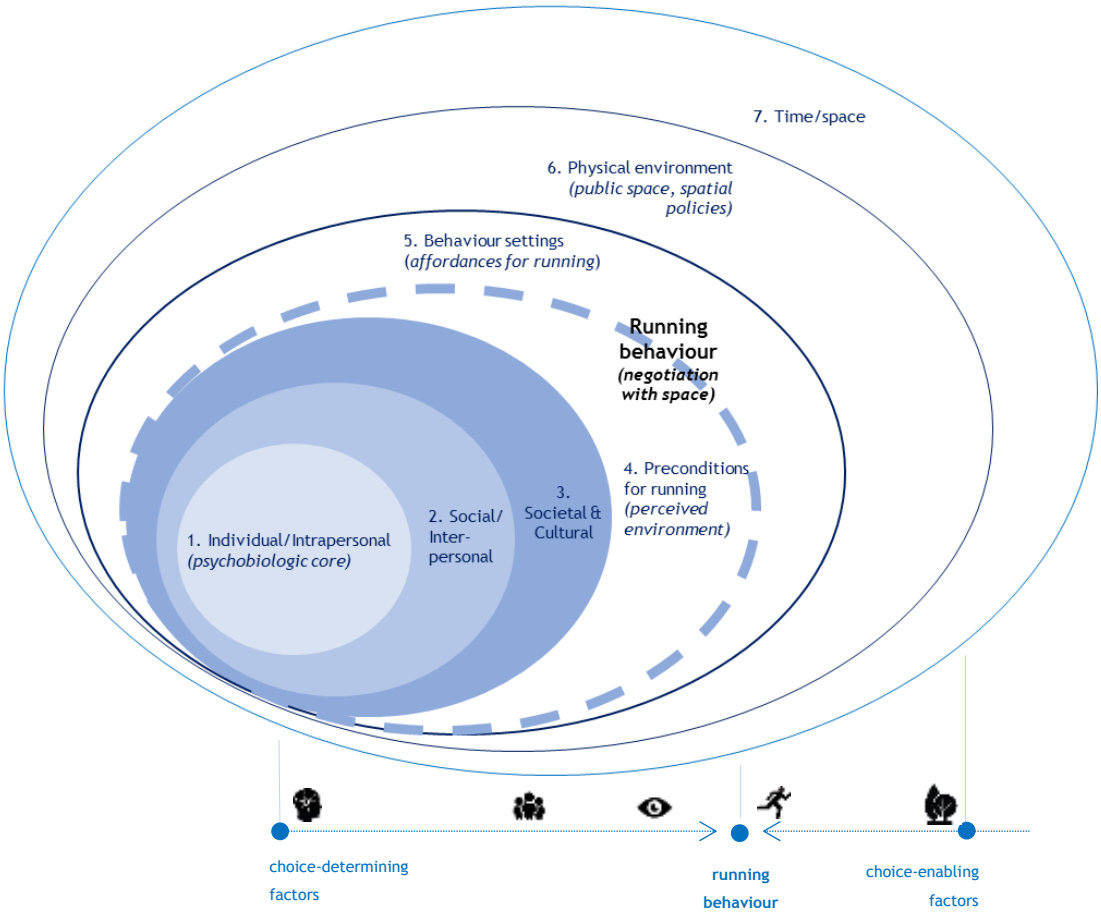


Fig. 16. A multilevel social-ecological model for running behaviour.

Choice-determining factors or constructs

1. Individual/Intrapersonal*: Genetically programmed metabolism and behaviour, instinctive behaviour, innate values related to survival, which are essentially immutable. Early conditioned behaviours (e. g., positive and negative reinforcement of pleasure, pain, etc.) and experiential learning, physiologic state; these are behavioural and metabolic phenotypes expressed within a given environment. The psychobiologic core also includes current health status.*

e.g.: commitment to running, physical capabilities, (mental) health status, basic environmental preferences

2. Social/Interpersonal*: Social roles and relationships.*

e.g.: role of encouragement for running by family and friends

3. Societal & Cultural*: "Acquired" values and beliefs, how society views the individual and vice versa, i.e., self-identity within broader social/cultural environment, broader societal values (e.g., social trends). This interacts with the cultural*

realm: how society views you affects how you view yourself. The cultural realm itself is concerned with "inherited" values and beliefs (e.g., ethnic and cultural identity), self-identity within immediate social/cultural surroundings.

e.g.: positive or negative attitude towards exercise, societal acceptance of running, identifying yourself as a runner

***4. Preconditions for running**: Most proximal factors affecting choices that are commonly identified as enhancers or barriers to change. These factors tend to be the ones most focused on in order to facilitate change.*

e.g.: buying shoes and clothes, joining a running group, environmental preferences for running, personal constructs

Choice-enabling factors or choice architecture

***5. Behaviour settings/affordances for running**: Physical and social settings/affordances in which running activities take place and choices are made (i.e. the elements in the environment and whether they afford/support running activities).*

e.g.: interaction with the social and physical environment, choice architecture

***6. Physical environment**: The wider environment in which the behaviour takes place (e.g. the characteristics and qualities of the public space, health and planning policies).*

e.g. characteristics of urban space, availability of parks, urban planning policies

***7. Time/space**: Macro-level influences of seasons, day/night, geography.*

***Running behaviour**: Visible behavioural choices made by the individual runner following from his/her negotiation with space.*

e.g.: chosen routes, speed, momentum, 'brute facts of movement', 'spatiotemporal experience' while running

Adapted from Booth, et al., 2001, p. S24 & Sallis et al., 2006, p. 301

This study will focus on the elements that most directly influence the running behaviour, being the conditions that runners set to their environment and the affordances in that environment, and the negotiation with space that follows from the interaction between both elements. Based on the theories and literature presented before, the most relevant choice-determining and choice-enabling factors of the running environment are presented below.

Choice-enabling factors or *choice architecture*:

1. Infrastructure (i.e. paving, lighting)
2. Greenery (i.e. green space attachment, *biophilia*)
3. Social environment (i.e. interaction with other people)
4. Time/space (i.e. climate, seasons, day/night, sightlines)

Choice-enabling factors are those elements in the environment that afford a pleasant running experience. These affordances are dependent on the needs of each individual runner, although some general behaviour settings for running can be defined. Sufficient infrastructure is a basic condition for creating routes, as it affords runner to move around in the environment. Greenery is especially important in the urban context of this study, because people are unconsciously attached

to green space (Kahn, 1997). Because running takes place in public space, other people will influence running experiences and the social environment cannot be ignored. Finally, time and space are enabling (or disabling) factors for running, as for example weather conditions and daylight 'frame' the possibilities for running.

Choice-determining factors or *constructs*:

1. Being away and fascination (i.e. arousal, mental restoration)
2. Landscape perception and attractiveness (i.e. coherence, complexity, legibility, mystery)
3. Safety (perception)
4. Continuity (i.e. momentum, not having to stop for other road users)
5. Compatibility with training objectives (i.e. challenge, facilities)

Choice-determining factors are the preconditions that runners set to their environment. The most relevant factors can be found in the existing literature on running, supplemented with findings from the theoretical framework. Firstly, running is important for mood control, relaxation and recovery from daily stresses (Allen-Collinson, 2008). Therefore, runners seek restorative environments which offer a sense of 'being away' and 'fascination' (Kaplan, 1995). Secondly, landscape perception theories point out that certain landscapes are more attractive than others because they provide an ideal mix of arousal-decreasing and arousal-increasing elements, in other words both overview and variety. Ideal landscape combine coherence, complexity, legibility and mystery (Jacobs, 2011). Thirdly, evolutionary theories point to the preference for landscapes that provide safety, which is relevant in an urban context as well, where traffic conditions and social safety issues play a major role for the experience of runners. Fourth, running research has pointed out the importance of continuity along the running route, as runners dislike being interrupted (Ettema, 2014). And the fifth and final precondition for runners is the compatibility of the environment with their training objectives (i.e. interval training, exercises, hills).

The nine factors come together in the negotiation with space during a running activity and define the environmental supportiveness for running. This is a process of adaptive action (Atmodiwirjo, 2014), in which the preconditions are weighed against the available affordances in the environment, resulting in a specific speed, rhythm, route, experience and friction. For example, the runner's physical condition and the quality of road surface will both influence the observed running speed; and the complexity of traffic situations and the runner's capability to cope with these will both affect the level of friction experienced by the runner. Table 4 schematically visualizes the process in a matrix.

Table 4. Negotiation with space-matrix for running experience and behaviour.				
	Choice-enabling factors/choice architecture			
Choice-determining factors/constructs	*Infrastructure*	*Greenery*	*Social environment*	*Time/space*
Being away				
Landscape perception and attractiveness				
Safety		**Running experience and behaviour** Negotation with space *Speed, rhythm, route, experience, friction*		
Continuity				
Compatibility with training objectives				

This process of adaptive action has been schematically visualised in the conceptual framework of this study, which basically is a simplified social-ecological model (Fig. 16). In the model, running behaviour is understood as the resultant of the indivudual preconditions for running and the attributes in the environment. However, the environmental attributes are not completely fixed, as through route choices, the runner can seek environments that better meets his/her preconditions (visualized by the double arrow from running behaviour to environmental attributes). Moreover, each precondition is influenced by multiple environmental attributes. For example, the sense of being away could be related to the quality of greenery, the absense of traffic and other people, and specific time periods. All factors together determine whether the run is experienced as restorative.

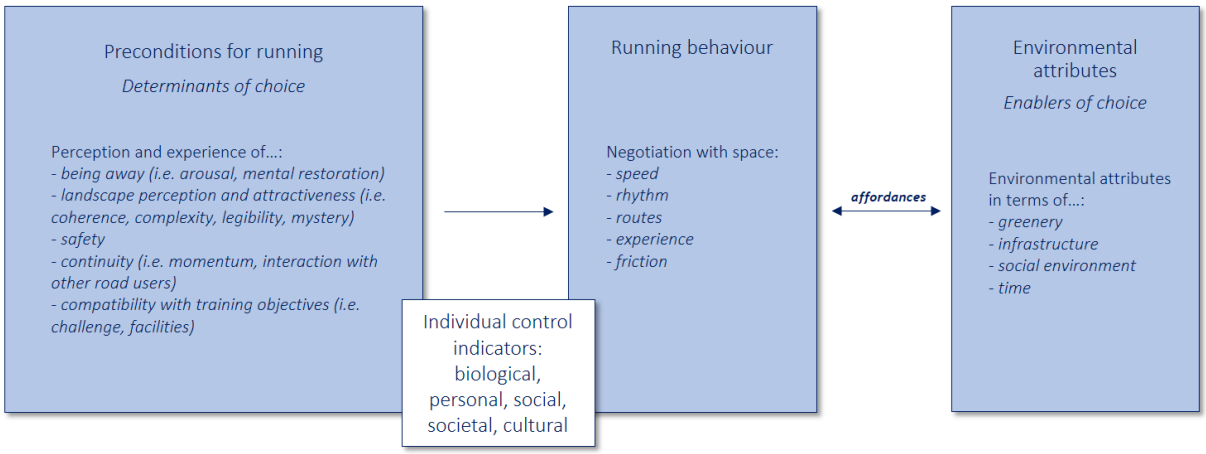


Fig. 17. Conceptual framework for the study of running behaviour and experiences.

The conceptual model covers the two sub-questions as defined before and provides a framework for answering the main question: How does the physical environment influence the running experience and behaviour of runners in the city of Groningen?

The first sub-question, *Where do runners in Groningen run?*, can mainly be found in the right part of the model, dealing with the environmental attributes that can be measured objectively (the *physical landscape* from Fig. 13). The second sub-question, *How do runners perceive the physical environment of Groningen while running?*, is covered in the left part of the conceptual model, which deals with the individual runner's perception and experience of the environment (the *psychological landscape* from Fig. 13). The central part of the model integrates both data sets to answer the main question, by linking the physical environment, perception and experience, towards holistically explaining running behaviour.

Chapter 3. Research Design

Key points:

- *This study was conducted using a mixed methods approach, combining a survey, GPS data collection and run-along interviews;*
- *The three methods were conducted sequentially, allowing to enrich the data from previous steps and both find out where runners in Groningen run, how they perceive the physical environment of Groningen while running and how this influences their route choices.*

This chapter will outline the methodology and multiple types of data collection applied in this study. The study was conducted in the city of Groningen, a historic student city in the Northern part of the Netherlands. The city is relatively compact and has just over 200.000 inhabitants (CBS Statline, 2015). The city hosts the *4 mijl* running event each year, one of the largest running event in the Netherlands in which 23.000 runners cover the 6,4 kilometres from Haren to the centre of Groningen (De 4 mijl van Groningen, 2016).

3.1 General methodology

Aiming for a holistic exploration and explanation of the running experience and the role of the physical environment therein, the research has an inductive theoretical drive and was conducted in 'discovery mode' (Morse, 2003). The research design contains a mix of both quantitative and qualitative data collection methods, in order to cover both the objective and subjective environments from the conceptual model (QUAL + quan research, see Morse, 2003, p. 198). The two main parts of the data collection were an online survey targeted at runners in the city of Groningen, and three run-along interviews with selected survey respondents that approved for a follow-up interview. The survey consisted of two parts, the first being a questionnaire about the backgrounds and running experiences of runners in the city of Groningen. Respondents were asked whether they use GPS tracking during their runs, and whether these data would be available for further research.

If so, a second survey was sent to this group of respondents, in which they were asked to send one GPS-track of a running route and were presented a short questionnaire about this route. The GPS-tracks were collected and analysed in GIS. The survey and GPS-tracks provide us with a general overview of the 'running landscape' in Groningen, in order to understand where runners in Groningen run and how they generally perceive the environment. The interviews were conducted after analysing the survey and GPS-tracks, and therefore allowed for a more in depth discussion of the most important environmental attributes for running. The interviews provide insight into individual perception, behaviour and the process of 'negotiation with space' (i.e. *microgeography*).

The advantages of a mixed methods approach follow from the notion that social science research questions are complex and cannot be grasped by one single method (Christensen, et al., 2011). Different methods can help to examine different aspects of the question. In that sense, methods are often complementary, and methodological triangulation combines the strengths of each distinct method, while overcoming their unique deficiencies. Together, the data produced from multiple methods are likely to have a higher validity. Moreover, mixed methods offer some flexibility in research design, as each method is designed and implemented based on the insights from preceding findings (i.e. sequential research design). In this study, for example, the survey data allowed for a more detailed interview setup, and interview guides were based on the findings from the survey and GPS-tracks.

Mixed methods research is affiliated to the philosophical tradition of pragmatism, which accepts multiple realities that are open to empirical inquiry and is oriented towards solving practical problems in the 'real world' (Feilzer, 2010). Pragmatists refer to the measurable world as a construct of different elements or layers, some objective, some subjective, and some a mixture of the two. The aim of pragmatist research is not to find 'the truth' as accurately as possible, but to gain knowledge that is useful. In pragmatism, researchers are encouraged to be open to unexpected findings, and in Kuhn's terms, have the duty to be curious and adaptable during the research process (Feilzer, 2010, p. 14). Causal relations are deemed transitory and hard to identify, as knowledge is relative rather than absolute. Pragmatists accept that phenomena can have different layers, of which some can best be measured with quantitative methods, and others with qualitative methods. The advantage of pragmatic research in the context of social research is that it accepts all data that is provided by responsents, regardless of whether it was specifically aimed for. For example, remarks in the margins of a questionnaire can provide valuable qualitative insights (Feilzer, 2010). For example, the survey in the current study specifically attempted to elicit qualitative statements from its respondents, as these were expected to give a much better picture of people's behaviour and perceptions.

A difficulty with mixed methods research, however, is to integrate findings consistently and draw the full picture. It is not certain that different datasets will converge towards clear conclusions. Therefore, Feilzer (2010) proposes to 'move back and forth' between different types of knowledge

in order to establish logical connections between data and theory (i.e. abduction). While induction implies converting observations into theories and deduction assessing those theories through action, abduction combines both approaches in order to generate new insights. In the current study, the survey for example provided patterns of running behaviour in Groningen, after which the findings were tested again with 'real-world' experiences in the run-along interviews.

In mixed methods research, it is of key importance to reflect on the results, and to critically examine whether understanding has been enriched by combining different data types (Bryman, 2007). In order to be able to justify the conclusions, the researcher should monitor the research process by asking reflexive questions, such as "what is it for", "who is it for", "how do the researchers' values influence the research", and about the added value of each method in addressing the research questions (Feilzer, 2010).

The conceptual model of this study immediately points towards a mixed methods approach, as it links environmental (objective) and personal (subjective) indicators of running behaviour. The theoretical framework, based on social-ecological models, further supports the use of multiple methods, as behaviour is understood as an outcome of both interpersonal and physical environmental aspects. Whereas the analysis of the objective physical environment can be done quantitatively, perception and experience are explicitly subjective and require qualitative data collection. Both approaches together are expected result in a balanced and more complete picture of running behaviour and experience.

3.2 Ethical Issues

All respondents and participants of the study were informed about the confidentiality and anonymity of data collected for this study. Although e-mail addresses were required to link multiple datasets (survey, GPS data and the accompanying survey), the data were subsequently anonymised for further analysis, using ID-codes (ID001, ID002, etc.). The transcripts and video stills from the run-along interviews were anonymised as well, and participants were informed about the publication of their data.

From a positionality perspective, it is relevant to mention that I (the researcher) am an active runner myself. My personal experiences and opinions might have influenced the research setup, formulation of survey questions and analysis of the results. On the other hand, it does offer a network for approaching the target group of the study, and informs the understanding and interpretation of the results.

The following sections will further outline the sampling procedure and different methods that were used in the study.

3.3 Sampling

The sampling procedure followed the general research design, and involved both quantitative and qualitative sampling. The sample for the qualitative study was a subset of the quantitative sample, and used its results to determine qualitative sampling criteria. Pragmatic considerations and limited resources (time) resulted in a compromise between the representativeness and saturation of the sample. Although a higher number of survey respondents would have increased the representativeness of the study, the qualitative data that was collected through the survey required careful analysis and therefore was a limiting factor to the number of respondents. The central aim in the sampling procedure was to reach qualitative saturation, both in terms of having a varied group of respondents in terms of backgrounds (age, zip code) and in terms of saturation of information in the open ended questions.

3.3.1 Survey sampling

Survey respondents were targeted through probability sampling, aimed at a broad group of Groningen runners that would be diverse in amongst others age, sex and running experience. As a first step, running clubs were approached and asked whether the survey could be distributed among their members, for example via their club website. Three Groningen running clubs agreed to this and were provided with the url to the survey and an introductory text. A second step in sampling used social media to approach runners in Groningen to fill out the survey. The weblink to the survey was shared in social networks on Twitter and Facebook (e.g. *Running Coffee*) and the municipal intranet website. After one month, 174 surveys were filled out and the survey was closed. Descriptive statistics of this group can be found in the Results section.

In the survey, respondents were asked whether they use GPS while running and whether they were willing to share a route for further research. 50 respondents agreed to this and were sent an e-mail with instructions and a link to a short questionnaire about this specific route. 35 respondents replied to this e-mail by sending a route and filling out the second survey.

3.3.2 Interview sampling

Participants for the run-along-interviews were selected from the 35 respondents that had sent a GPS-route, through purposive sampling based on the survey responses. Selection criteria were sex, age and commitment to running. The aim was to get a varied group of participants that would provide different perspectives and insights on the running environment in Groningen (i.e. information rich cases).

3.4 Survey

The survey was built in a *Google Forms* environment, enabling online distribution and digital processing of the responses. For pragmatic reasons, the survey was available in Dutch only.

Fig. 18. Survey layout in Google Forms.

The survey consisted of several sections, beginning with a series of questions on the running behaviour of the respondents (i.e. average speed and distance, commitment to running, reasons for running). This data provided a general 'profile' of the sample. The question on commitment to running was adapted from Carmack & Martens (1979), and consisted of 12 questions that could be answered on a 1-5 Likert scale, such as "I enjoy running" and "I prefer not to think of running".

The second section dealt with the general environmental preferences of the respondents, for example which criteria determine route choice and what are the most important nuisances during a run. This second section was complemented with a 'photo question', asking respondents to value the attractiveness of 6 photos depicting potential running environments (Fig. 19). The third section of the survey asked respondents about their experiences with running in the city of Groningen, for example their preferred running areas and their use of marked running routes.

Respondents were then guided to a digital map (Google MyMaps) in which they could mark specific locations in Groningen where they have had positive or negative experiences, and note down why (Fig. 20). This question was optional, as it required a login with a Google account. It offered valuable qualitative data linked to specific areas in the city. The *Hotspotmonitor* is a comparable (although more advanced) research tool (Vries, et al., 2013).

The second last section asked respondents whether they used GPS tracking and were willing to share some of their data in a follow-up survey. The questionnaire ended with a few questions about the respondent's personal backgrounds (age, PC6, occupation, health status).

The survey questions were of varied types, including Likert-scale, checkbox, multiple choice and open ended questions. For a full overview of the questions (in Dutch), see Appendix 2.

Fig. 19. Photo question.

Respondents were first asked to value these (potential) running environments on a Likert scale (1-5), secondly to choose the image representing their most and least attractive running area, and thirdly to note down why. The photos show significantly different running environments, containing elements that were expected to elicit varying value judgements (urban versus natural environment, presence of other people, momentum, type of pavement and topography/'challenge').

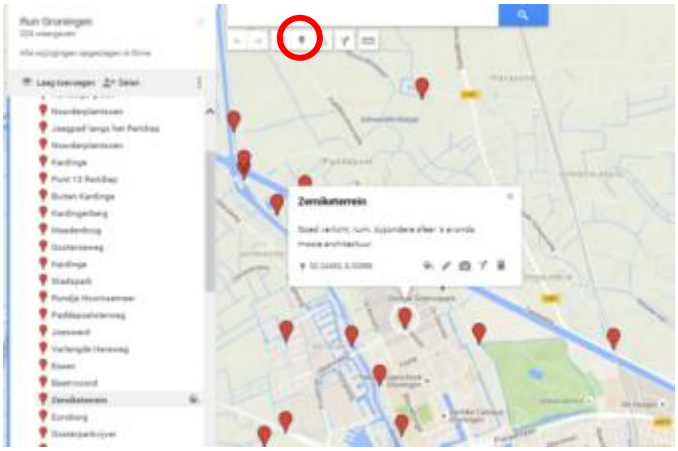


Fig. 20. Map question interface with symbol markers and comments.

Respondents could freely add new markers on the map.

3.5 GPS data

For the collection of GPS-tracks from respondents that approved to share this data, a second survey was developed, containing a manual for downloading this data from their devise. This manual was written for 9 different devices which were used by the respondents and supported downloading of tracks in GPX or TCX format (Fig. 21). The files were received by e-mail and subsequently linked to the first survey responses by appointing the respondent's ID-codes. After sending the files, respondents were asked to fill out a short questionnaire with questions on the characteristics and impression of their route. The completed questionnaires were appointed ID-codes as well in order to establish a link with the other datasets.

Respondents were asked to send a route they recorded in September or October 2015. This time frame was chosen as a compromise between the memories respondents would have on running these routes, compatibility with the survey (asking about their situation in the previous six months), and favourable weather conditions. Because the survey was conducted in early 2016, more recent routes would more likely be affected by bad weather conditions, such lack of daylight, low temperatures, ice and snow. Respondents were then free to choose a route that best represented their 'average' running route, and were guided through the downloading process (Fig. 21).

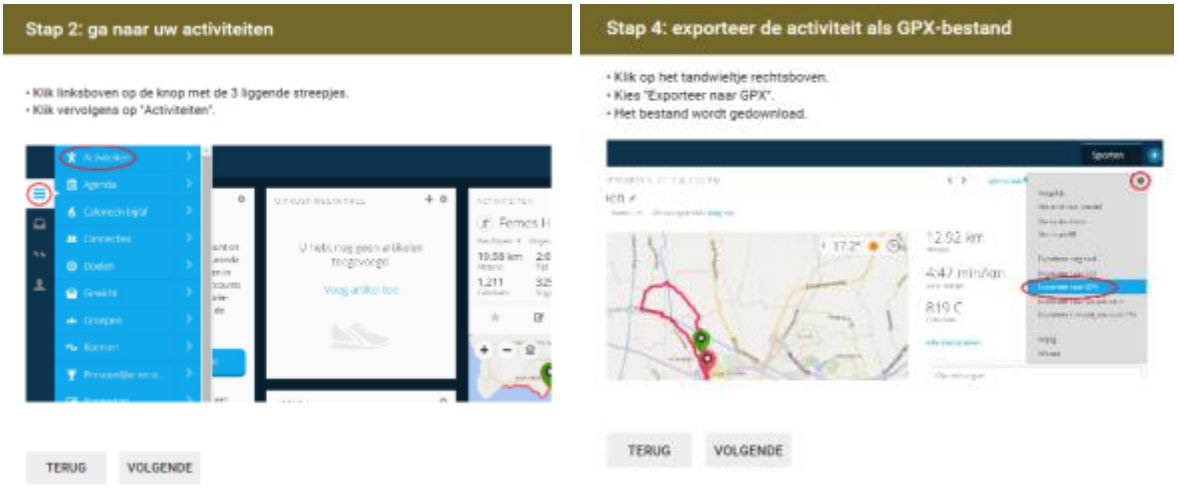


Fig. 21. Manual for GPS-tracks (step 2 and step 4 for *Garmin Connect*).

The received GPS-tracks were imported into GIS-software (ArcGIS 10.3) for spatial analysis on the correlations between routes and physical spatial characteristics of their surroundings. For this purpose, a topographic base map of Groningen was edited to create separate feature layers containing built-up area, main roads, bike and footpaths, greenery and water.

It should be noted that the GPS-devices are not always fully accurate and precise, and might not reveal micro-scale movements, such as which side of the pavement the runner was on, whether a slaloming movement was performed or whether as straight run was achieved (Cook, 2013; Fig. 22).

Fig. 22. Inaccuracies in GPS-recordings.

3.6 Run-along interviews

In order to be able to measure the *in situ* experiences of running in Groningen, three run-along interviews were conducted with selected survey respondents who had sent a GPS-track as well. The main reason for conducting these interviews was to gain detailed insight into the process of 'negotiation with space' during a run, by recording real-time and context-specific perceptions along the route (i.e. speed, rhythm, route, experience and friction). The method allows for testing the survey results in the field, and add stories and personal accounts to the rather abstract survey data. Moreover, the run-along interviews could reveal some of the reflexive aspects of the lived experience of running in the social and physical context of Groningen, and between structural conditions and individual agency for shaping action (Kusenbach, 2003; Carpiano, 2009).

The run-along interview is a novel research method, although it is strongly affiliated to other go-along methods such as the walk-along interview. Essentially, the go-along interview involves interviewing a participant while receiving a tour of their neighbourhood (Carpiano, 2009). During the interview, the participant's experiences, interpretations and practices are observed and discussed, providing insight into their negotiation with space during a run (Allen-Collinson, 2008; Cook, 2013). Five facets of the negotiations with space were monitored during the interview:

1. **Speed**. can the desired speeds be reached?
2. **Rhythm**. recurring patterns of movement and rest, continuity
3. **Route**. what route is taken, habitual routes, predictable or not?
4. **Experience**. how does it feel?
5. **Friction**. what are barriers to mobility?

The interviews were recorded with an action camera, mounted on the interviewer's head with a head strap (Fig. 23). The camera recorded both video (i.e. the encountered environment) and audio (i.e. corresponding comments of the participant and discussion). Before starting the run, the aim of the run-along interview was explained to the participant. The participant was asked to comment freely on their experiences and considerations along the route; further questions were posed when necessary. During the interview, the participant was leading in terms of route choice, speed and interaction with other traffic, trying to approximate the participant's 'natural' situation.

After completing the run, the experiences during the interview and the results from the survey were discussed with the participant. For example, maps showing the GPS data from all survey participants was compared to the participant's route, and the comments from the interactive map were discussed. Participants were also asked to point out the most and least attractive segments of their route, and why.

The interview recordings were transcribed (in Dutch) and analysed though mapping the quotes alongside the route in Google MyMaps. Video stills were — insofar providing relevant information — linked to the quotes from the interview.

Fig. 23. Action camera with head strap.

Fig. 24. Negotiation with space: street crossing. Still from a run-along interview.

Chapter 4. Results & discussion

Key points:

- *Runners prefer to run in a varied environment, in the presence of greenery, good quality of paving, presence of street lighting, and avoid routes that are obstructed by high levels of arousal (dense urban fabric, interactions with other road users);*
- *Running routes therefore tend converge in non-built-up areas outside the city and in green and spacious 'corridors' within the urban fabric;*
- *The actual experiences of runners are highly dependent on the preferences and characteristics of the individual person. However, runners tend to be pragmatic in relation to their physical environment, and dynamically interact with the situations they encounter.*

This chapter will present the main results from the study. After characterising the sample, the main findings from the survey, GPS data collection and run-along interviews will be described and interpreted separately. Finally, all findings will we integrated and discussed in the *Synthesis* section, where they will be linked to the theoretical framework.

4.1 Sample characteristics

172 surveys were filled out between January 22nd and February 27th, 2016. After filtering out respondents that did not live in Groningen municipality, 156 cases were included in the final sample.

4.1.1 Socio-demographic descriptive statistics

The socio-demographic characteristics of the sample seem to fit the general running population of the Netherlands, as it is overrepresented by middle-aged, highly educated and healthy people (Table 5). The relatively large proportion of respondents from the 18-25 and 26-35 cohorts can be explained by the fact that Groningen has a large student population (a quarter of the population is

20-30 years old; CBS Statline, 2015). Concluding, the sample of this study is representative for the running population of Groningen.

Table 5. Descriptive statistics for study sample (n=156).

Sex			**Number of years living in Groningen**		
	frequency	**%**		**frequency**	**%**
Male	79	51,0	Less than 1 year	3	1,9
Female	77	49,0	Between 1 and 5 years	26	16,7
Total	**156**	**100,0**	More than 5 years	127	81,4
			Total	**156**	**100,0**
Age distribution			**Education level**		
	frequency	**%**		**frequency**	**%**
< 18	0	0,0	Primary school	0	0,0
18-25	28	17,9	mavo/vmbo	0	0,0
26-35	38	24,4	havo/vwo	13	8,3
36-45	26	16,7	mbo	13	8,3
46-55	54	34,6	hbo	54	34,6
56-65	10	6,4	wo	74	47,4
> 65	0	0,0	No answer	2	1,3
Total	**156**	**100,0**	**Total**	**157**	**100,0**
Occupation			**Health status**		
	frequency	**%**		**frequency**	**%**
Pension	1	,6	Bad	1	,6
Entrepreneur	1	,6	Moderate	4	2,6
Student	24	15,4	Good	63	40,1
Working	121	77,6	Very good	61	39,1
Seeking a job	5	3,2	Excellent	27	17,3
Other	4	2,4	**Total**	**157**	**100,0**
Total	**157**	**100,0**			

The spatial distribution of the respondents is mapped Fig. 25. The cases are evenly distributed over the municipality; the 'blank spots' are mostly green areas, business districts and rural areas. The mean center of all cases is located relatively central on the map. Four respondents did not provide their PC on PC6-level, but only on PC4-level. Another four PC6-zones proved false and could not be mapped correctly. These cases were excluded from the map. Consequently, 148 cased can be shown on the map.

Fig. 25 also shows the neighbourhoods that were assigned in order to be able to compare different areas of Groningen. The division is based on PC4-zones and the neighbourhood division of Groningen that was developed by *Onderzoek en Statistiek Groningen* (2014).

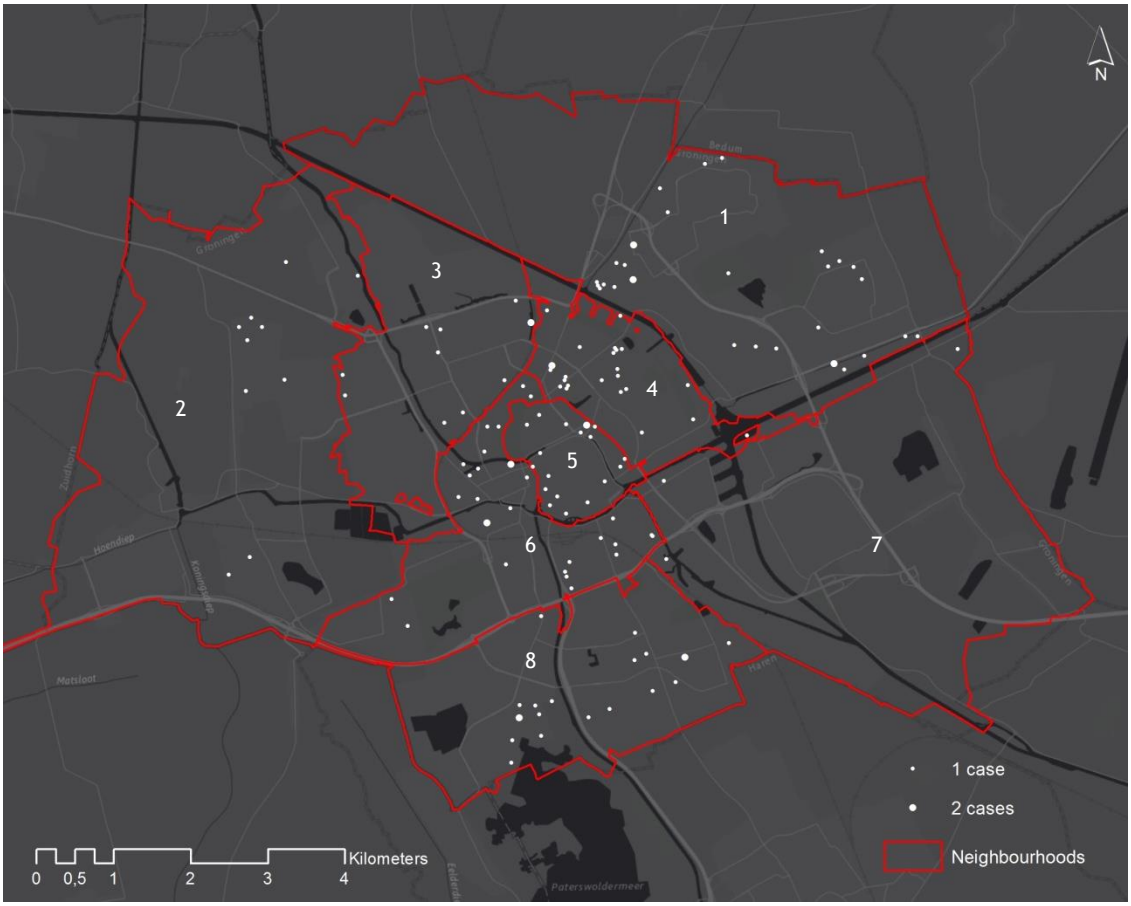


Fig. 25. Map showing spatial distribution of respondents on PC6-level (n=148) and neighbourhoods.

Each dot is the centroid of a PC6-polygon.

The numbers correspond to the neighbourhood division of Groningen:

1. Northeast (n=33)
2. West (n=10
3. Vinkhuizen and Northwest (n=11)
4. Oosterpark and Old-north (n=25)
5. Centre (n=20)
6. Old-west and Old-south (n=31)
7. Southeast (n=6)
8. Helpman and Southwest (n=20)

4.1.2 Running-related characteristics of the sample

A series of questions were asked about the general running behaviour of the participants, such as distance and speed. Appendix 3 (p. 122) presents the results for these questions. It can be concluded that the group of respondents is relatively experienced, as more than 90% has been running for more than one year, and 57% more than five years. Furthermore, 50% of the respondents go for a run two or more times per week and 75% train for races. These figures are not surprising as the survey was partly targeted at running clubs, and people that are more committed to running are expected to be more willing to participate in a study about running.

To analyse these results, statistical testing was performed using Spearman's rank-order correlations. Significant differences were found for sex and health status. Firstly, men run significantly faster (r=-0,460; p=0,000), more often (r=-0,199; p=0,013) and further (r=-0,255; p=0,001) than women. And secondly, health status is positively correlated with running frequency (r=0,326; p=0,000), distance (r=0,420; p=0,000), speed (r=261; p=0,001) and years of running experience (r=0,189; p=0,018). This seems to confirm the claim that running has a positive influence on health status, although other factors that were not included in this study might impact the outcome as well.

Fig. 27 shows that runners in Groningen often start their training from home; only a few runners report travelling to a park or another area to go for a run. Evening hours are the most popular time for running, although many runners report running during the day as well (Fig. 26).

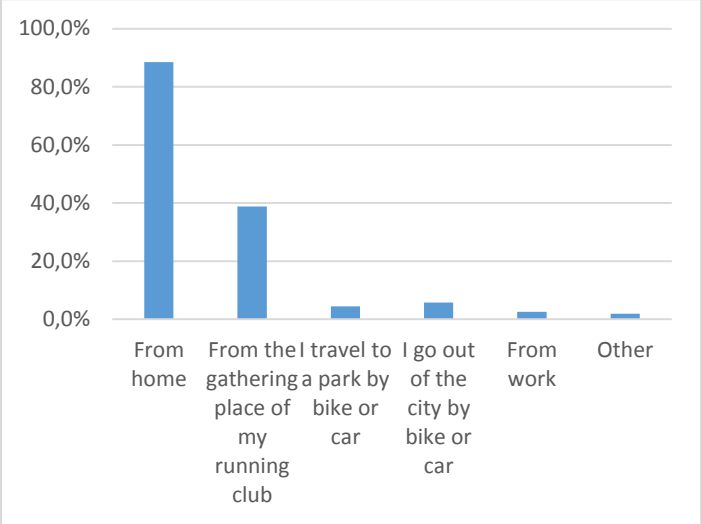


Fig. 27. Where do you start running?

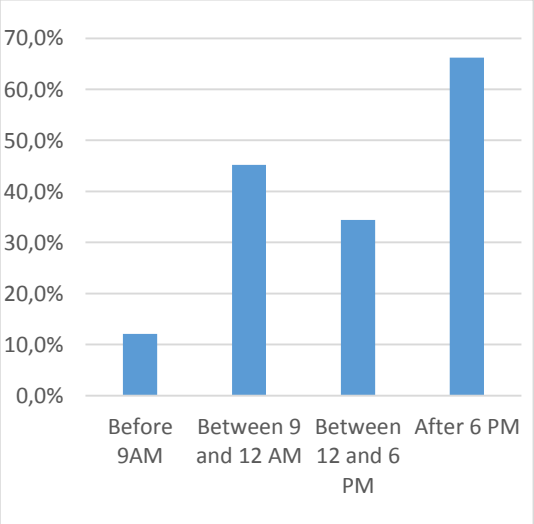


Fig. 26. What time of the day do you run most often?

Figures in Appendix 3 show that 40% of the respondents are member of a running club and 16% have a running buddy, to which they have to travel before starting their run. This explains why 24% of the respondents report travelling more than 5 minutes to their start location.

Respondents were asked how they determine their running route. The results are presented in Fig. 28, indicating that most runners have a number of fixed routes to choose from, and only eight respondents always use the same route. Whether it is light or dark influences the route choice of 47% of the respondents.

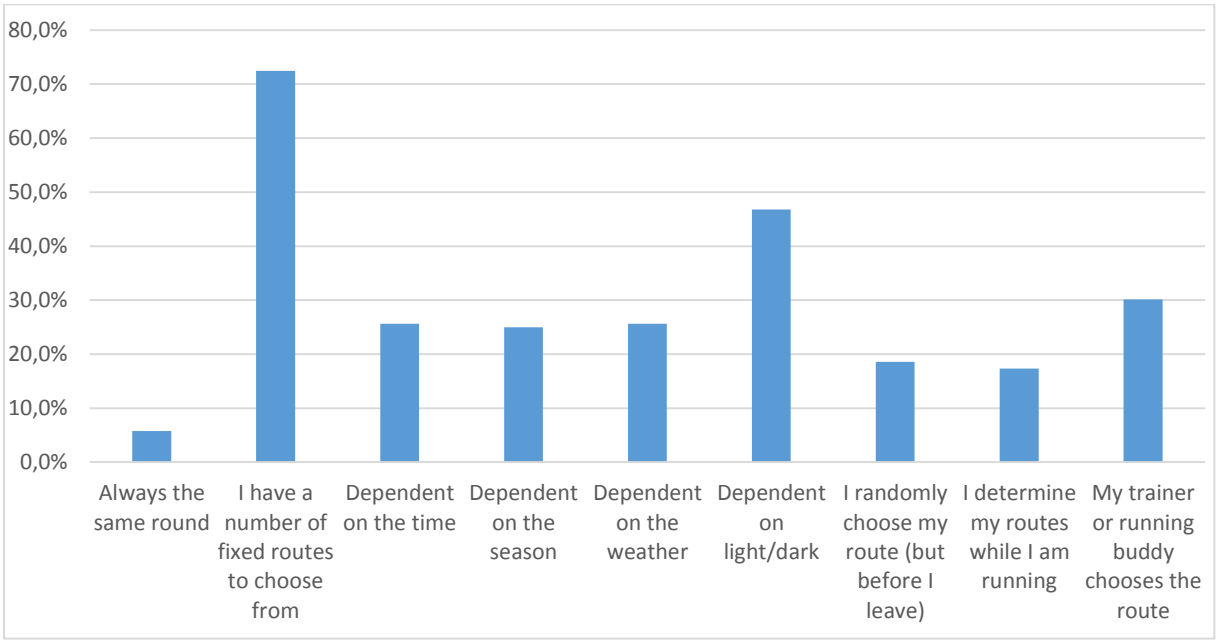


Fig. 28. How do you determine your route?

4.2 Survey results

The main part of the survey dealt with the affordances of the physical environment in relation to running, and the individual perception and experiences in that environment. In this section, the conditions of a good running environment, nuisances and experiences while running in Groningen will be outlined.

4.2.1 Criteria

Fig. 29 shows the importance attached to certain environmental criteria when determining a running route (on a 1-5 Likert scale). Many criteria are relevant for more than half of the respondents. Presence of greenery, sense of safety and the quality of roads and paths are marked 'very important' by nearly 20% of the respondents. Only the presence of water, presence of sporting people, architecture and presence of slopes are important to less than 20% of the respondents. The continuity of running routes is important to 84,7% of the respondents (Fig. 32). Fig. 31 and Fig. 30 further stress the importance of the physical environment for runners, as it appears that most runners think that the physical environment is relevant for their total running experience. Secondly, their environmental awareness while running is high. Finally, respondents were asked to select the types of paths they prefer to run on (Fig. 33). It turns out that bike paths are the most popular (75%), followed by gravel paths and sidewalks (50%). For Groningen, this is not surprising, since the

city has a large and fine-grained bike path network which offers a comfortable and continuous surface.

These findings are in accordance with the literature on attractive running routes as found in earlier running research, which mentioned continuity, comfortable surfaces and a varied landscape (Ettema, 2015). The findings stress the complexity of designing a runner-friendly environment, in which many affordances have to be integrated in the context of multifunctional public space.

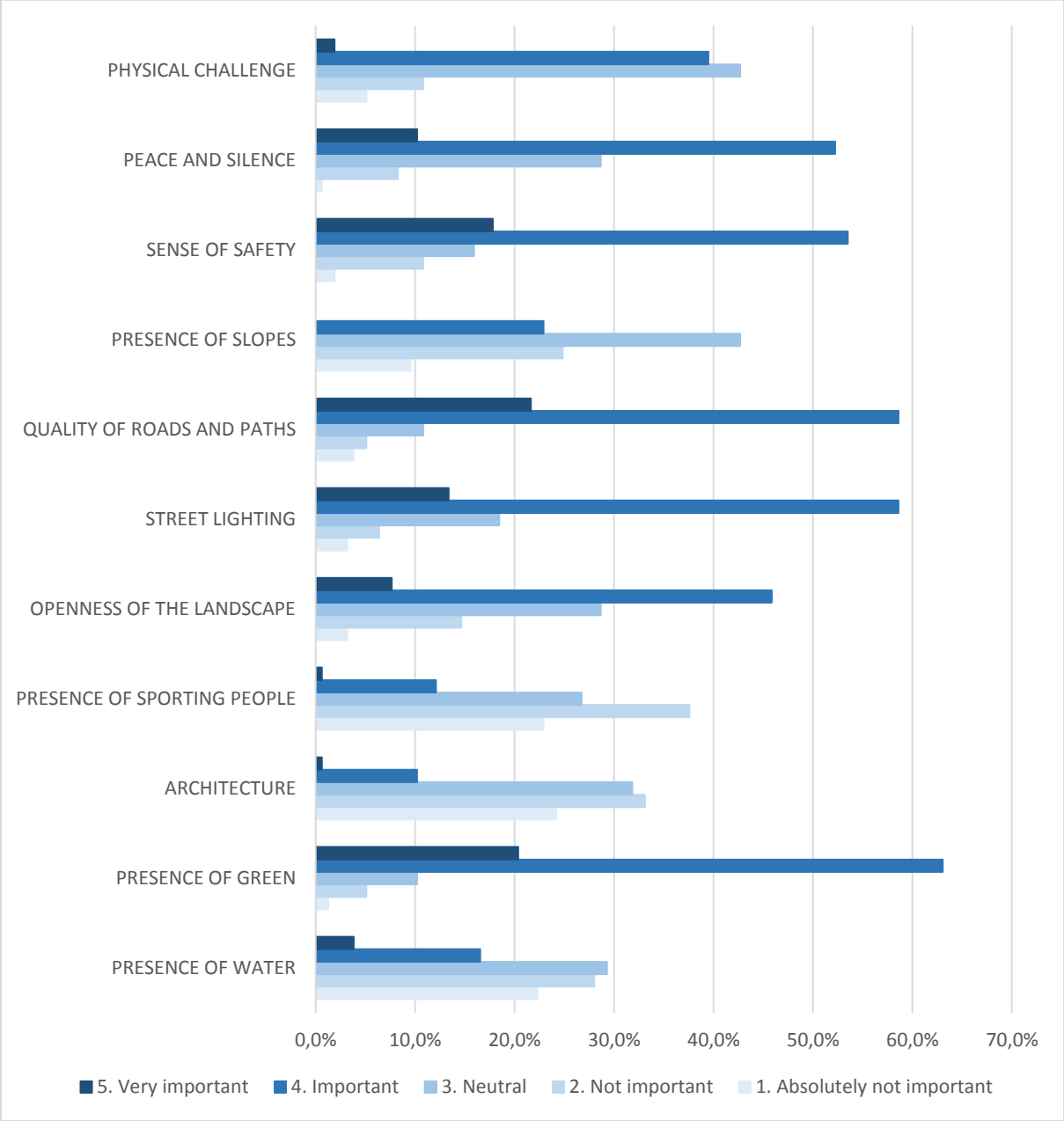


Fig. 29. Criteria determining running routes, on a 1-5 Likert scale.

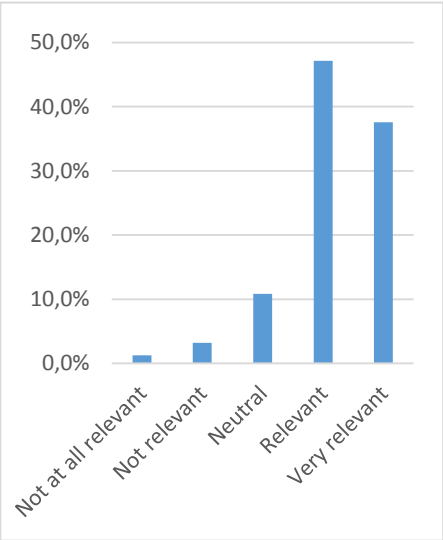


Fig. 32. Relevance of the continuity of running routes.

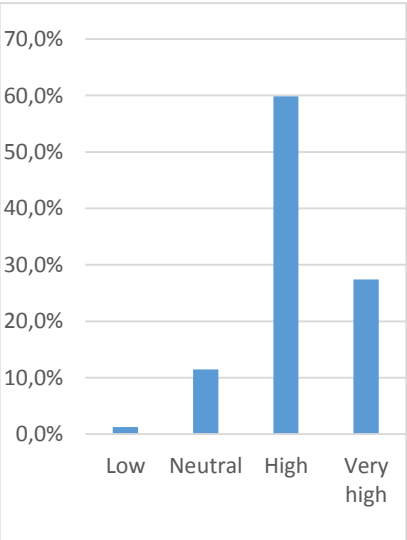


Fig. 31. Environmental awareness while running.

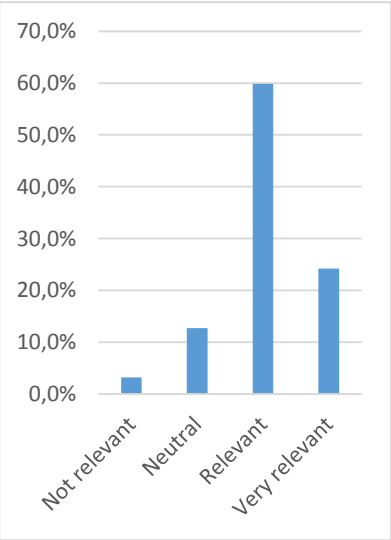


Fig. 30. Relevance of the physical environment for total running experience.

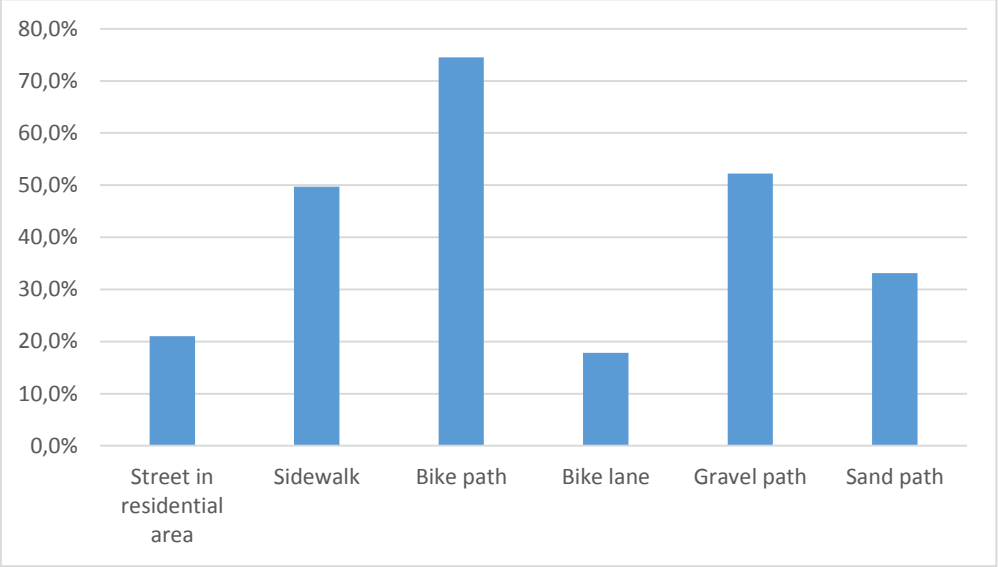


Fig. 33. Responses for "What type(s) of paths do you prefer to run on?"

4.2.2 Nuisances

Having determined the criteria of a runner-friendly environment, we will now turn to the impediments that runners encounter. Respondents were presented with a list of eight potential nuisances, of which they had to mark the level of nuisance on a 1-5 Likert scale (Fig. 34). As the literature points to the importance of maintaining momentum while running, interactions with other

traffic modalities are relevant in the urban context of Groningen and were specifically asked for (Ettema, 2015).

In line with the relevance attached to route continuity (Fig. 29), interruptions on the route are obstructive to nearly two thirds of the respondents. The same goes for road surface and street lighting, of which deficiencies are seen as a nuisance. Lastly, cars and mopeds are more annoying for runners than bicyclists and pedestrians, which could be explained by the fact that bicyclists and pedestrians have a lower speed and are therefore easier to 'negotiate' with.

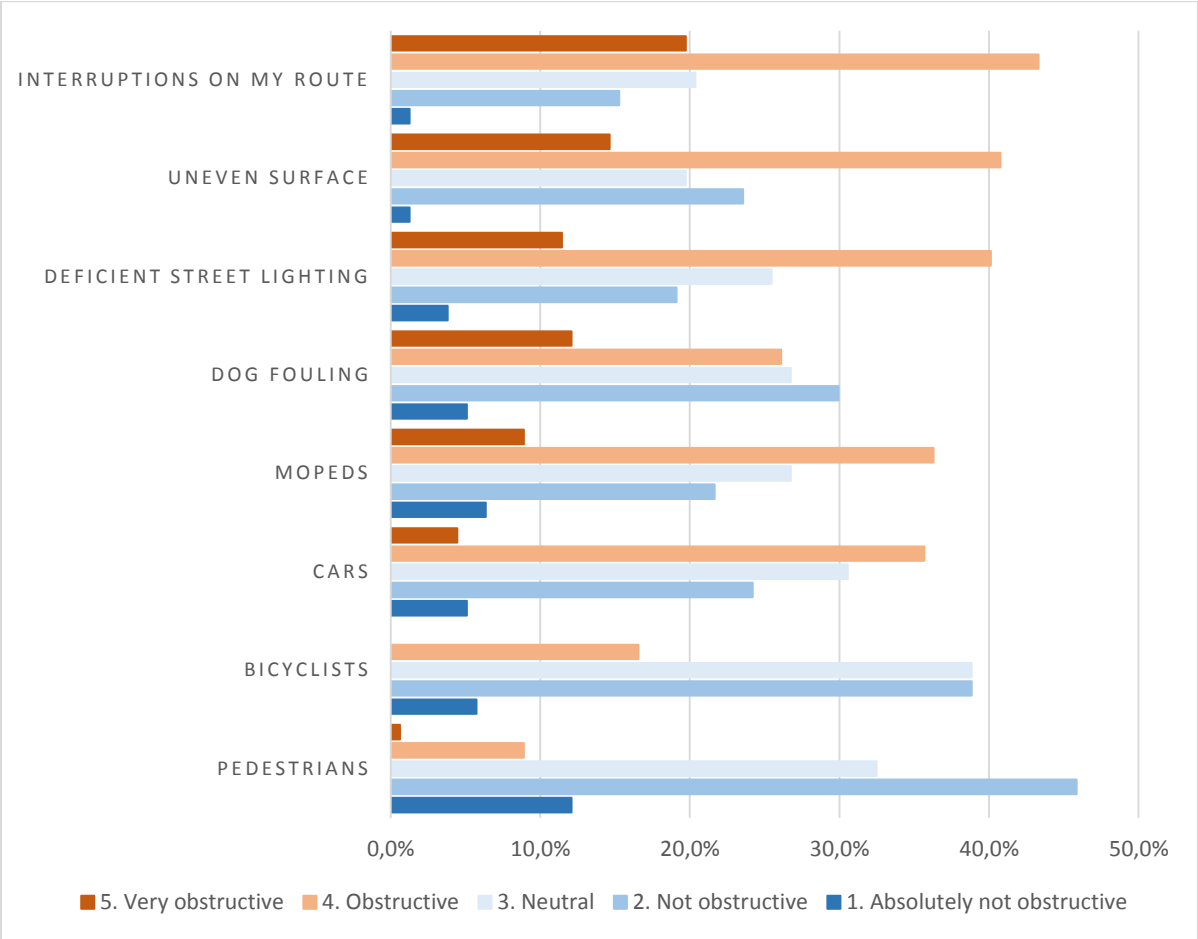


Fig. 34. Nuisances while running, on a 1-5 Likert scale.

4.2.3 Experiences

In the next question, respondents were asked to report their experiences with running in Groningen, by marking 16 Likert-scale statements (Fig. 35 (continued)). In general, runners are satisfied with their running environment as for most questions no more than 10% of the respondents are dissatisfied. However, a quarter of the respondents are dissatisfied with the amount of street lighting, and a quarter state their living environment is not inviting to go for a run. Moreover, more than 30% report being bothered by dogs, or to avoid places because they feel unsafe; nearly 20% report losing momentum due to other traffic.

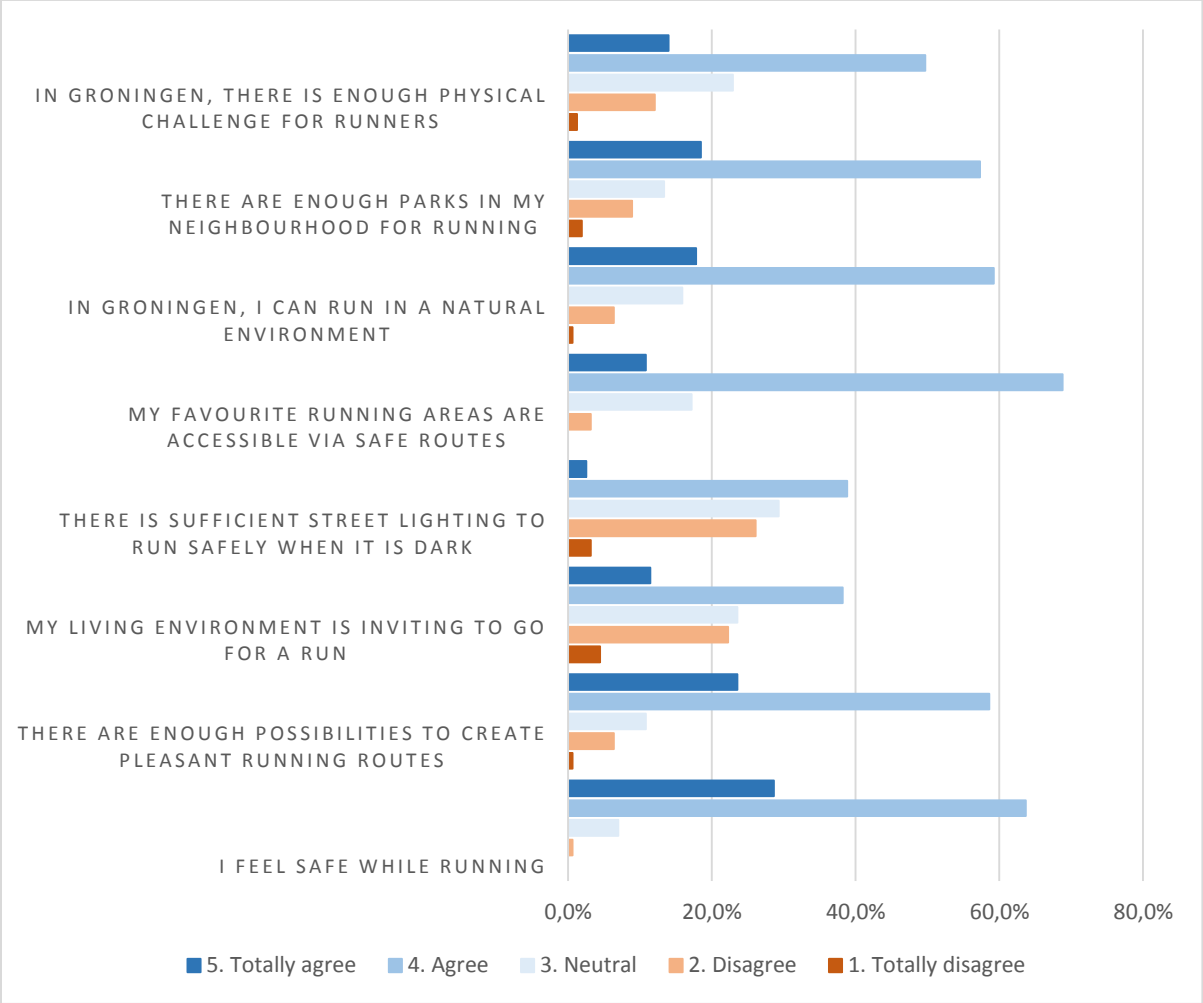


Fig. 35. Experiences with running in Groningen, on a 1-5 Likert scale.

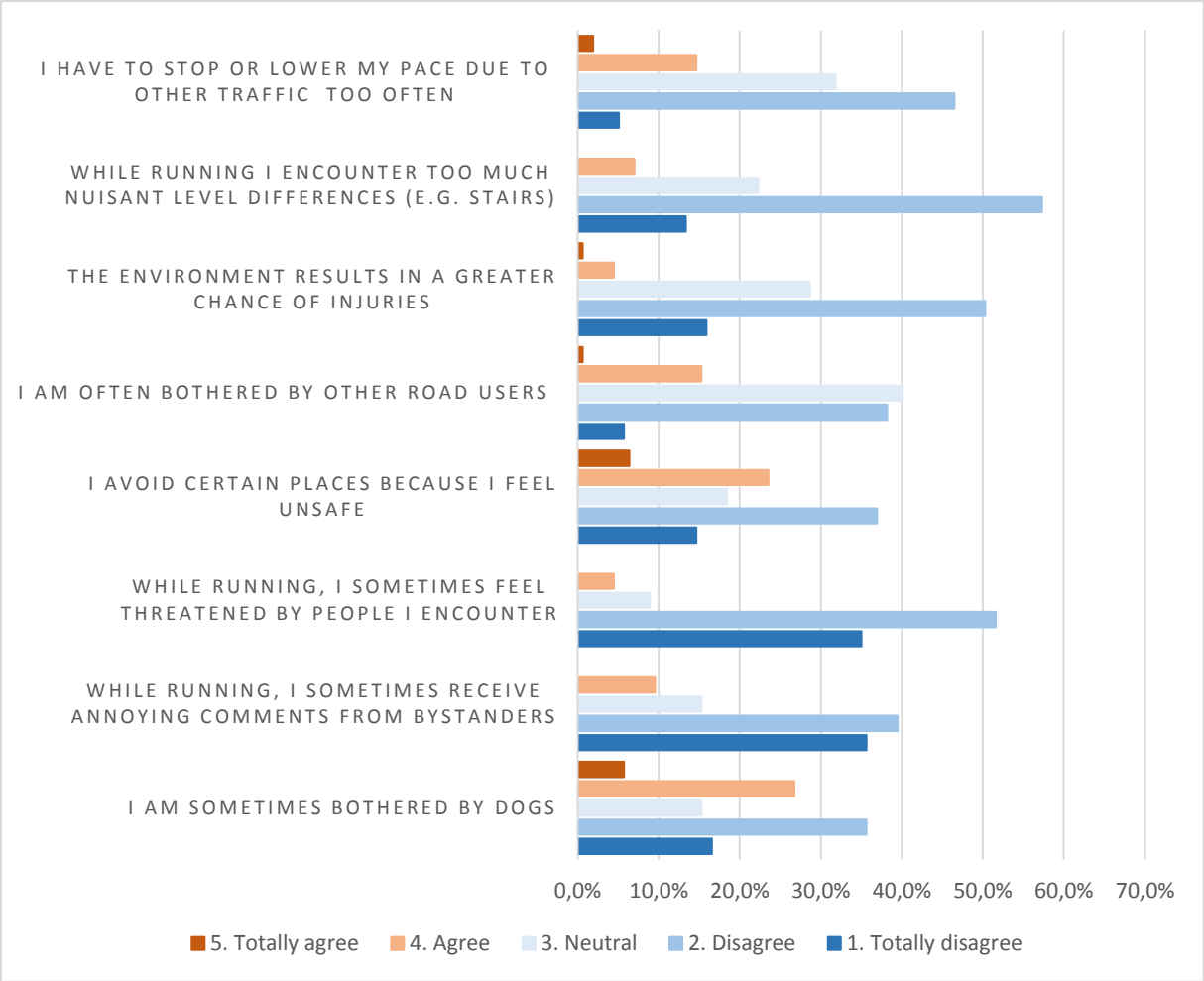


Fig. 35 (continued). Experiences with running in Groningen, on a 1-5 Likert scale ('negative' statements).

To be able to quicly compare the running experiences of all respondents, individual mean scores were calculated from all 16 indicators, indicating the level of satisfaction with running in Groningen: the higher the mean score, the more satisfied a runner is.[2] For this purpose, the scores of the second part of Fig. 35, containing 'negative' questions, were reversed. Then, all scores were summed up and divided by 16.

Eight out of 156 respondents had a mean score below 3, in other words, only eight respondents were generally dissatisfied with their running environment. Fig. 36 shows the mean scores for all respondents on PC6-level.

[2] Please note that the mean was calculated for ordinal variables.

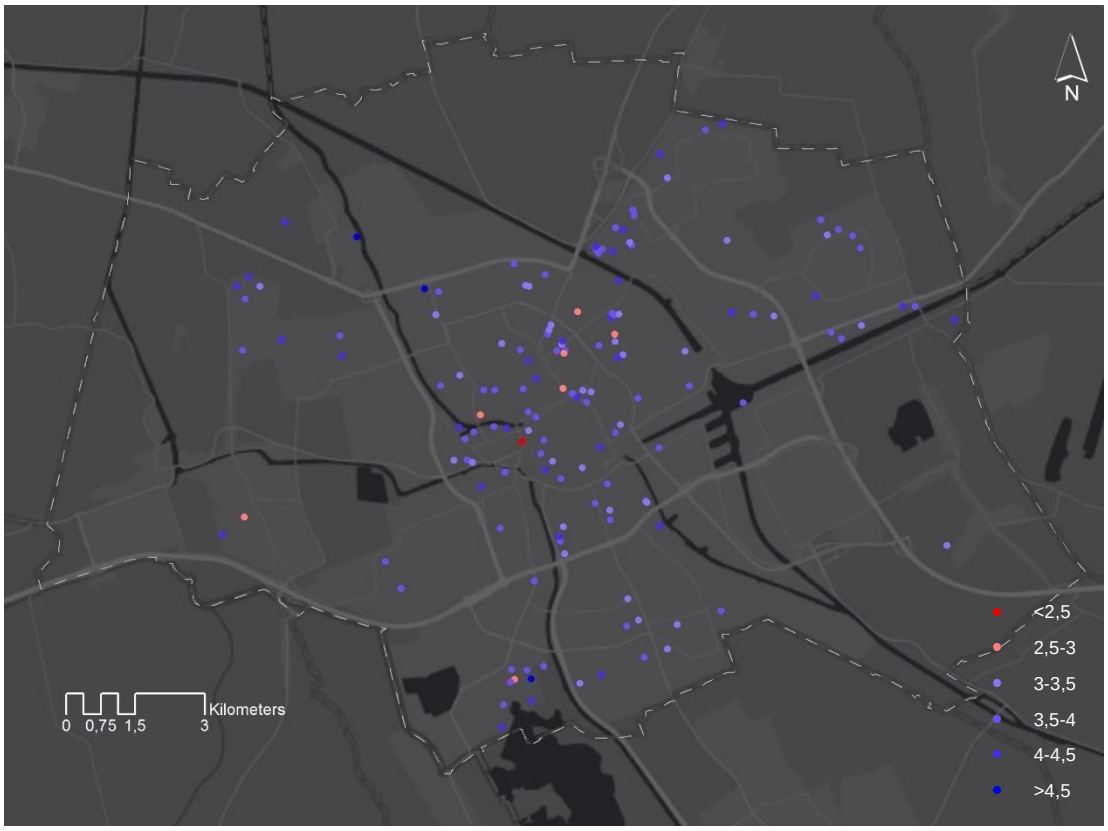


Fig. 36. Mean scores for running experiences.

Because the descriptive statistics already indicated siginificant differences between men and women, the mean experience scores were compared for these two groups. Firstly, a normality test was performed in SPSS, indicating that the mean scores are not normally distributed. Therefore, a Mann-Whitney U test was performed to statistically compare men and women, indicating a significantly lower value ($p<0,01$) for women than for men. The difference is caused by six social safety-related indicators, on which women reported a significantly lower satisfaction than men:

- There is sufficient street lighting to run safely when it is dark;
- My favourite running areas are accessible via safe routes;
- I have to stop or lower my pace for other traffic too often;
- While running, I sometimes receive annoying comment from bystanders;
- While running, I sometimes feel threatened by people I encounter;
- I avoid certain places because I feel unsafe.

No statistical correlations were found for age and education, indicating that the running experience is not much influenced by these factors.

To be able to compare neighbourhoods in Groningen, the mean experience scores were calculated for each statement and neighbourhood (Table 6, see Fig. 25 for neighbourhood division). In the table, the deviation from the mean value for each statement is indicated, and scores indicating a lower than average satisfaction are marked with an asterisk (*). The scores should be interpreted

with some caution, as some neighbourhoods have a small sample, and/or have a skewed male/female distribution which could interfere with the mean score. Moreover, the neighbourhood division is based on purely administrative borders and therefore does not perfectly resemble different 'landscapes'. Even within the neighbourhoods, significant differences in spatial quality exist, as for example some respondents live nearby parks and others in densely built-up areas.

When looking at the mean experience scores for all 16 indicators together, it appears that the central neighbourhoods of Groningen have a below average score, and the outskirts an above average score (see also Fig. 36, where most of the red dots can be found in the middle of the map). This suggests a spatial pattern, where the more urbanized (i.e. built-up) areas are less suitable for running than more spacious neighbourhoods. Indeed, respondents from central neighbourhoods have indicated that their living environment is less inviting to go for a run, that there are less possibilities for creating pleasant running routes, and it is more difficult to run in a natural environment. Moreover, this group of runners has more problems with maintaining momentum due to interactions with traffic, and reports more problems with social safety (feeling threatened, receiving annoying comments). However, the city centre stands out as runners from this neighbourhood report a relatively good social safety perception. This could be related to the high level of social activity and social control ('eyes on the street'). The 'old neighbourhoods' surrounding the city centre (Oosterpark, Old-North, Old-West, Old-South) are the least suitable for running. These neighbourhoods are characterized by high building densities and a limited number of green areas, which point towards a lower suitability for running.

Table 6. Mean experience scores by neighbourhood.

	Average	Southeast	West	Northeast	Helpman and Southwest	Vinkhuizen and Northwest	Old-West and Old-south	Oosterpark and Old-North	Centre
		Outskirts			Central neighbourhoods				
n	*156*	6	10	33	20	11	31	25	20
Male/Female	*79/77*	3/3	7/3	17/16	10/10	6/5	11/20	13/12	12/8
Mean experience score		**3,90**	**3,90**	**3,76**	**3,69**	**3,63***	**3,61***	**3,54***	**3,66***
	3,68	***+0,22***	***+0,22***	***+0,08***	***+0,01***	***-0,05***	***-0,07***	***-0,14***	***-0,02***
I feel safe while running		4,33	4,20	4,15*	4,40	4,27	4,10*	4,08*	4,35
	4,20	*+0,13*	-	*-0,05*	*+0,20*	*+0,07*	*-0,10*	*-0,12*	*+0,15*
There is enough street lighting to run safely when it is dark		3,33	2,70*	2,88*	3,15	3,36	3,26	3,08*	3,25
	3,11	*+0,22*	*-0,41*	*-0,33*	*+0,04*	*+0,25*	*+0,15*	-0,03	*+0,14*
My favourite running areas are accessible via safe routes		4,00	3,70*	3,97	3,65*	4,09	3,90	3,84*	3,80*
	3,87	*+0,13*	*-0,17*	*+0,10*	*-0,22*	*+0,22*	*+0,03*	*-0,03*	*-0,07*
There are enough parks in my neighbourhood for running		3,83	3,40*	3,97	3,70*	3,73*	3,77*	3,88	3,90
	3,82	*+0,01*	*-0,42*	*+0,15*	*-0,12*	*-0,09*	*-0,05*	*+0,06*	*+0,08*
In Groningen, I can run in a natural environment		4,17	4,20	4,09	3,90	4,00	3,65*	3,52*	3,90
	3,87	*+0,30*	*+0,33*	*+0,22*	*+0,03*	*+0,13*	*-0,22*	*-0,35*	*+0,03*
In Groningen, there is enough physical challenge for runners		3,67	3,90	3,73	3,55*	3,82	3,45*	3,44*	3,80
	3,63	*+0,04*	*+0,27*	*+0,10*	*-0,08*	*+0,19*	*-0,18*	*-0,19*	*+0,17*
There are enough possibilities to create pleasant running routes		4,50	4,30	4,09	4,10	3,73*	3,81*	3,96*	3,80*
	3,98	*+0,52*	*+0,32*	*+0,11*	+0,12	*-0,25*	*-0,17*	*-0,02*	*-0,18*
My living environment is inviting to running		3,67	4,20	3,63	3,40	3,18*	3,07*	2,84*	3,05*
	3,30	*+0,37*	*+0,90*	*+0,33*	*+0,10*	*-0,12*	*-0,23*	*-0,46*	*-0,25*

Note: low value = low satisfaction, high value is high satisfaction
Values below average are marked with an asterisk (*)

Table 5 (continued). Mean experience scores by neighbourhood.

	Average	Southeast	West	Northeast	Helpman and Southwest	Vinkhuizen and Northwest	Old-West and Old-south	Oosterpark and Old-North	Centre
		Outskirts			Central neighbourhoods				
I avoid certain places because I feel unsafe	*2,70*	2,83* *+0,13*	2,60 *-0,10*	2,64 *-0,06*	2,80* *+0,10*	2,82* *+0,12*	3,00* *+0,30*	2,52 *-0,18*	2,35 *-0,35*
While running, I sometimes feel threatened by people I encounter	*1,83*	1,50 *-0,33*	1,80 *-0,03*	1,82 *-0,01*	1,70 *-0,13*	2,18* *+0,35*	1,84* *+0,01*	2,04* *+0,21*	1,65 *-0,18*
While running, I sometimes receive annoying comments from bystanders	*1,99*	1,67 *-0,32*	1,70 *-0,29*	2,12* *+0,13*	1,60 *-0,39*	2,46* *+0,47*	2,10* *+0,11*	2,04* *+0,05*	1,95 *-0,04*
I am often bothered by other road users	*2,67*	2,00 *-0,33*	2,20 *-0,47*	2,55 *-0,12*	2,75* *+0,08*	2,64 *-0,03*	2,71* *+0,04*	3,00* *+0,33*	2,80* *+0,13*
I have to stop or lower my pace for other traffic too often	*2,62*	1,83 *-0,79*	2,00 *-0,62*	2,30 *-0,32*	2,80* *+0,18*	2,36 *-0,26*	2,77* *+0,15*	2,92* *+0,30*	3,05* *+0,43*
The environment results in a greater chance of injuries	*2,24*	2,00 *-0,24*	1,90 *-0,34*	2,27* *+0,03*	2,25* *+0,01*	2,64* *+0,40*	2,10 *-0,14*	2,28* *+0,04*	2,40* *+0,16*
While running I encounter too much nuisant level differences	*2,23*	2,33* *+0,10*	1,70 *-0,53*	2,21 *-0,02*	2,10 *-0,13*	2,27* *+0,04*	2,23 -	2,32* *+0,09*	2,55* *+0,32*
I am sometimes bothered by dogs	*2,69*	3,00* *+0,31*	2,50 *-0,19*	2,64 *-0,05*	2,85* *+0,16*	2,91* *+0,22*	2,52 *-0,17*	3,00* *+0,31*	2,45 *-0,24*
Number of indicators with lower than average satisfaction (out of 16)		**3**	**3**	**4**	**8**	**9**	**11**	**14**	**7**

Note: low value is high satisfaction, high value is low satisfaction
Values above average are marked with an asterisk (*)

Finally, the mean experience scores were compared with the commitment to running scores. As could have been hypothesized, the trend line is slightly positive, indicating that people who are more committed to running, have a better running experience (or vice versa). However, the relation is not significant according to a linear regression analysis (p=0.340).

4.2.4 Photo question

The photo question presented the survey respondents with 6 photos of (potential) running environments (see Fig. 19). They were asked to rate each photo on a 1-5 Likert scale, and to choose the most and least attractive environment and motivate their choice. In general, the photos showing an urban landscape (2, 3 and 5) were appreciated less than the largely natural landscapes (1 and 4), in line with psycho-evolutionary and arousal theories (Jacobs, 2011).

Photo 1, showing a green forest landscape with a winding sand path, is appreciated the most, followed by the park landscape of photo 4. The environments on both photos are appreciated for their natural qualities. Photo 1 is further appreciated for the peacefulness and unpaved surface, whereas on photo 4, “the presence of people provides safety” (respondent).

Photo 2, depicting a crowded (yet tree lined) urban street, is by far selected as the least attractive running area: only 4 respondents mark is as attractive. For many respondents, the area is too crowded with people, which makes it “difficult to run in your own pace” (respondent). Apparently, this landscape contains too much arousal, whereas photo 5 shows a “boring” environment with a lack of psychological stimuli.

For detailed results, see Appendix 4: photo-question results (p. 125).

4.2.5 Map question

The next section of the survey presented the respondents with an optional question. They were asked to open an interactive map and add place-specific personal experiences. 44 respondents (28,2%) have opened the map and added makers with positive or negative running experiences in and around Groningen municipality (Fig. 37). In total, 142 markers were placed; 108 markers were labelled with a comment, explaining why someone had a positive of negative (or both) experience.

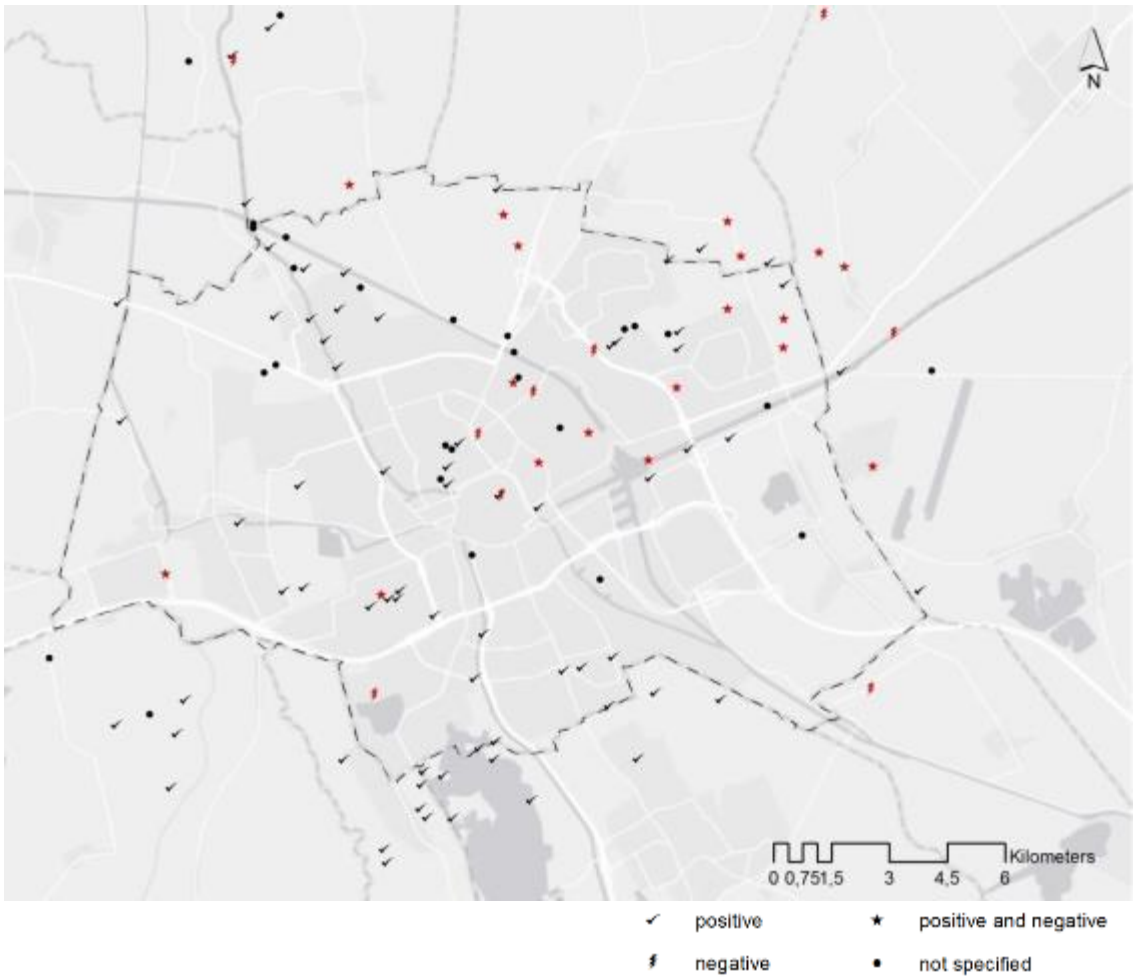


Fig. 37. Map showing markers that were placed on the interactive map.

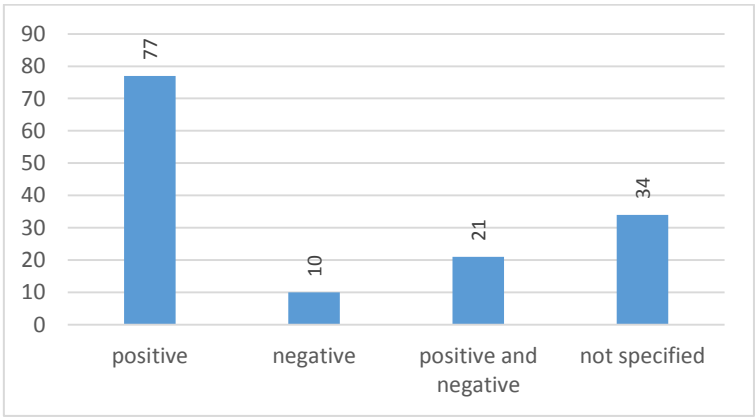


Fig. 38. Count of positive, negative, both positive and negative, and not-specified running experiences.

Most comments were of a positive nature; among the negative comments, most were associated with a positive comment as well (Fig. 38). It can be assumed that most of the (experienced) runners from this dstudy have already discovered the most favourable places for running, and thereby do not encounter that much negative experiences any more.

Appendix 6 (p. 137) summarizes the comments that respondents placed on the map, sorted by code. The markers cover most areas in the city and multiple themes were mentioned. Built environment-related themes (i.e. quality of paving and lighting) were mentioned most often, followed by landscape attractiveness, being away and nature. Although the comments are derived from a relatively small group of 44 respondents, they give a general impression of the 'daily experiences' of runners in Groningen.

The comments will be further discussed in the Synthesis section of this chapter.

4.2.6 Where do people (prefer to) run in Groningen?

Fig. 39 shows the popularity of certain areas for running. Respondents were asked to select the parks and green areas they like to go to for a run. Almost all areas are appreciated by more than one third of the respondents, suggesting that most runners have some choice regarding their running location or route.

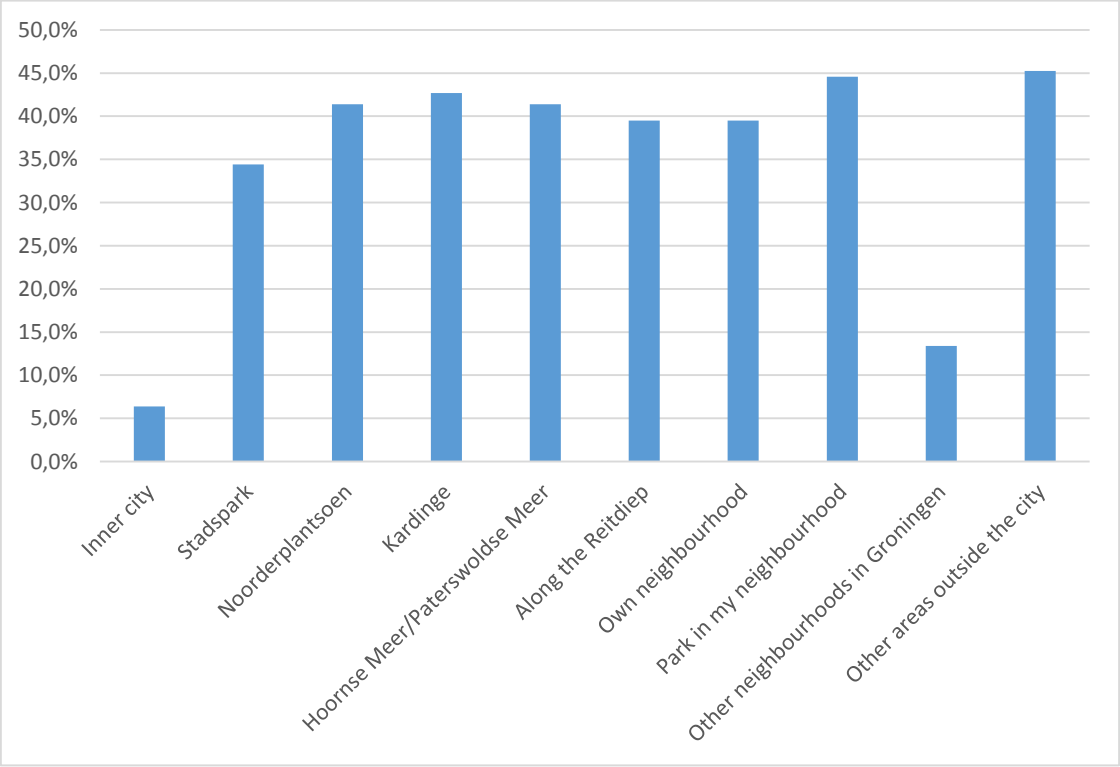


Fig. 39. Responses for "Where do you like to run in Groningen?" (%).

Appendix 5 (p.132) shows the same data on a base map of Groningen, by home address of the respondents choosing a particular area. White dots indicate that the respondent likes to run in the area represented by the map. On the maps, a dashed circle approximately marks a 5 km buffer zone around the area. It is assumed that respondents living outside this buffer have to take more effort to reach the area, as they have to run at least 10 km back and forth or travel to the area by other

means. The more respondents that are willing to take this effort, the more attractive the running area is. It appears that the Paterswoldse Meer area (see Fig. 40) attracts the most runners from more than 5 km away (more than six out of ten), and the inner city the least (two out of ten). The Noorderplantsoen, Reitdiep area, Kardinge area and Stadspark take a middle position, as approximately a quarter of the runners come from outside the buffer zones. Concluding, the Paterswoldse Meer is the most attractive to runners, which can be explained by its characteristics of high quality nature, limited traffic and the ability to run around the lake without any barrier.

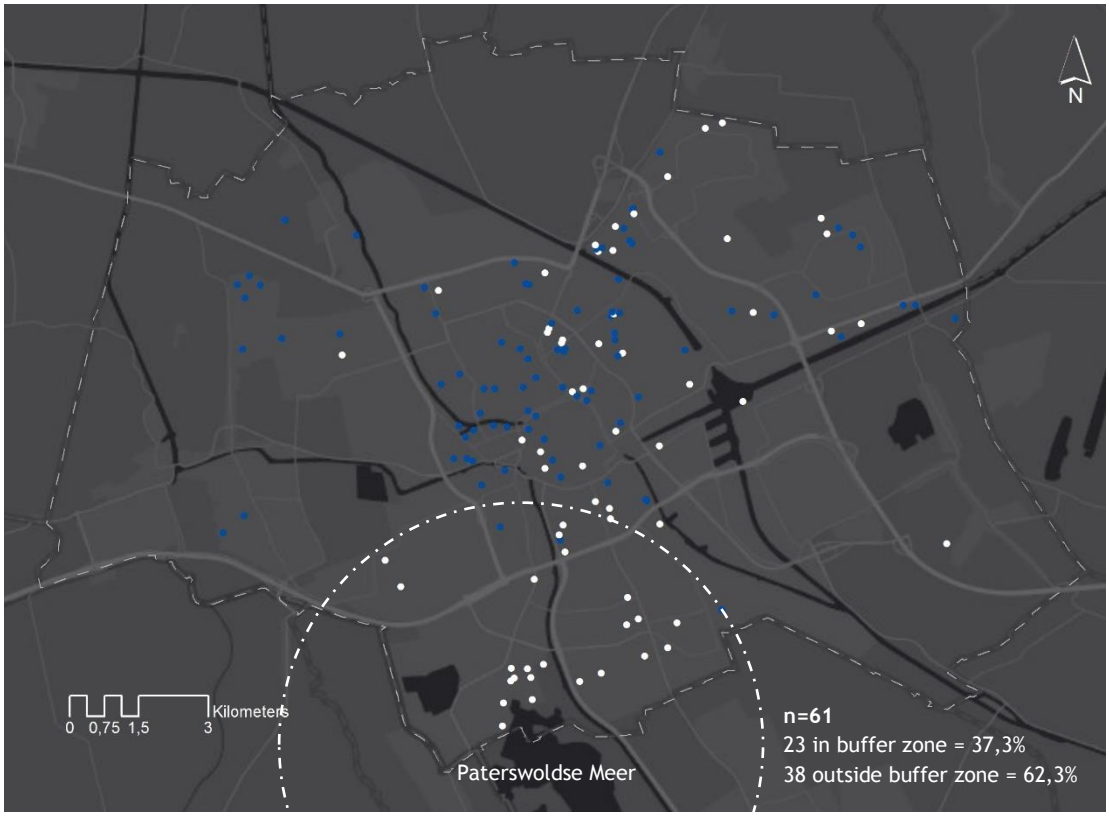


Fig. 40. Respondents choosing Paterswoldse Meer as an area they like to go for a run.

4.2.7 Marked running routes

Marking routes is one specific measure to enhance public space for running. Some of the routes have been created in Groningen in the past years, and some questions about these routes were asked in the survey. In general, respondents are familiar and satisfied with the marked running routes in Groningen, such as the 4 miles track in Kardinge. They are used by 55% of the respondents from all over the city; 17% were not aware of their existence (Fig. 42). The routes are marked as attractive, safe and varied by the 131 respondents that knew about them (Fig. 41). Respondents were less unanimous regarding the need for a marked route in their neighbourhood. Some respondents commented that new routes would be an improvement; others claim it would be of no added value to their running experience. When comparing this need with commitment to running and the mean running experience, it appears that the runners who are in favour of marked routes, are less

committed to running and report a less positive running experience (Fig. 43). However, only the second relation is significant at the 0,05 level (r=-0,203; p=0,020).

Some respondents further commented on marked running routes in the open questions. These comments will be discussed in section 4.5 (Synthesis).

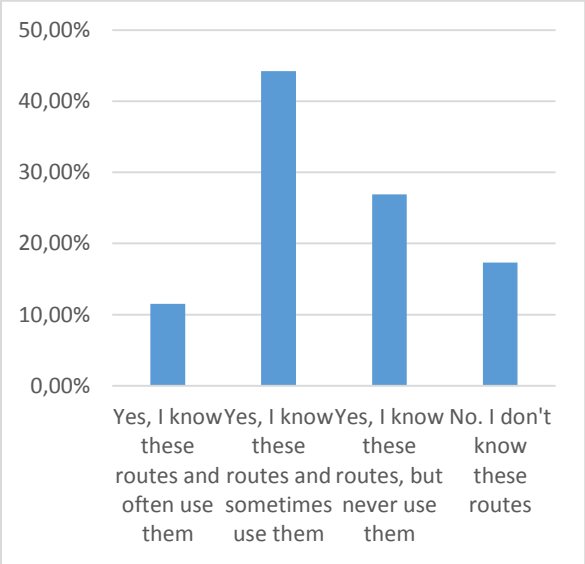


Fig. 42. Do you know marked running routes in Groningen (n=156)?

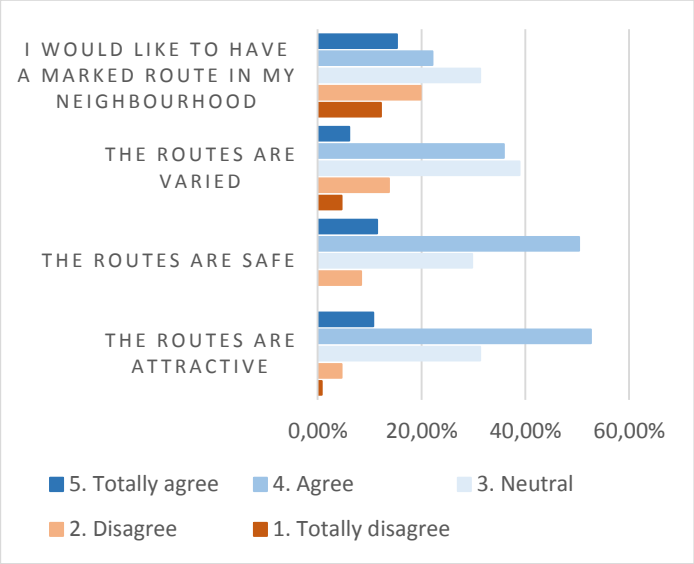


Fig. 41. 4 statements about the marked running routes on a 1-5 Likert scale (n=131).

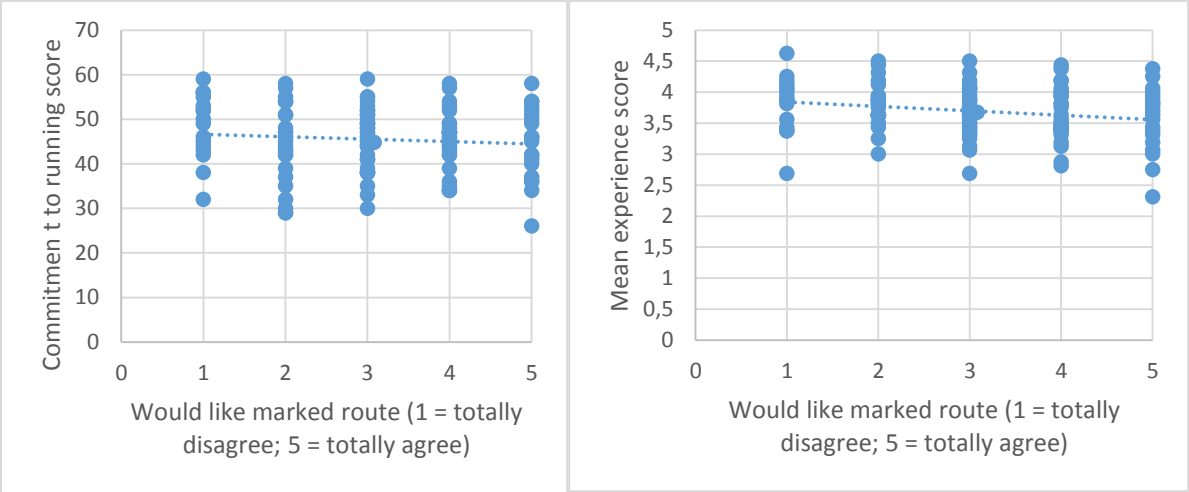


Fig. 43. Scatter plots comparing the need for marked running routes with commitment to running scores and mean experience scores, including trend line.

The second relation is significant (r=-0,203; p=0,020).

4.3 GPS data results

In addition to the survey results, the GPS data will provide more insight into where people (like to) run in Groningen. This section will provide an overview of the main findings.

4.3.1 Sample

In total, 35 routes were shared for this study by a subset of the survey respondents. Their descriptive statistics are summarized in Table 7. In comparison to the survey respondents, the group is overrepresented by men and has a better health status. Furthermore, the group has a relatively high commitment to running score of 48, compared to 44,8 on average (significant at 0.01 level). However, their average mean experience of running in Groningen is 3,63, compared to 3,68 for all survey respondents, which is not significantly lower (p=0.15). Fig. 44 shows the spatial distribution of the respondents, showing that the north-eastern part of Groningen is overrepresented in the dataset.

Table 7. Descriptive statistics for GPS data respondents (n=35).

Sex			**Number of years living in Groningen**		
	frequency	**%**		**frequency**	**%**
Male	22	62,9	Less than 1 year	1	2,9
Female	13	31,1	Between 1 and 5 years	5	14,3
Total	**35**	**100,0**	More than 5 years	29	82,9
			Total	**35**	**100,0**
Age distribution			**Education level**		
	frequency	**%**		**frequency**	**%**
18-25	8	22,9	Primary school	0	0,0
26-35	9	25,7	mavo/vmbo	0	0,0
36-45	4	11,4	havo/vwo	13	8,3
46-55	9	25,7	mbo	13	8,3
56-65	5	14,3	hbo	54	34,6
Total	**35**	**100,0**	wo	74	47,4
			No answer	2	1,3
			Total	**157**	**100,0**
Occupation			**Health status**		
	frequency	**%**		**frequency**	**%**
Student	6	17,1	Bad	0	0,0
Working	25	71,4	Moderate	0	0,0
Seeking a job	3	8,6	Good	5	14,3
Other	1	2,9	Very good	22	62,9
Total	**35**	**100,0**	Excellent	8	22,9
			Total	**35**	**100,0**

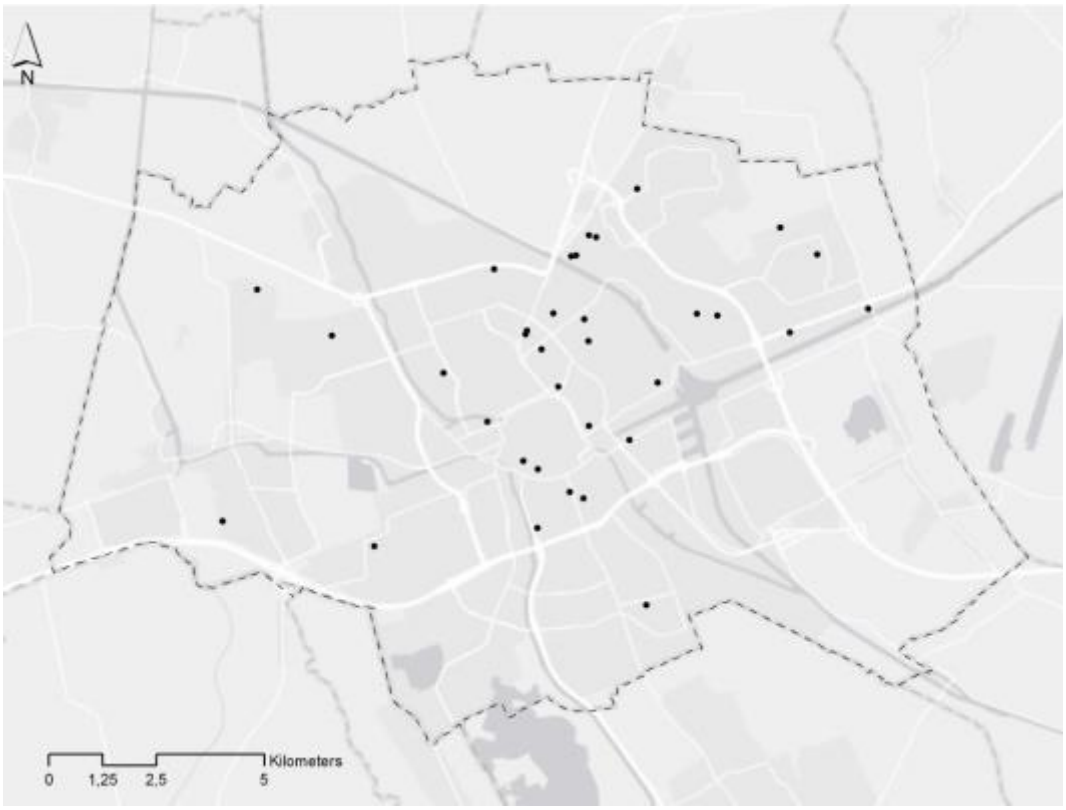


Fig. 44. Spatial distribution of GPS data respondents.

4.3.2 Routes

All routes are shown together in Fig. 45 in an overlay map. The darker the line, the more often the segment was used. The map shows that the Paterswoldse Meer, Noorderplantsoen, Kardinge and Reitdiep areas are frequently used, thereby following the patterns found in section 4.2.6. However, the density of routes in the Stadspark is strikingly low, which could be related to the spatial distribution of respondents. The high number of routes in the Paterswoldse Meer area seems to be related to the earlier reported popularity of the area among runners.

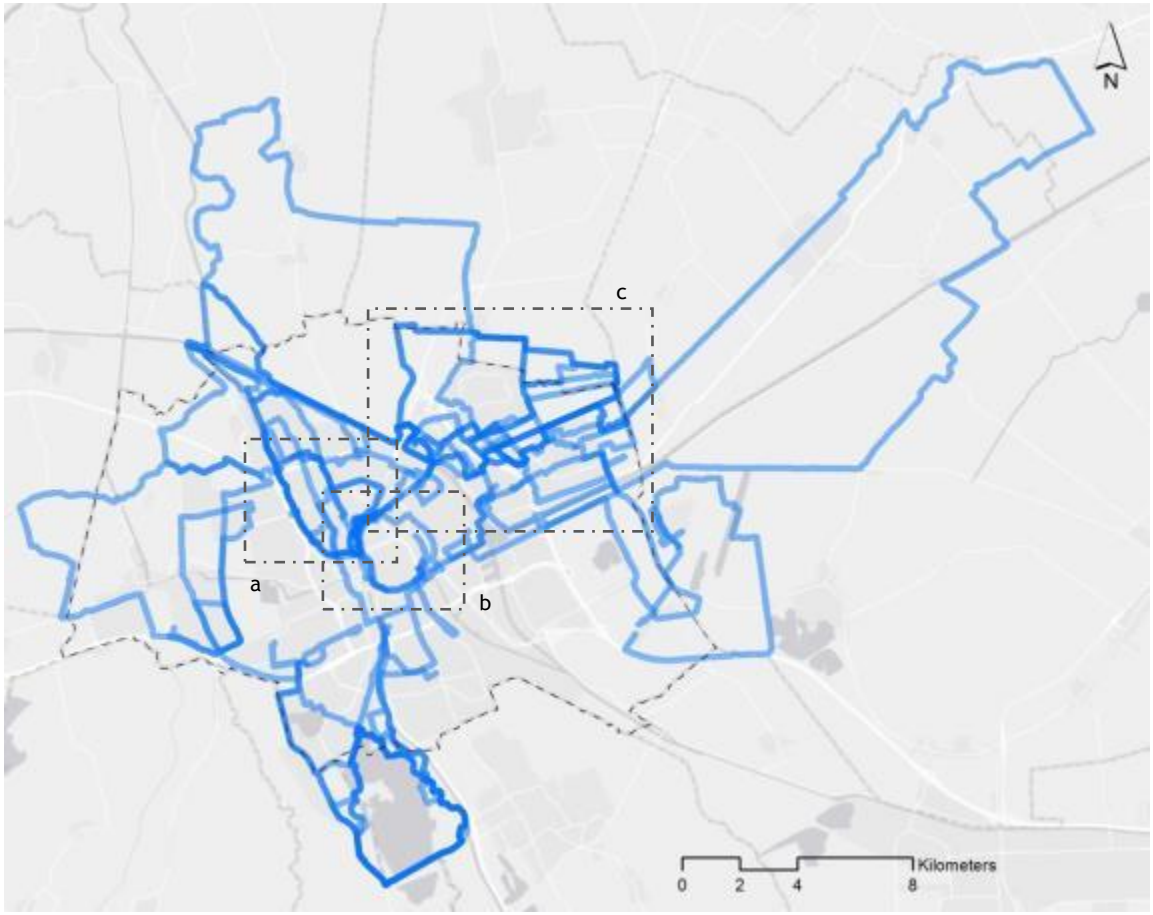


Fig. 45. Overlay map showing all running routes that were shared for research (n=35).

More detailed maps in Fig. 61 (a-c).

Table 8 shows the (average) speeds and distances, which fit the survey data from section 4.1.2. Fig. 46 (a-c) provide a closer look to some areas on the map.

Table 8. Descriptive statistics for running routes.	
Average length	**12,2 km**
Longest	34,7 km
Shortest	4,0 km
Average speed	**10,5 km/h**
Fastest	14,3 km/h
Slowest	8,4 km/h

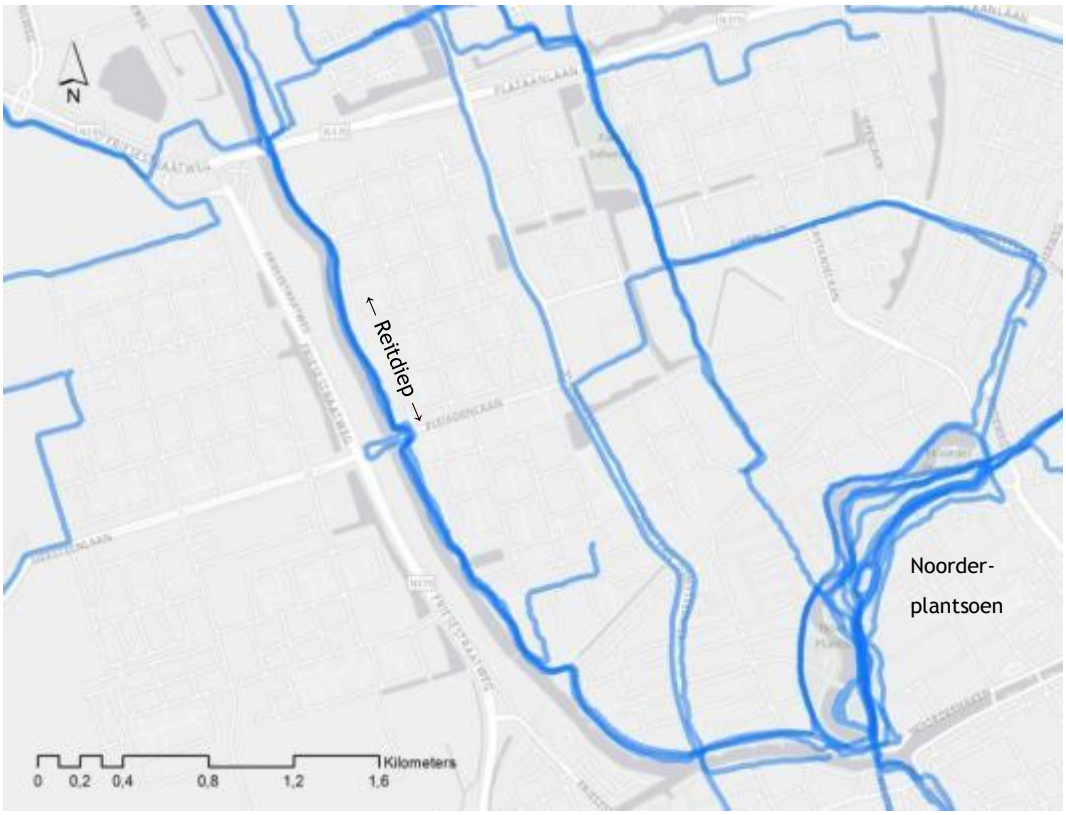


Fig. 61a. Routes in Noorderplantsoen and Reitdiep area.

Fig. 61b. Routes in inner city area.

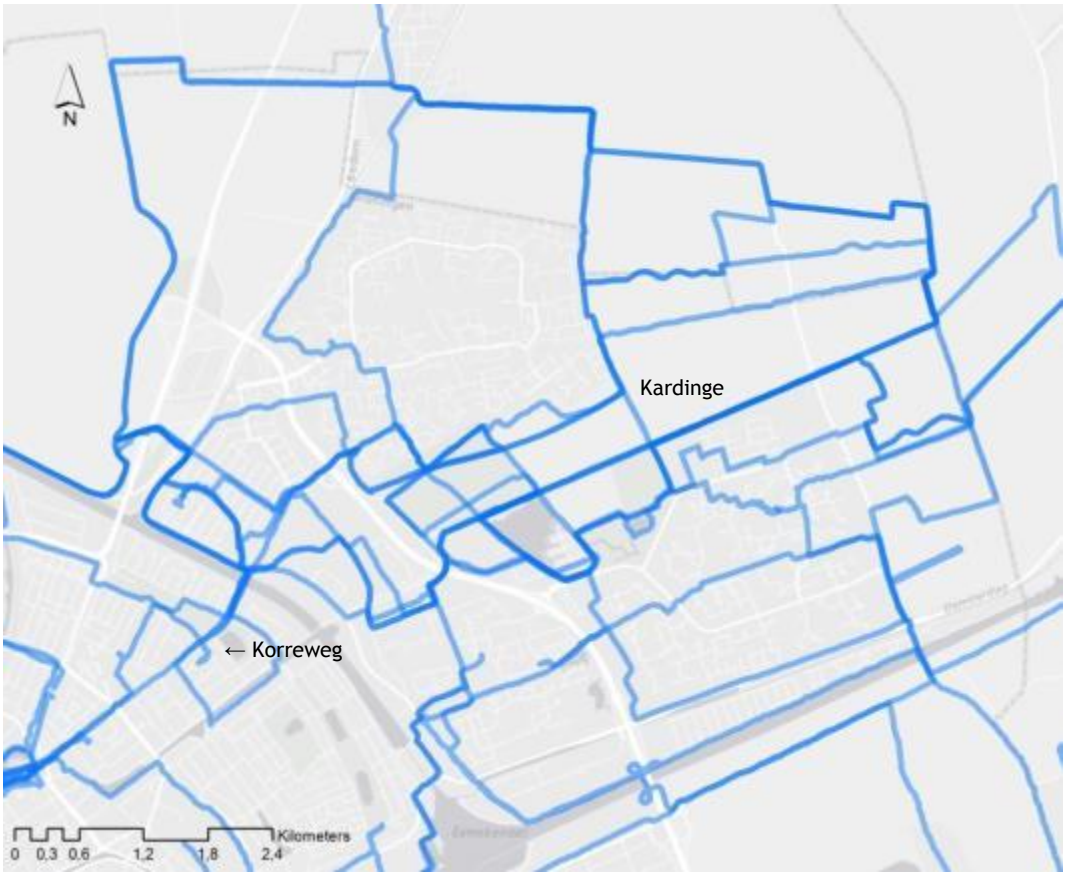


Fig. 61c. Routes in Korreweg and Kardinge area.

In appendix 7, some of the popular running areas and the routes that pass by these areas are shown in a series of maps. For example, six routes are (partly) located in the Paterswoldse Meer area. Interestingly, three out of these six respondents covered more than five km to reach the Paterswoldse Meer area; one went running, two travelled by other means and started their run from a parking lot (see also Fig. 51). For the other areas, most respondents live relatively close by.

Besides looking at the aggregated running routes, individual routes can reveal interesting patterns as well. Most routes are circular, trying to avoid running the same path twice. There are a few exceptions to this rule, such as two runs in the Noorderplantsoen, which circulate through and around the park a few times, and a circular interval training in Kardinge (Fig. 47). Other runs are characterised by the 'lollipop' model with identical first and final kilometres (Fig. 48). The route in Fig. 49 shows an interesting loop in the south-eastern part of Groningen, which appears to be a sand path along the *Stadsmarkering*.

Concluding, all routes have distinctive characteristics, determined by among others the runner's home address, preferred distance, training objectives and other individual preferences. However, patterns emerge on an aggregate level, as some areas and paths are more suitable for running than others. These patterns will be further explored in the next section.

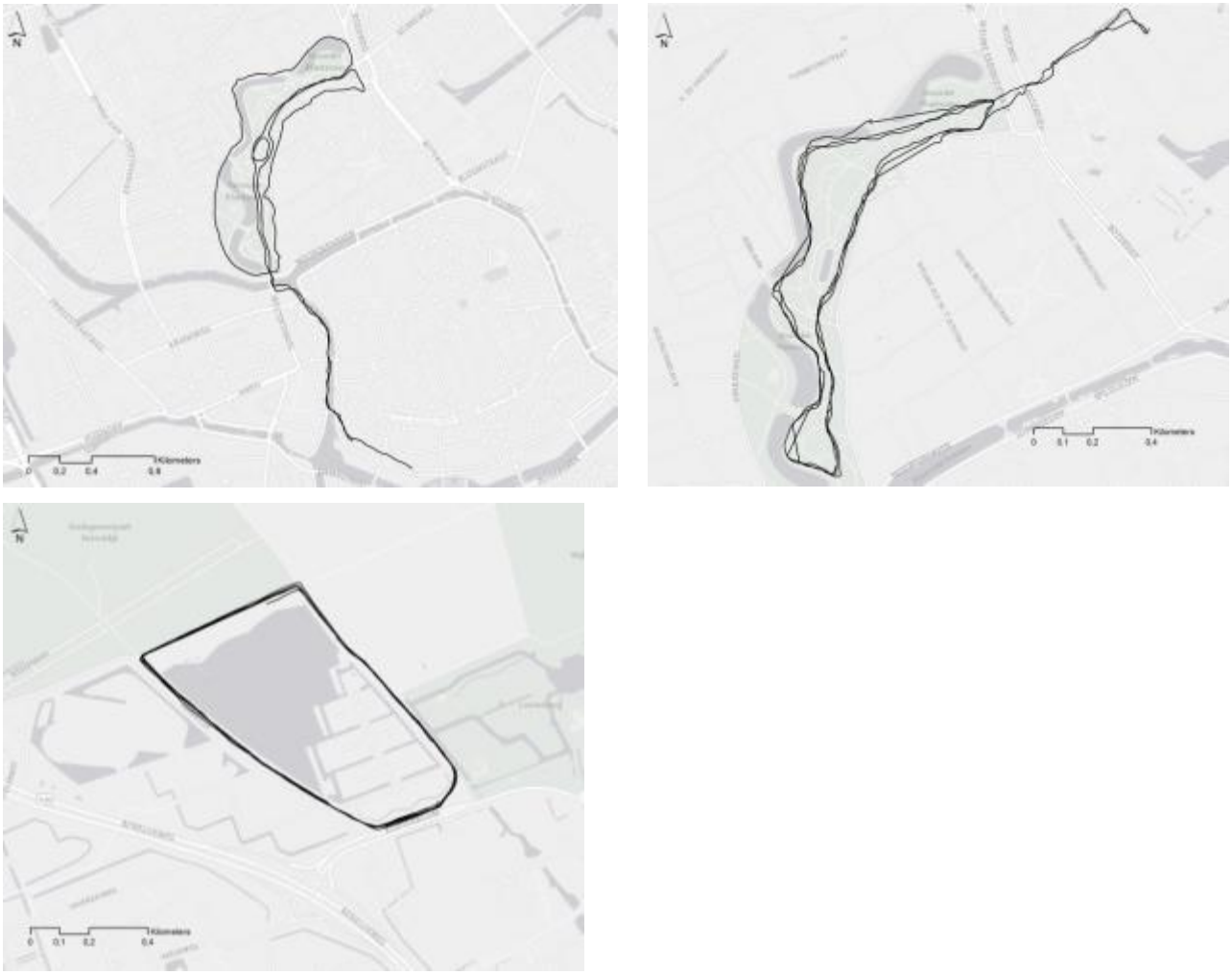


Fig. 47. Repetition during individual runs in the Noorderplantsoen (top) and a group interval training in Kardinge.

Fig. 48. ‘Lollipop’ model.

Fig. 49. Unpaved detour around the *Stadsmarkering*.

Fig. 50. Viaduct as a challenge.

Fig. 51. ‘Park and run’ at Paterswoldse Meer.

Fig. 52 compares the dataset of running routes from this study with a larger online dataset from *Strava Labs*. Similar patterns are found, which seems to validate the representativeness of the data collected through this study. The small deviations are likely to be caused by the uneven spatial distribution of respondents.

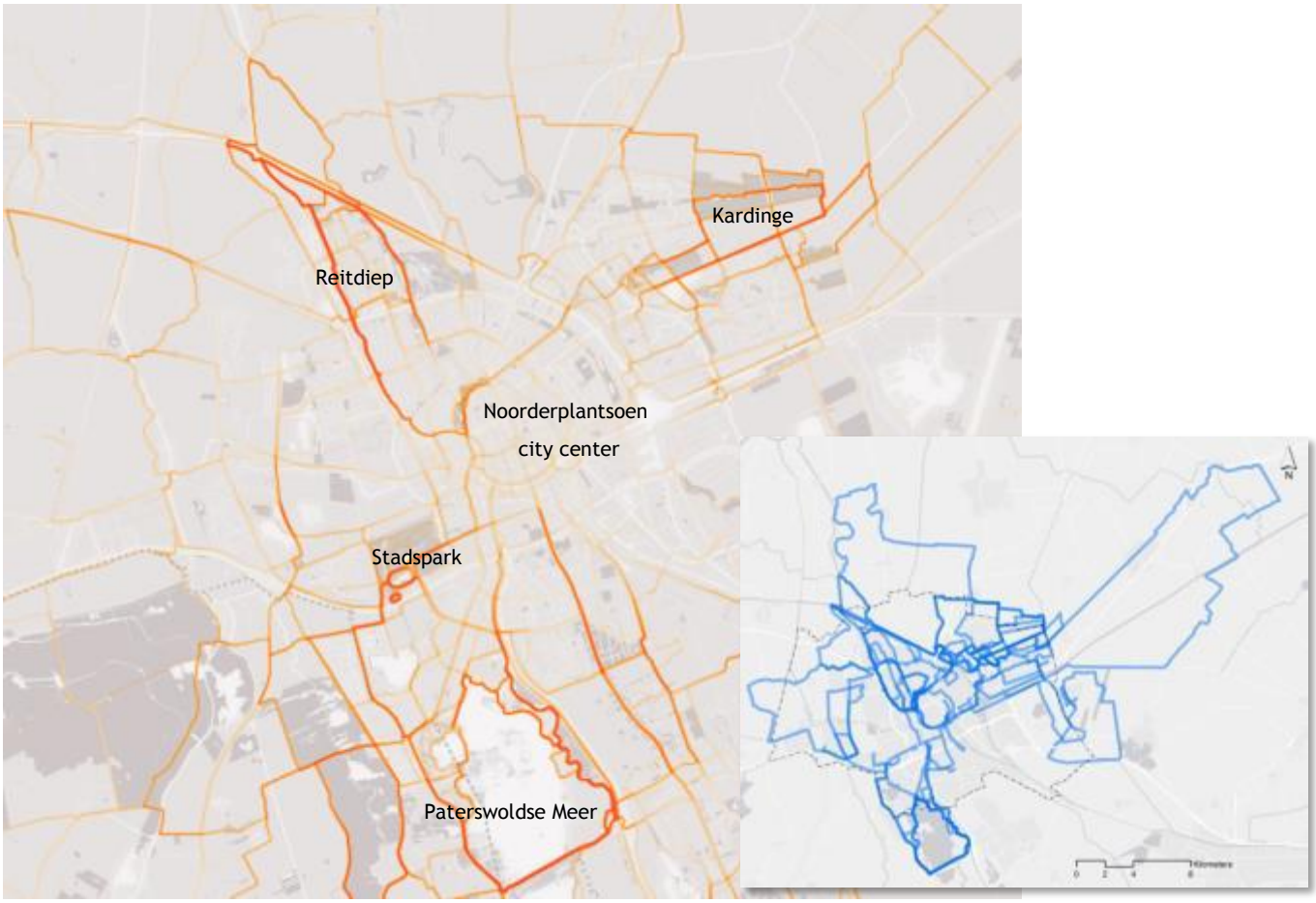


Fig. 52. Aggregated running data for Groningen in 2015 and overlay map of routes from this study. (Strava Labs, 2016)

4.3.3 Routes and physical environment

To be able to better explain the course of the routes, their physical environments are explored by projecting them on a topographic map, showing built-up area, greenery and water, and infrastructure (Fig. 53). In the subsequent maps, the landscape elements are shown separately, allowing for an analysis of the position of the routes in relation built-up area, infrastructure, and greenery.

Fig. 54a shows the routes and built-up area of Groningen. Approximately 50% of the routes is situated outside the city, indicating that many runners seek the spatiality of the surrounding landscape. Within the borders of the city, 66% of the routes situated in green areas or near water bodies. In other words, runners seem to avoid strongly urban environments. In Fig. 54b can be seen

that runners tend to follow continuous and spacious routes through the urban fabric (i.e. routes are situated at the edges of neighbourhoods rather than through neighbourhoods). These findings can be explained by evolutionary landscape perception theories, indicating that people feel better in the presence of nature and prefer half-open landscapes that enable orientation and visual control over the environment (Jacobs, 2011).

Fig. 55 shows how main infrastructure influences where runners run, as the routes cluster at places where the highway and ring road can be crossed. In the cut-outs can be seen how the routes merge and spread out in the proximity of these passages. The passages are often used by runners from the central parts of the city, in order to expand their route options and reach the open areas at the city's surroundings. However, routes do not seem to be fundamentally constrained by the main infrastructure, as there are passage opportunities almost every kilometre. In other words, these passages afford sufficient continuity.

The next map (Fig. 56) shows (parts of) the bike and footpaths in Groningen. It can be seen that, at least in the built-up area of Groningen, most running routes follow this bike and pedestrian infrastructure. Nine runners reported encountering gravel of sand paths on their route, which can be found in the Noorderplantsoen and Kardinge area. These 'soft pavements' positively contribute to the prevention of running injuries.

Finally, Fig. 57 shows the routes in the context of greenery and water. Although this map does not show the greenery on a micro level (i.e. verges and gardens) that could have a significant influence on the green appearance of an area, it does show that most of the routes are situated in a relatively green or natural environment. The cut-outs show the clustering of routes in green strips, indicating that runners prefer tree-lined streets over routes.

Box 2 further discusses some interesting patterns from the topographic map.

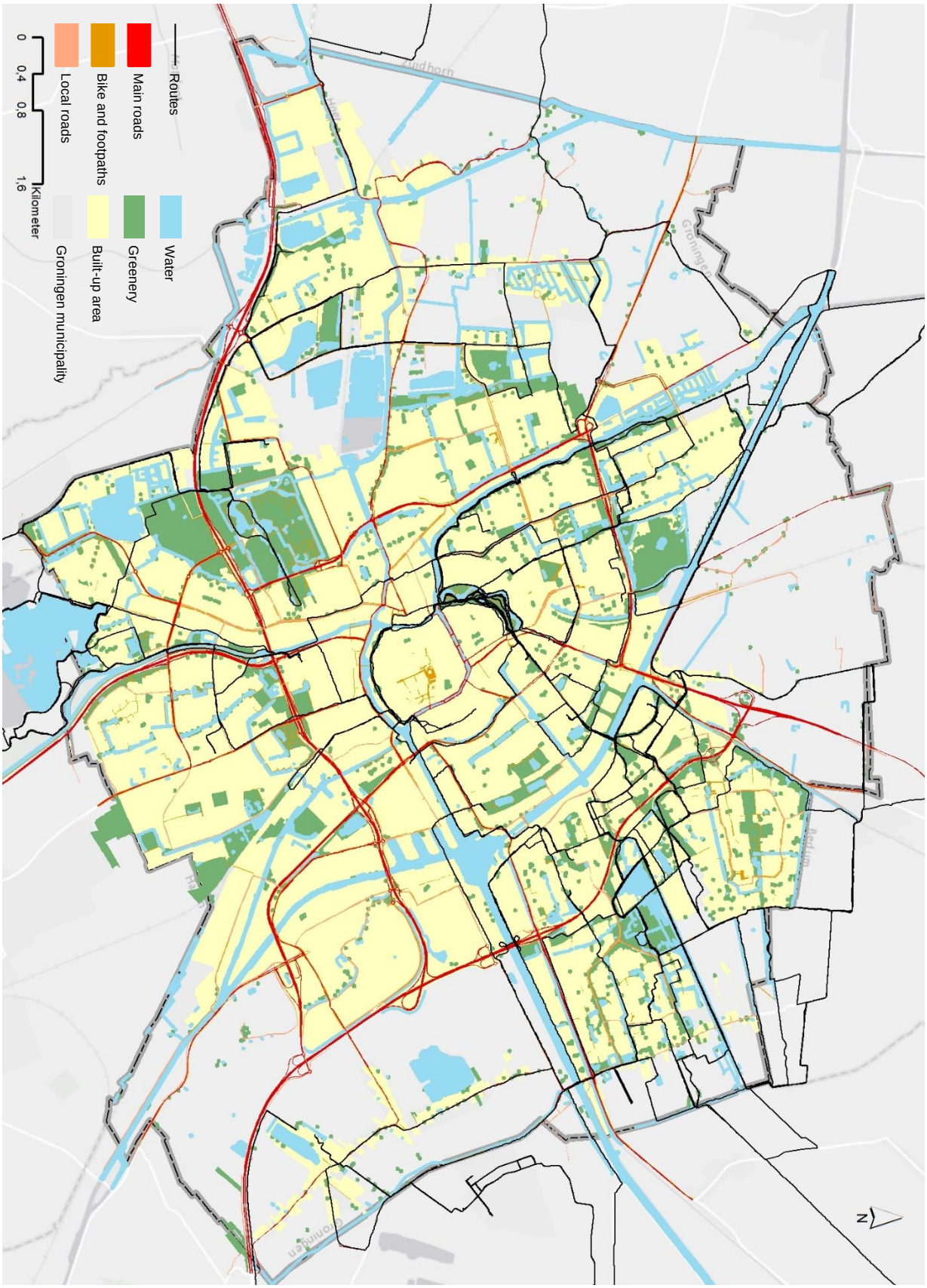


Fig. 53. Routes on a topographic map of Groningen.

Fig. 54a. Routes and built-up area.

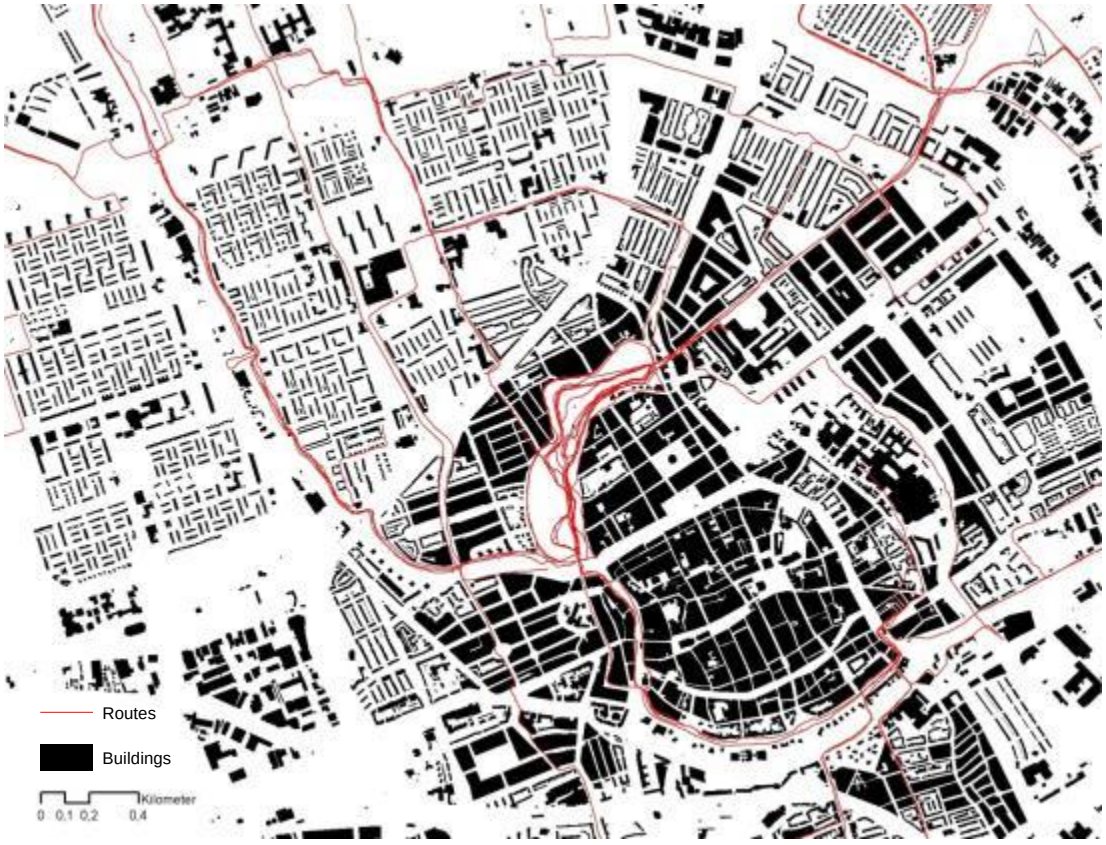


Fig. 54b. Routes and buildings (northeastern part of the city)

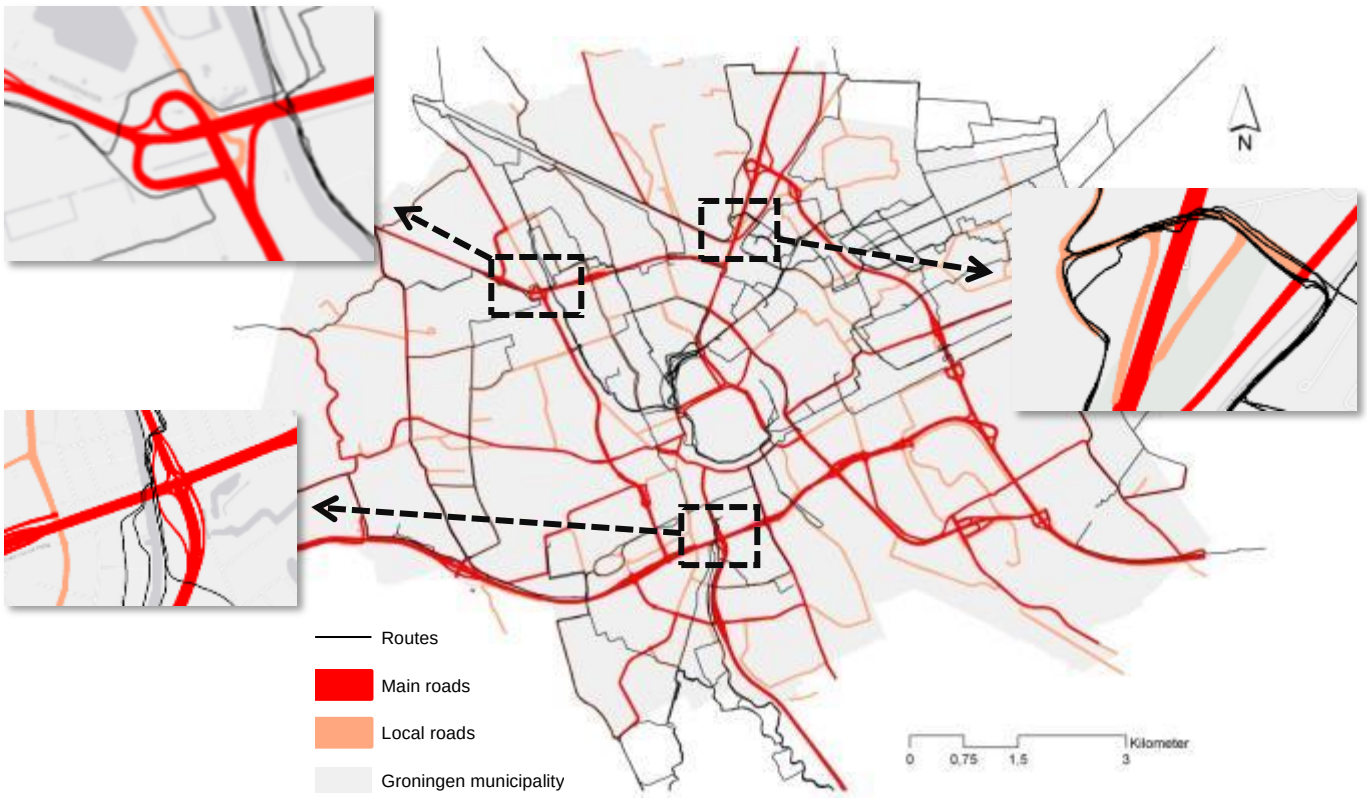


Fig. 55. Routes and main infrastructure.

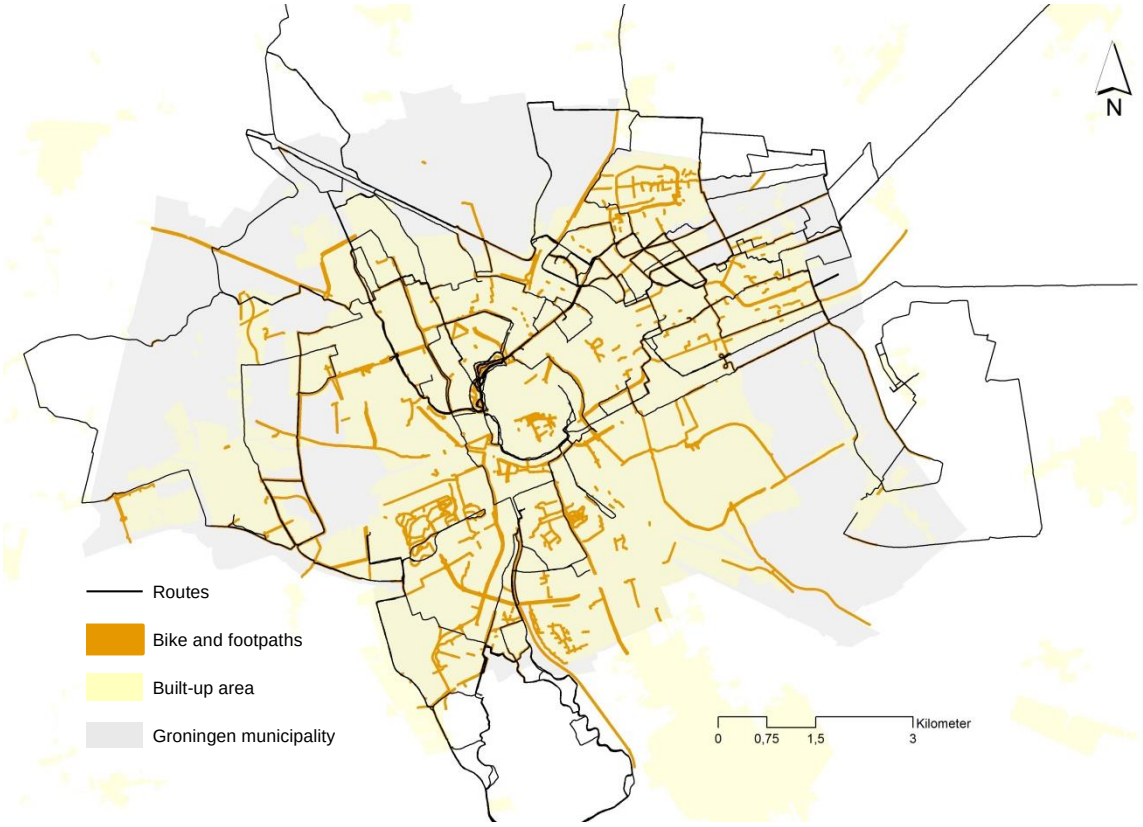


Fig. 56. Routes and bike/footpaths.

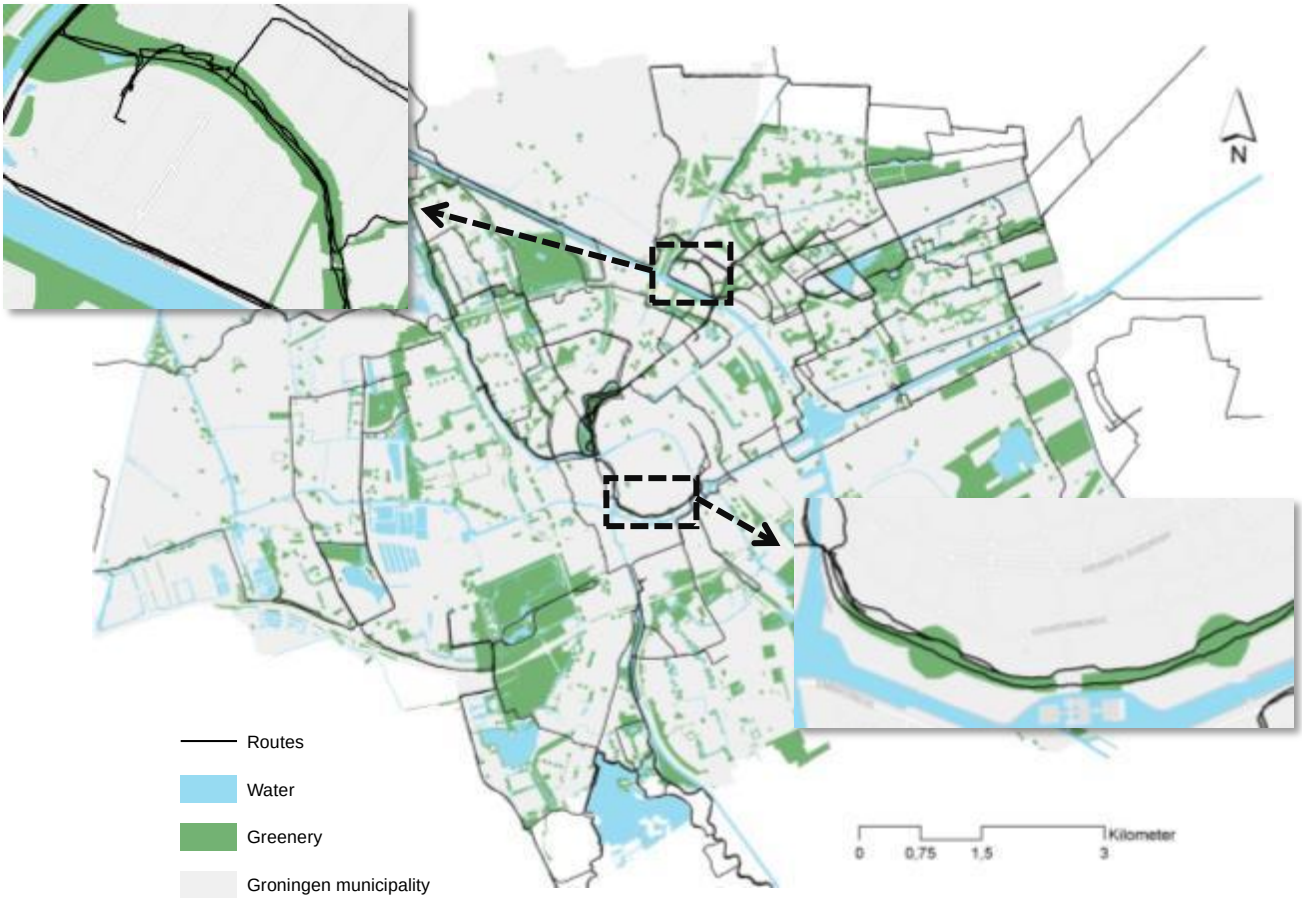


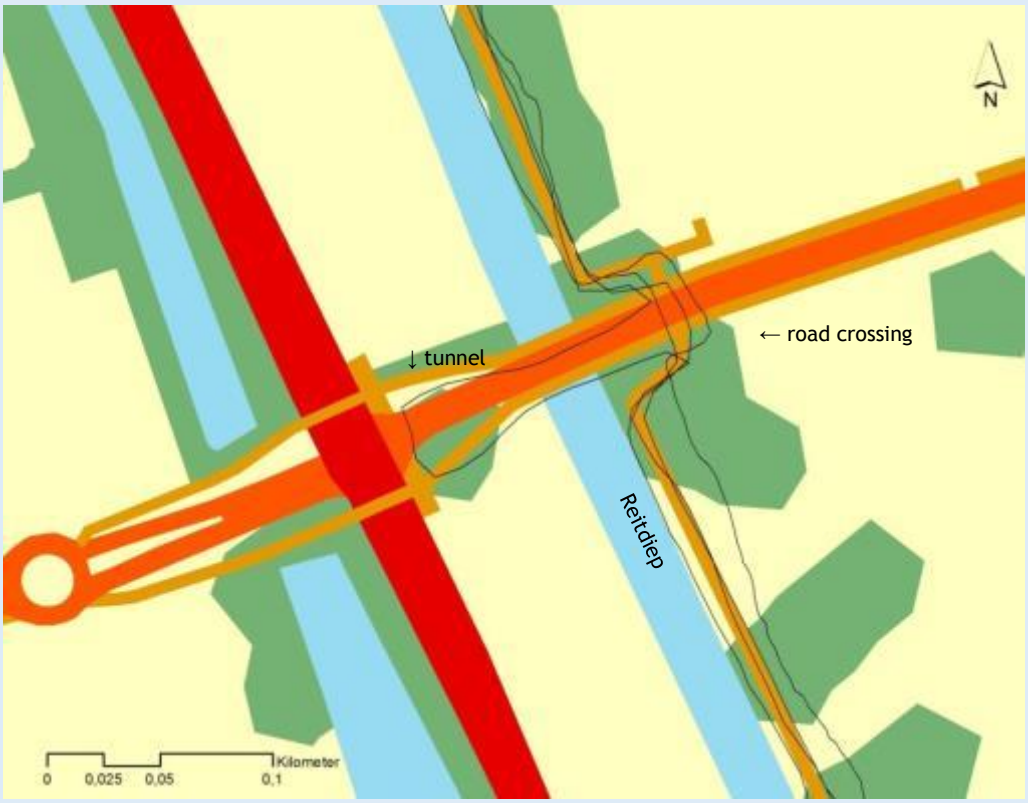
Fig. 57. Routes and greenery/water.

Box 2

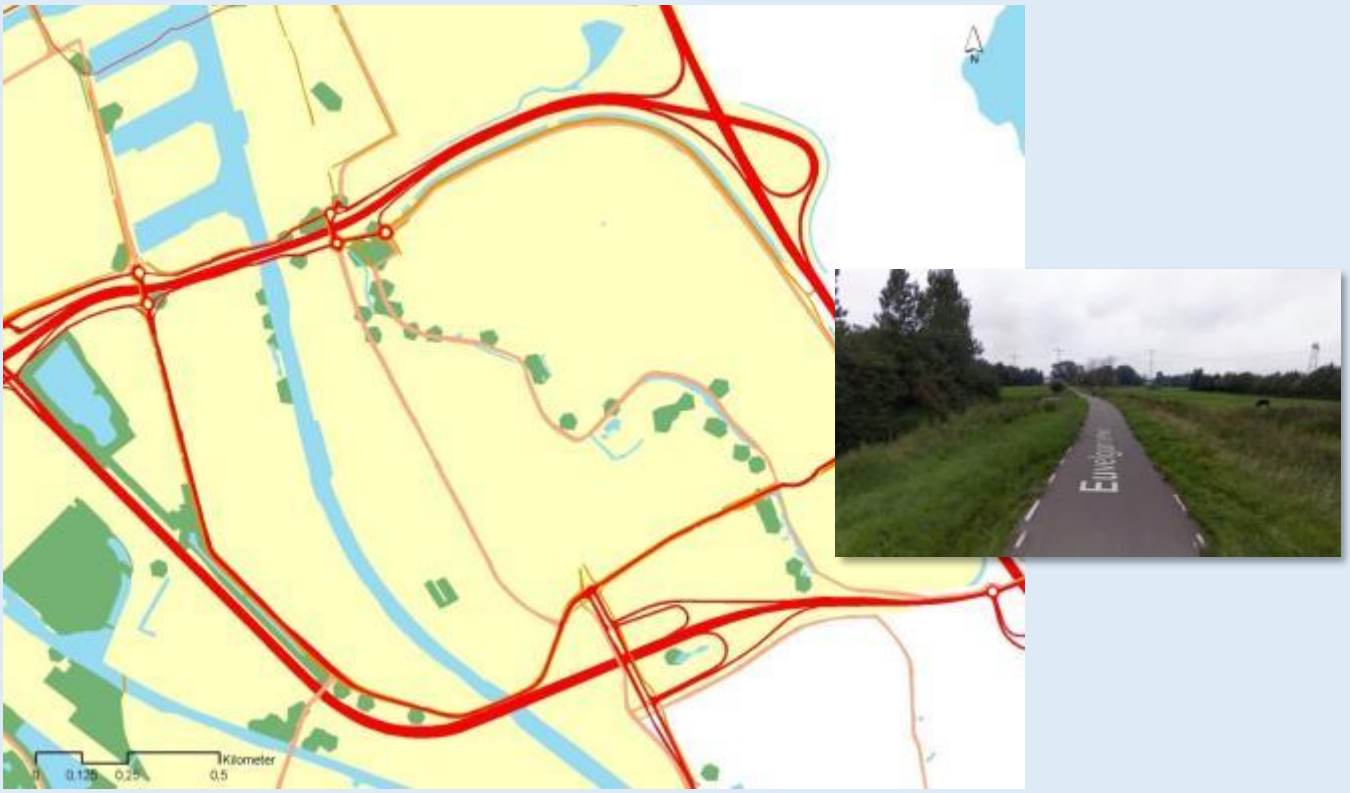
The Noorderplantsoen (left) and Stadspark offer many route options in a green and watery environment. However, relatively few routes are seen in the Stadspark, which could be related to the spatial distribution of respondents, or the reported lack of lighting.

This map shows the main links between the central city to the Kardinge area. Two barriers have to be crossed, firstly the bridge over the Van Starkenborghkanaal and then the ring road. As was indicated on the interactive map, one of the bike and pedestrian bridges over the ring road was closed off due to construction works, forcing runners to take an alternative route. However, two alternative bridges are close by, which were often used by the GPS data respondents.

Box 2



The runners along the Reitdiep are confronted with a major road. One runner creatively circumvented this road crossing by using the tunnel on the other side of the Reitdiep.



The largest 'blank spot' on the route map is located in the business park *Euvelgunne* in the south-eastern part of the city. The area is surrounded by highways and businesses, but offers an extensive green zone as well. Although the size of the sample does not allow for firm conclusions, it could be that runners avoid the area because of the barriers surrounding it.

4.3.4 Routes: experiences and evaluation

After sending the GPS data, respondents were guided to a short questionnaire with questions about their route. They were asked to rate 7 statements on a 1-5 Likert scale. The results are shown in Fig. 58 and mapped in Appendix 8 (p. 142). It can be concluded that most respondents are satisfied with their route. Comparable to the mean experience scores in section 4.2.3, mean scores were calculated for these routes as well, and are displayed on the route map in Fig. 59. Only one route had a mean score below 3 (i.e. below 'neutral'); the highest mean scores are attached to routes in the Paterswoldse Meer and Kardinge areas.

Respondents were asked to grade the route themselves as well, and this shows a similar pattern (Fig. 60). However, it should be noted that attaching a single grade to the route proved to be difficult for some respondents, as routes can be very varied from segment to segment (i.e. a low valued route could have pleasant segments, and vice versa).

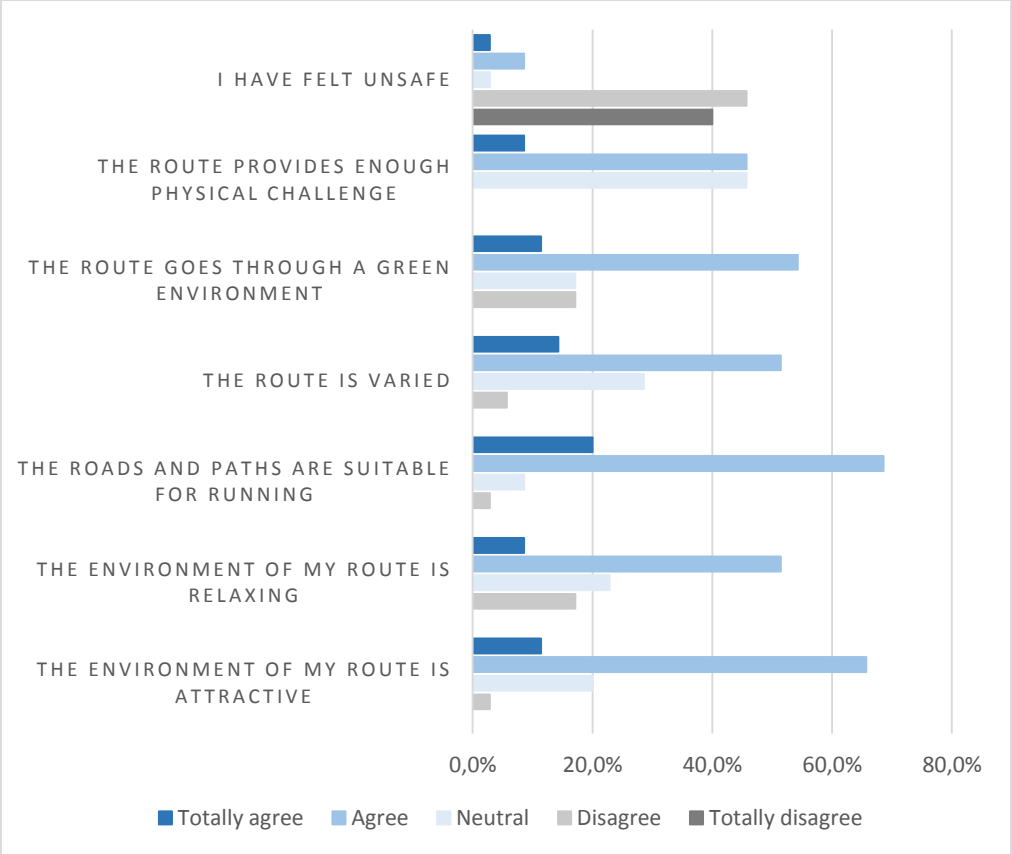


Fig. 58. Survey results for running routes.

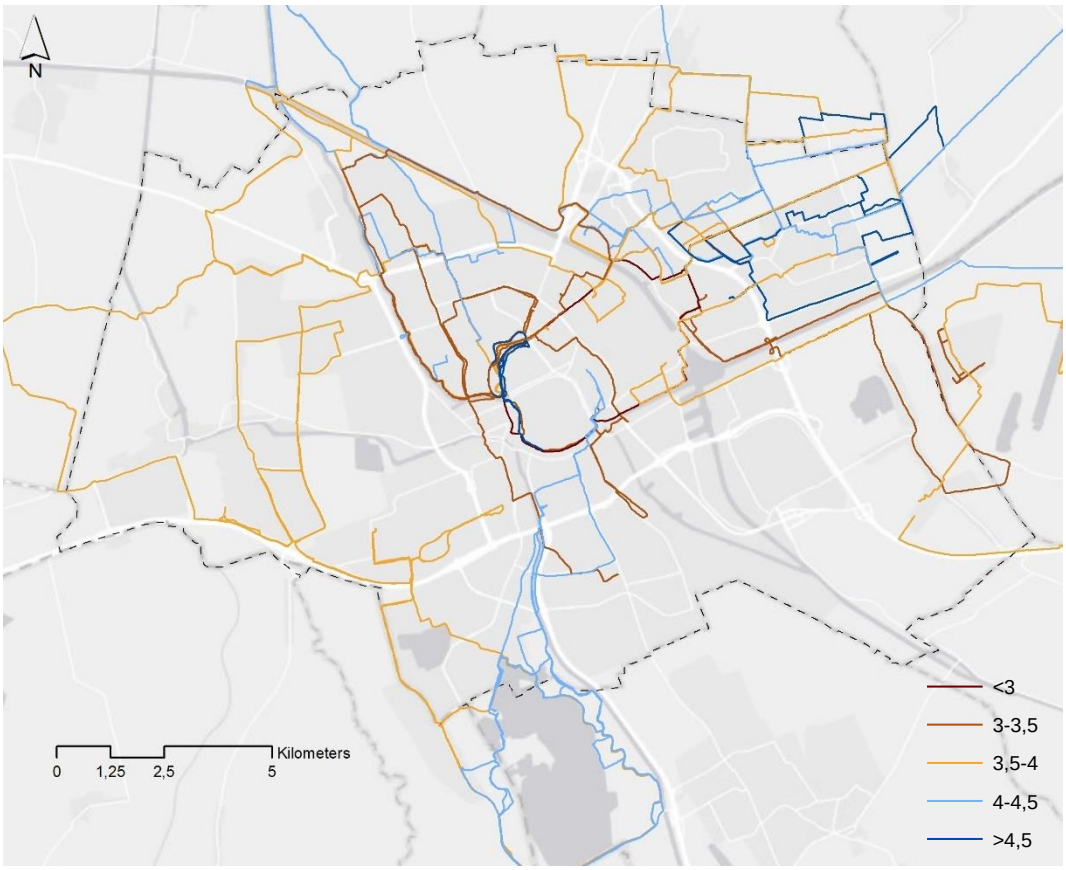


Fig. 59. Mean experience scores for the routes.

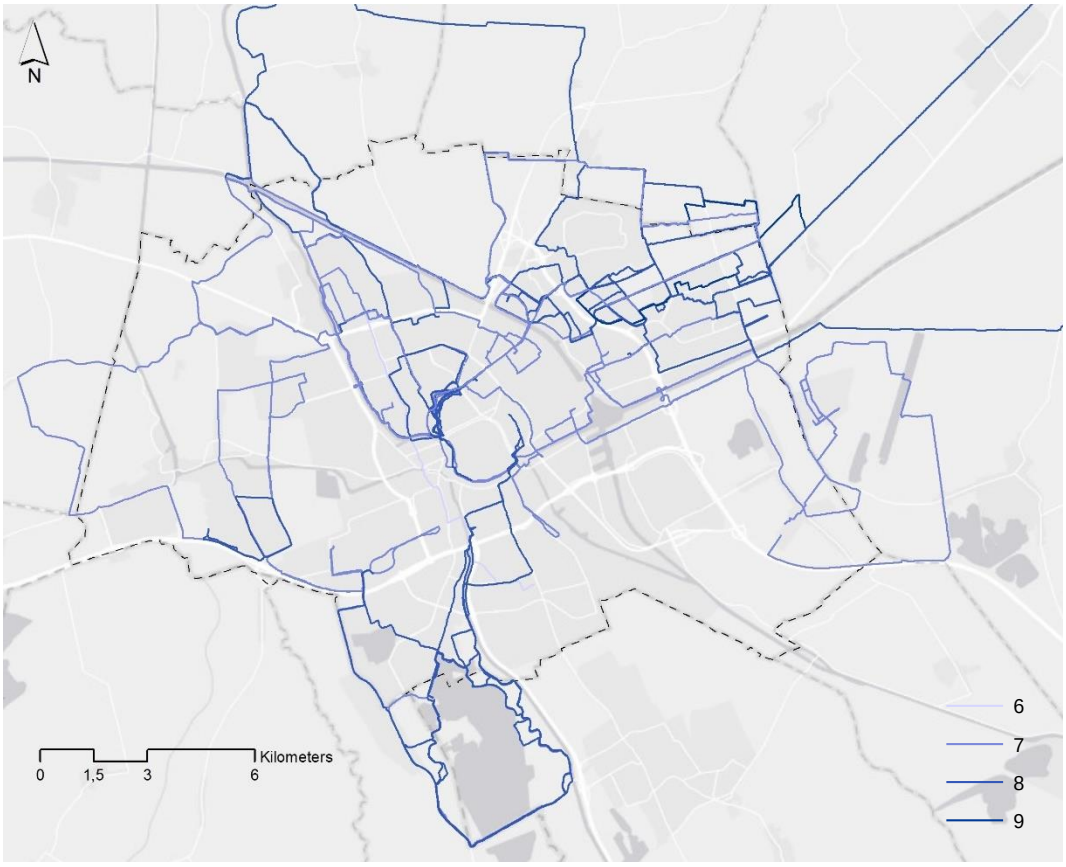


Fig. 60. Grades that were assigned to the routes.

4.4 Run-along interview results

After the analysis of the survey and GPS data, three respondents were interviewed while running 'their' route. This phase in the research further confirms earlier insights, and provides a better understanding of the individual motives, experiences and running behaviour.

4.4.1 Participants

Table 9 shows the descriptive statistics from the interview participants. The sample is relatively young and healthy, and reported a good experience with running in Groningen. Two participants (1 and 2) reported the highest, respectively lowest commitment to running.

Table 9. Descriptive statistics for run-along interview participants.

Participant	Sex	Age	Education	Occupation	Health status	Running since	Commitment to running	Running experience score
1	Male	36-45	University	Working	Excellent	+5 years	59	3,56
2	Female	18-25	mbo	Student	Very good	2-5 years	38	4,06
3	Female	26-35	University	Working	Excellent	2-5 years	51	4,19

4.4.2 Routes

Table 10 and Fig. 61 show the (proposed) routes for the run-along interviews. These routes were largely followed, although two participants chose to partly deviate from this route during the interview.

Table 10. Run-along interview routes.

Participant	Distance	Grade	Types of road	Route experience score
1	6,0 km	7	Street, sidewalk, bike path, gravel path, grass strip *Note: due to an injury, the route was explored by bike*	3,29
2	5,7 km	8	Sidewalk, bike path, gravel path	3,71
3	10,9 km	7	Street, sidewalk, bike path	2,57

Fig. 61. Map showing proposed routes for the run-along interviews.

4.4.3 Main findings

The interview recordings were transcribed, coded and stills were taken from the video material. The transcript was then copied to a map, to be able to link the participants' comments to specific places along the route (Fig. 62). In the following sections, the interviews will be discussed separately and illustrated with a selection of video stills. Then, the main findings from the run-along interviews will be analysed in relation to the literature and earlier findings.

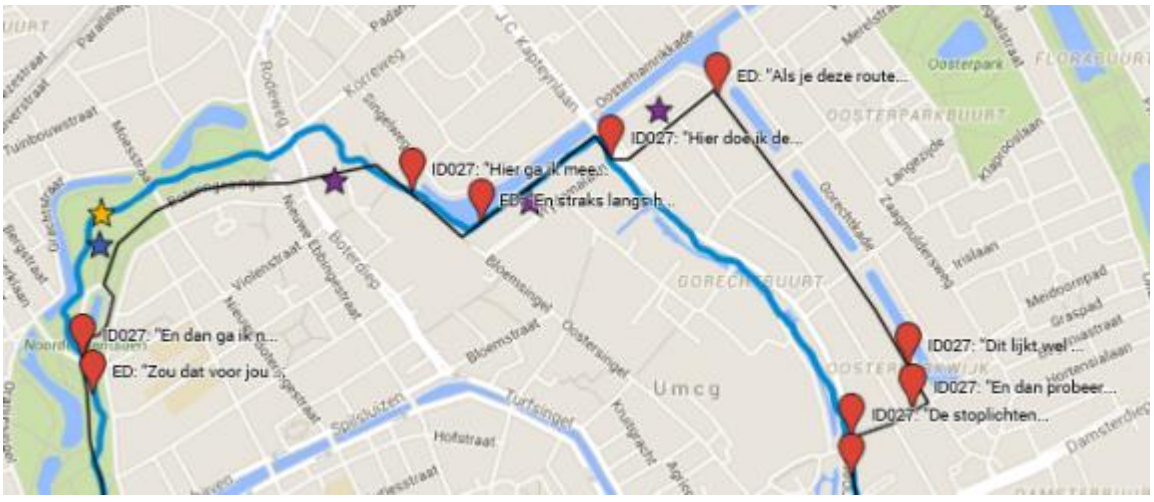


Fig. 62. Example of a mapped interview transcript (*Google MyMaps*).

4.4.3.1 Participant 1

Participant 1 (male, 36-45 years) proposed a route circling around the city centre, which he regularly runs in the morning, before going to work. The route was explored by bike, due to an injury of the participant. The route passes some dense built-up areas, alternated by small strips of greenery and the larger Noorderplantsoen. Both the green zones and the old buildings along the canal are appealing to the participant. The Noorderplantsoen was identified as the main 'goal' of the route, offering a green and restful environment, many alternative gravel paths, and some challenge on the hills (Fig 63.5). Participant 1 has a few fixed rituals along the route, such as doing stretching exercises near a parking meter, and speeding up on specific segments. The route may vary a little throughout the year, mostly depending on the presence of daylight. When it is dark, some segments in the Noorderplantsoen and other small paths are avoided and replaced by lit paths (Fig 63.6).

The route has only two traffic lights, and because the streets are not busy in the early morning, the momentum is barely obstructed by traffic. However, on zebra crossings, cyclists do not always give way. The route passes cobble road, which can be quite annoying, especially when the participant is feeling tired at the end of his run (Fig. 63.1). A positive feature is the urinal at the Hoge der Aa. Finally, the artworks in the Tschumi pavilion provide a supplementary experience along the route:

> *"There you have the Tschumi pavilion. A while ago there was an artwork that produced sounds, which was barely hearable. However, early in the morning, you could hear it quite well. Sometimes they have a new artwork here. And when I pass by, I take a look at the artwork. It often is a surprise" (participant 1).*

Fig. 63. Stills from interview 1 (by bike).

1. Underpass provides easy crossing of major road; 2. Cobble road is annoying, especially when respondent is feeling tired at the end of his run; 3. Bike and pedestrian bridge; 4. Shortcut crossing roundabout; 5. Multiple route options in the Noorderplantsoen, depending on the season; 6. Speeding up on the gravel path along Oosterhamrikkade. An alternative path is chosen when it is dark; 7. An alternative segment was chosen after a road block at the Petrus Campersingel, which proved to be an improvement of the route ("This seems to be the longest straight end in my route. Funny, because when I am running here, I don't experience it like that").

4.4.3.2 Participant 2

Participant 2 (female, 18-25 years) lives in Hoogkerk and has a local round for her regular evening run. Safety perception seems to be an important motivation for her route choices and running experiences, especially at night. She therefore prefers to run in the presence of other people:

> *"When I run this route, I think, when something happens to me, I am near the civilized world. When you run in the Onlanden, there is nobody around, and if something happens, then…" (participant 2).*

On some segments of het route, lighting is absent or of bad quality (Fig. 64.2/5). However, when lampposts are present, they can serve as distance indicators for interval training as well. Participant 2 often wears an earphone with music while running, which sometimes hamper interaction with other road users. However, in other occasions she actively seeks interaction, such as through making eye contact with car drivers at crossings and taking the bike path on the left side of the road to see bicyclists coming (Fig. 64.3/4). However, car drivers and cyclists do not always give way, so caution is needed at every road crossing (Fig. 64.7).

Participant 2 prefers running on bike paths over sidewalks, as sidewalks are often blocked by trees, have loose tiles, and require stepping up and down at curbs (Fig. 64.6). However, in case the bike paths is busy with bicyclists, the sidewalk is a better option for her. The new marked 4 miles routes in Hoogkerk are a good addition to the running environment, as they enable her to explore new routes and areas.

Fig. 64. Stills from run-along interview 2.

1. Gravel path; 2. Bike path without lighting; 3. Major road crossing: seeking eye contact with drivers to make them give way; 4. Choosing left-side bike path to see forthcoming bicyclists; 5. A slope provides some challenge along the route; 6. Tiled foot path with some loose tiles; 7. Zebra crossing: the car driver did not give way to the participant; 8. Choosing bike path rather than sidewalk for continuity reasons.

4.4.3.3 Participant 3

The third run-along interview followed a route starting from the eastern part of Groningen, and then circling around the city centre. The route is sometimes used in group trainings of participant 3 (female, 26-35 years), and she stated that she would not choose this route herself:

> *"It actually is a rather boring route. First going this way, and then back. However, you encounter many things along the route" (participant 3).*

Although this route is rather varied, she prefers to run in greener, more natural environments. However, the lack of lighting in these areas restricts the route choices in winter:

> *"We of course start our training in Kardinge, and then you have to go somewhere. We often go the other way, in the direction of Zuidwolde, and that is nice. But that is not ideal in winter, when it is dark" (participant 3).*

> *"Yes, street lighting is important. Once we were running in Kardinge, on the narrow paths of the 4 miles track. Well, that's not to be recommended, especially because the paths have an uneven surface" (participant 3).*

When running alone, poorly lit places such as the Eemskanaal segment negatively influence the participant's sense of safety and are being avoided (Fig. 65.9). The Korreweg segment is an annoying part of the route because it is busy and there are many parked bikes on the (narrow) sidewalk (Fig. 65.1). Because the bike path is narrow and busy as well, running there is not an option. By contrast, the sidewalk on the Singel is wide and therefore pleasant for running.

In terms of the interactions with other traffic, participant 3 is sometimes annoyed by the fact that people do not always give way to runners. However, she has quite some experience with running in the city and seems to be self-assertive in the 'negotiation' with other traffic (Fig. 65.4/6/7). On the

other hand, she notices that other road users are sometimes annoyed by a group of runners. She makes sure that her routes pass by zebra crossings, as she does not like to wait at traffic lights (Fig. 65.2).

The Noorderplantsoen is one of the most attractive parts of the route (Fig. 65.3). The paving is ideal, as the gravel offers a smooth but soft surface. However, participant 3 does not like to run here on crowded summer days, when people seem to be running in the Noorderplantsoen just 'to be seen'. Finally, one remark sheds an intersting light on the perception and experience of the running environment:

> *"In our running group, we have a blind man. Sometimes I run with him, but then your really have to adapt. You have to keep an eye on everything, such as obstacles in 5 meter. You run with a guidance rope" (participant 3).*

Fig. 65. Stills from run-along interview 3.

1. Slaloming in between parked bikes; 2. Zebra crossing; 3. Noorderplantsoen; 4. Street crossing, interacting with other road users; 5. Sidewalk blocked due to construction works; 6. Negotiating space among pedestrians; 7. Diagonal street crossing; 8. Passage along road construction works; 9. Eemskanaal; 10. Underpass to cross major road.

4.4.4 Analysis

The run-along interviews provided relevant insights into the 'negotiation with space'-process of runners. Five aspects will be outlined below:

1. **Speed.** Because the runners were interviewed, they ran at 'conversation speed' which may be lower than their regular speed. However, most of the segments seem to provide suffucient space for speeding up.
2. **Rhythm**. The environment offers rhythm to runners, on the one hand by providing alternating landscapes that are interesting to explore (offering fascination (Kaplan, 1995)), and on the other hand by structuring their training (e.g. interval training supported by lampposts). These findings are in accordance with the landscape preference matrix of Table 3, indicating that both complexity and predictability are important landscape affordances.
3. **Route**. Runners seem to be rather conservative regarding their route choices. Most runners have a few fixed routes, whether or not with some minor changes depending on the season. This could be explained by the fact that runners aim for control over (the distance of) their route and do not want to risk going the wrong way. Marking routes can therefore be a significant improvement to the running landscapes, as they enable runners to explore new routes and add new areas to their mental map.
4. **Experience**. As the theory of affordances suggests, running experiences are very personal. Although the physical characteristics of the environment are fixed, each individual runner perceives it differently. Moreover, the running experience is not only determined by the

physical environment that is available to the runner, but by the way he/she copes with situations as well (i.e. feeling in control, adaptability). Indicators such as sex, individual preferences and assertiveness play a major role for the total running experience.

5. **Friction**. The interaction with traffic and other road users is the most notable barrier to a continuous running movement. Referring back to Fig. 11, it requires adaptive action to find one's way though the city, which means adjusting speeds and directions in response to situations in public space. Most runners try to avoid incentive rich environments, and prefer running in green and rural areas.

The most important lesson from the interviews is perhaps the notion that runners are pragmatic in relation to their physical environment. Although nuisances may be present along their 'daily' routes, they are creatively circumvented or simply accepted.

4.5 Synthesis

Finally, all findings from the study will be discussed and analysed together, following the structure of the conceptual framework. The five choice-determining factors will be discussed separately, whereby each factor will be linked to the relevant choice-enabling factors and its impact on runners' negotiation with space (see box 3).

Box 3

Choice-determining factors or *constructs*:

1. Being away and fascination (i.e. arousal, mental restoration)
2. Landscape perception and attractiveness (i.e. coherence, complexity, legibility, mystery)
3. Safety (perception)
4. Continuity (i.e. momentum, not having to stop for other road users)
5. Compatibility with training objectives (i.e. challenge, facilities)

Choice-enabling factors or *choice architecture*:

1. Infrastructure (i.e. paving, lighting)
2. Greenery (i.e. green space attachment, *biophilia*)
3. Social environment (i.e. interaction with other people)
4. Time/space (i.e. climate, seasons, day/night)

Running behaviour/Negotiation with space:

Speed, rhythm, route, experience, friction

4.5.1 Being away and fascination (i.e. arousal, mental restoration)

The first factor relates to the mental restorative benefits of running, by 'running away' from daily (urban) stresses (Ulrich, et al., 1991; Allen-Collinson, 2008). Indeed, peace and silence are relevant criteria for determining running routes, as more than 60% of the respondents agree to this statement and 40% aims at reducing stress (see Fig. 29 and Appendix 3). In the photo question, many respondents preferred the forest landscape for its peaceful and quiet appearance, whereas

the picture showing a crowded urban street was “too busy” for most respondents (see Appendix 4). It can be concluded that greenery and absence of other people (“isolation”, interactive map) are important affordances for mental restoration. Time plays a role here as well, as certain time periods during the day provide more tranquillity than others (for example the early morning run from interview participant 1).

Peace and silence were often mentioned on the interactive map as well, referring to “being out of town” or being “on top of the world” (Fig. 66). Interestingly, these merits are assigned to areas just outside the urban area, indicating that runners do not have to travel far from the civilized world to gain mental restoration. Interestingly, one respondent mentioned that despite some new bike- and footpaths are needed, certain areas should be kept isolated above all. In other words, the provision of infrastructure to attract more runners towards certain areas could have a negative impact on the experiences of some runners.

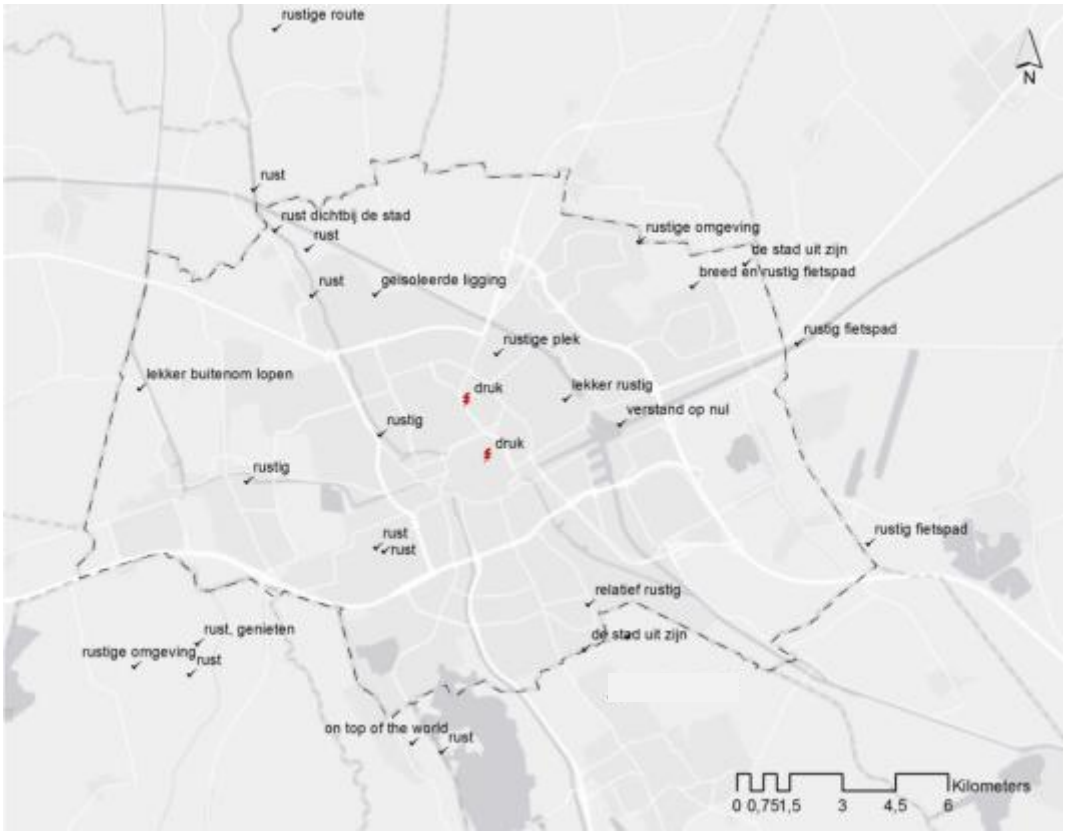


Fig. 66. Comments on being away.

4.5.2 Landscape perception and attractiveness (i.e. coherence, complexity, legibility, mystery)

Landscape perception theory suggests that certain landscapes are more attractive than others because they provide an ideal mix of arousal-decreasing and arousal-increasing elements (Jacobs, 2011). In other words, landscapes providing both overview and variety are preferred. Consequently, landscape openness is a relevant criterion for determining running routes for half of the

respondents. It is therefore not surprising that many segments of the GPS tracks can partly be found outside the built-up area of Groningen, and otherwise follow relatively 'spacious' zones of water bodies and green areas within the city (see Fig. 53). This may be explained by theories on human survival and by arousal theory, claiming that the individuals' physical and emotional well-being are enhanced when environments provide sufficient resources and are controllable and predictable. Many of the comments on the interactive map relate to landscape perception and aesthetics, referring to the beauty of the landscape, views, variety, space and atmosphere (Fig. 67).

Fig. 67. Comments on landscape perception.

Half of the respondents think their living environment is inviting to go for a run; 25% disagree (Fig. 35). Respondents from peripheral neighbourhoods are more positive in this respect than respondents from the central neighbourhoods of Groningen, which seems to be mainly explained by differences in availability of greenery and traffic intensity (Table 5).

The green environment is one of the most important criteria for running routes (83% (strongly) agree) and provides many affordances for landscape attractiveness. The photo question supports this conclusion, as 'green' photos were preferred over 'urban' photos (Appendix 4). Groningen performs rather well in offering a green environment to its runners, as more than three quarters of the respondents agree that they can run in a natural environment in Groningen (Fig. 35). Moreover, 75% think there are enough parks in their neighbourhood that are suitable for running. However, some respondents suggested creating a network of green areas by better linking the parks and green

areas in and around the city (Appendix 9). This would enable a continuous green running experience without disturbing elements, and resembles the century-old aim of developing 'lungs of the city (Ignatieva, et al., 2010).

The experience map shows merely positive associations with greenery and nature, mostly outside the built-up areas of Groningen ("beautiful nature", "green", "water"; Fig. 68). This is in line with the literature on green exercie and well-being (Ulrich, et al., 1991; Barton & Pretty, 2010). Seasonal changes may further enhance the experience of nature, as for example "autumn colors" and "meadow birds" create new vistas every time the runner passes by. It can be concluded that green space is an important affordance for runners, both for landscape attractiveness and for mental restoration.

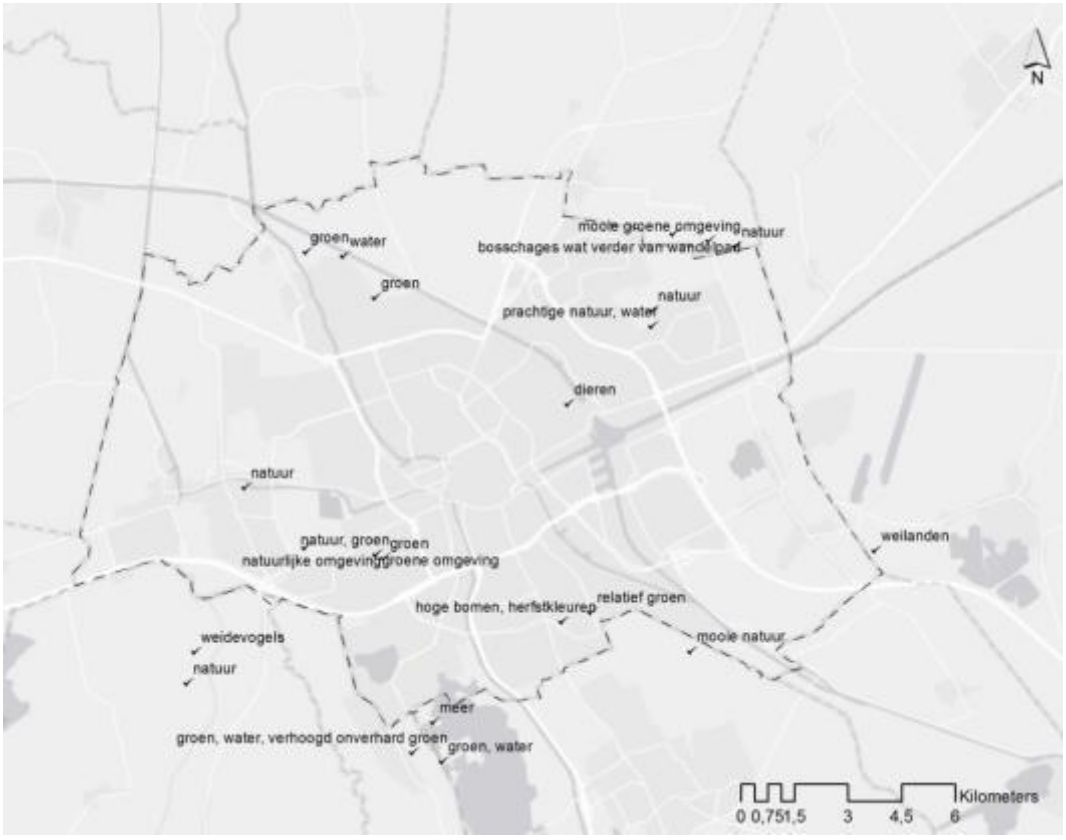


Fig. 68. Comments on natural environment.

4.5.3 Safety (perception)

Sense of safety is an important criterion for 70% of the respondents, and is negatively influenced by a lack of street lighting and (fast-driving) cars on some back roads (Fig. 29). Because evening hours are popular for running, the lack of daylight in winter negatively affects the number route options. Dark areas and paths hamper a smooth and comfortable run and negatively affect safety perception.

Significant differences in running experiences for men and women were found, which are caused by indicators related to social safety perception. Women report problems with street lighting, receive annoying comments and avoid places for safety reasons more often than men. One female respondent even reported having experienced an assault while running. Having a co-runner can reduce the feelings of insecurity: “For a women alone it can be difficult to run in a very natural environment (only possible during the day). I adapt my routes, or go together with others” (Appendix 9).

In general social interactions are avoided as runners seem to prefer an environment where not too many (sporting) people are present. This may be related to the need for ‘being away’ and to the fact that other people can be threatening or make annoying comments. One interview participant mentioned feeling a certain social pressure to run “prettier” when other people pass by, and another participant sometimes avoids the Noorderplantsoen and other crowded areas dus to a sense of being watched and receiving comments.

Some respondents suggest that more people should be seduced or inspired to start running (or doing other active leisure activities in outdoor spaces). Seeing more people being active is expected to lower the barrier to start running and raises safety perception.

4.5.4 Continuity (i.e. momentum, interaction with other road users)

The continuity of running routes is an important factor for most runners, as 85% of the respondents (strongly) agree to this statement, and less than 5% (strongly) disagree (Fig. 32). Asking whether interruptions are a nuisance, 63% agree (Fig. 34). However, the experiences of runners in Groningen are reasonably positive with respect to momentum, as only 17% of the respondents — mostly living in the central neighbourhoods of Groningen — state they have to stop or lower their pace for other traffic too often (Fig. 35). Mopeds are the most annoying road users, bicyclists and pedestrians are not so problematic (Fig. 34).

The run-along interviews and observations during these interviews revealed that runners are constantly trying to retain their momentum by interactively moving through traffic. Seeking eye contact with other road users and sometimes even forcing priority on crossings was observed. However, even on zebra crossings, they were not always given priority by other road users. In another example from the GPS data, a runner circumvented a busy road crossing by taking a detour through a nearby tunnel.

The requirement of continuity may also explain the popularity of bike paths for running, as many sidewalks contain obstacles such as parked bikes, trees, loose tiles and curbs. By contrast, the bike path network of Groningen is of high quality and offers a smooth and continuous routing. However, street-scale interventions such as creating safer street crossings, ensuring sidewalk continuity and

traffic calming measures could further improve enhance momentum for runners (see Heath, et al., 2006).

4.5.5 Compatibility with training objectives (i.e. challenge, facilities)

Physical challenge is not a very important criterion for runners, and the same goes for presence of slopes (Fig. 29). Nearly two thirds of the respondents agree there is sufficient physical challenge in Groningen, and 80% says there are enough possibilities to create pleasant running routes (Fig. 35). On the interactive map, respondents mention slopes and the ability to choose different paths in the same area as a positive contributor to the running experience.

Some runners would like to have more facilities for warming-up exercises. Route markings are appreciated because they enable runners to keep track of their speeds and support interval training. The construction of new marked routes is encouraged. Furthermore, facilities such as water fountains and lockers would improve the running environment (Appendix 9).

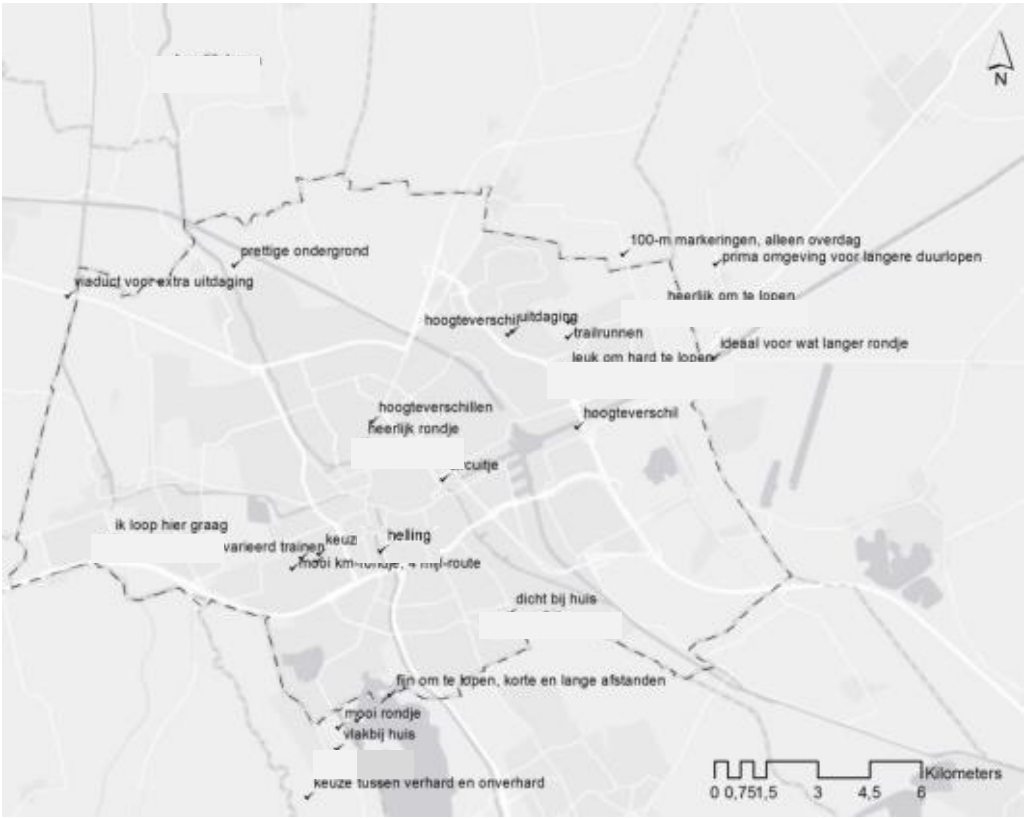


Fig. 69. Comments on compatibility with training objectives.

Infrastructure is an important basic condition for a good running environment, which is further confirmed by the large number of comments on the map (Fig. 70). The quality of roads and paths (80%) and lighting (72%) are important criteria for selecting running routes, just as an uneven surface and deficient lighting are considered as an obstruction by more than 50% (Fig. 29, Fig. 32). In Groningen, street lighting is judged insufficient by nearly a third of the respondents, suggesting that runners have limited route options when it is dark (Fig. 35).

Many respondents would like to have more routes accommodated with lighting, especially in Kardinge and the Stadspark. The pavement and markings of some of the marked running routes are in a bad condition, and should be maintained better. Creating more unpaved routes, such as the gravel paths in the Noorderplantsoen, is recommended (Appendix 9). The existing marked routes are appreciated; respondents suggest creating more routes by marking distances and route directions in their neighbourhoods. One respondent even mentioned using a spray can to mark the distances on his favourite training routes.

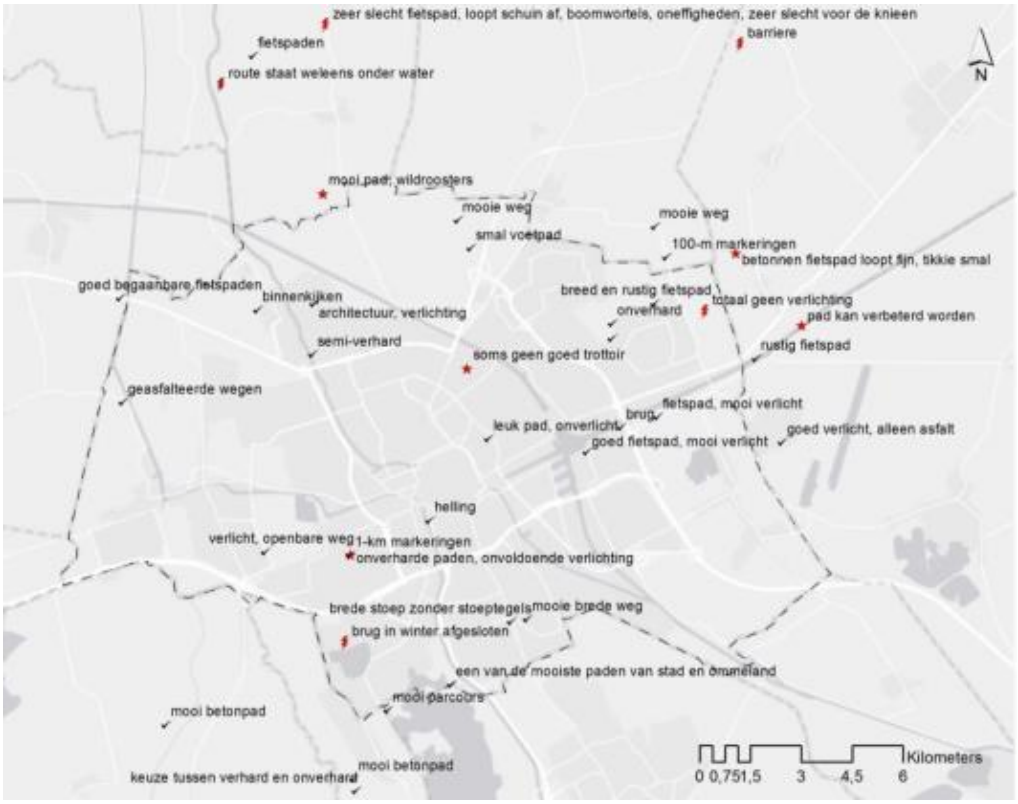


Fig. 70. Comments on built environment.

4.5.6 Negotiation with space (i.e. speed, rhythm, route, experience and friction)

The observed running behaviour is a result of the negotiation with space of each individual runner. Although runners clearly set preconditions to their routes and physical environment, and prefer environments that are compatible with their goals, the interaction with the physical and social environment results in rather pragmatic behaviour. For example, most runners start from their homes and pass by areas that fit within their range, rather than travelling to potentially more suitable areas for running. Especially on a micro scale, runners are adaptive and dynamically interact with (e.g. traffic) conditions, for example by intuitively choosing bike paths or sidewalks to maintain speed and rhythm and limit friction along the route.

Table 10 summarizes the most relevant insights from this study, by linking the preconditions for running and the environment, to the way runners negotiate with space (see also Table 4).

Table 11. Insights on runners' negotiation with space.

	Choice-enabling factors/choice architecture			
Choice-determining factors/constructs	*Infrastructure*	*Greenery*	*Social environment*	*Time/space*
Being away	**Route/Experience**: Runners like the experience of being away, which may be negatively affected by the provision of new running infrastructure in certain (remote) areas.	**Experience**: Green environments positively influence the sense of restfulness/being away, even in urban parks and areas nearby the city.	**Friction**: Runners prefer areas where not too many people are around and with low levels of arousal. **Experience**: Being watched while running can negatively affect the running experience, especially for women.	-
Landscape perception and attractiveness	-	**Experience:** A green landscape is highly attractive to most runners, and incorporated in nearly all running routes.	Seeing more people enjoying being active in outdoor space could encourage even more people to become active.	**Experience/Friction**: Spacious landscapes are preferred over dense landscapes (because of views, orientation).
Safety	**Route/Experience:** Street lighting is an important affordance for providing (sense of) safety on running routes. When street lighting is absent, the pavement should at least be free of obstacles.	**Experience**: Although green areas are appreciated, their remoteness and lack of lighting can negatively influence the running experience, especially for women.	**Experience:** Although large crowds are avoided by most runners, they like to have some people around that ensure some social control (i.e. in case of emergency).	**Route/Experience:** On dark evenings, route options are limited because runners avoid certain areas where they do not feel safe (i.e. unlit areas).
Continuity	**Route/Friction:** Runners prefer routes that are unobstructed by steps and road crossings, to ensure a 'smooth' run.	-	**Rhythm/Experience:** Runners avoid environments with many encounters with other road users, as they disrupt the momentum during a run.	**Experience:** Certain time frames provide less annoyance from other road users (low traffic intensity), as for example experienced by early morning runners.
Compatibility with training objectives	**Rhythm/Route:** Marked routes provide guidance to runners, by for example enabling interval training and providing certainty over the (max.) distance of their run.	**Route:** Green environments such as parks often offer softer paving as well, which helps preventing injuries. On the other hand, hills can provide extra challenge and training opportunities.	-	-

Chapter 5. Conclusions & recommendations

This study aimed at providing insights into the interactions between runners and the (urban) physical environment, and how these interactions influence the perception, behaviour and route choices of runners. These insights were gained through a mixed methodology, collecting quantitative, qualitative and spatial data. This chapter will provide an answer to the sub- and main questions, and put forward recommendations for further research and policies.

5.1 Where do runners in Groningen run?

The GPS data that was shared for this study shows a varied pattern of routes throughout the city and surrounding landscape. Most routes are shaped as a loop, in order to avoid running the same path twice and achieving variety along the route. The home location and intended distance of the runner play a major role in determining the scope of the route: most runners often start their run from home, and then their intended distance limits the range of areas they can pass by. Although urban parks provide good conditions for running, they are often too small for the common 5-10 km runs. Therefore, many runners link multiple green areas or run outside the city limits/ring road.

The GPS data show that running routes tend to converge in non-built-up areas outside the city, in green and spacious ‘corridors’ within the urban fabric (such as relatively wide streets), and on bridges and underpasses that enable crossing barriers such as main roads and canals. Most of the routes follow the infrastructure for slow modes (cycling and walking) as long as obstacles are absent.

5.2 How do runners perceive and experience the physical environment of Groningen while running?

The second step in this study is to better understand how runners perceive their physical environment, and what their experiences are during a run. The results show a mixed picture of positive and negative experiences. Although experiences are very personal, some significant

differences have been found for males vs. females and for specific neighbourhoods in Groningen. Firstly, women have a less positive running experience than men due to feelings of (social) insecurity. And secondly, respondents from central neighbourhoods report a less positive running experience than respondents from peripheral neighbourhoods at the outskirts of the city, as there is more nuisance from interaction with people and traffic, and the environment is deemed less inviting to go for a run due to a lack of nature and physical challenge. This explains why, although half of the respondents live in the central neighbourhoods, less than 20% of the routes is situated here.

Running routes are determined by a varied array of criteria; presence of greenery, the quality of paving, presence of street lighting, sense of safety, momentum and spatiality are the most relevant facets of the choice architecture of runners. Most runners also tend to avoid environments with high levels of arousal, and seek tranquil and traffic-calmed spaces. Runners (women especially) tend to avoid unsafe areas without street lighting when it is dark, which makes that insufficient street lighting and sense of safety can significantly limit route options. The other criteria are less decisive, as runners tend to be pragmatic and are able find their way through barriers, even though traffic situations and uneven paving can be rather obtrusive to a smooth running experience.

5.3 How does the physical environment influence the running experience and behaviour of runners in Groningen?

The main conclusions of this study are that Groningen generally provides a good running environment for most runners, offering many route options in a varied urban and natural landscape. The differences found for men versus women in terms of safety perception, and for runners from central versus peripheral neighbourhoods in terms of suitability of the living environment for running, are in line with what could be expected from theory. Although the physical environment is important for the running experience, runners are pragmatic and adaptive when it comes to finding their way in the city, as long as the baseline conditions of sufficient lighting, momentum, sense of safety, good paving and greenery are met. Runners prefer variety along the route and the ability to choose from multiple route options, suggesting that the connectivity between running areas and granularity of the path network is important.

The influences from the environment on running experience and behaviour can be described on three levels of choice:

1. **Macro**. On the city level, certain areas are more suitable for running than others, as there is a preference for non-urban and green areas that allow for mental restoration and sense of ‘being away’. Time plays a role as well, because areas with a lack of lighting are avoided when it is dark and therefore constrain route options. Therefore, on dark (winter) evenings, runners may be limited in finding truly restorative running routes.
2. **Meso**. When zooming in, running routes tend to cluster in relatively spacious and green ‘corridors’ within the urban fabric. Furthermore, passages over canals and highways seem to

have a clustering effect, as runners have to cross these canals and highways to reach more suitable running areas outside the city.

3. **Micro**. On the level of individual runners and routes, individual preferences and habitual behaviour play a major role in determining the running experience. Whether certain environmental characteristics afford a pleasant run, is determined by the capacities of the individual runner to cope with situations. Because running takes place in the public domain, it requires a certain level of assertiveness, flexibility and alertness to guarantee a both smooth and safe run.

The results from this study confirm the social-ecological theories on human-environment interactions, indicating that running behaviour is the resultant of complex interactions between personal constructs and the choice architecture of affordances that is available in the environment. Runners have to negotiate between their preferences for continuity, mental restoration, distance, speed, etcetera, and the situations they encounter in their surroundings.

5.4 Working process and data quality

This study was conducted as a mixed methods research, intending to continuously enrich the data and understanding of the topic. It can be concluded that the three data types have fulfilled these intentions, as each step further confirmed and specified earlier findings. However, there are some limitations to this study that need to be mentioned.

The sample of this study contains a relatively experienced and motivated group of runners, which raises some critical reflexive questions. This group of runners may already have adapted its routes in response to earlier positive and negative experiences, which may not be representative for novice runners. On the other hand, this group of runners has a lot of valuable 'insider' knowledge that was shared through the open questions. This group knows from experience which environmental attributes afford a pleasant run.

The quality and accuracy of the topographic data available to this study, combined with the inaccuracy of the GPS data, limited the possibilities for detailed spatial analysis. For example, satellite-based data or aerial photography of greenery containing all green areas including private gardens, linear greenery and bushes would have provided insight into the actual degree and quality of greenery along a running route and whether this is correlated with route choice (Fig. 71). Using the new BGT (*Basisregistratie Grootschalige Topografie*) for detailed topographic analysis is recommended as well. However, researchers should be aware that the 'visual experience' of an environment may be very different than can be seen from a map. Video recordings from running routes have shown to be valuable for adding contextual information. 3D-modelling could be use as well for the analysis of views (i.e. spaciousness, orientation, dominant objects) along running routes.

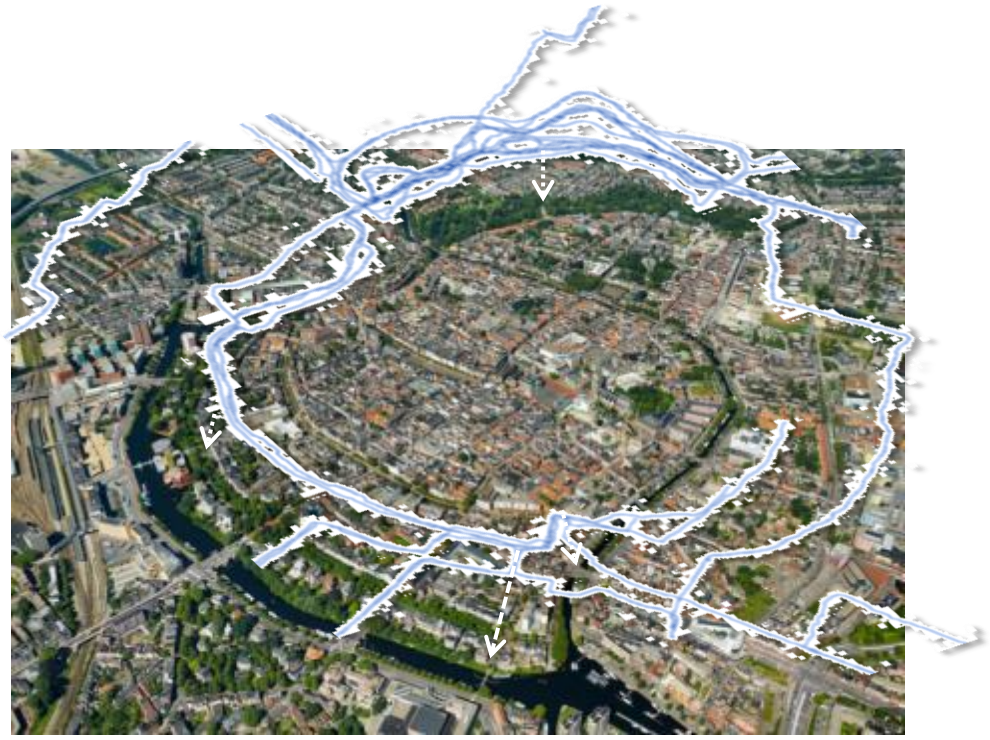


Fig. 71. Aerial photo showing the centre of Groningen, and overlay of routes.
(Aerophoto Schiphol, 2015)

5.5 Research recommendations

Further research is recommended to address the data quality issues and better analyse the observed patterns. Firstly, following individual runners over a longer time period could reveal how experiences relate to different route choices throughout the seasons (e.g. summer versus winter). And how these route choices are related to environmental characteristics, the runner's preference for continuity, his/her training objectives, and the season or whether there is daylight. And more importantly, which areas are avoided, and why.

Because the interaction between the individual runner and his/her environment are so complex, it may be interesting to study the experiences of multiple runners on one specified route. It then becomes possible to discern how different people respond certain affordances in the environment, and eventually find specific design principles. The overlap in two of the run-along interview routes in this study already showed that each segments offers specific affordances to each runner (e.g. toilets, art), but that there are commonalities as well (e.g. the added value of multiple route options in the Noorderplantsoen).

Finally, as mentioned earlier, using better topographic data such as the *BGT*, will enable more detailed spatial analysis and understanding of the role of specific environmental affordances for the running experience.

5.6 Policy recommendations

Based on this study, three recommendations for policies are provided here. Firstly, the observed gender inequalities in running experience should be addressed in policy making for health promotive environments. As women have a different experience than men, both sexes should be consulted when designing public spaces and routes.

Secondly, there is a tension between runner's preferences for green restorative areas in and just outside the city, and the reported lack of lighting and in these green areas. Improvements in street lighting should be considered, as well as offering alternative routes within the urban fabric that offer a sense of being away though improved landscape design.

Thirdly, new running routes can be created throughout the city, especially those routes that connect the existing running friendly areas. The interventions could be rather small, such as improvements of existing sidewalks. This may result in a network of routes that runners can easily adapt to their intended distance and effort. This should be done in cooperation with surrounding municipalities, nature organisations, and, above all, local citizens that will use the routes, as it is their running experience that will determine the success of a route. And within the municipality, links could be established with healthy ageing and active living policies (i.e. creating obstacle-free walkways) and bike policies (i.e. comfortable and 'green' routing, prioritising slow modes at crossings).

Although these measures will result in a better running experience, it cannot be simply assumed that they will encourage more people to start running. The complexity of the social-ecological model of running behaviour shows that the role of the individual, social and cultural dimensions of health-promotive or health-impairing environments and their joint influence on personal and collective well-being cannot be ignored (Stokols, 1992). This study for example found that being male or female can fundamentally affect the environmental supportiveness for running, stressing the need for a broadly oriented policy framework:

> *"The potential health benefits of a well-designed physical environment may go unrealized if the interpersonal or intergroup relationships in the setting are chronically conflicted and stressful. On the other hand, a socially supportive family or organization may enable setting members to cope more effectively with physical constraints (e.g., high spatial density, aesthetically drab surroundings, and resource shortages), thereby avoiding the negative behavioural and health outcomes sometimes associated with those conditions" (Stokols, 1992, p. 9)*

Therefore, all policy measures should be monitored critically in relation to other societal trends, before firm causal relations can be established.

Lastly, appendix 9 (p. 146) provides a list of suggested improvements of the running environment in Groningen. International examples could further inspire policy makers, such as the *Valencia Ciudad*

del Running programme, which has positively influenced the physical activity levels in the city and is for example linked to city marketing (Fig. 72).

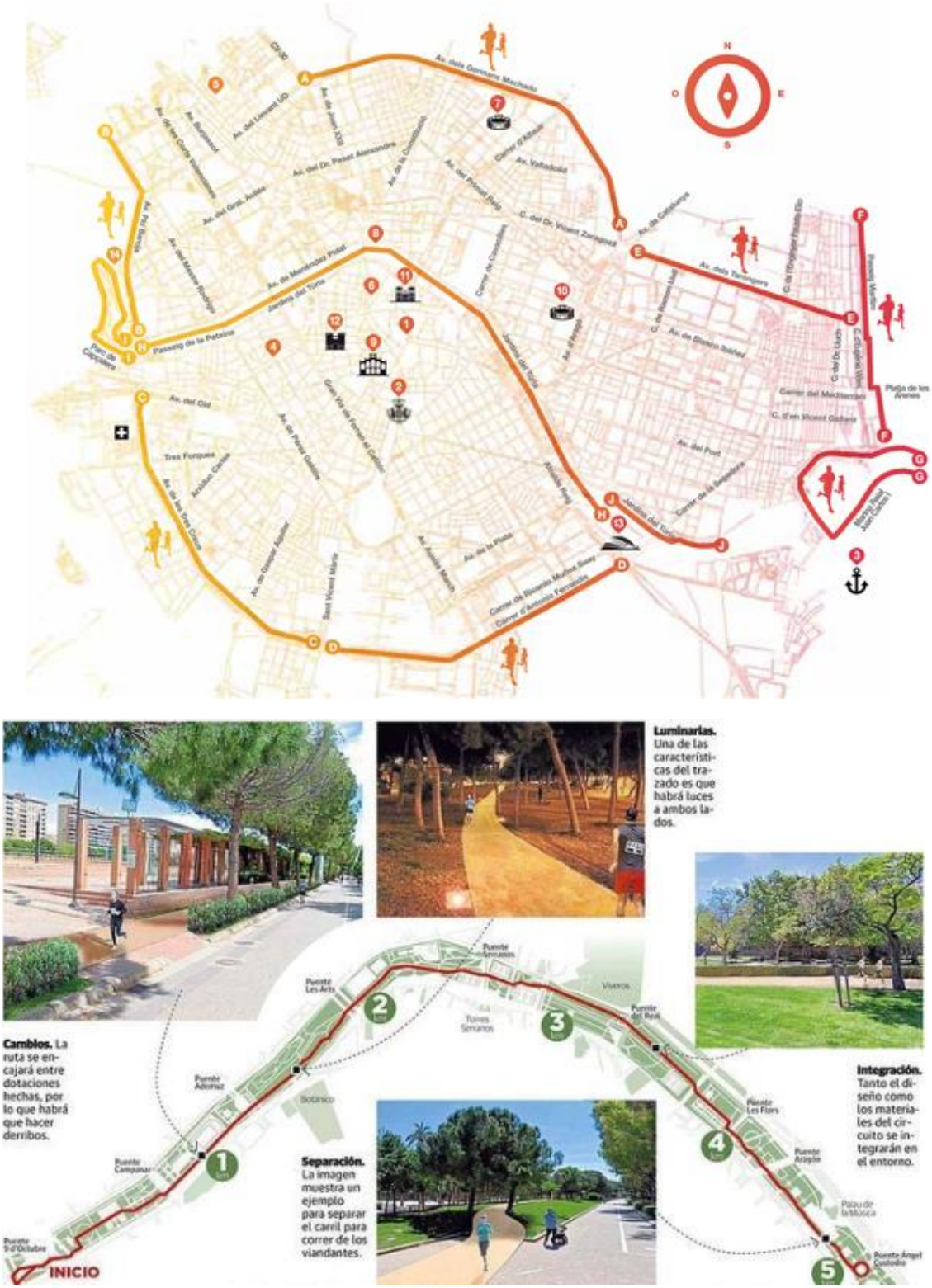


Fig. 72. International example of running infrastructure: Valencia's running network.

(Valencia Ciudad del Running, sd)

Bibliography

Aerophoto Schiphol, 2015. *Aerophotostock.com.* [Online]
Available at: http://www.aerophotostock.com/-/galleries/all/-/medias/4e2f743f-c2a3-4aac-9c58-c6bd713ced88-groningen-nederland-9-aug-2015-oude-stadscentrum-en-uitbreid
[Accessed 27 May 2016].

Allen-Collinson, 2008. Running the routes together: co-running and knowledge in action. *Journal of contemporary ethnography,* 37(1), pp. 38-61.

Architect Magazine/RAAAF, 2015. *The Evolving Landscape of Architectural Affordances.* [Online]
Available at: http://www.architectmagazine.com/design/culture/the-evolving-landscape-of-architectural-affordances_o
[Accessed 01 June 2016].

Asics, 2009. *Everyting about running.* [Online]
Available at: http://www.everythingaboutrunning.asics.eu
[Accessed 22 October 2015].

Atmodiwirjo, P., 2014. Space Affordances, Adaptive Responses and Sensory Integration by Autistic Children. *International Journal of Design (online),* 8(3), pp. 35-47.

Baan, I., 2012. *Superkilen / Topotek 1 + BIG Architects + Superflex.* [Art] (Arch Daily).

Babbie, E., 2012. *The Practice of Social Research.* Wadsworth: Cengage Learning.

Barton, H., Grant, M., Mitcham, C. & Tsouro, C., 2009. Healthy urban planning in European cities. *Health Promotion International,* 24(S1), pp. i91-i99.

Barton, J. & Pretty, J., 2010. What is the Best Dose of Green Exercise for Improving Mental Health? A Multi-Study Analysis. *Environmental Science & Technology,* 44(10), p. 3947–3955.

Bleich, S. & Sturm, R., 2009. Developing policy solutions for a more active nation: Integrating economic and public health perspectives. *Preventive Medicine,* Volume 49, pp. 306-308.

Bodin, M. & Hartig, T., 2003. Does the outdoor environment matter for psychological restoration gained through running?. *Psychology of Sport and Exercise,* Volume 4, pp. 141-153.

Booth, S. et al., 2001. Environmental and Societal Factors Affect Food Choice and Physical Activity: Rationale, Influences, and Leverage Points. *Nutrition Reviews,* 59(3), pp. S21-S39.

Bottenburg, M. v., Scheerder, J. & Hover, P., 2010. *Don's miss the Next Boat; Chances and challenges of the second wave of running for athletics' member federations,* s.l.: Utrecht University/KU Leuven/W.J.H. Mulier Institute.

Bronfenbrenner, U., 1977. Toward an Experimental Ecology of Human Development. *American Psychologist,* pp. 513-531.

Bryman, A., 2007. Barriers to integrating quantitative and qualitative research. *Journal of Mixed Methods Research,* 1(1), pp. 8-22.

Carmack, M. & Martens, R., 1979. Measuring Commitment to Running: A Survey of Runners' Attitudes and Mental States. *Journal of Sport Psychology,* 1(1), pp. 25-42.

Carpiano, R., 2009. Come take a walk with me: The ''Go-Along'' interview as a novel method for studying the implications of place for health and well-being. *Health & Place,* pp. 263-272.

CBS Statline, 2015. *Bevolking; geslacht, leeftijd, burgerlijke staat en regio, 1 januari,* s.l.: CBS.

Christensen, P., Romero Mikkelsen, M., Alexander Sick Nielsen, T. & Harder, H., 2011. Children, Mobility, and Space: Using GPS and Mobile Phone Technologies in Ethnographic Research. *Journal of Mixed Methods Research,* 5(3), pp. 227-246.

Cook, S., 2013. *Jography: Exploring the Mobilities of Running,* s.l.: s.n.

Das, P. & Horton, P., 2012. Rethinking our approach to physical activity. *The Lancet,* pp. 1-2.

De 4 mijl van Groningen, 2016. *De 4 mijl van Groningen.* [Online]
Available at: http://www.4mijl.nl/evenement/
[Accessed 16 June 2016].

Dijkstra, M., 2013. *Ontwerpen voor gezondheid.* Groningen, Congres Ruimte voor Gezondheid.

Duijvesteijn, P., Eck, J. v. & Kuitert, K., 2010. *Vooronderzoek 'Aanpak beweegvriendelijke omgeving',* Amsterdam: DSP-groep .

Ettema, D., 2014. Hardlopen in de stad: hoe beleven verschillende groepen beginnende hardlopers hun hardloopomgeving?. *Vrijetijdstudies,* Volume 3.

Ettema, D. F., 2015. Runnable Cities: How Does the Running Environment Influence Perceived Atttractiveness, Restorativeness, and Running Frequency?. *Environment and Behavior,* pp. 1-21.

Ettema, D. & Smajic, I., 2015. Walking, places and wellbeing. *The Geographical Journal,* 181(2), pp. 102-109.

Feilzer, M., 2010. Doing Mixed Methods Research Pragmatically: Implications for the Rediscovery of Pragmatism as a Research Paradigm. *Journal of Mixed Methods Research,* 4(1), pp. 6-16.

Franz, A., Worrell, M. & Vogele, C., 2013. Integrating Mixed Method Data in Psychological Research: Combining Q Methodology and Questionnaires in a Study Investigating Cultural and Psychological Influences on Adolescent Sexual Behavior. *Journal of Mixed Methods Research,* 7(4), pp. 370-389.

Gemeente Groningen, 2014. *De bewegende stad: Visie op de inrichting van de sportieve en speelse openbare ruimte,* Groningen: Gemeente Groningen.

Ghekiere, A. et al., 2014. Critical Environmental Factors for Transportation Cycling in Children: A Qualitative Study Using Bike-Along Interviews. *PLoS ONE,* 9(9).

Gibson, J., 1979. The Theory of Affordances. In: J. Gibson, ed. *The Ecological Approach to Visual Perception.* Hillsdale: Lawrence Erlbaum Associates, Inc., pp. 127-143.

Giesbers, H., 2014. *Volksgezondheid Toekomst Verkenning, Nationale Atlas Volksgezondheid: Trimmen en hardlopen per gemeente 2014.* [Online]
Available at: http://www.zorgatlas.nl
[Accessed 18 January 2016].

Gladwell, V. et al., 2013. The great outdoors: how a green exercise environment can benefit all. *Extreme Physiology & Medicine,* 2(3).

Guilhem Alandry/In Pictures/Corbis, 2015. *The Guardian.* [Online]
Available at: http://www.theguardian.com/travel/2015/mar/04/jakob-fenger-copenhagen-superflex-superkilen-norrebro
[Accessed 9 February 2016].

Hallal, P. et al., 2012. Physical activity: more of the same is not enough. *The Lancet,* pp. 2-3.

Haskell, W. et al., 2007. Physical Activity and Public Health: Updated Recommendation for Adults from the Americam College of Sports Medicine and the American Heart Association. *Medicine & Science in Sports & Exercise,* pp. 1423-1434.

Heath, G. et al., 2006. The Effectiveness of Urban Design and Land Use and Transport Policies and Practices to Increase Physical Activity: A Systematic Review. *Journal of Physical Activity and Health,* Issue 1 (Suppl 1), pp. S55-S76.

Hildebrandt, V., Bernaards, C. & Stubbe, J., 2013. *Trendrapport Bewegen en Gezondheid 2010/2011,* Leiden: TNO.

Ignatieva, M., Meurk, C. & Stewart, G., 2010. Planning and Design of Ecological Networks in Urban Areas. *Landscape and Ecological Engineering,* 7(1), pp. 17-25.

Jacobs, M., 2011. Psychology of the visual landscape. In: *Research in Urbanism Series (online).* s.l.:s.n., pp. 41-55.

Jolley, L., 2010. *In and out of the garden.* [Online]
Available at: http://inandoutofthegarden.blogspot.nl/2010/11/beauty-of-stourhead-gardens-and.html
[Accessed 20 May 2016].

Jong, J. d. & Verver, T., 2015. *Beweegvriendelijke Inrichting Openbare Ruimte,* Groningen: Centre of Expertise Healthy Ageing.

Kahn, P., 1997. Developmental Psychology and the Biophilia Hypothesis: Children's Affiliation with Nature. *Developmental Review,* Volume 17, pp. 1-61.

Kaplan, S., 1979. Perception and Landscape: conceptions and misconceptions. In: G. Elsner & R. Smardon, eds. *Proceedings of our national landscape: a conference on applied techniques for analysis and management of the visual resource.* Berkeley, CA: US Forest Service, pp. 241-248.

Kaplan, S., 1987. Aesthetics, affect, and cognition; Environmental Preference from an Evolutionary Perspective. *Environment and Behavior,* 19(1), pp. 3-32.

Kaplan, S., 1995. The restorative benefits of nature: toward an integrative framework. *Journal of Environmental Psychology,* Volume 15, pp. 169-182.

Kasemier, J., 2016. *4 Mijl Hoogkerk.* [Online]
Available at: http://www.md-l.nl/nl/projecten/portfolio/de-gezonde-stad/
[Accessed 10 January 2016].

Kenzer, M., 1999. Healthy cities: a guide to the literature. *Environment and Urbanization,* 11(1), pp. 201-220.

King, A., Stokols, D., Brassington, G. & Killingsworth, R., 2002. Theoretical Approaches to the Promotion of Physical Activity; Forging a Transdisciplinary Paradigm. *American Journal of Preventive Medicine,* 23(2S), pp. 15-25.

Kompier, V. & Vasas Valle, D., 2012. *Lay-out 22: Sport in the city,* Rotterdam: Stimuleringsfonds voor de Architectuur.

Kusenbach, M., 2003. Street phenomenology: The go-along as ethnographic research tool. *Ethonography,* 4(3), pp. 455-485.

Lee, C. & Vernez Moudon, A., 2004. Physical Activity and Environment Research in the Health Field: Implications for Urban and Transportation Planning Practice and Research.. *Journal of Planning Literature,* Volume 19, pp. 147-181.

Lier, L. v., 2004. "Relations". In: *Handbook of Psychology, Volume 6: Developmental Psychology: Psychology, Human development (e-book).* s.l.:Springer, p. 91.

Matthijs Dijkstra Landschapsarchitecten, 2013. *De Gezonde Stad.* [Online]
Available at: http://www.md-l.nl/nl/projecten/portfolio/de-gezonde-stad/
[Accessed 28 January 2016].

Ministerie van Volksgezondheid, Welzijn en Sport, 2015. *Toezegging over het gebruik van buitenruimten.* Den Haag: s.n.

Morse, J., 2003. Principles of mixed methods abd multimethod research design. In: A. Tashakkori & C. Teddlie, eds. *Handbook of Mixed Methods Research.* Thousand Oaks: Sage, pp. 189-208.

NOS, 2015. *Vrouwen maken hardlopen tot groeimarkt,* Hilversum: NOS.

Omanson, B., 2015. *In the shade of the ivied wall.* [Online]
Available at: http://shadeoftheiviedwall.blogspot.nl/2015/09/the-english-landscape-garden-and-rise.html
[Accessed 20 May 2016].

Onderzoek en Statistiek Groningen, 2014. *Buurt- en wijkindeling gemeente Groningen,* Groningen: Onderzoek en Statistiek Groningen.

Rijksinstituut voor Volksgezondheid en Milieu, 2014. *Nationaal Kompas Volksgezondheid: Lichamelijk activiteit.* [Online]
Available at: http://www.nationaalkompas.nl/gezondheidsdeterminanten/leefstijl/lichamelijke-activiteit/lichamelijke-activiteit-samengevat/
[Accessed 18 January 2016].

Sallis, J., 2009. Measuring Physical Activity Environments; A Brief History. *American Journal of Preventive Medicine,* Issue 36(4S), pp. S86-S92.

Sallis, J. e. a. et al., 2006. An Ecological approach to creating active living communities. *Annual Review of Public Health,* Volume 27, pp. 297-322.

Sallis, J., Owen, N. & Fisher, E., 2008. Ecological models of health behavior. In: *Health behavior and health education*. San Fransisco: John Wiley & Sons, pp. 465-486.

Shipway, R. & Holloway, I., 2010. Running free: Embracing a healthy lifestyle through distance running. *Perspectives in Public Health,* 130(6), pp. 270-276.

Stokols, D., 1992. Establishing and Maintaining Healthy Environments; Towards a Social Ecology of Health Promotion. *American Psychologist,* pp. 6-22.

Strava Labs, 2016. *Strava Global Heatmap.* [Online]
Available at: http://labs.strava.com/heatmap/#12/6.56450/53.20757/orange/run
[Accessed 28 January 2015].

Szabo, A. et al., 1998. Runners' anxiety and mood on running and non-running days: An in situ daily monitoring study. *Psychology, Health & Medicine,* 3(2), pp. 193-199.

Teddlie, C. & Yu, F., 2007. Mixed Methods Sampling: A Typology with Examples. *Journal of Mixed Methods Research,* 1(1), pp. 77-100.

Thompson Coon, J. et al., 2011. Does Participating in Physical Activity in Outdoor Natural Environments Have a Greater Effect on Physical and Mental Wellbeing than Physical Activity Indoors? A Systematic Review. *Environmental Science & Technology,* Volume 45, pp. 1761-1772.

Thompson, C., 2013. Activity, exercise and the planning and design of outdoor spaces. *Journal of Environmental Psychology,* pp. 79-96.

Tiessen-Raaphorst, A., 2015. *Rapportage Sport 2014,* Den Haag: Sociaal en Cultureel Planbureau.

Tsouros, A. & Green, G., 2009. Health Promotion International: special supplement on European Healthy Cities. *Health Promotion International,* 24(S1), pp. i1-i3.

Ulrich, R. et al., 1991. Stress recovery during exposure to natural and urban environments. *Journal of Environmental Psychology,* Volume 11, pp. 201-230.

Valencia Ciudad del Running, n.d. *Valencia Ciudad del Running.* [Online]
Available at: http://www.valenciaciudaddelrunning.com/en/city/circuit-5k-vlc/
[Accessed 2 June 2016].

VeiligheidNL, 2014. *Cijferfactsheet Hardlopen,* s.l.: VeiligheidNL.

Vries, S. d. et al., 2013. Measuring the attractiveness of Dutch landscapes: Identifying national hotspots of highly valued places using Google Maps. *Applied Geography,* Volume 45, pp. 220-229.

Wagenaar, C., 2013. *Town Planning in the Netherlands since 1800; responses to enlightenment ideas and geopolitical realities.* Rotterdam: nai010.

Wapner, S. & Demick, J., 2002. The Increasing Contexts of Context in the Study of Environment Behaviour Relations. In: R. Bechtel & A. Churchman, eds. *Handbook of Environmental Psychology.* New York: John Wiley & Sons, pp. 3-14.

Ward Thompson, C., 2013. Activity, exercise and the planning and design of outdoor spaces. *Journal of Environmental Psychology,* Volume 34, pp. 79-96.

WHO, 1986. *Ottawa Charter for Health Promotion,* Ottawa: WHO.

World Health Organisation, 2015. *Public Health*. [Online]
Available at: http://www.who.int/trade/glossary/story076/en/
[Accessed 20 October 2015].

Zarauz Sancho, A. & Ruiz-Juan, F., 2011. Commitment and negative addiction to training and competion for marathoners. *Revista Internacional de Medicina y Ciencias de la Actividad Física y el Deporte*, 11(44), pp. 817-834.

Zhang, Y., van Dijk, T., Tang, J. & van den Berg, A., 2015. Green Space Attachment and Health: A Comparative Study in Two Urban Neighborhoods. *International Journal of Environmental Research and Public Health*, 12(11), p. 14342–14363.

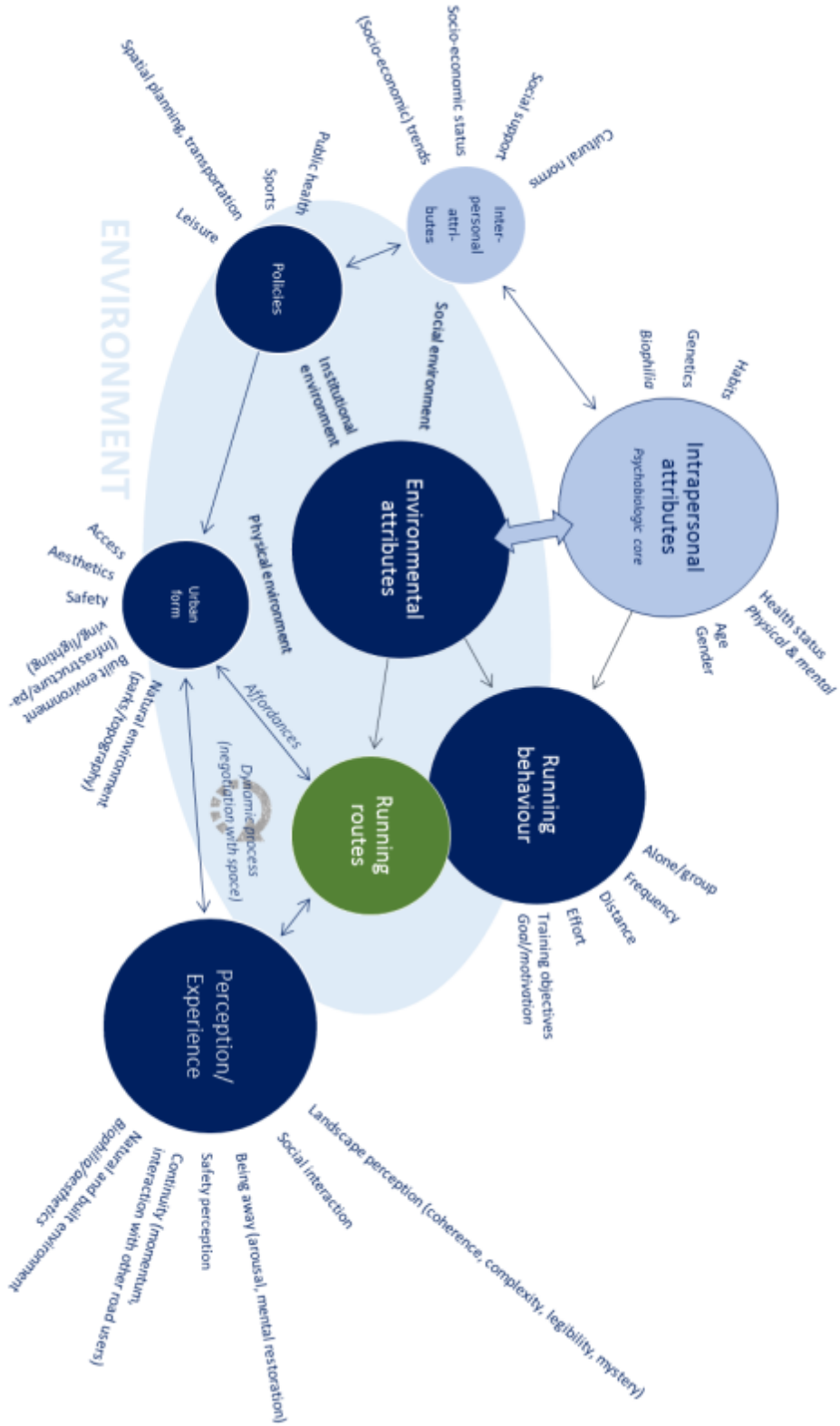
Zimmerman, F., 2009. Using behavioral economics to promote physical activity. *Preventive Medicine*, Volume 49, pp. 289-291.

Mapping

Basemaps provided by Esri, HERE, © OpenStreetMap contributers and the GIS user community

Appendices

Appendix 1: relationships between running behaviour, the individual and the environment

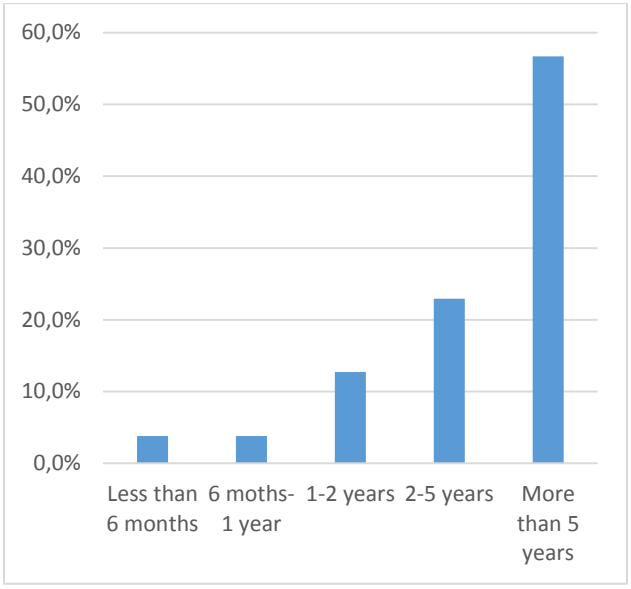


Appendix 2: survey questions

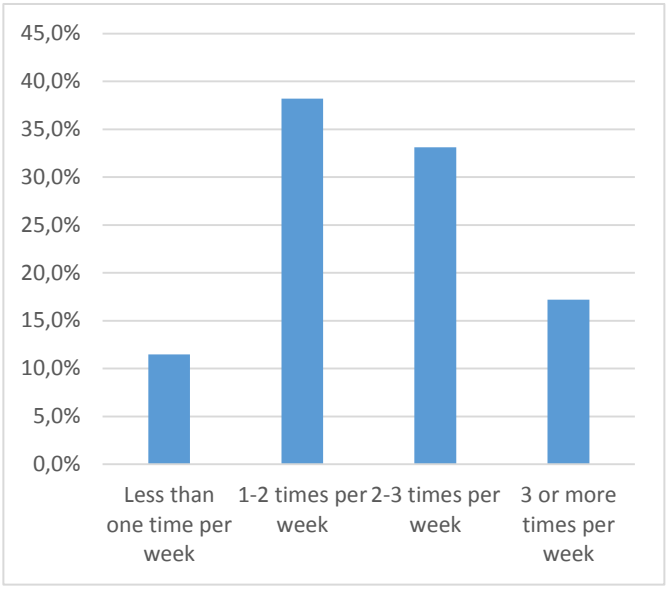
- Survey: https://docs.google.com/forms/d/10BLXE2hDFDISaqVvow-htUNzK_jGmIZO7rTrcFh9YPo/prefill
- GPS data collection: https://docs.google.com/forms/d/1wjD1WFAIdw01CQrui8GxTqBrjey_WwHuyvVVNHvH66k/prefill

Appendix 3: survey results

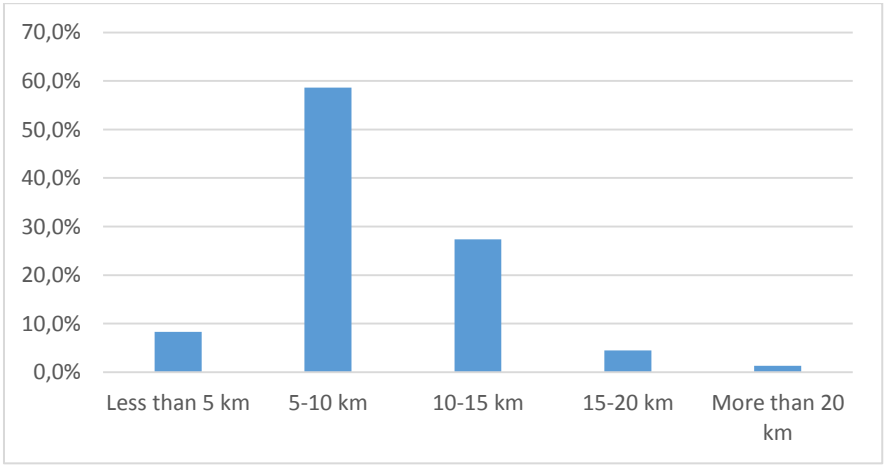
Graphs showing the responses on the survey-questions.



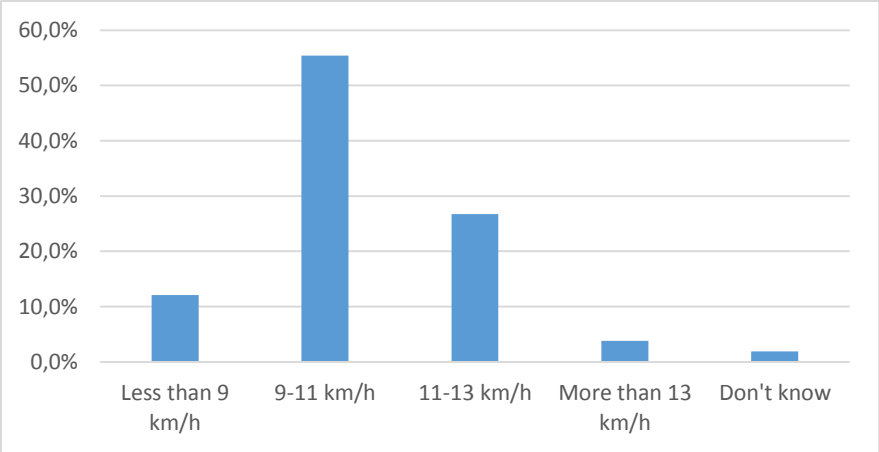
For how long have you been running?



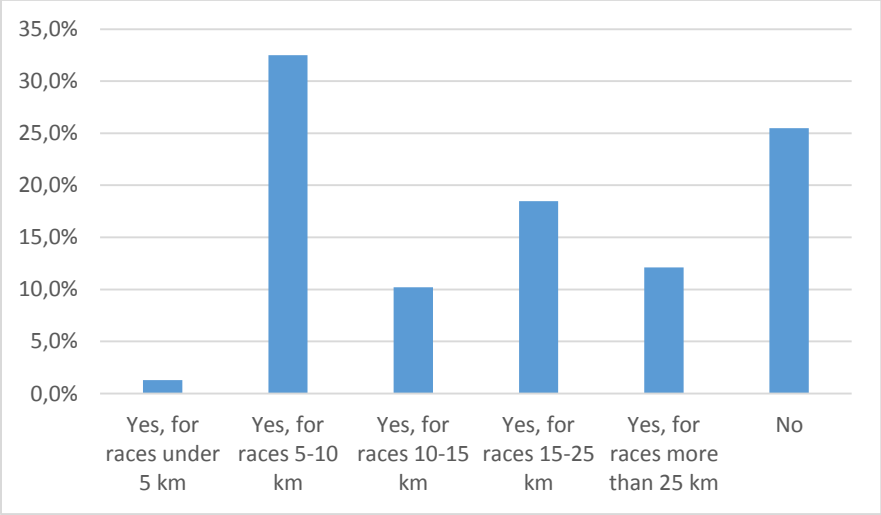
How often do you run?



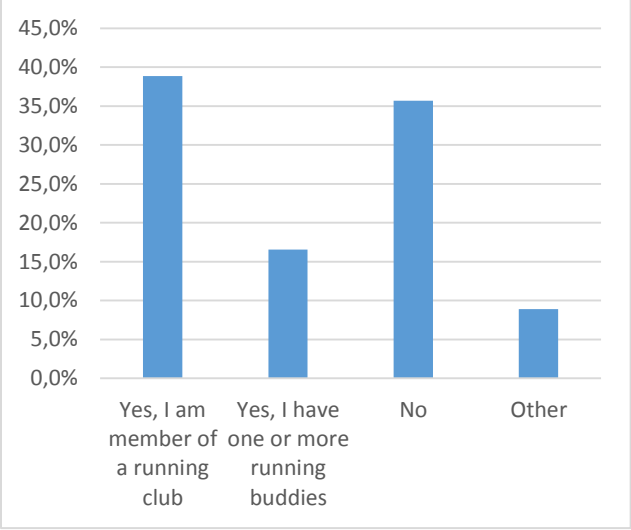
What distance do you run each time?



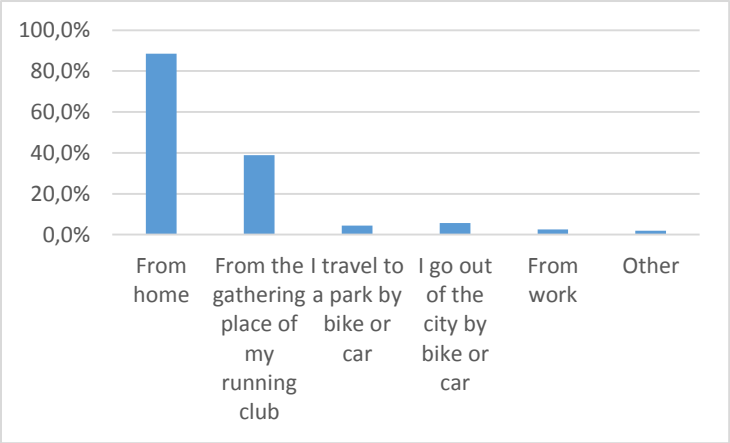
What is your average speed?



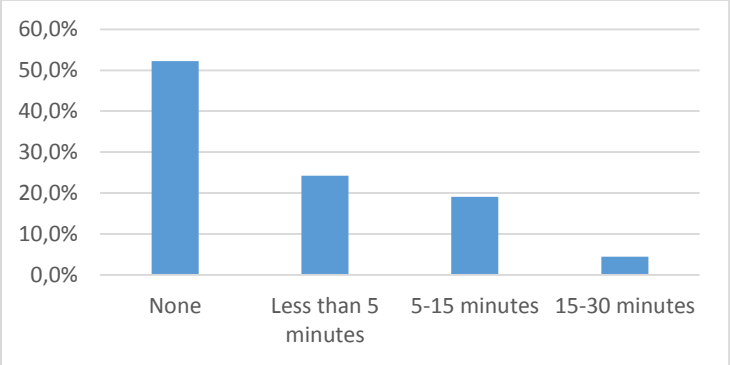
Do you train for races?



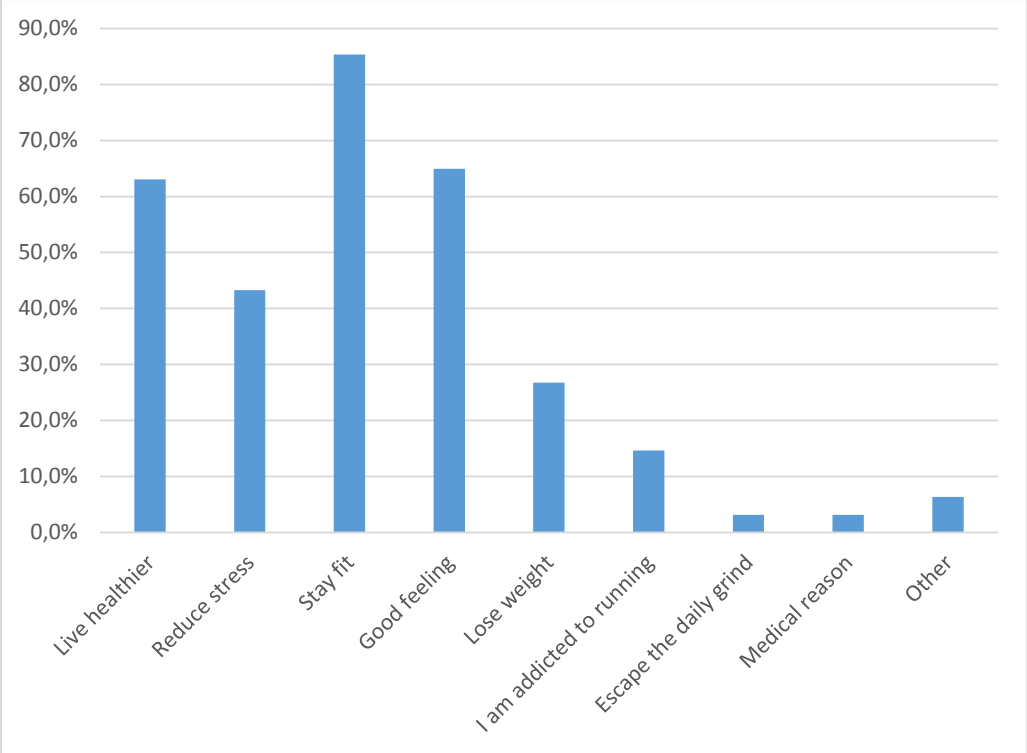
Do you run with other people



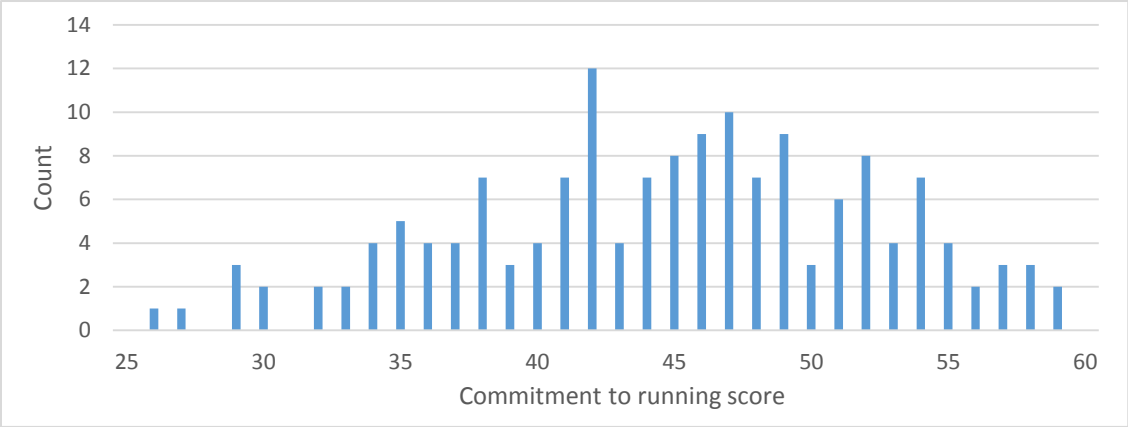
Where do you start running?



How much time do you travel to reach your start location?



Why do you run? *Other* reasons include training for other sports.



Commitment to running scores, based on the sum of 12 Likert-scale questions (1-5). Based on Zarauz Sancho & Ruiz-Juan (2011).

Appendix 4: photo-question results

Most attractive photo

Q22: Which photo is the most attractive as a place for running?

photo #	frequency	%
Photo 1	95	60,5
Photo 2	0	0,0
Photo 3	4	2,5
Photo 4	54	34,4
Photo 5	1	,6
Photo 6	3	1,9
Total	**157**	**100,0**

Least attractive photo

Q24: Which photo is the least attractive as a place for running?

Photo #	frequency	%
Photo 1	1	,6
Photo 2	128	81,5
Photo 3	15	9,6
Photo 4	1	,6
Photo 5	9	5,7
Photo 6	3	1,9
Total	**157**	**100,0**

Photo 1

Scores for photo 1 (average: 4,46)		
value	**frequency**	**%**
1 (very unattractive)	3	1,9
2 (unattractive)	1	,6
3 (neutral)	9	5,8
4 (attractive)	51	32,5
5 (very attractive)	92	59,0
Total	**156**	**100,0**

Motivations for choosing most attractive

- "nature"
- "green"
- "quiet/peaceful"
- "few people"
- "pleasant surface"
- "no traffic"

Motivations for choosing least attractive

- "chaotic" (?)

Photo 2

Scores for photo 2 (average: 1,69)		
value	**frequency**	**%**
1 (very unattractive)	73	46,8
2 (unattractive)	61	39,1
3 (neutral)	18	11,5
4 (attractive)	4	2,6
5 (very attractive)	0	0,0
Total	**156**	**100,0**

Motivations for choosing most attractive

- -

Motivations for choosing least attractive

- “too many people”
- “too busy”
- “lack of space”
- “only concrete”
- “difficult to run in your own pace”

Photo 3

Scores for photo 3 (average: 2,42)		
value	**frequency**	**%**
1 (very unattractive)	35	22,4
2 (unattractive)	51	32,7
3 (neutral)	39	25,0
4 (attractive)	25	16,0
5 (very attractive)	6	3,8
Total	**156**	**100,0**

Motivations for choosing most attractive

- "I like running in a big city"
- "level surface"

Motivations for choosing least attractive

- "ugly environment"
- "not quiet"

Photo 4

Scores for photo 4 (average: 4,28)		
value	**frequency**	**%**
1 (very unattractive)	2	1,3
2 (unattractive)	2	1,3
3 (neutral)	12	7,7
4 (attractive)	75	47,1
5 (very attractive)	65	41,7
Total	**156**	**100,0**

Motivations for choosing most attractive

- “relaxed atmosphere”
- “green and water”
- “presence of people provides safety”
- “good paths”
- “spacious”
- “not too remote”
- “no traffic”

Motivations for choosing least attractive

- “crowded”

Photo 5

Scores for photo 5 (average: 2,96)		
value	**frequency**	**%**
1 (very unattractive)	10	6,4
2 (unattractive)	33	21,2
3 (neutral)	71	45,5
4 (attractive)	38	24,4
5 (very attractive)	4	2,6
Total	**156**	**100,0**

Motivations for choosing most attractive

- "watching into people's houses"

Motivations for choosing least attractive

- "boring"
- "lack of green"

Photo 6

Scores for photo 6 (average: 3,64)		
value	**frequency**	**%**
1 (very unattractive)	3	1,9
2 (unattractive)	18	11,5
3 (neutral)	38	24,2
4 (attractive)	77	49,4
5 (very attractive)	20	12,8
Total	**156**	**100,0**

Motivations for choosing most attractive

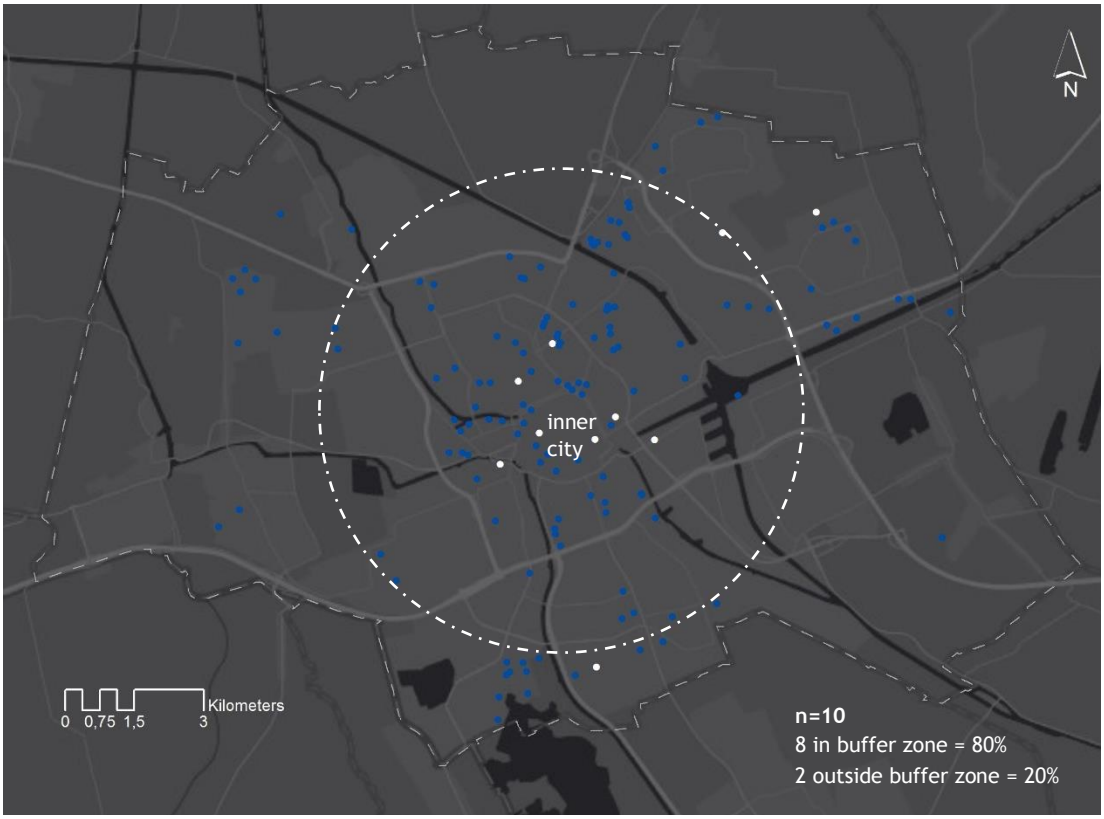
- "hills"
- "challenge"
- "stairs"

Motivations for choosing least attractive

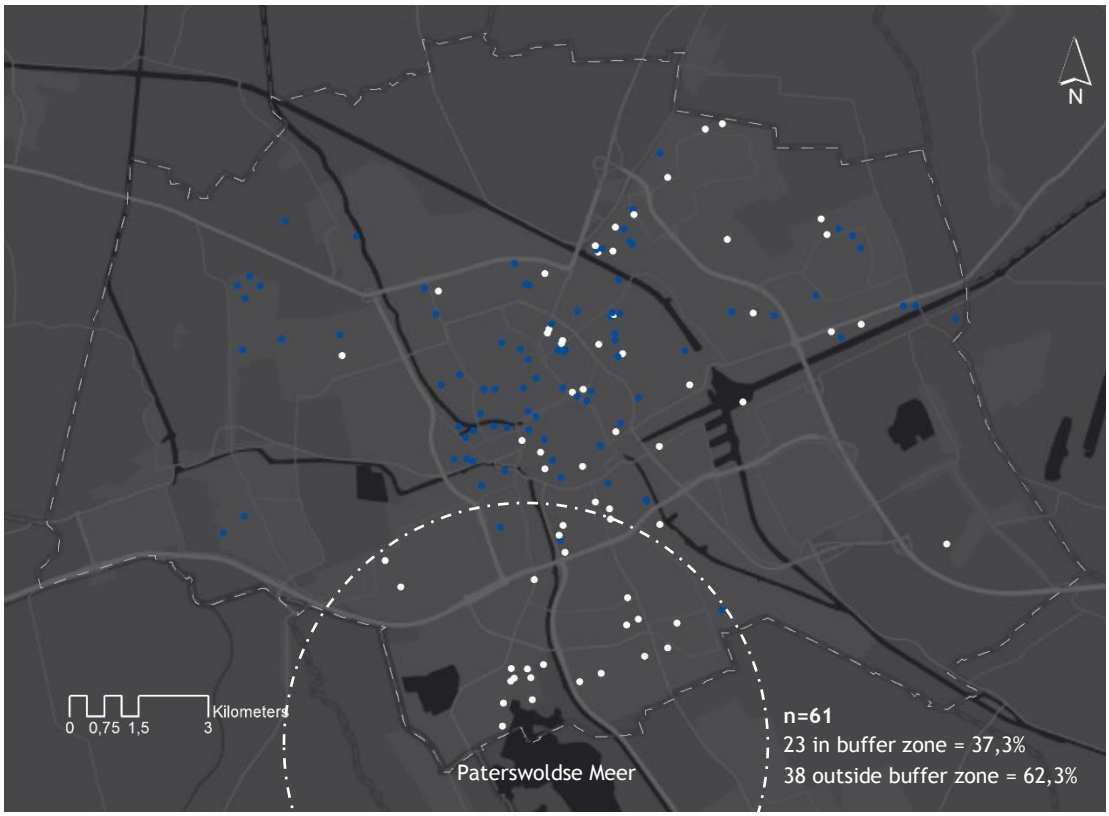
- "fuck stairs"
- "preference for running level"

Appendix 5: preferred running locations in Groningen

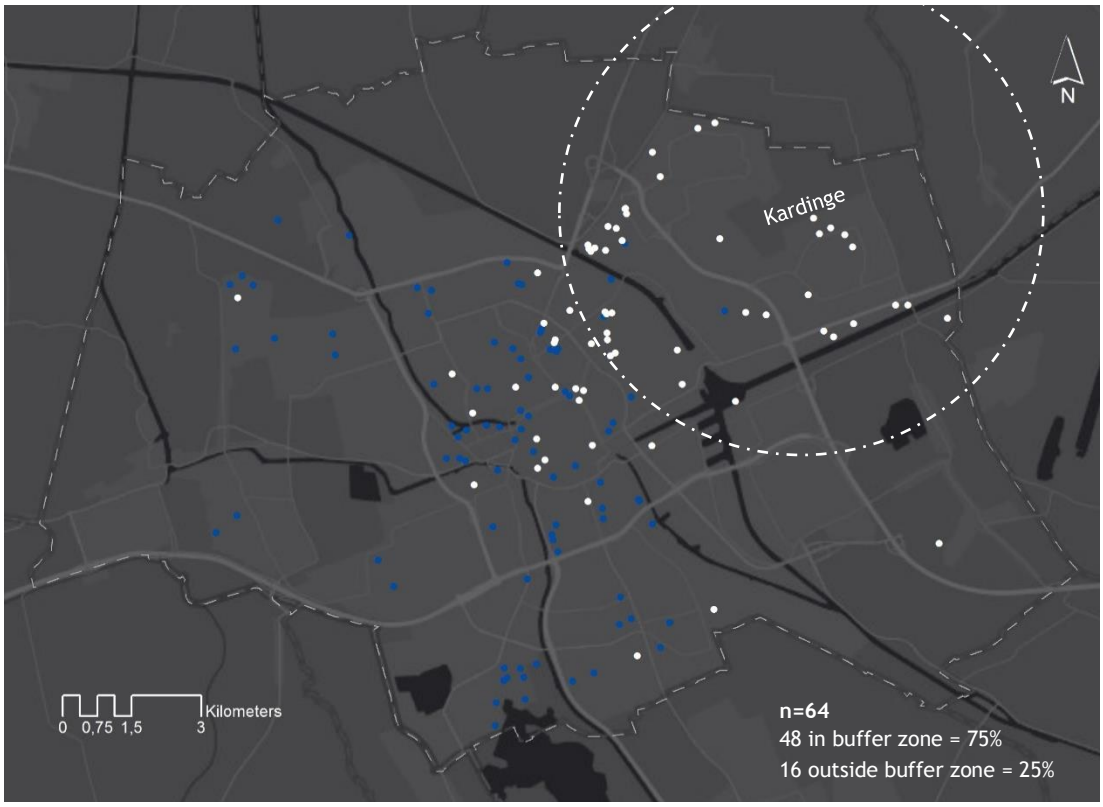
Maps showing potential running locations and the origin of respondents that like to run in those areas, and 5km buffer zones.



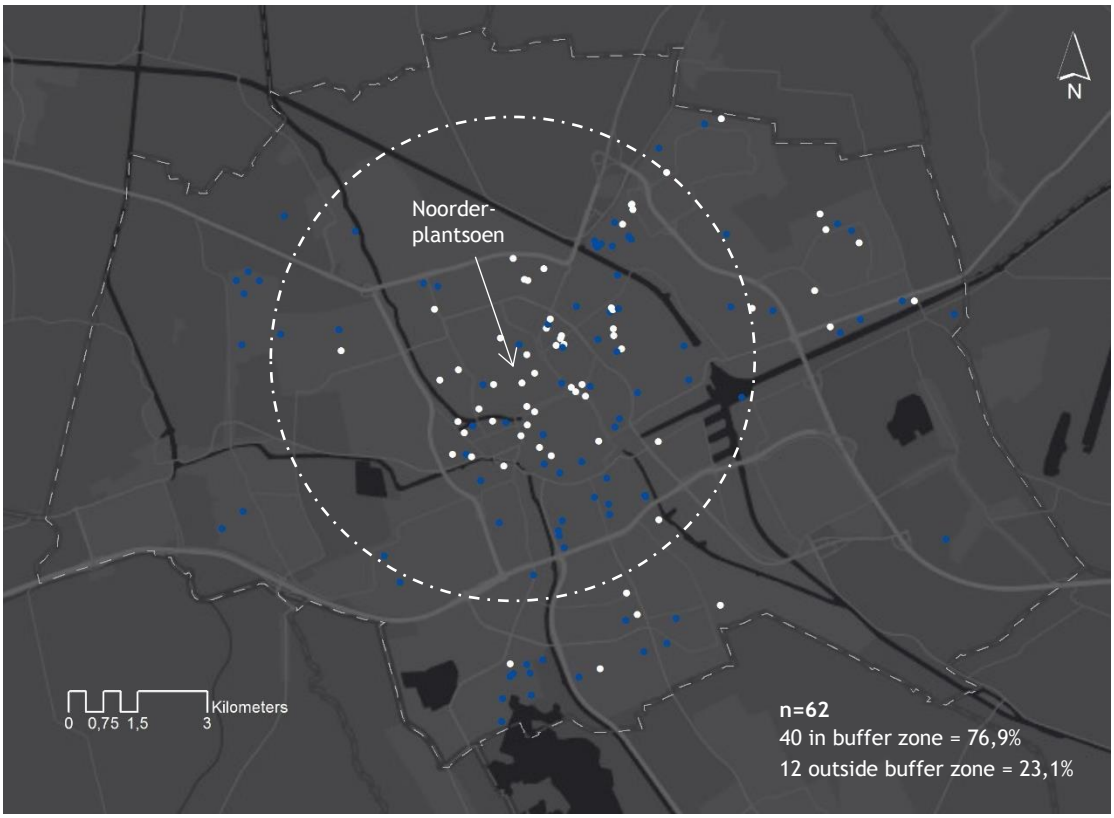
Respondents choosing inner city.



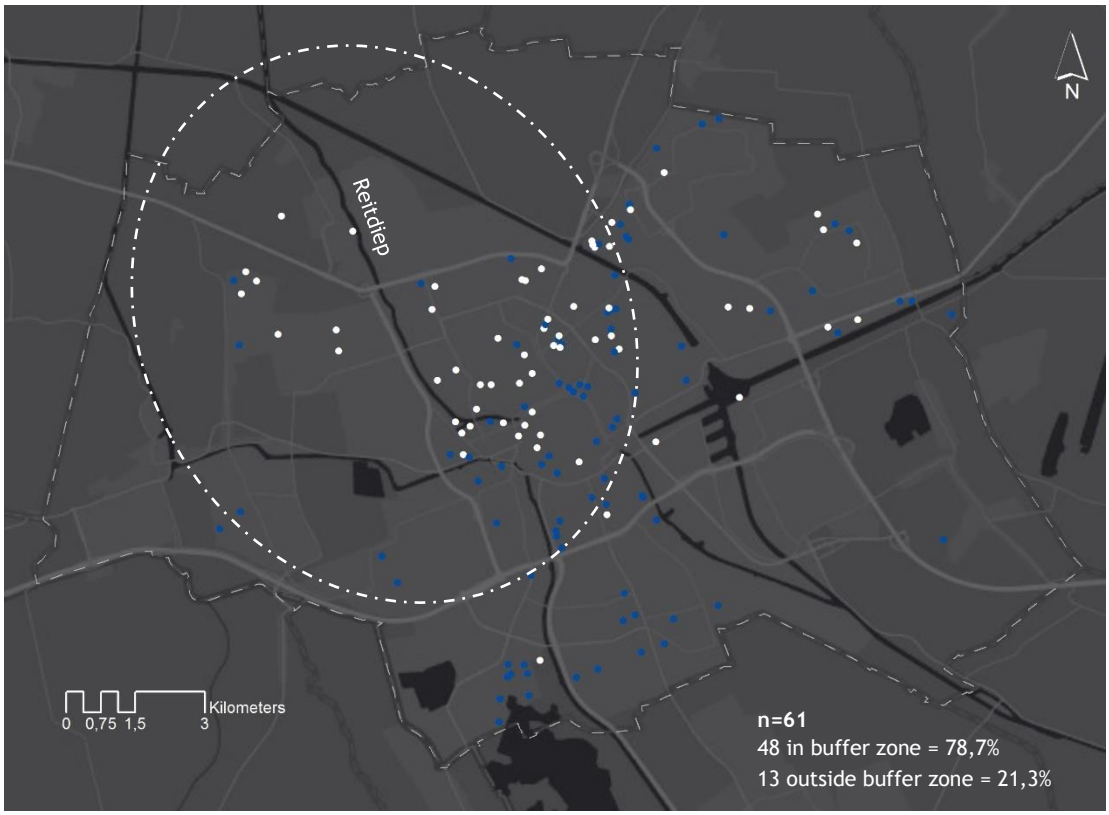
Respondents choosing Paterswoldse Meer.



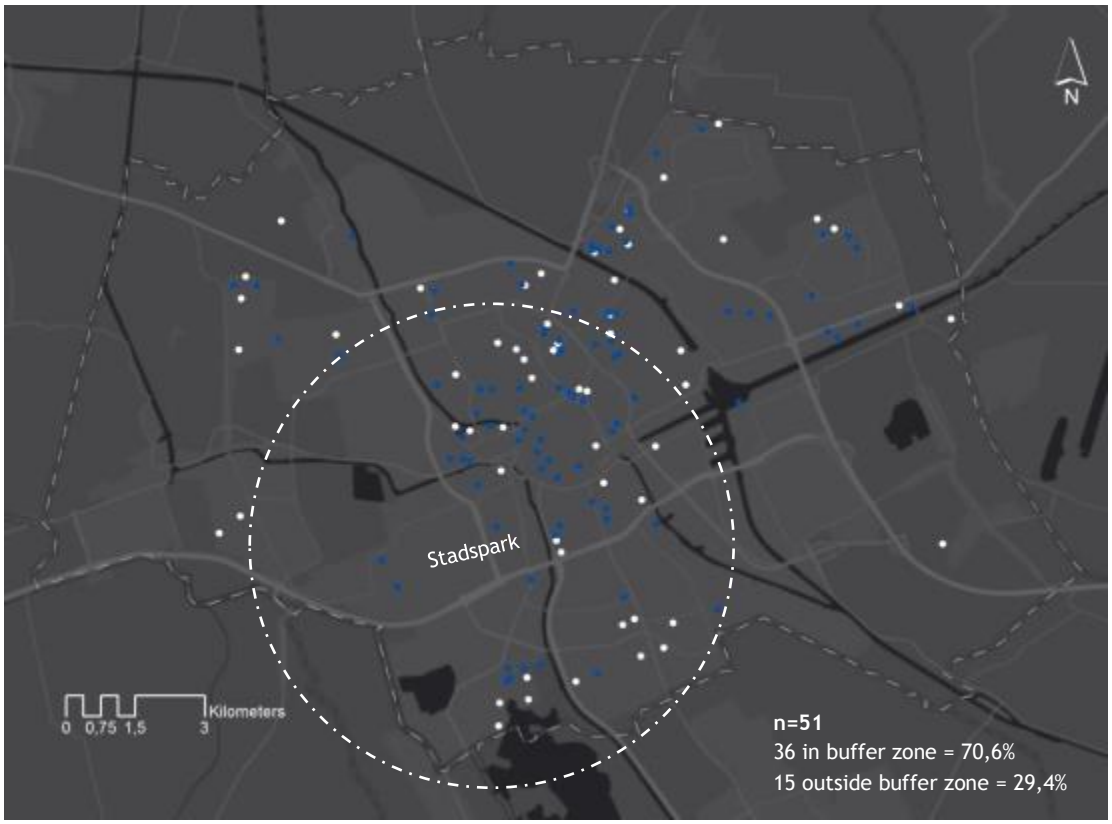
Respondents choosing Kardinge.



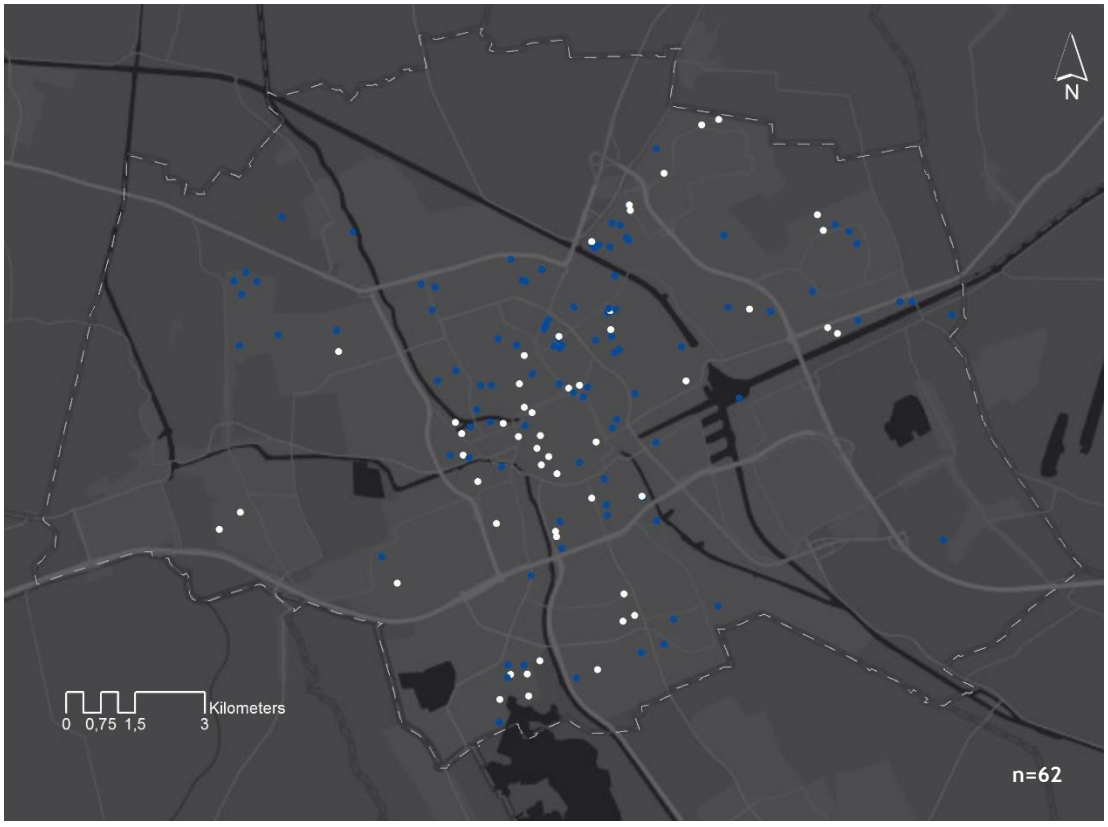
Respondents choosing Noorderplantsoen.



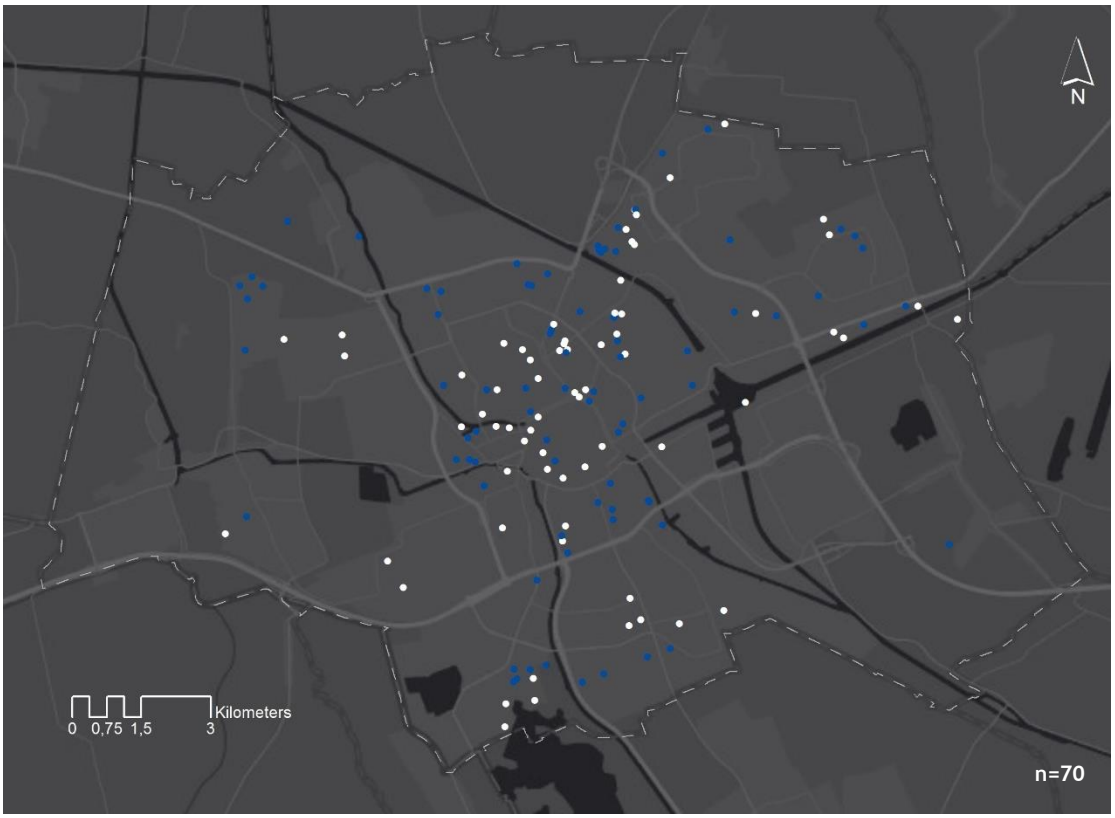
Respondents choosing Reitdiep.



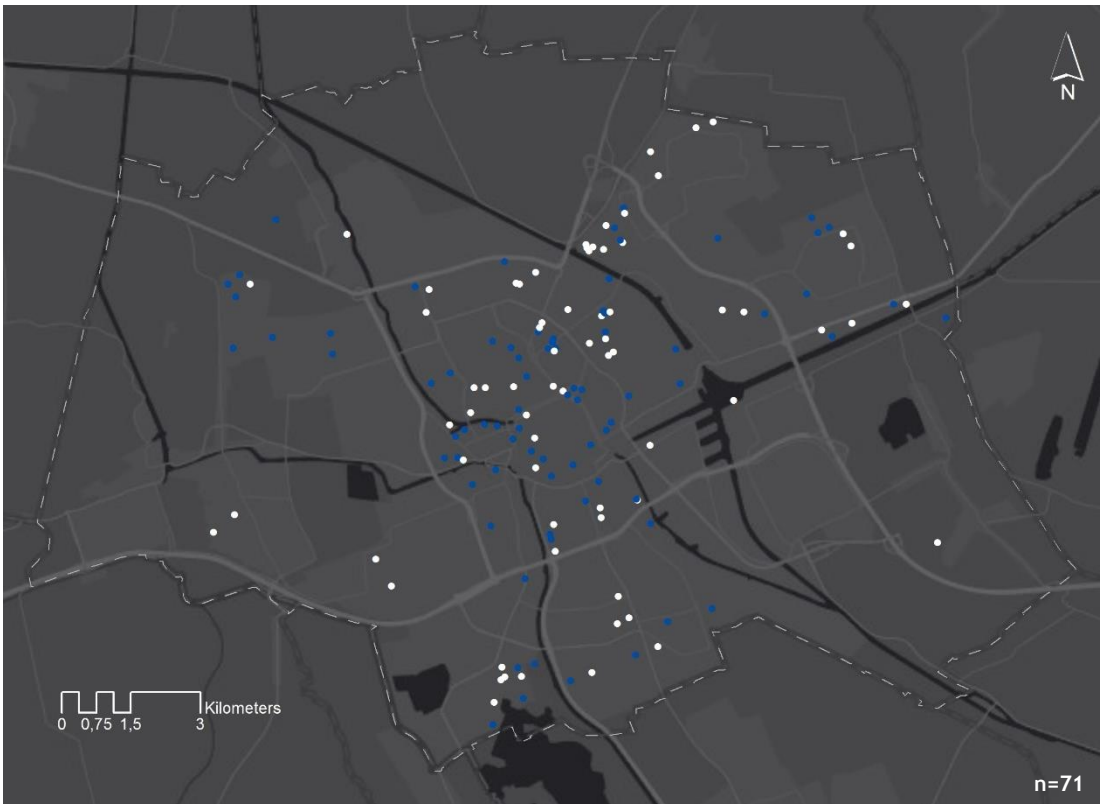
Respondents choosing Stadspark.



Respondents choosing Own neighbourhood.



Respondents choosing Park in my neighbourhood.



Respondents choosing Other areas outside Groningen.

Appendix 6: map-question results

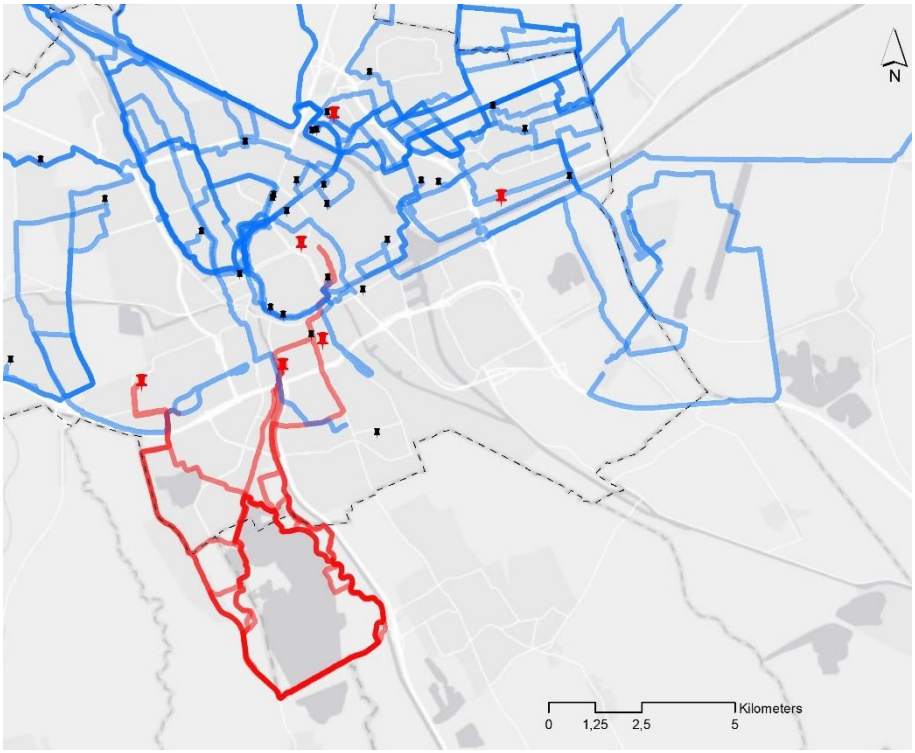
Summary of the comments placed on the interactive map in the survey. The comments are sorted by code.

Being away (i.e. arousal, mental restoration) (n=33)			
n positive = 31		***n negative = 2***	
"Quiet bike path"	*Kardingermaar*	"(Too) busy with people"	*Korreweg (Beren), Grote Markt*
"Being out of town"	*Essen*		
"On top of the world"	*Hoornse Plas*		
"Peace"	*Stadspark, Reitdiep*		
"Wandering"	*Noordlaarderbos*		
Continuity (i.e. momentum, interaction with other road users (n=3)			
n positive = 2		***n negative = 1***	
"No obstacles"	*Stadspark*	"Bridge closed"	*Meedenpad*
"Continuous route because of bike tunnel"	*Stadspark*		
Landscape perception and attractiveness (i.e. coherence, complexity, legibility, mystery) (n=39)			
n positive = 38		***n negative = 1***	
"Beautiful views"	*Madijk, Onlanden*	"Confusing (once got lost)"	*Lewenborg*
"Fantastic place"	*Grote Markt*		
"Spacious"	*Stadspark, Onlanden*		
"Atmosphere"	*Zernike*		
"Overview, clarity"	*Noord-Willemskanaal, Reitdiep*		
Natural environment (i.e. *Biophilia*) (n=29)			
n positive = 29		***n negative = 0***	
"Green"	*Stadspark, Helperzoom*	-	
"Nature"	*Kardinge, Wijkpark*		
"Forest"	*Vosbergen, Appelbergen*		
"Beautiful natural environment"	*Onlanden*		

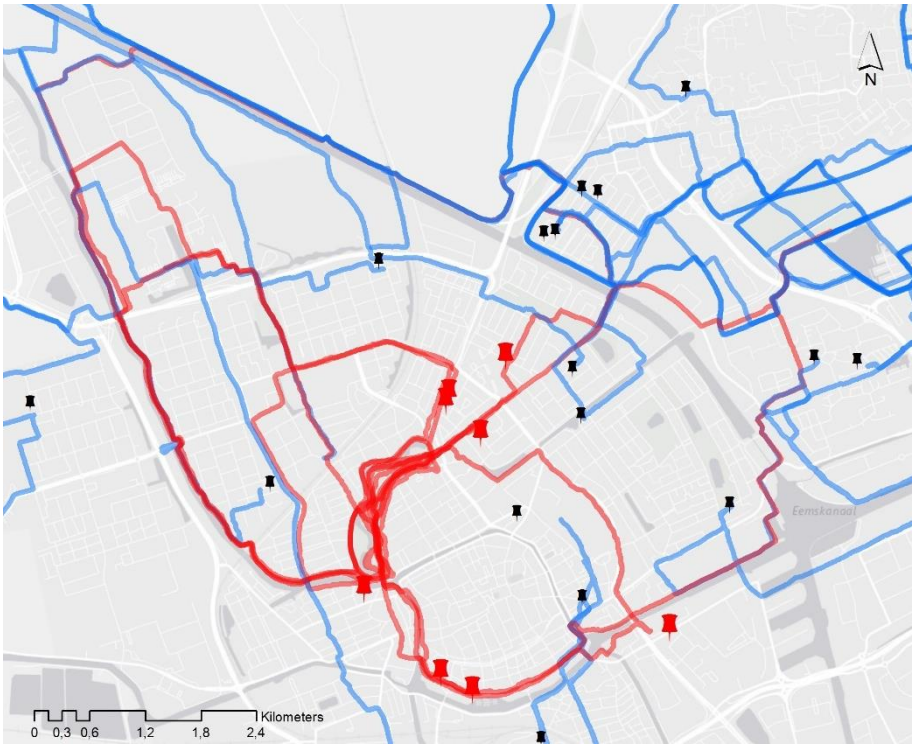
Built environment (i.e. infrastructure, paving, lighting) (n=46)			
n positive = 32		***n negative = 14***	
"Bike tunnel"	*Stadspark*	"Bad quality bike path"	*N361 Sauwerd*
"Unpaved"	*Kardinge, Stadspark*	"Not a good sidewalk"	*Park Indische buurt*
"Nice path/road"	*Wolddijk*	"Lack of lighting/no lighting"	*Stadspark, Petrus Campersingel*
"100m-markings"	*Kardinge*		
"Broad (concrete) bike path"	*Onlanden, Kardingermaar*		
	Meerstad, Driebondsweg		
"Good lighting"	*Madijk, Onlanden*		
"Choice between paved and unpaved"			
Safety (perception) (n=3)			
n positive = 0		***n negative = 3***	
-		"Unsafe feeling due to cars"	*Wolddijk, Woortmantsdijk*
		"Unsafe feeling at night"	*Stadspark*
Compatibility with training objectives (i.e. suitability, challenge) (n=20)			
n positive = 32		***n negative = 0***	
"100m/1km markings"	*Kardinge, Stadspark*	-	
"Varied training"	*Stadspark*		
"Interval training"	*Stadspark*		
"Ideal for long runs"	*Lageweg*		
"Altitude difference"	*Noorderplantsoen, Noordzeebrug*		
Social interaction (n=17)			
n positive = 8		***n negative = 9***	
"No car traffic"	*Kardinge*	"Fast driving cars"	*Oosterseweg*
"Quiet bike path"	*Sint Petersburgweg, Eemskanaal*	"People making comments"	*Korreweg (Beren)*
		"Sometimes dogs"	*Pioenpark*
		"Nuisance of bikes, pedestrians and dogs "	*Eemskanaal*

Appendix 7: routes by area

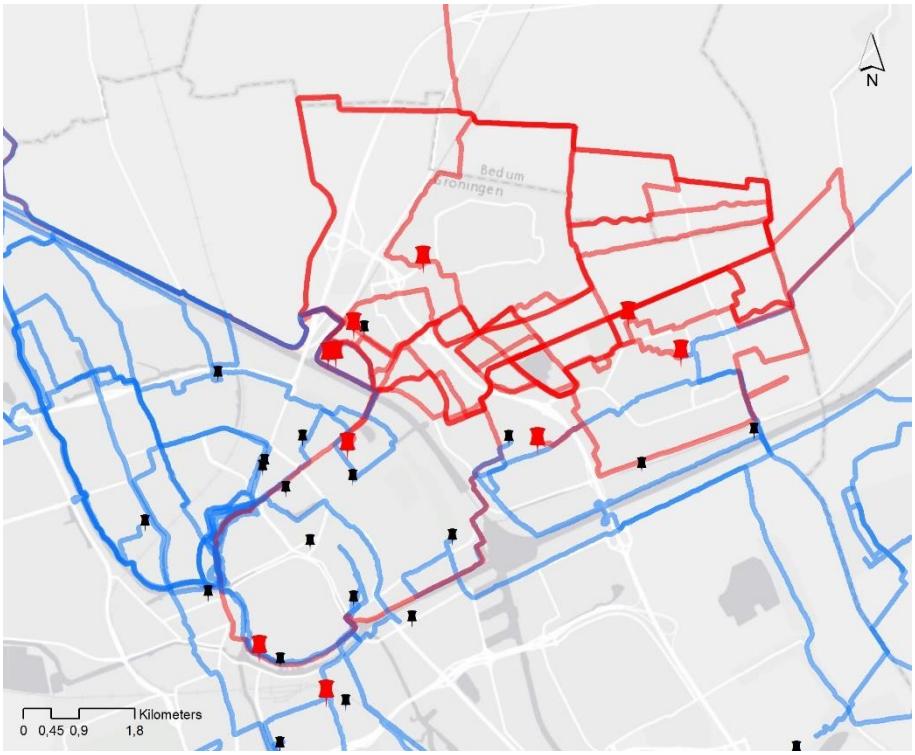
Series of maps indicating the routes and home address of runners in five popular running areas.



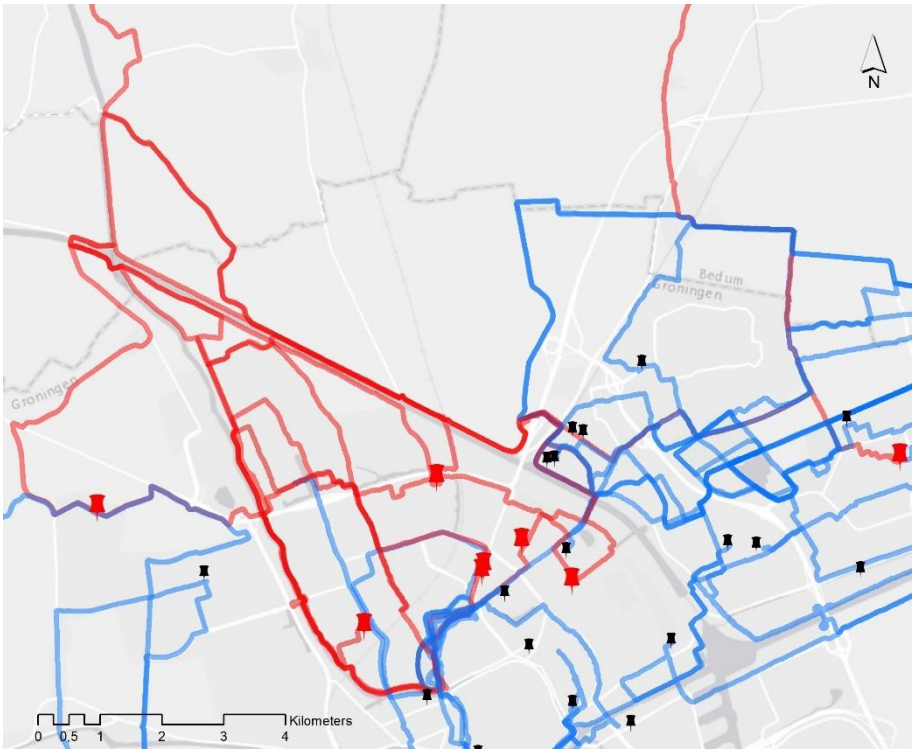
Routes in Paterswoldse Meer area and origin of respondents (n=6).



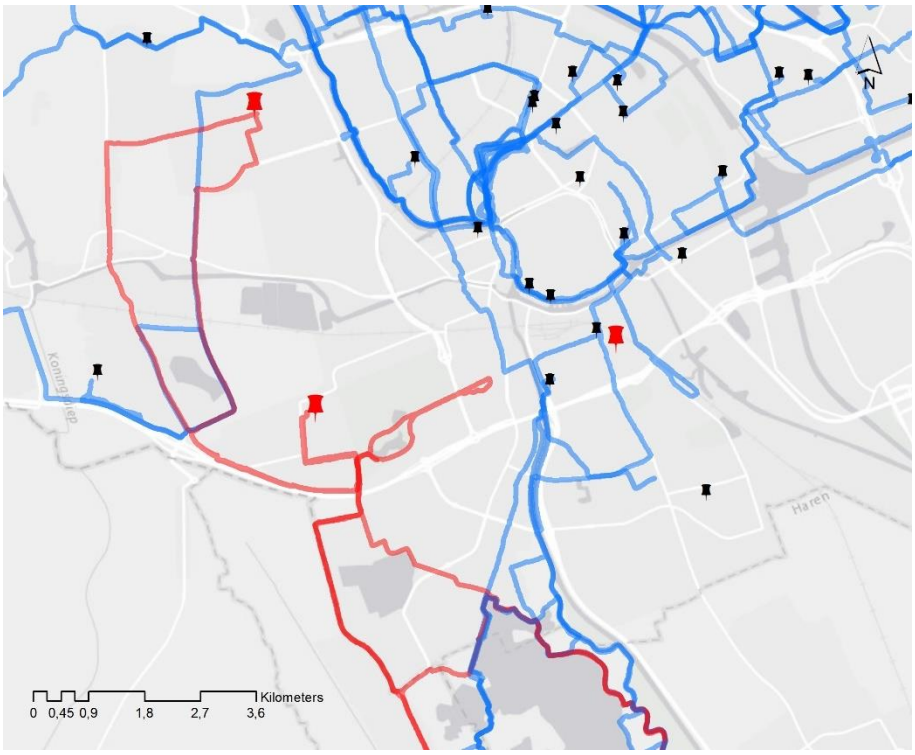
Routes in the Noorderplantsoen and origin of respondents (n=8).



Routes in Kardinge area and origin of respondents (n=10).



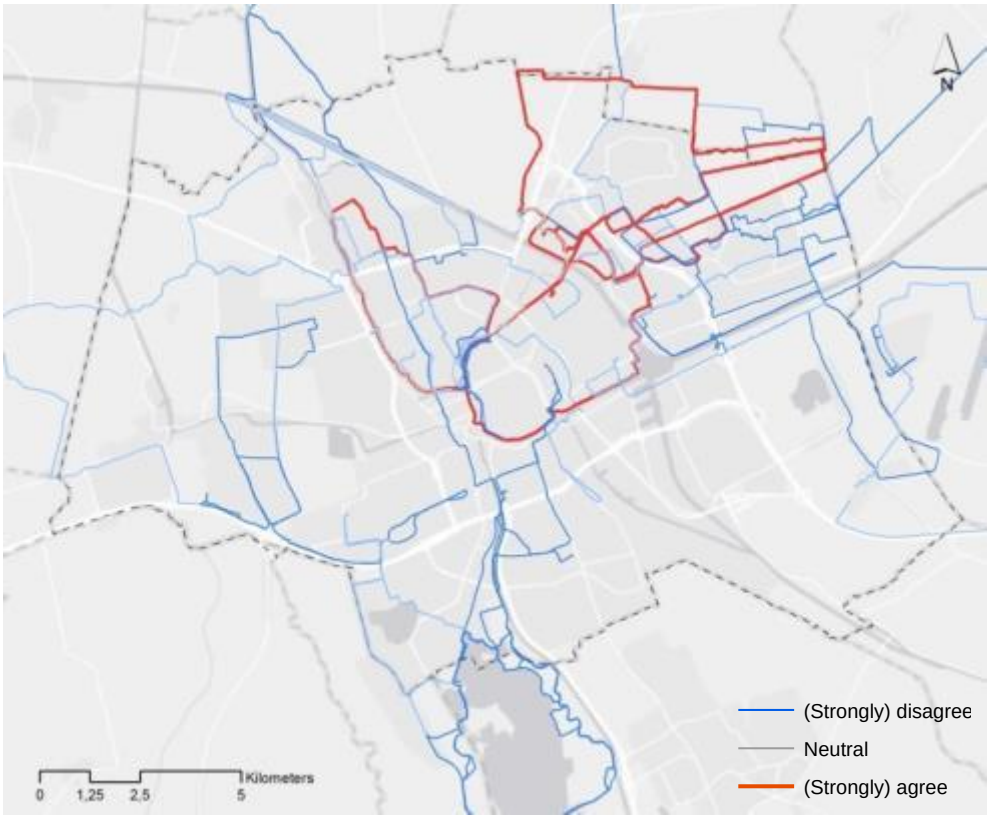
Routes in Reitdiep area and origin of respondents (n=8).



Routes in Stadspark area and origin of respondents (n=3).

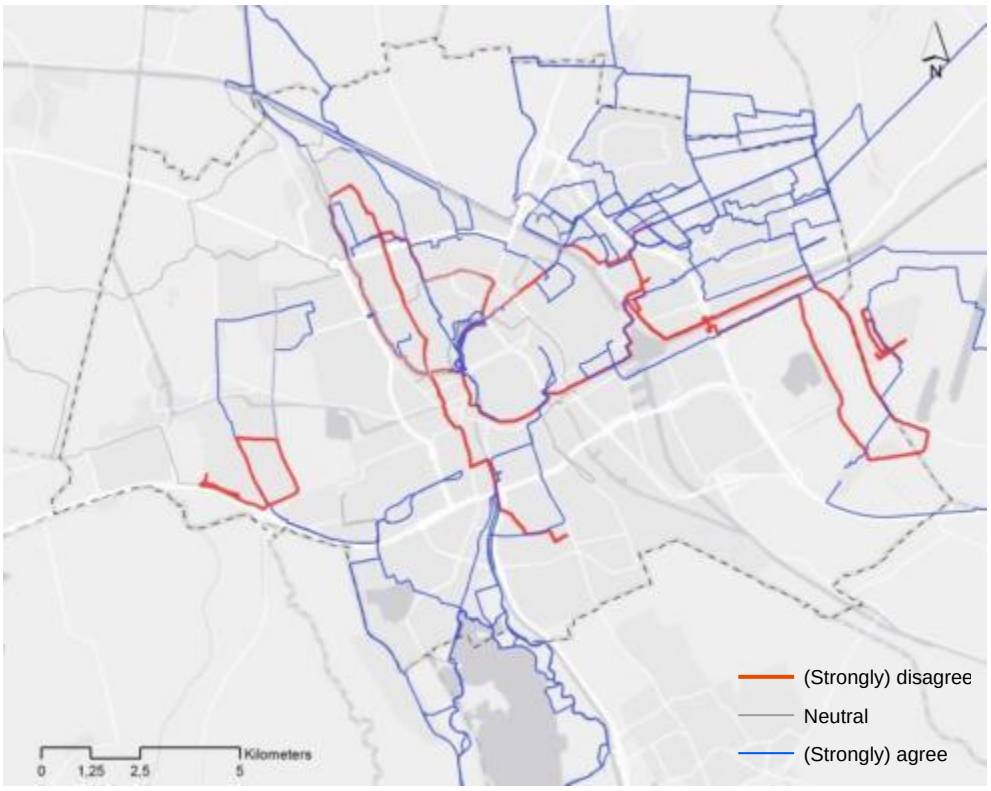
Appendix 8: routes and experiences

The following maps show the results for the statements about the runners' experiences along their routes.



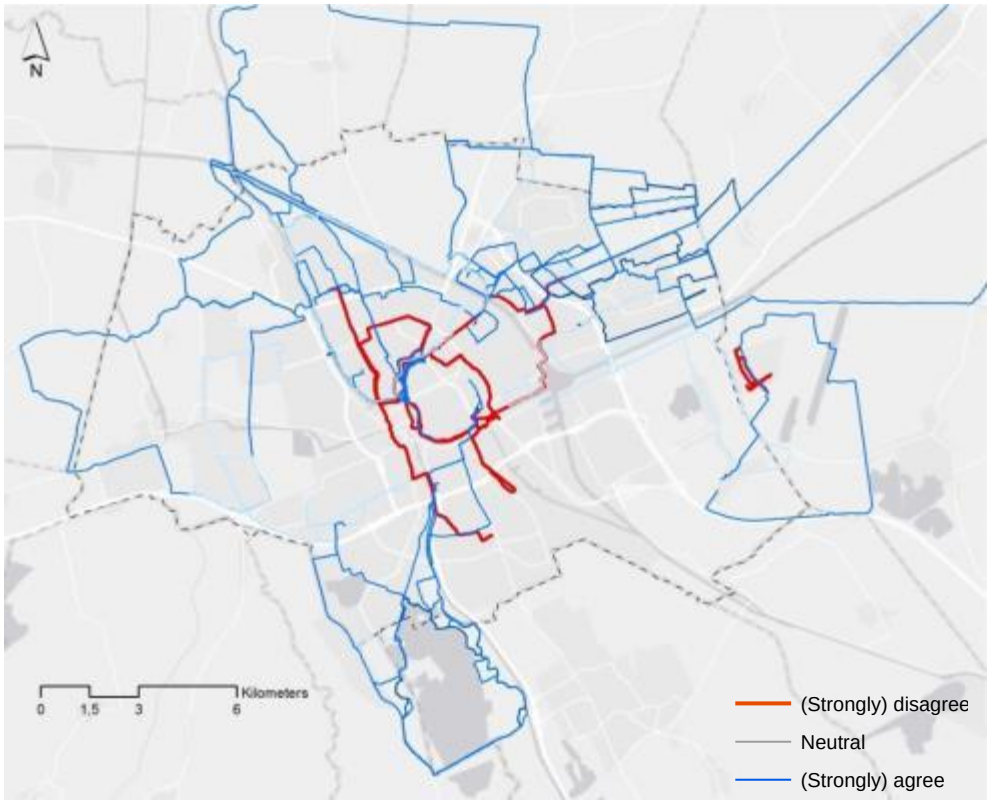
I have felt unsafe while running this route.

Four respondents have felt unsafe on their route. One mentioned safety issues resulting from traffic on a back road; other reasons are unknown.



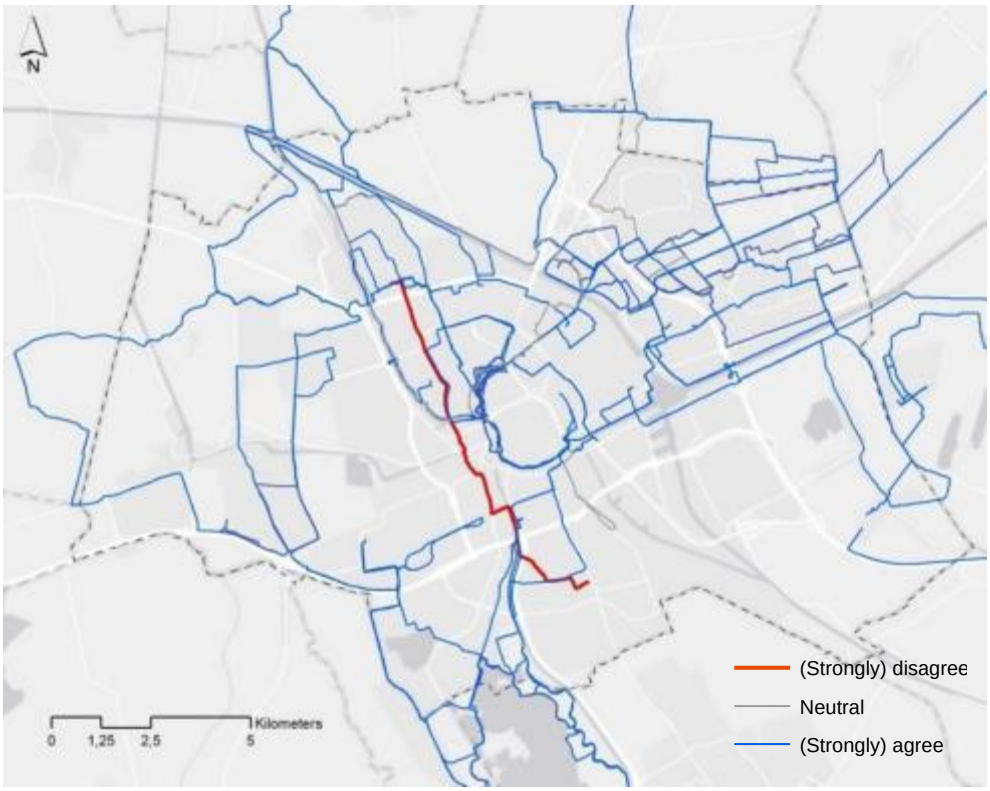
My route goes through a green environment.

Six respondents state their route does not go through a green environment. The map does not reveal a clear spatial pattern.



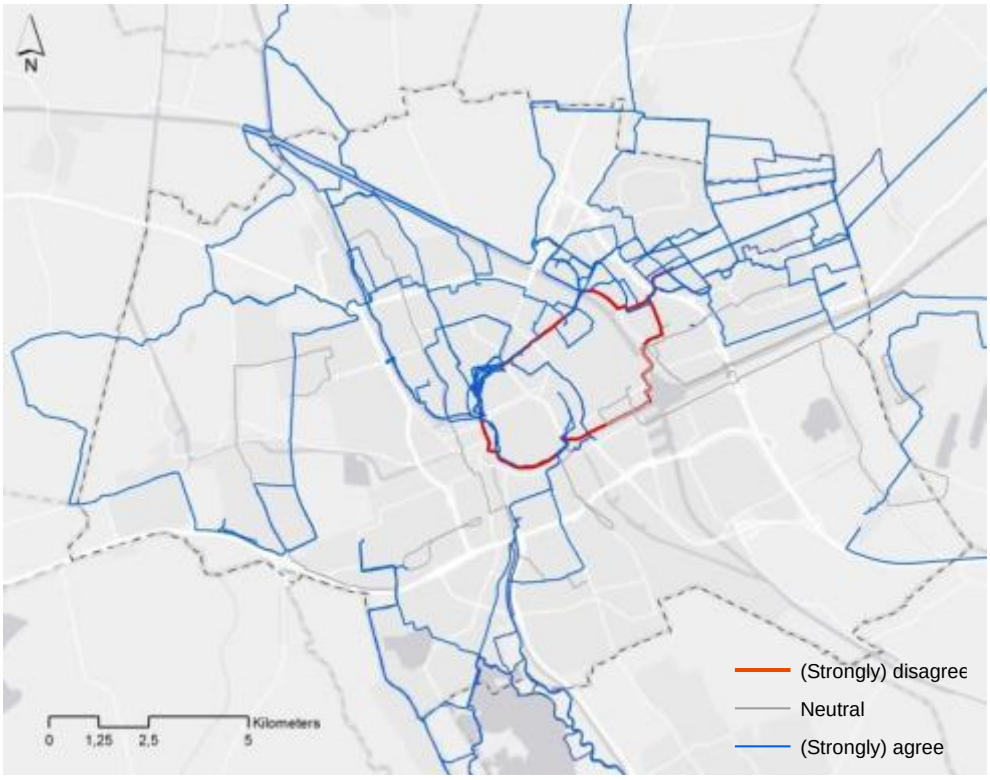
The environment of my route is relaxing.

Six respondents find their route not relaxing. Most of their routes go through the central neighbourhoods of Groningen, which explains the outcome.



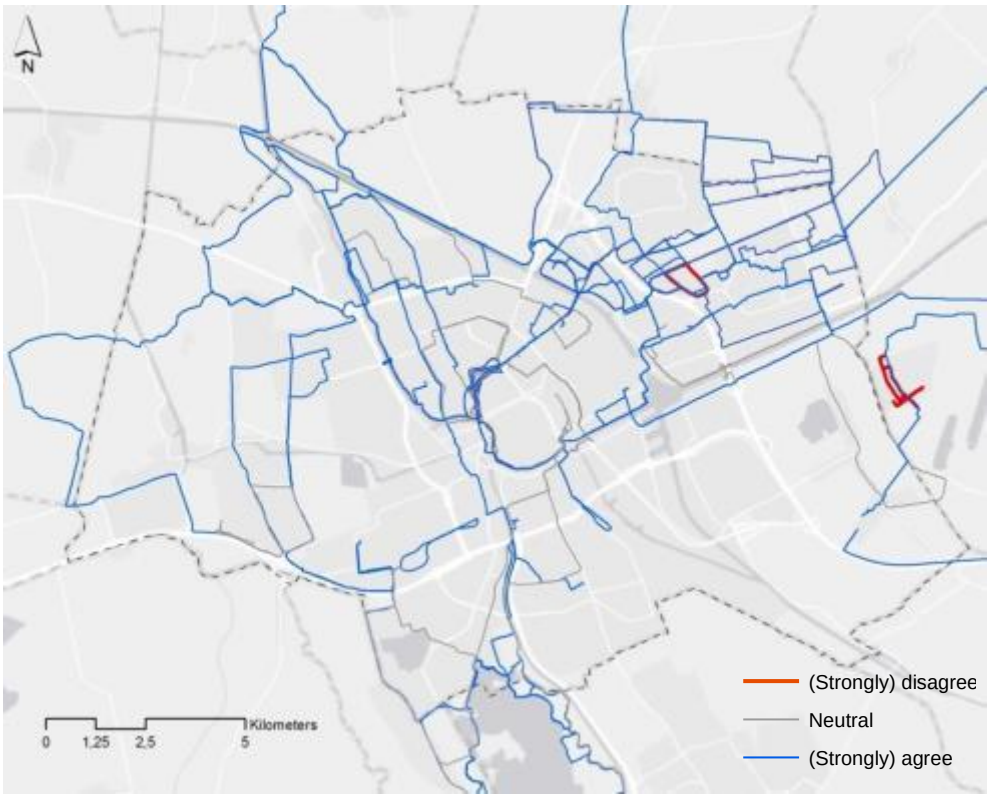
The roads and paths are suitable for running.

One respondent thinks the roads and paths on his/her route are not suitable for running. This is caused by the many road crossings and traffic lights along the route.



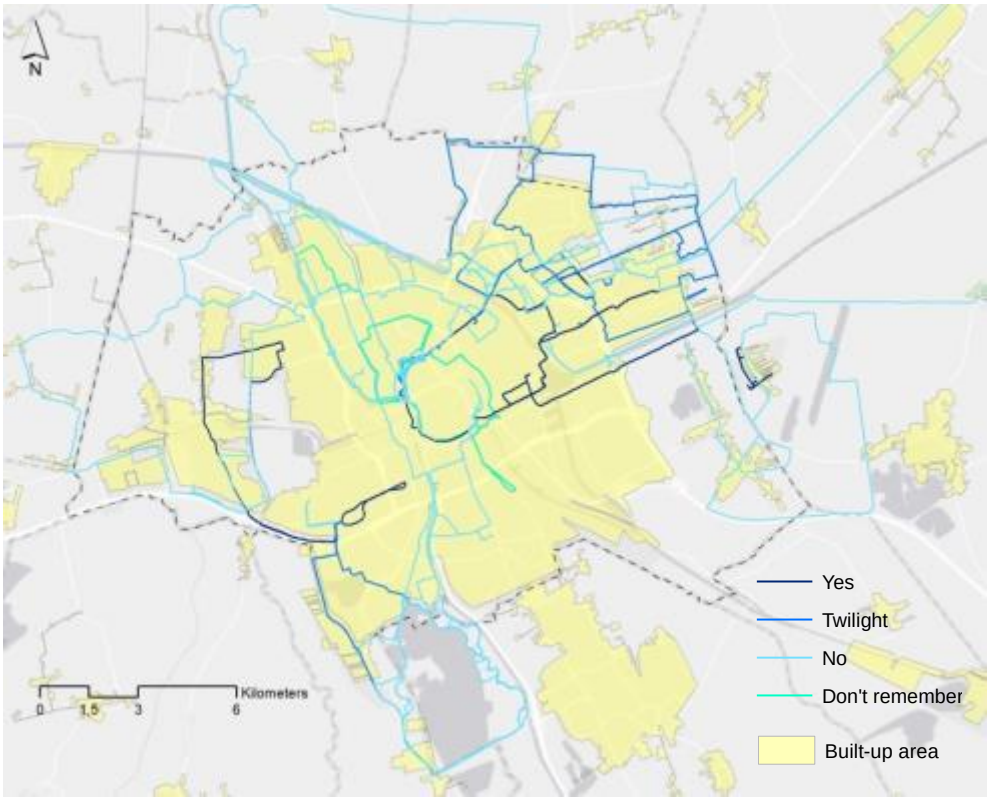
The environment of my route is attractive.

Only one respondents 1 disagrees. In a run-along interview, this respondent stated that the route has both attractive and less attractive segments. However, compared to other routes in more natural areas, the respondent rated this route as not attractive.



My route is varied.

Two respondents disagree. Both of them did an interval training on a circuit, explaining the low variability.



Was it dark while running your route?

Appendix 9: suggestions for improvement

Respondents were asked to suggest improvements in the running route network of Groningen. The responses are categorized below.

Lighting/safety
Betere verlichting
Betere verlichting, bij Kardinge is in het donker niet veilig
4 mijl Kardinge is niet geschikt in het donker, verlichting, alternatieve route
Dan toch de verlichting. Vooral in de winter zijn mijn hardlooprondjes beperkt
Meer verlichting bij het fietspad tussen Hoogkerk en de Peizerweg en in het Stadspark meer verlichting
Meer verlichting in het Stadspark
Meer verlichting op Hoornse Dijk
Meer verlichting, markeren zodat duidelijk is dat het pad ook voor hardlopers is
Goed wegdek en verlichting
Straatverlichting buiten de wijk en op toegangspaden naar de wijk
Verlichting (Kardinge)
Verlichting langs het pad langs de Petrus Campersingel
Verlichting op de 4 mijl-route bij Kardinge. 's Avonds is het daar niet veilig en pikkedonker
Verlichting op de Hoornse Dijk
Verlichting optimaal en geen onveilige plekken
Verlichting rond Kardinge zou beter kunnen (parkeerplaats, weg rond Kardingerbult, driehoekje). Afgelopen winter heeft dit wekenlang niet gebrand
Meer straatverlichting, want door drukke schema's lopen mensen vaak ‘s avonds, maar het is heel onveilig met weinig licht.
Meer licht in Stadspark in najaar/winter
Routes rondom Hoornse Meer/Paterswoldse Meer zouden deels meer verlicht kunnen worden (met bewegingssensors bijvoorbeeld)
Paving and infrastructure
Aanleg van voetpaden (bijv. langs het Reitdiep) op de drukke routes, dus tot het Zernike. Een fietspad langs de Noordelijke Ringweg. Verder moeten sommige gebieden vooral geïsoleerd blijven liggen! (Bijv. de Paddepoelsterweg)
Beter breder fietspad, vlakker
Bijvoorbeeld duidelijk voetpad tussen Noorderplantsoen en Stadspark
Bredere fietsstroken
Egale ondergrond (geen boomwortels onder looppaden)

Her en der is de weg er slecht aan toe, dat zou gerepareerd moeten worden
Veel kruispunten, stoplichten, je moet goed opletten in het verkeer. Maar dit is lastig op te lossen denk ik
Veilige oversteekplaatsen voor hardlopers
Veiligere oversteek
Het voetpad langs de Helperzoom onderhouden
Veel blessures ontstaan door lopen op verharde ondergrond (stoep of fietspad). Er zijn nauwelijks mogelijkheden in de buurt om onverhard te lopen (rubber, bosgrond, zand etc.). Ik zou daar graag gebruik van maken, als dat dichtbij zou zijn (te ver weg, en je gebruikt het niet, door te lange reistijd naar de route zelf)
Op sommige punten zou het trottoir wel een opknapbeurt kunnen gebruiken, bijvoorbeeld de Kerkstraat in de gelopen route
Meer voetpaden zoals in het Noorderplantsoen, deze ondergrond is net iets zachter en loopt prettig
Meer onverharde paden in de route
In veel gevallen kan het wegdek verbeterd worden
Meer autoluwe plekken, meer aaneengesloten groen, bredere trottoirs met minder fietsen erop
De weg naar Zuidwolde is best gevaarlijk. Eventueel zouden er een pad voor fietsers/lopers aangelegd kunnen worden
Duidelijk gemarkeerde loop tracés in het Noorderplantsoen zodat hardlopers en fietsers elkaar niet in de weg zitten
Duidelijkere aanduiding dat het hardloop routes zijn zodat het overige verkeer we rekening mee kan houden
Duidelijkheid geven over hoe en waar hardlopers, wandelaars en fietsers zich kunnen begeven, b.v. in Stadspark is het soms erg gevaarlijk vanwege de wandelaars die midden op de rijbaan lopen en zo ook de fietsers alle kanten op sturen. Kortom gezamenlijke routes proberen te vermijden en proberen duidelijke afspraken te maken waar men dient te lopen
(Marked) running routes
Het 4 Mijl pad bij Kardinge moet op sommige plekken hersteld worden vooral bij de start, slecht asfalt. Ook zijn veel cijfers op de grond niet meer leesbaar
Veel km-aanduidingen op het 4mijl-parcours zijn weggesleten. Het lijkt alsof het niet onderhouden wordt. Dat nodigt niet echt uit...
Woon in Oosterpoort. Gemarkeerde routes van 2, 4 en 6 km zou hardlopen stimuleren
Ook langere afstanden dan 4 mijl
Op meer plekken markeren van afstanden
Reitdieproute markeren en pad verbeteren
Routes aangeven met paaltjes, in verschillende afstanden. Wijk Beijum leent zich er goed voor!
Vast logo maken en bordjes en grondtekens plaatsen voor verschillende routes
Ik wist niet eens dat ze bestonden, dus de promotie ervan zou al een goed begin zijn!
In Amsterdam en Rotterdam hebben ze routes op de weg aangegeven, idee voor Groningen?
Meer variatie en meer markeringen
Meer bekendheid aan geven, ik heb nog niet eerder gehoord van bovenstaande routes.

Meer gemarkeerde hardlooproutes in parken in directe woonomgeving
Een route op onverharde paden met verlichting
Markering van Strava-segementen
Wel iets te wensen: zouden er meer van moeten zijn! Zoals eerder in de enquête gezegd, ik zou graag in de minder bekende gebieden markeringen zien. Zodat je een afslag durft te nemen omdat die geschikt is voor hardlopers. Nu durf ik vaak geen onbekende paden in te slaan omdat ik bang ben dat ze ineens ophouden, of er na 100m geen verlichting meer is, of dat ze eindeloos duren. Een hardloopnetwerk gelijk de fietsknooppunten zou geweldig zijn.
Facilities for runners
Meer trapjes en opstapjes in een veilige plek in het Stadspark waar je oefeningen kunt doen
Waterpunt om iets te kunnen drinken
De mogelijkheid om meegenomen spullen (kleding, drinken) veilig op te kunnen bergen
Een waterput bij start/finish 4 mijl van Kardinge
Meer mogelijkheden tot oefeningen tbv warming up, toestellen, obstakels
Een betere infrastructuur de stad die gericht zijn op hardlopers (niet alleen paadjes, maar bv. ook kranen waar je water bij kan vullen) en op andere sportievelingen (bv. fitness apparaten)
Waterpunten, fietsenstalling bij start
Langs veelgebruikte routes zouden openbare toiletten kunnen komen
Greenery
Een aaneengesloten stuk groen in Groningen aanbrengen die alle delen van de stad en de omgeving buiten de stad met elkaar verbindt (soort EHS in de stad)
Meer groene verbindingszones tussen bijvoorbeeld Stadspark en Noorderplantsoen
Meer groen en minder verkeer
Social/societal
Dat in het algemeen meer mensen buiten vertoeven (dus achter de tv/mobiele telefoon of computer vandaan) zorgt voor meer gezelligheid en dus meer veiligheid en dan kun je ook meer routes aangeven en goed verlichten etc., dan is het effect veel beter meetbaar van de verbeteringen die je kan aangeven. Een groot rondje rond het Paterswoldse Meer fietsen/lopen is dacht ik niet goed mogelijk. Het Stadspark kan ook veel gezelliger zijn. Misschien moet je daar de route heel feestelijk/grappig maken om te lopen of te skaten
Ik denk dat mensen elkaar met hardlopen of met andere actieve bezigheden kunnen aansteken (waardoor er dus ook meer mensen gaan hardlopen als ze anderen zien hardlopen, fitnessen, wandelen of fietsen)
Geen loslooproute voor honden in het Noorderplantsoen
Minder hondenpoep

Improvements not necessary
In het algemeen is er voldoende. Voor een vrouw alleen is het wat lastiger om in een heel natuurlijke omgeving te lopen (kan alleen overdag). Ik pas routes wel aan - of ga met anderen.
Ik kan binnen deze route voldoende uitbreiden of alternatieven vinden die de route aantrekkelijker maken, zoals b.v. door het natuurgebied Noordijk, alleen is dat niet altijd mogelijk i.v.m. het tijdstip. Echter kan ik in verlichte gedeelten ook genoeg andere routes erbij aan lopen of afsnijden, hierdoor kan ik in mijn omgeving beste gevarieerd, veilig en lang of kort genoeg lopen.
Hoezo verbeterd? Dat is toch geheel afhankelijk van je type training. Ik heb Ja gezegd om deze opmerking te plaatsen. Soms vind ik het prettig om juist op een ruige ondergrond te lopen en soms op asfalt. Is bovendien goed voor je belasting