Case study TU/e: Evaluating the walkability of the Groene Loper

The use and perception of the Groene Loper by pedestrians

The Groene Loper at the TU/e campus is designed to be a zone for pedestrians. However, no study has been done to evaluate how the pedestrians perceive and use the Groene Loper. This study evaluates the perception and use of pedestrians by combining different research methods. By mapping and classification, different zones are specified. These are further narrowed down to two specific zones for the surveys and video observation. In the survey, questions are asked about the perception, together with design related questions about the physical environment. The data of the video observation is used to map the routes of the pedestrian and cyclists, to get an insight into the different users, still standing pedestrians and pedestrians who walked outside the paths. Together these methods will give insight and understanding of how pedestrians behave, how the perception is and what can be improved.

The Groene Loper is overall perceived as a pleasant place to stay, although the zones do not provide a vibrant learning environment and pedestrians feel less safe from cyclists. The results of this study can be used to improve the Groene Loper or be a guideline for new pedestrian based areas at the TU/campus.

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Introduction

Over the last decades 'walkability' has become an important field of research in order to understand how to optimize spaces for pedestrians (Lo, 2009). Urban experts have for decades advocated for an urban environment designed with the pedestrian in mind (Gehl & Rogers, 2010; Jacobs, 1961; Lynch, 2005; Speck, 2013). But despite their efforts, the focus of urban planning and design has long gone to understanding how to create streets and highways to improve the safety and efficiency only for motorized modes (Forsyth & Southworth, 2008; Lo, 2009). While focusing on motorized modes and ignoring the pedestrian experience, the streets got devoid of public life while losing its intimacy and transparency (Forsyth & Southworth, 2008). However, over the last years, there can be seen a tendency towards optimizing the space for pedestrians, moving away from the motorized modes (Forsyth & Southworth, 2008). With new research on health and economics, the benefits of a walkable environment are becoming more evident (Ewing & Handy, 2009; Forsyth & Southworth, 2008; Lee & Talen, 2014; Lo, 2009). Walking is a form of 'green transport' and it thus can provide health benefits for its users but also for the environment which becomes more sustainable (Forsyth & Southworth, 2008; Speck, 2013). A walkable environment can also provide economic benefits, it attracts for example young people who prefer urban living – who in their turn attract companies – and a walkable life can generate considerable savings for a household, which can, in turn, be spent locally (Speck, 2013).

With the benefits of a walkable environment becoming more evident, research towards a walkable environment is increasing. In contrast to earlier qualitative research more research is now focusing on a way to measure walkability (Lo, 2009). Studies have been done to urban design qualities (Ewing & Handy, 2009), pedestrian paths and pedestrian movement (Naghavi & Abdul Hamid, 2014), zoning for pedestrians (Bloomberg, n.d.), a GIS-based approach to measure walkability (Lee & Talen, 2014), or linking the perception of the pedestrian to design elements (Park, Kim, Choi, & Seo, 2013). Therefore, how walkability is measured depends on the point of view from which one looks at it. Walking cannot be captured by one discipline since it is a multidisciplinary activity and it, therefore, requires multidisciplinary metrics to measure it (Lo, 2009). This study does not create a metric or measure for walkability but it rather evaluates the Groene Loper by combining qualitative and quantitative research.

The Groene Loper is a zone at the TU/e campus which is redesigned in 2014 by MTD Landschapsarchitecten. MTD Landschapsarchitecten intended to make the Groene Loper a scenic walk, with the pedestrian as its main focus. It is designed as a place for slow traffic. The place needed to inspire to be a meeting point, with workplaces and seating elements who provided views on the Dommel and where the greenery was used as a connecting factor (MTD Landschapsarchitecten, 2014). While the intentions of the designers were clear, there has not been any research

done to see if this vision was realized. Therefore, the aim of this study is to evaluate how the Groene Loper at the TU/e campus is perceived and used by the pedestrian.
In order to investigate the walkability of the Groene Loper different research methods where used. Through a literature review, a better understanding of the relationship between walking and the urban environment is obtained. By mapping and classification of the Groene Loper, the characteristics of the different zones become clear. This data is used to narrow down the research to two particular zones where the research will continue. In order to get an understanding of how the pedestrian experience the Groene Loper and what the perception of the surrounding environment is, surveys will be conducted in these zones. By combining the data from the surveys, classification and video observation this study evaluates the Groene Loper, hereby looking if it provides a walkable urban environment.

The result of this study can be used to evaluate if the intention of the designer is translated into the current situation. It can also be used in order to improve the walkability of the Groene Loper. The TU/e wants to be a leading and innovative University and therefore want its campus to be a showcase which has to strengthen its image of sustainability and innovation (TU/e, 2011). A walkable environment can attract talent, new students and can have numerous health and economic benefits for its users (Lee & Talen, 2014; Speck, 2013). It also creates a place where people want to stay and where interaction can take place (Forsyth & Southworth, 2008; Speck, 2013).

Methodology

In order to evaluate how the pedestrians perceive and use the Groene Loper, data is collected through five different research techniques. Literature study is done to get an overview of the current research in walkability and it led to the following research design (Fig. 1).

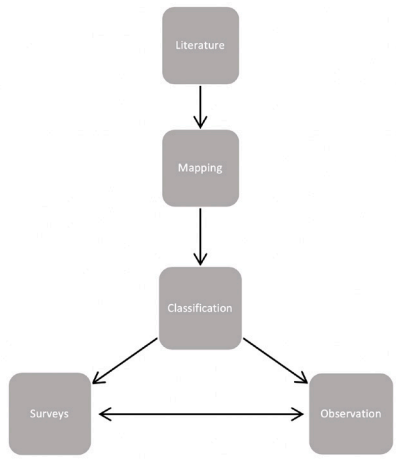

Figure 1. Research design

Inventorisation of the Groene Loper is done through mapping and classification, followed by surveys in combination with video observation. This will give insight and understanding of how pedestrians behave, how the perception is and what can be improved.
Due to the limited amount of time to conduct the research, this research will focus on two zones in particular. The two zones are chosen in collaboration with the company Heijmans with the improvement of the campus in mind. These zones are zone 2 and 6 which are named zone A and B respectively in the rest of the research (Fig.2).

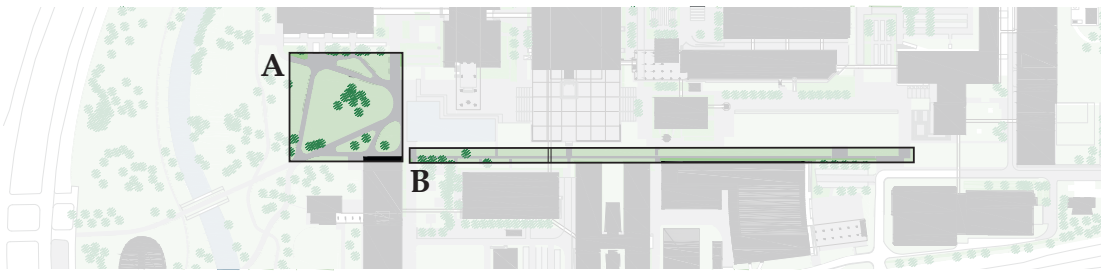

Figure 2. Map of zone A and B

Mapping and classification

With mapping qualitative data is gained in order to evaluate and get an overview of all the pedestrian paths of the Groene Loper. These paths are highlighted in a map. Next, the Groene Loper is divided into different zones with their own characteristics. With classification, we continued the research and checked if the zone-mapping is correctly done. This physical classification is done with an inventory of the mapped pedestrian paths based on the different characteristics and specific elements. With this, quantitative and qualitative data is gained. Data for mapping and classification is collected by using digital maps and observations. Maps are made by using computer software.

Survey

The survey provides subjective, quantitative insight into the perception and experience of the pedestrians of a particular zone. An equal survey, in Google Form, is conducted for both zones. The surveys are distributed outside at the Groene Loper and inside at the different canteens of the TU/e buildings; Vertigo, Matrix, Metaforum, Gemini and Flux. Both surveys are conducted during lunchtime in the timeslot 12.30-13.30 at three different days, namely Monday 17th, Thursday 20th and Friday 21st of December 2018. The timeslot corresponds with the video observations. Direct responses are received by using digital devices containing the survey and indirect responses are received by distributing QR-codes during lunch time. The aim is to receive a minimal sample size of 30 responses per zone.

Based on research of Park, Kim, Choi & Seo (2013) a distinction is made between the perception factors and physical environment for the set-up of the survey. This research argues that there is no direct relationship between a physical element and the decision to walk, but it is a combination of several elements. They proposed a conceptual step, perception, where four perception factors are extracted: pleasantness, vitality, unsafety, and complexity. These influence the decision-making process to walk in a certain area. The perception factors are the dependent values and are related to the physical environment, the independent values (Fig.3). In this research, the perception factors pleasantness, vitality, safety, and complexity are used. Unsafety is replaced by safety to prevent to give a certain meaning in the answers. Four categories are distinguished for the physical environment for the set up of the survey namely, pedestrian path design, street furniture, and surrounding elements, functionality, and routing. Per category of the perception factors and the physical environment four or five questions are conducted (Appendix 1). The 5 point Likert-scale is used for grading the answers in the survey research (1 strongly disagree; 2 disagree; 3 neutral; 4 agree; 5 strongly agree). The results have an ordinal ranking level.

Figure 3. Framework survey

The data originating from the survey is analyzed by using Microsoft Excel and SPSS. A comparison between zone A en B is made by using a diverging stacked bar chart. To conduct the analysis some questions are rewritten so that the most positive answer is 'strongly agree' and the most negative answer is 'strongly disagree'. Based on this visual presentation the responses can be interpreted. To get an insight into how the physical environment affects the perception the Spearman correlation analysis is conducted in SPSS. For both zones all the perception questions have been checked on a correlation with the physical environment factors, the results are visualized in a matrix. The correlations are tested two-tailed and a correlation coefficient with a significance below 0.05 ($p<0.05$) is considered significant.

Video observation

The video observation provides objective data and insight into the use of a particular zone. Research of Naghavi and Hamid (2014) shows that by using basic camera videotapes it is possible to get an understanding of the pedestrian's movement and their quantity. These observations are conducted during the same period as the surveys but on different days to prevent people from behaving differently while conducting the surveys. The observation is done during lunchtime on 12th, 17th and 19th of December 2018. This quantitative research will focus mainly on pedestrian circulation. Three themes are researched: how are the pedestrian paths used, by whom are they used, and where do conflicts between pedestrians and cyclists occur? Data is collected by recording the zones with the use of video cameras in considered positions (Fig. 4 and 5). For zone B only the left part is being analyzed because of camera limitations. Because of the number of pedestrians and cyclists through the frame during the video observations, each zone is divided into different entries and different grass areas to count all the users (Fig. 6 till 9).

For analyzing the video observations mapping is used to map the routes of the pedestrians and cyclists who walked outside the designed paths and to get insight in where pedestrians and cyclists are standing still. The quantitative data is visualized in a table concerning numerical quantities, to get insight into the numbers of different users of the paths, pedestrians standing still and pedestrians walking outside the paths. The surveys, which provide subjective insight in the perception of the pedestrians in combination with the objective, quantitative data from the video observations enables insight in the use and experience of the particular zones. By linking this to the classification of the physical environment, this study aims to evaluate how the Groene Loper at the TU/e campus is perceived and uses by the pedestrian.

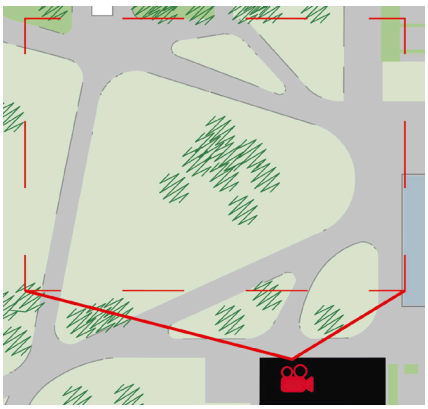

Figure 4. Camera position zone A

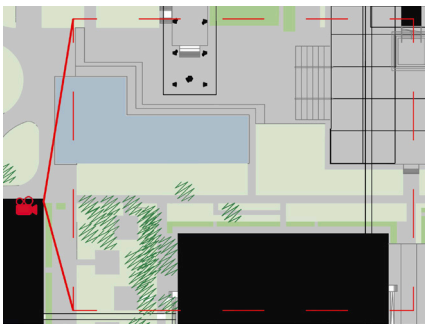

Figure 5. Camera position zone B

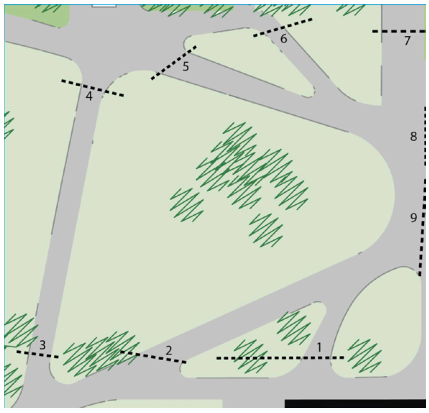

Figure 6. Entries zone A

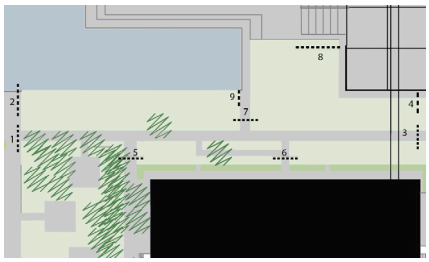

Figure 7. Entries zone B

Figure 8. Grass areas zone A

Figure 9. Grass areas zone B

Results

Mapping

Mapping of the pedestrian paths at the Groene Loper shows that the Groene Loper consists only of slow traffic routes. All the fast traffic is positioned in circulations outside the Groene Loper. Two different types of paths can be distinguished, namely paths that are designed to get from point A to point B, and paths that are designed to stay in. A map is made showing all the slow traffic routes of the Groene Loper (Fig. 10).

Striking about figure 10 is that different elements are distinguishable on the basis of different characteristics (Table 1). Therefore the Groene Loper is divided into different zones on the basis of visual and physical cohesion (Fig. 11).

With mapping, insight into the structure of the Groene Loper is gained. With classification, the subdivision of the Groene Loper in different zones will be tested.

Table 1. Location and characteristics zones

Zone	Location	Characteristics
1.	Limbopad	Small path, meandering through the Dommel dal.
2 (A)	KOE-field, between Auditorium and Vertigo buildings.	Big open green spaces, with small rounded paths
3	Underneath the Atlas building	Square like pedestrian zone, alongside the pond
4	Markthal	Covered square
5	Path from Metaforum to Flux	Wide path, with on one side Gemini and on the other side the Flux-field
6 (B)	Path from Vertigo to Flux	Small long path, covering almost the entire Groene Loper, with changing surroundings.

Classification

The results of the research method classification (Appendix 2) show that there is a distinction in different zones on the Groene Loper with different characteristics per zone. Important findings are that there is a similarity in the materialization of the paths, namely all concrete, and the minimal height differences in the zones. Furthermore, in all of the zones, there are almost no seating elements situated.

A big difference is seen in the dimensions of the paths. There is a great variety in the lengths and

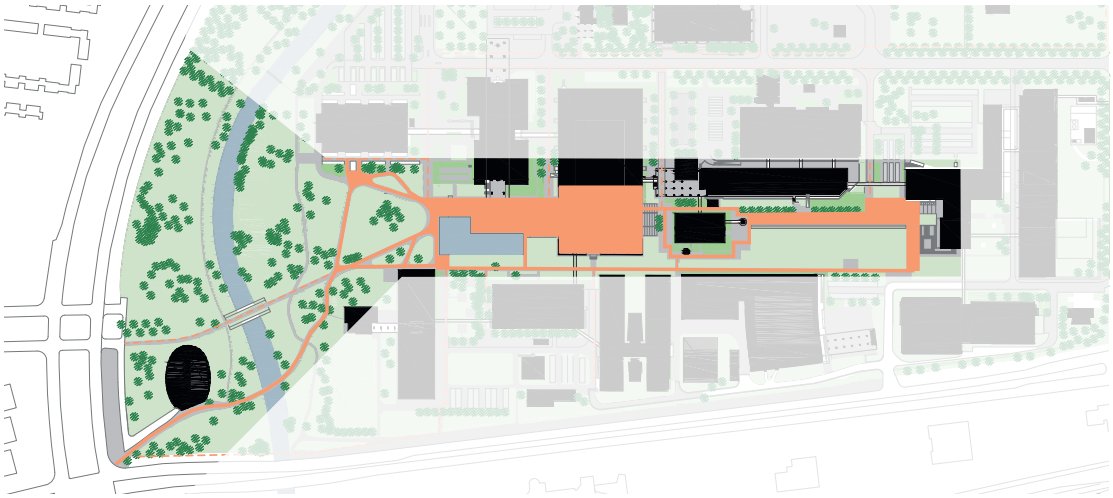

Figure 10. Slow traffic routes of the Groene Loper

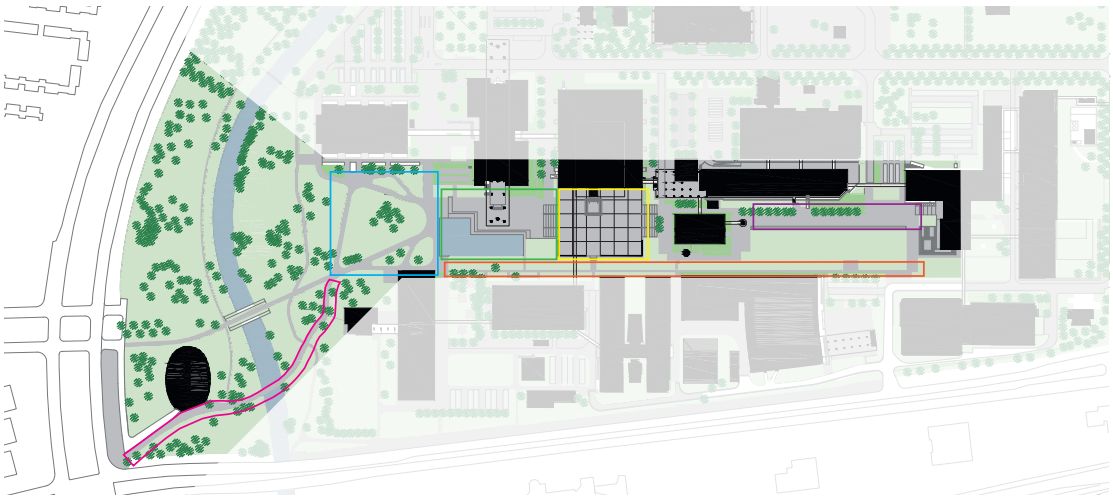

Figure 11. Different zones of the Groene Loper

widths of the path, but also in the distance to the nearest building. Besides that, a big difference is the number of trees, green and water that is visible.

With classification, insight in the visual and physical cohesion of the zones is gained. With classification, the subdivision of the Groene Loper in different zones is tested correctly. This research will continue by investigating two of the six zones due to time limitations.

Survey

The two of the six zones by which this research continues are zone two and six which are named zone A and B respectively. By analyzing and comparing the outcomes of the survey of zone A en B, quantitative insight is generated in the perception and use of the zones. The survey of zone A has 42 responses (N=42) and zone B has 43 responses (N=43). Table 2 and 3 show the comparison of zone A and zone B. Table 2 belongs to the perception factors: pleasantness, vitality, safety, and complexity. Table 3 belongs to the physical environment.

The results of the perception factors questions in the survey show that both zones are a pleasant place to walk and that respondents enjoy being there. In both zones, respondents think they can safely walk without being hassled, that the zones are easy to navigate and that the Groene Loper connects well with the buildings. During day- and night time respondents feel safe when walking around in both zones.

In contrast to that, both zones are not perceived as an anonymous place and respondents think that both zones are not a place to meet new people. Respondents do not think the zones are supporting a learning environment and they do not feel safe from cyclists.

Results with noticeable differences in response are that both zones do not support the interaction with other people, but in zone A results are more positive than in zone B. Zone A is perceived as a vibrant place, while zone B is not. In zone B respondents think they can cross the pedestrian paths safely and that the paths are logical, while in zone A the results for this are neutral.

Both in zone A and B, the responses if the zones provide an interesting walk and if the pedestrian paths are designed for pedestrians are neutral.

The results of the physical environment questions in the survey show that in both zones the surface of the pedestrian paths is perceived as pleasant to walk on and as flat without height differences. Respondents perceive the pedestrian paths as well maintained and at night as sufficiently lit. The routing is perceived as very clear in both zones and respondents think the pedestrian paths are well connected and have a clear structure.

In contrast to that, both zones are not providing enough seating elements, the pedestrian paths are not perceived as designed only for pedestrians and respondents think the paths do not have lots of obstacles.

Results with noticeable differences in response are that in comparison to zone A the path in zone B is experienced as less wide enough. In both zones, the landscape is perceived as not attractive, but in zone A the results are more positive than in zone B. In zone A the pedestrian paths and bicycle paths are perceived as designed for shared space while in zone B it is perceived as not. Respondents think that in zone B the pedestrian paths are efficient in going from point a to b, while in zone A neutral. In both zones the surrounding environment does not provide intimacy, but in zone B the results are more positive than in zone A. Respondents think that a collision with cyclists occurs often in both zones, but more in zone A than in zone B.

Both in zone A and B the responses if the

Table 2. Perception factors

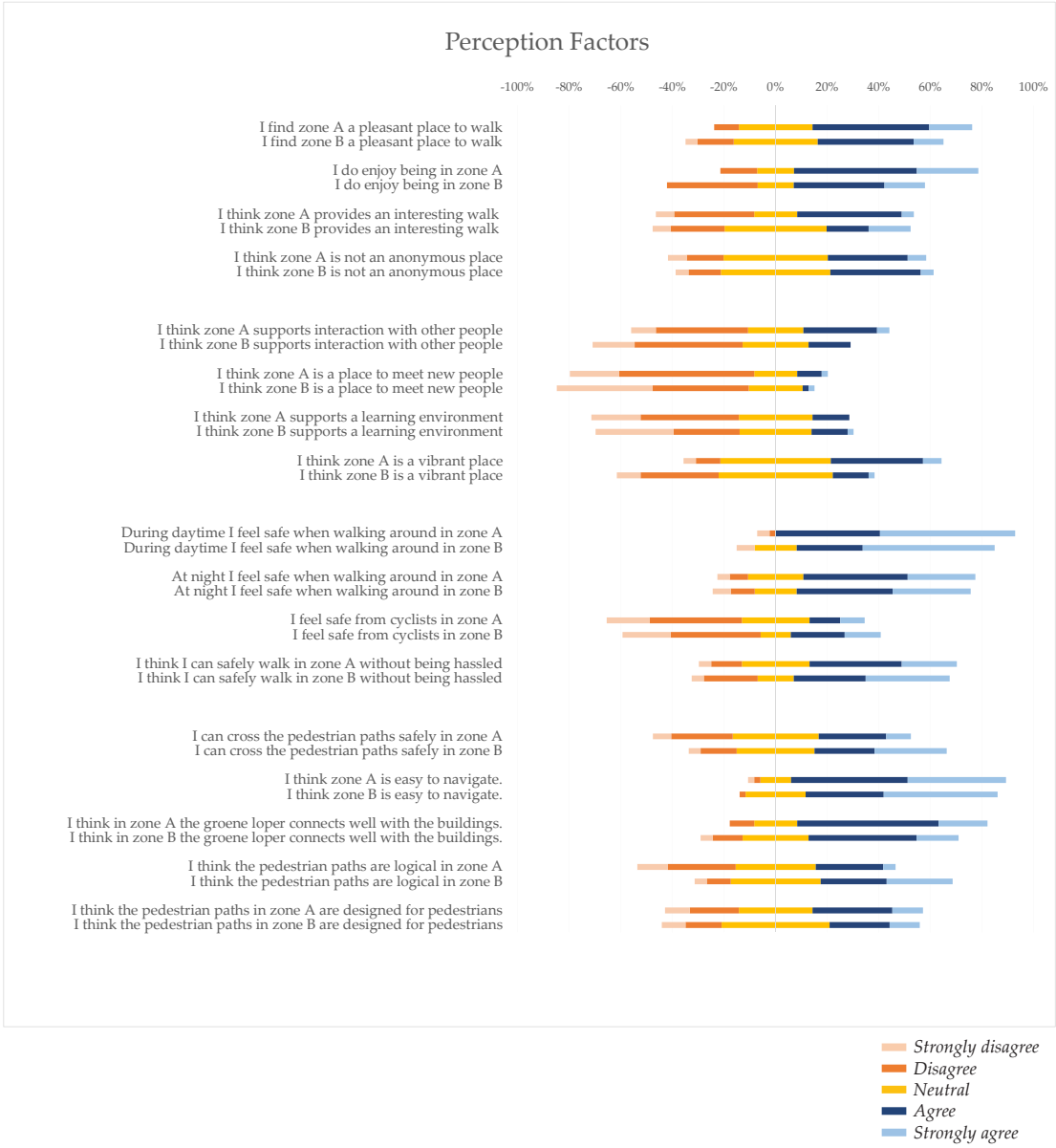

Table 3. Physical environment

surface of the pedestrian paths are experienced as slippery when it rains or snow are neutral.

Since the perception factors are related to the physical environment correlation analysis is used to find design elements that influence the perception of the Groene Loper. As seen in the correlation tables (Appendix 3 and 4) some of the correlations differ between the two zones. The physical environment is something the designers can change and the positive perception is something designers want to achieve. Hence, it is important to see the relationship between each other to improve both the environment and the perception of the environment.

When improving the intimacy of both zones, the possibility to meet new people can improve. In zone B improving intimacy appears to also increase the learning environment. Adding sitting elements as well improves the learning environment, this is not only true for zone B but also applicable in zone A. Furthermore, in zone B adding sitting elements does have an influence on the interaction between people and meeting new people.

When in both zones the attractiveness of the landscape is improved, it is likely that both zones will be experienced as an even more vibrant place. Furthermore, safety from cyclists is another factor that can be improved. Because collisions with cyclists often occur, people do not feel safe from cyclists and the pedestrians don't feel like they can always cross the paths safely. Pedestrians do feel safe at night because both zones are well lit.

With the survey the data of the perception of the pedestrians is gained, whereby during the video observations insight and understanding is gained of how the users of the Groene Loper move through space.

Video observation

To combine the perception of the users of the Groene Loper with the actual situation, video observations are used. The results show similarities and differences between the two zones. Although the total amount of pedestrians and cyclists are higher in zone A than in zone B, the ratio pedestrians and cyclists are almost the same (Appendix 5 and 6).

Where the zones do not differentiate from each other is the human movement. In both zones, the people standing still (Fig. 12 till 17) caused evasive movements with the cyclists and the pedestrians. In zone B it caused cyclists and pedestrians walking over the grass. Zone A has wider paths than zone B, possibly causing pedestrians not walking over the grass, but only evasive movements. In the video observation of 12th of December, there are people promoting in the east of the zone causing lots of people and standing still.

Another cause for evasive movements is cyclists. Cyclists have different speeds than the pedestrians, causing them to move around the pedestrians and zigzag through the zones. Most of the time cyclists made maneuvers, but also pedestrians needed to make maneuvers, because of cyclists coming to close.

Results with notable differences are the number of pedestrians walking beside the pedestrian paths. Figure 18 till 26 show the amount and routing of pedestrians and cyclists beside the paths in zone A and B. Correlating this to the total amount of people walking in the zones it results that 5,6% walked beside the paths in zone A and 61,3% in zone B.

Figure 18 till 20 show that in zone A a direct route between the Vertigo building and the Auditorium building is missing, causing people walking over the grass. Figure 21 till 23 show that in zone B rounded corners are missing, causing pedestrians cutting the corners between perpendicular paths. Common about

Figure 12. Standig still zone A
December 12th 2018

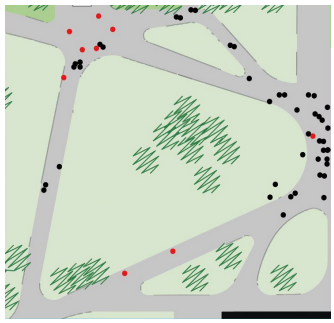

Figure 13. Standig still zone A
December 17th 2018

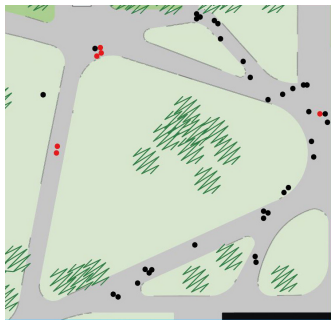

Figure 14. Standig still zone A
December 19th 2018

- *Pedestrian*
- *Pedestrian with bicycle*

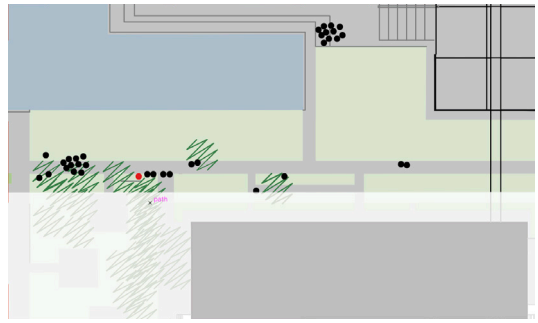

Figure 15. Standig still zone B
December 12th 2018

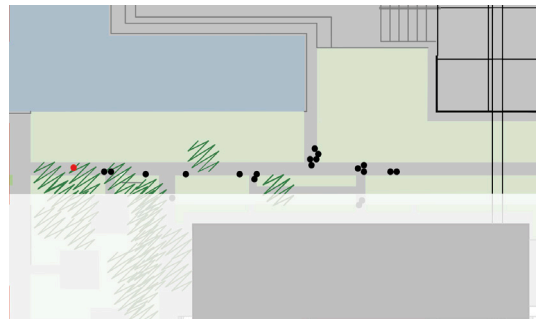

Figure 16. Standig still zone B
December 17th 2018

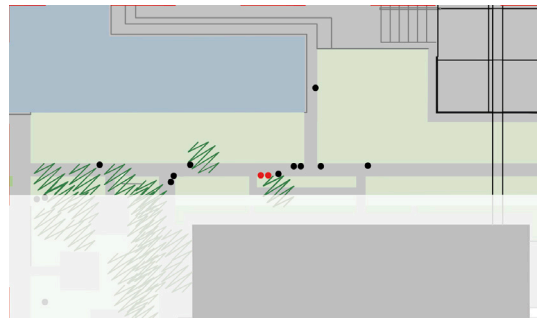

Figure 17. Standig still zone B
December 19th 2018

- *Pedestrian*
- *Pedestrian with bicycle*

Pedestrian
Cyclist

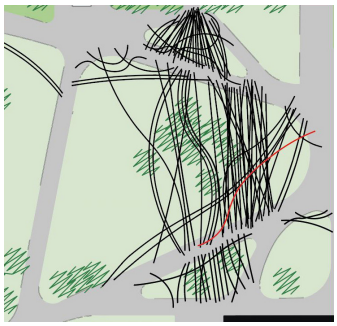

Figure 18. Routing besides the path zone A
December 12th 2018

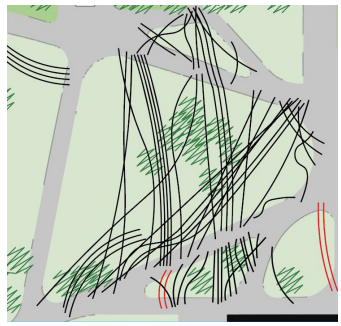

Figure 19. Routing besides the path zone A
December 17th 2018

Figure 20. Routing besides the path zone A
December 19th 2018

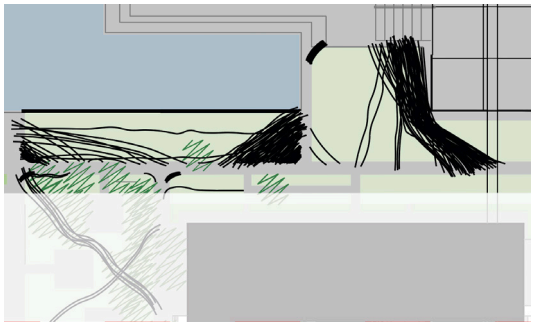

Figure 21. Pedestrian routing besides the path zone B
December 12th 2018

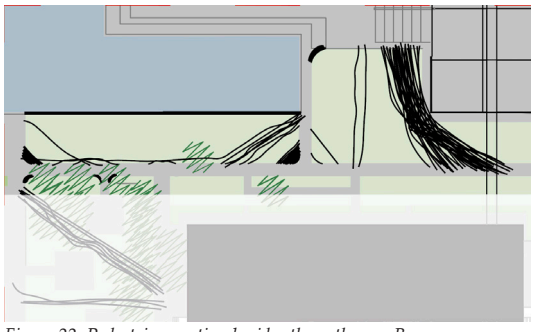

Figure 22. Pedestrian routing besides the path zone B
December 17th 2018

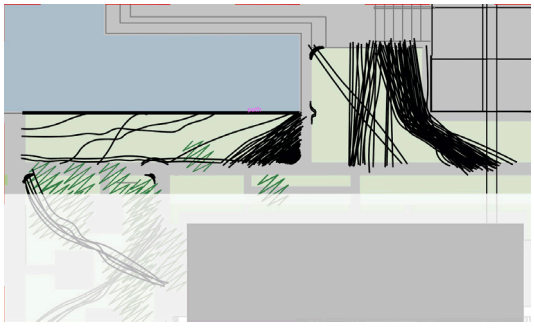

Figure 23. Pedestrian routing besides the path zone B
December 19th 2018

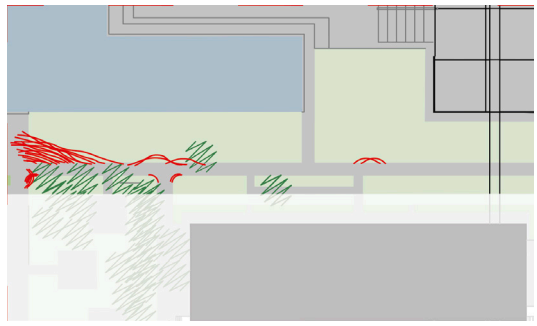

Figure 24. Cyclists routing besides the path zone B
December 12th 2018

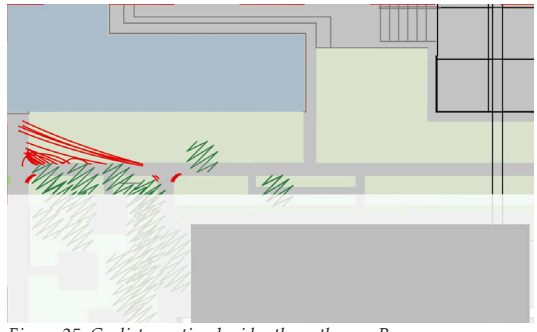

Figure 25. Cyclists routing besides the path zone B
December 17th 2018

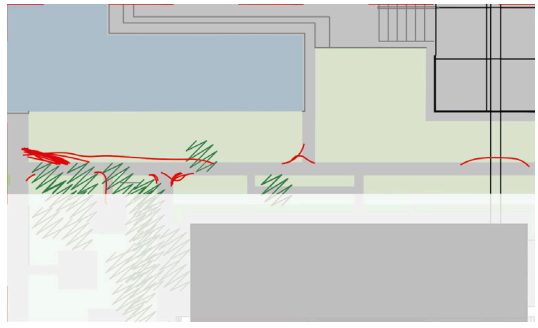

Figure 26. Cyclists routing besides the path zone B
December 19th 2018

both zones is that pedestrians tend to take the shortest route and that pedestrians need to step outside the paths to dodge other pedestrians or cyclists.

The ratio evasive movements and people standing still are different in the two zones, while the number of users is the same. This relates back to the difference in design in zone A and B. The style of zone A is a romantic landscape design with organically shaped paths, while zone B contains a rectangular design with perpendicular paths. Because of the organically shaped paths in zone A the corners are not cut by the pedestrians, but a direct routing from point a to b is missing. Zone B provides a direct routing from point a to b, but because of the perpendicular paths pedestrians are cutting the corners for walking the fastest route.

Comparative analysis

Comparing the video observation (objective) with the perception of the users (survey, subjective) and the classification (the current situation, objective) gives an overview of the researched situation.

A lot of the results between the zones are roughly the same. This can be related to the fact that both zones are part of the Groene Loper without any strict boundaries. The differences in the results can be related to the characteristics of the zones.

The differences between the behavior of people are mostly because of the design of the different zones. In zone A, pedestrians walk over the grass to get from Vertigo building to Auditorium building or the other way around, while in zone B the corners are cut. This can be related back to the design as seen in the classification. This can also be related back to some of the answers in the survey. The paths are more logical perceived in zone B than zone A and the pedestrians find the paths more efficient in going from point a to b in zone B than in zone A.

The classification shows that there are almost no sitting elements in both zones. This is in line with the results of the survey, the users as well think that there are not enough sitting elements. The lack of sitting elements can cause people standing still in the middle of the paths, as seen in the video observation, causing evasive movements.

The users of the zones did not perceive the zones as safe from cyclists. A significant amount of pedestrians found that they could not cross the paths safely and most pedestrians found that a collision with cyclists happens often. Although there were no actual collisions between the cyclists and the pedestrians during the video observations, there were a lot of evasive movements visible. In zone A the paths are wide enough for people to avoid collisions, but in zone B pedestrians and cyclists were forced to move over the grass.

Zone A is experienced as a more vibrant place then zone B, this relates to the characteristics of the direct environment. Zone A is described in the classification as park-like and zone B as a geometric straight path. Therefore, the paths in zone B are perceived as more logical than in zone A.

Discussion and conclusion

The results of the research offer insight to the extent that the Groene Loper at the TU/e campus provides a walkable environment. The surveys, which provide subjective insight in the perception of the pedestrians, in combination with the objective, quantitative data from the video observations enables insight in the use and experience of the particular zones. By linking this to the classification of the physical environment of the zones, it enables a complete and overall insight of the walkability of a certain zone at the Groene Loper.

The design of the Groene Loper is intended to create a walkable environment. It aimed to be an attractive environment where social interaction and meeting occurs. The results demonstrate that not all these design intentions are met in the actual situation. It appears that zone A and B are perceived as a pleasant place to be, routing is logical and the pedestrians feel overall safe by walking there. However, other aspects improvements can be made. The results indicate that although it is overall perceived safe, pedestrian feels less safe from cyclist an. Both zones do not provide an environment which supports interaction or provides a learning environment, however zone A is perceived as a more vibrant space as zone B.

To create an environment that simulates interaction and a place to stay, the results suggest that improvements can be made by adding sitting elements or by creating a more intimate zone. Sitting elements have a positive correlation with social interaction and providing a learning environment.

The study, however, is limited due to restricted time and resources. The research focused on zone A and B, respectively zone two and six, instead of all the zones classified in the Groene Loper. The video observations are conducted during lunchtime at three different days. This gives no overall insight about the use during the entire day. Likewise, the surveys have a limited sample size. For this reason, the accuracy might be not sufficient. A sample size of 100-200 responses per survey would provide more reliable results for the correlation analysis. Moreover, the research is conducted during the winter period, means that it is unlikely that the results will be the same during the summer period. Finally, the situation of the Groene Loper is currently changed due to the opening of a new education building located at the Groene Loper, which means future situations might differ from the researched situation.

The results of this study can be used to improve the Groene Loper or be a guideline for new pedestrian based areas at the TU/campus. In a broader field, the methodology, conducted in this research offers a framework for similar evaluations of the walkability of a certain urban environment. It enables insight into improvements of the walkability of this area.

The limitations of this research can be addressed in future research. It is recommended to repeat the research for also the other zones to receive a complete insight of the Groene Loper.

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Appendix 1

Survey Questions

The surveys about Zone A and B are conducted by QR-codes which lead to a google form. In this appendix Zone, A or Zone B is replaced by Zone X.

Experience of the Groene Loper in zone B at the TU/e campus

Thank you for taking part in this survey about measuring the experience of the pedestrian in zone X at the 'Groene Loper'. By completing this survey we try to get a better understanding of your experience in this zone. The survey should only take 3-4 minutes to complete. Be assured that all the answers you provide will be collected anonymously. The first part of the survey will be about your perception, the second part about the physical environment of the Groene Loper. Below you can find a map to see where zone X is.

The 5 point Likert-scale is used for to grading the answers in the survey research

1 (strongly disagree)	**2** (agree)	**3** (neutral)	**4** (agree)	**5** (strongly agree)

Perception factors

Pleasantness

1. I find zone X a pleasant place to walk.
2. I do not enjoy being at zone X
3. I think zone A provides an interesting walk (attractive buildings, attractive landscape, special elements, etc)
4. I think zone X is an anonymous place.

Vitality

5. I think zone X supports interaction with other people
6. I think zone X is a place to meet new people.
7. I think zone X supports a learning environment.
8. I think zone X is a vibrant place.

Safety

9. I feel safe when walking around zone X
10. At night I feel fearful when walking around zone X
11. I feel safe from cyclists at zone X
12. I think I can safely walk at zone X without being hassled.
13. I can cross the pedestrian paths safely at zone X.

Complexity

14. I think zone X is easy to navigate.
15. I think in zone X the Groene Loper connects well with the buildings.
16. I think the pedestrian paths are logical at zone X.
17. I think the pedestrian paths at zone X are designed for pedestrians.

Physical environment

Pedestrian path design

1. Pedestrian paths at zone X are narrow/wide enough.
2. When it rains or snows, pedestrian paths at zone X are slippery.
3. The surface of the pedestrian paths is pleasant to walk on at zone X.
4. Pedestrian paths are flat without height difference at zone X.
5. Pedestrian paths are well maintained at zone X.

Street furniture and surrounding environment

1. At night, the pedestrian paths are sufficiently lit
2. The landscape at zone A is attractive (trees, flowers, etc).
3. Zone X provides enough sitting elements.
4. The surrounding environment at zone A provides intimacy (a cozy and private or relaxed atmosphere)

Functionality

1. Pedestrian paths and bicycle paths are designed for shared space in zone X
2. Pedestrian paths are designed for only pedestrians in zone X
3. A collision with a cyclist occurs often in zone X
4. Pedestrian paths have lots of obstacles at zone X.

Routing

1. The routing at zone X is very clear.
2. Pedestrian paths are efficient in going from point a to b at zone X.
3. Pedestrian paths are frequently disconnected in zone X.
4. Pedestrian paths have a clear structure at zone A

Demographic factors

1. Age

   (<15, 16-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, 61-65, 66-70, 71-75, 76-80, 81>)

2. Sex

   (male, female, other)

3. Type of user (more options possible)

(Employee TU/e - research/education,
Employee TU/e - supporting,
Employee - other organization then TU/e
Student TU/e
Student Fontys
Student Summa
Student - active board/committee
Resident
International
Visitor
others…

Thank you for completing the survey!
Thank you for taking time to complete this survey. We truly value your response. It will contribute to our analyses to get a better understanding of the Groene Loper.

Appendix 2

	zone 1	zone 2 (A)	zone 3	zone 4	zone 5	zone 6 (B)
width pedestrian path	6 m	5 - 6 m	19,5 m, 34 m and 38,5 m	61,5 m	11 m, 25 m	3 m
lenght pedestrian path	270 m	490 m	108,5 m	75 m	141 m	426 m
materialization path	solid concrete path	concrete tiles, semi-stone bond	big concrete tiles, semi-stone bond	solid concrete slap	big concrete tiles, semi-stone bond	big concrete tiles, semi-stone bond
demarcation path	the landscape / vertical steel elements as border towards the river. It connetcs the train/bus station with the TU/e, the path is crossed by a biclyle path.	no demarcation	big water element along the south side of the area. It is the square beneath the Atlas building, which has coloms on the area.	outside the roof	seating elements along the north side of the path.	no demarcation
amount of trees	1 tree	17 trees	0 trees	0 trees	12 trees at the north side of the path	1 tree at the north side of the path, 9 trees at the south side of the path
seatings	no seatings	no seatings at the path, in the green area between the paths are diverse seating possiblilities	no seatings around, the steps could be used as seating, mostly used in the summe	seating around the green planter	Strip with seating along he north side of the path	none
distance to nearest buildig - North	0 m	18 m	9,5 m	0 m	17 m	26 m
distance to nearest buildig - East	14 m	37m	0 m	30 m	31 m	92 m
distance to nearest buildig - South	67 m	0 m	43 m	27,5 m	45 m	2,5 m
distance to nearest buildig - West	108 m	357 m	-	-	23 m	13 m
height differences	The path has a rolling character, differences height between 0 - 3 meter are experienced	none /minimal height differences	two steps on the west of the zone, 6 steps on the east of the zone	The whole zone is 6 stairssteps higher than the surrounding zones	none /minimal height differences	none /minimal height differences
characteristic path	organic shaped	organic shaped	square like area	square like area	east side a square like area	straight path
special elements	The path is also a bridge over "de Dommel", the path is demarcted by the lifted up path and the vertical steal elements along the path	In the middle of the three paths is a green area with seatings	waterelement on the south side, overstep of the building (Atlas)	It has a roof, piano, big suares with benches, entrance to the canteen and staircase to entrance of Metaforum.	Steel artwork	Footbridge on level 1 crosses the path, yellow picnic table on the north side, old high chimney on the north side, some artworks along the north and south side of the path
characteristic environment - North	grass area with diverse trees, the dommel which is flowing through is park environment and a building situated in this park	building (auditorium) entrance by stairs, in front of this building a row of trees	Grass, building (atlas)	building (metaforum)	Green strip with trees and plants and building entrance with height differences (Gemini)	Waterelement, Markthal (metaforum), entrance with height differences of closest building (CERES), grass/event area
characteristic environment - East	park environment with waterelement and a building with a terrass.	Building (atlas, water element and grass.	Markthal	Steps to the next zone and building (ceres)	Building entrance with height differences (Flux)	Grass area
characteristic environment - South	park environment and behind this park a busy road	Buidling (Vertigo and de Zwarte doos)	Waterelement, building(matrix)	Grass, path and building (Helix and Matrix)	Grass/event area	Grass with artworks/sitting elements, building entrance (Matrix), other buildings, parking area
characteristic environment - West	busy road and park environment	grass field with trees, a river "de Dommel" and a bicycle path.	Grass field	Other zone, waterelement	Small square with tree	Building (Vertigo), park like surrounding (zone 2)
characteristics direct environment:	park-like character with grassfiels, a small river and diverse trees	park-like character with diverse pedestrian paths, a green area between the paths	buildings and large water element	almost like a building with walls and a roof. Open spaces to go through to the other zones	Geometric straight path character with grass/event area at the south side	One continious route from the beginning to the end of the Groene Loper. Geometric straight path character.
green	****	***	-	*	*	**
water	****	-	***	-	-	*
stone/buildings	*	**	***	**	***	****
ongoing route/staying area	ongoing route	ongoing route	ongoing route	staying area	ongoing route and staying area	ongoing route and staying area

Appendix 3

Correlation Analysis	Zone A			
I find zone A a pleasant place to walk	Pedestrian paths are flat without height difference in zone A	.518** .000	**At night I feel safe when walking around in zone A**	At night, the pedestrian paths are sufficiently lit	.403** .008
	At night, the pedestrian paths are sufficiently lit	.405** .008	**I feel safe from cyclists in zone A**	Zone A provides enough sitting elements.	.423** .005
I do enjoy being in zone A	Pedestrian paths in zone A are wide enough	.443** .003		A collision with cyclists rearly occurs in zone A	.497** .001
	Pedestrian paths are flat without height difference in zone A	.553** .000	**hassled**	Pedestrian paths are well maintained in zone A	.336* .029
	Pedestrian paths are well maintained in zone A	.457** .002		A collision with cyclists rearly occurs in zone A	.345* .025
	Pedestrian paths and bicycle paths are designed for shared space in zone A	.332* .032	**I can cross the pedestrian paths safely in zone A**	A collision with cyclists rearly occurs in zone A	.403** .008
	Pedestrian paths are free from obstacles in zone A	.317* .041	**I think zone A is easy to navigate.**	Pedestrian paths and bicycle paths are designed for shared space in zone A	.452** .003
I think zone A provides an interesting walk	Pedestrian paths have a clear structure at zone A	.333* .031	**with the buildings.**	Pedestrian paths in zone A are wide enough	.394** .010
I think zone A is not an anonymous place	Pedestrian paths in zone A are wide enough	.391* .010		Pedestrian paths are flat without height difference in zone A	.471** .002
	The surrounding environment at zone A provides intimacy (a cosy and private or relaxed atmosphere)	-.374* .015		Pedestrian paths and bicycle paths are designed for shared space in zone A	.361* .019
	Pedestrian paths are free from obstacles in zone A	.460** .002		A collision with cyclists rearly occurs in zone A	.358* .020
	The routing in zone A is very clear.	.449** .003		Pedestrian paths are well connected in zone A	.528** .000
I think zone A supports interaction with other people	-		**I think the pedestrian paths are logical in zone A**	The surface of the pedestrian paths are pleasant to walk on in zone A	-.352* .022
I think zone A is a place to meet new people	The surrounding environment at zone A provides intimacy (a cosy and private or relaxed atmosphere)	.402** .008		Zone A provides enough sitting elements.	.541** .000
I think zone A supports a learning environment	Zone A provides enough sitting elements.	.323* .037		The routing in zone A is very clear.	.441** .003
	The routing in zone A is very clear.	.313* .043		Pedestrian paths are efficient in going from point a to b in zone A	.517** .000
	Pedestrian paths have a clear structure at zone A	.363* .018		Pedestrian paths are well connected in zone A	.428** .005
I think zone A is a vibrant place	The landscape in zone A is attractive (trees, flowers, etc).	.345* .025		Pedestrian paths have a clear structure at zone A	.552** .000
	The routing in zone A is very clear.	.460** .002	**for pedestrians**	Pedestrian paths in zone A are wide enough	.362* .018
	Pedestrian paths are well connected in zone A	.336* .029		Pedestrian paths are designed for only pedestrians in zone A	.481** .001
	Pedestrian paths have a clear structure at zone A	.348* .024		Pedestrian paths are free from obstacles in zone A	.305* .049
During daytime I feel safe when walking around in zon	When it rains, pedestrian paths are not slippery	.306* .049			
	At night, the pedestrian paths are sufficiently lit	.389* .011			

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Correlation Coefficient
Sig. (2-tailed)

Appendix 4

Correlation Analysis	Zone B				
I find zone B a pleasant place to walk	Pedestrian paths in zone B are wide enough	.456**	**I feel safe from cyclists in zone B**	Pedestrian paths in zone B are wide enough	.595**
		.002			.000
	When it rains, pedestrian paths are not slippery	.514**		When it rains, pedestrian paths are not slippery	.345*
		.000			.023
	The surface of the pedestrian paths are pleasant to walk on in zone B	.368*		The surface of the pedestrian paths are pleasant to walk on in zone B	.311*
		.015			.043
	Pedestrian paths are well maintained in zone B	.400**		At night, the pedestrian paths are sufficiently lit	.398**
		.008			.008
	The surrounding environment at zone B provides intimacy (a cosy and private or relaxed atmosphere)	.398**		Zone B provides enough sitting elements.	.376*
		.008			.013
	Pedestrian paths and bicycle paths are designed for shared space in zone B	.374*		The surrounding environment at zone B provides intimacy (a cosy and private or relaxed atmosphere)	.461**
		.014			.002
	A collision with cyclists rearly occurs in zone B	.362*		Pedestrian paths and bicycle paths are designed for shared space in zone B	.561**
		.017			.000
	Pedestrian paths are free from obstacles in zone B	.535**		A collision with cyclists rearly occurs in zone B	.589**
		.000			.000
	Pedestrian paths have a clear structure at zone B	.330*	**I think I can safely walk in zone B without being hassled**	Pedestrian paths in zone B are wide enough	.481**
		.031			.001
I do enjoy being in zone B	Pedestrian paths in zone B are wide enough	.443**		When it rains, pedestrian paths are not slippery	.408**
		.003			.007
	When it rains, pedestrian paths are not slippery	.389**		The surface of the pedestrian paths are pleasant to walk on in zone B	.547**
		.010			.000
	The surface of the pedestrian paths are pleasant to walk on in zone B	.589**		Pedestrian paths are flat without height difference in zone B	.370*
		.000			.015
	Pedestrian paths are flat without height difference in zone B	.358*		Pedestrian paths are well maintained in zone B	.480**
		.018			.001
	Pedestrian paths are well maintained in zone B	.375*		The surrounding environment at zone B provides intimacy (a cosy and private or relaxed atmosphere)	.390**
		.013			.010
	Pedestrian paths are free from obstacles in zone B	.340*		Pedestrian paths and bicycle paths are designed for shared space in zone B	.352*
		.026			.020
I think zone B provides an interesting walk (attractive buildings, attractive landscape, special elements, etc)	Pedestrian paths are designed for only pedestrians in zone B	.306*		A collision with cyclists rearly occurs in zone B	.453**
		.046			.002
I think zone B is not an anonymous place	-			The routing in zone B is very clear.	.328*
					.032
I think zone B supports interaction with other people	Zone B provides enough sitting elements.	.444**		Pedestrian paths have a clear structure at zone B	.378*
		.003			.013
I think zone B is a place to meet new people	Zone B provides enough sitting elements.	.339*	**I can cross the pedestrian paths safely in zone B**	Pedestrian paths in zone B are wide enough	.630**
		.026			.000
	The surrounding environment at zone B provides intimacy (a cosy and private or relaxed atmosphere)	.344*		The surface of the pedestrian paths are pleasant to walk on in zone B	.479**
		.024			.001
I think zone B supports a learning environment	The landscape in zone B is attractive (trees, flowers, etc).	.369*		At night, the pedestrian paths are sufficiently lit	.391**
		.015			.009
	Zone B provides enough sitting elements.	.356*		Pedestrian paths and bicycle paths are designed for shared space in zone B	.354*
		.019			.020
	The surrounding environment at zone B provides intimacy (a cosy and private or relaxed atmosphere)	.383*		Pedestrian paths are designed for only pedestrians in zone B	-.373*
		.011			.014
I think zone B is a vibrant place	When it rains, pedestrian paths are not slippery	.373*		A collision with cyclists rearly occurs in zone B	.557**
		.014			.000
	The landscape in zone B is attractive (trees, flowers, etc).	.375*	**I think zone B is easy to navigate.**	When it rains, pedestrian paths are not slippery	.311*
		.013			.042
	The surrounding environment at zone B provides intimacy (a cosy and private or relaxed atmosphere)	.584**		The surface of the pedestrian paths are pleasant to walk on in zone B	.336*
		.000			.027
During daytime I feel safe when walking around in zone B	Pedestrian paths in zone B are wide enough	.435**		Pedestrian paths are flat without height difference in zone B	.418**
		.004			.005
	When it rains, pedestrian paths are not slippery	.430**		Pedestrian paths are well maintained in zone B	.389**
		.004			.010
	The surface of the pedestrian paths are pleasant to walk on in zone B	.592**		Zone B provides enough sitting elements.	-.355*
		.000			.020
	Pedestrian paths are flat without height difference in zone B	.488**		Pedestrian paths are free from obstacles in zone B	.405**
		.001			.007
	Pedestrian paths are well maintained in zone B	.513**		The routing in zone B is very clear.	.533**
		.000			.000
	The landscape in zone B is attractive (trees, flowers, etc).	-.303*		Pedestrian paths are efficient in going from point a to b in zone B	.554**
		.048			.000
	A collision with cyclists rearly occurs in zone B	.346*		Pedestrian paths have a clear structure at zone B	.618**
		.023			.000
	Pedestrian paths are free from obstacles in zone B	.388*	**I think in zone B the groene loper connects well with the buildings.**	Zone B provides enough sitting elements.	.383*
		.010			.011
	The routing in zone B is very clear.	.374*	**I think the pedestrian paths are logical in zone B**	The surface of the pedestrian paths are pleasant to walk on in zone B	.479**
		.013			.001
	Pedestrian paths are efficient in going from point a to b in zone B	.402**		Pedestrian paths are flat without height difference in zone B	.361*
		.008			.017
	Pedestrian paths are well connected in zone B	.357*		Pedestrian paths are well maintained in zone B	.563**
		.019			.000
	Pedestrian paths have a clear structure at zone B	.468**		Pedestrian paths are designed for only pedestrians in zone B	.338*
		.002			.027
At night I feel safe when walking around in zone B	When it rains, pedestrian paths are not slippery	.328*		Pedestrian paths are free from obstacles in zone B	.417**
		.032			.005
	The surface of the pedestrian paths are pleasant to walk on in zone B	.434**		The routing in zone B is very clear.	.530**
		.004			.000
	Pedestrian paths are flat without height difference in zone B	.386*		Pedestrian paths are efficient in going from point a to b in zone B	.575**
		.011			.000
	Pedestrian paths are well maintained in zone B	.353*		Pedestrian paths are well connected in zone B	.440**
		.020			.003
	At night, the pedestrian paths are sufficiently lit	.316*		Pedestrian paths have a clear structure at zone B	.738**
		.039			.000
	The routing in zone B is very clear.	.319*	**I think the pedestrian paths in zone A are designed for pedestrians**	Pedestrian paths in zone B are wide enough	.549**
		.037			.000
	Pedestrian paths are efficient in going from point a to b in zone B	.363*		The surface of the pedestrian paths are pleasant to walk on in zone B	.351*
		.017			.021
	Pedestrian paths are well connected in zone B	.326*		Pedestrian paths are well maintained in zone B	.337*
		.033			.027
	Pedestrian paths have a clear structure at zone B	.488**		Pedestrian paths are designed for only pedestrians in zone B	.304*
		.001			.048
				A collision with cyclists rearly occurs in zone B	.351*
					.021
				Pedestrian paths are free from obstacles in zone B	.322*
					.035
				Pedestrian paths are efficient in going from point a to b in zone B	.378*
					.013
				Pedestrian paths are well connected in zone B	.444**
					.003
				Pedestrian paths have a clear structure at zone B	.411**
					.006

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Correlation Coefficient
Sig. (2-tailed)

Appendix 5

Zone A		Wednesday 12/Dec	Monday 17/Dec	Wednesday 19/Dec	total number	percentage per entry	percentage total
number of pedestrians		1431	1578	1267	4276	100.00%	75.15% pedestrians
	enter 1	82	63	58	203	4.75%	
	enter 2	281	261	339	881	20.60%	
	enter 3	95	129	89	313	7.32%	
	enter 4	102	92	79	273	6.38%	
	enter 5	27	115	21	163	3.81%	
	enter 6	274	202	220	696	16.28%	
	enter 7	123	171	108	402	9.40%	
	enter 8	172	205	151	528	12.35%	
	enter 9	275	340	202	817	19.11%	
number of cyclists		501	465	448	1414	100.00%	24.85% cyclists
	enter 1	19	5	10	34	2.40%	
	enter 2	136	113	125	374	26.45%	
	enter 3	84	58	78	220	15.56%	
	enter 4	44	44	30	118	8.35%	
	enter 5	18	33	18	69	4.88%	
	enter 6	0	0	1	1	0.07%	
	enter 7	128	147	117	392	27.72%	
	enter 8	0	4	1	5	0.35%	
	enter 9	72	61	68	201	14.21%	
scooters		4	0	1			
	enter 1	0	0	0			
	enter 2	2	0	1			
	enter 3	0	0	0			
	enter 4	0	0	0			
	enter 5	0	0	0			
	enter 6	0	0	0			
	enter 7	2	0	0			
	enter 8	0	0	0			
	enter 9	0	0	0			
cars		3	2	0			
	enter 1	0	0	0			
	enter 2	1	0	0			
	enter 3	0	0	0			
	enter 4	2	0	0			
	enter 5	0	0	0			
	enter 6	0	0	0			
	enter 7	0	1	0			
	enter 8	0	0	0			
	enter 9	0	1	0			
totaal					5690		
use							
pedestrian crossing the grass (amount)		98	61	81	240	5.61%	
	grass 1	31	11	22			
	grass 2	2	4	2			
	grass 3	45	30	41			
	grass 4	17	15	13			
	grass 5	3	1	3			
cyclists crossing the grass		1	4	4	9	0.64%	
	grass 1	0	0	0			
	grass 2	0	0	0			
	grass 3	1	0	1			
	grass 4	0	2	3			
	grass 5	0	2	0			
standing still		78	51	40	169	3.95%	
	pedestrian	71	44	34			
	pedestrian with bike	7	7	6			

Appendix 6

Zone B	Wednesday 12/Dec	Monday 17/Dec	Wednesday 19/Dec	total number	percentage per entry	percentage total
number of pedestrians	**769**	**548**	**567**	1884	100.00%	72.60% pedestrians
1 enter west	295	222	209	726	38.54%	
enter west						
2 pond	29	7	23	59	3.13%	
3 enter east	85	106	74	265	14.07%	
enter east						
4 markthal	36	30	15	81	4.30%	
5 enter south	26	36	35	97	5.15%	
enter south						
6 matrix entrance	43	32	38	113	6.00%	
7 enter north	207	100	121	428	22.72%	
enter north						
8 markthal	35	12	41	88	4.67%	
enter north						
9 pond	13	3	11	27	1.43%	
amount of cyclists	**301**	**204**	**206**	711	100.00%	27.40% cyclists
1 enter west	166	114	128	408	57.38%	
enter west						
2 pond	0	0	0	0	0.00%	
3 enter east	120	79	69	268	37.69%	
enter east						
4 markthal	0	0	0	0	0.00%	
5 enter south	15	10	8	33	4.64%	
enter south						
6 matrix entrance	0	0	0	0	0.00%	
7 enter north	0	1	1	2	0.28%	
enter north						
8 markthal	0	0	0	0	0.00%	
enter north						
9 pond	0	0	0	0	0.00%	
Scooter	**0**	**0**	**2**	2		
enter west	0	0	0	0		
enter west						
pond	0	0	0	0		
enter east	0	0	0	0		
enter east						
markthal	0	0	0	0		
enter south	0	0	2	2		
enter south						
matrix entrance	0	0	0	0		
enter north	0	0	0	0		
enter north						
markthal	0	0	0	0		
enter north						
pond	0	0	0	0		
totaal				2595		
use						
pedestrian crossing the grass (amount)	468	285	401	1154	61.25%	
grass 1	199	88	151			
grass 2	141	81	134			
grass 3	79	84	69			
grass 4	49	32	47			
cyclists crossing the grass	32	35	18	85	11.95%	
grass 1	15	19	10			
grass 2	2	0	1			
grass 3	13	11	3			
grass 4	2	5	4			
standing still	33	15	21	69	3.66%	
pedestrian	32	13	20			
pedestrian with bike	1	2	1			

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