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Protected bicycle lanes and cyclists' perceptions of safety: a case study of Groningen and Berlin

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Abstract

Currently, sustainable mobility options are on the rise in cities as governments actively promote public transportation, cycling and walking over private motor vehicles. In particular, cities have focused on incentivizing cycling by building adequate infrastructure to improve road safety and decrease real and perceived accident risk. This paper explores the effect of protected bicycle lanes on cyclists' perceptions of safety in Groningen as well as how these lanes can be implemented in Berlin. Groningen is chosen to better understand the impact of protected bicycle lanes on safety perception in a city where a cycling culture is well-established. Meanwhile, research in Berlin gives insight into the challenges of implementing a bicycle lane network and how the size of a city impacts it. Moreover, Groningen serves as a more advanced example from which Berlin can learn. Two surveys were created for data collection: one in Groningen and one in Berlin. Additionally, government documents and websites were used to complete the research for Berlin. The paper discovers that safety when cycling is defined by the participants as feeling relaxed and having a low risk of accidents. Road safety in Groningen is still a concern and the most preferred form of separation seems to be a curb, as it provides a vertical component and does not leave cyclists feeling entrapped. Lastly, the main challenges highlighted in Berlin regarding implementation are making the lanes wide enough as well as creating a network throughout the city. These insights underline the indispensability of a physical, vertical separation when constructing bicycle lanes and the importance of creating a network for increased road safety and higher cycling incentives.

Key words: sustainable mobility, protected bicycle lanes, bicycle lane network, cyclists' safety perceptions, road safety, spatial redistribution

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1. Introduction

1.1 Background

Cities throughout the world are currently focusing on promoting cycling as a means of transportation. Switching to sustainable transport modes, such as cycling, provides numerous advantages at the societal and individual levels. These include reduced carbon dioxide emissions contributing to a cleaner environment, lower costs for users and health benefits due to increased activity (Kiviluoto et al., 2022). Cycling is also revealed to be the fastest transport mode for trips of less than five kilometres, making it the ideal mode of transportation for medium-sized cities (Wei and Lovergrove 2013).

Groningen in the Netherlands is an example of one of the world's most progressive cities regarding cycling legislation, infrastructure, and usage. With a population of approximately 200,000, the municipality of Groningen estimates that 61% of trips in the city are made by bicycle. Only 36% of the trips are done by car and 3% by public transportation (Gemeente Groningen, 2015). The city began its transition towards this in 1977 when the Traffic Circulation Plan was established (Gemeente Groningen, 2015). As a result, more space was made for cyclists and pedestrians in the city centre while cars were pushed to the margins on the ring roads. Moreover, Groningen's municipality focused on implementing cycling-specific infrastructure across the city in the form of protected bicycle lanes. These lanes separate cyclists from traffic through a physical barrier, enhancing safety and convenience while increasing the number of bicycle journeys in the city.

Berlin has been at the forefront of initiatives in Germany to encourage cycling among people and has been actively involved in the shift towards a more bicycle-friendly culture. According to Creutzig et al., the modal split for trips in Berlin is 30% walking, 27% public transit, 18% cycling, and 26% driving (2020). In the same study by Creutzig et al., it was discovered that only 6% of the space was designated for cycling, while 60% was used for driving lanes and car parking (2020). This disparity demonstrates how Berlin's street planning is still car-oriented, limiting the possibilities for cyclists. However, Berlin is a suitable city for implementing bicycle infrastructure as it is flat and has a dense network of smaller streets as well as many wide city roads (Senate Department for Urban Development and the Environment, 2013).

An effort to implement bicycle infrastructure in Berlin was seen during COVID-19 when the government created temporary cycling lanes, also known as pop-up bike lanes (Becker et al., 2022). This idea was part of a collective effort throughout Europe to reallocate street space in order to enhance sustainable mobility options. In Berlin, the pop-up bike lanes proved to be successful, as cycling usage increased by an average of 73% in the following twelve months after they were implemented (Becker et al., 2022). In a survey conducted with bicycle users, most people were satisfied with the pop-up bike lanes as they made cycling safer by increasing the distance from cars, increasing the visibility of cyclists and making cycling more stress-free (Becker et al., 2022). However, some cyclists complained that the bicycle lanes were still too narrow, making them dangerous for overtaking and blocked by several obstacles such as parked cars, delivery vans, or taxis (Becker et al., 2022). A key lesson to learn from these pop-up bike lanes is that a completely different distribution of street space in Berlin is both possible and has already occurred. They can

serve as the foundation for establishing protected bike lanes as a permanent element of the city to incentivize sustainable travel behaviours.

1.2. Research problem

Protected bike lanes as a form of bicycle infrastructure are often discussed with regard to how they can make cycling more convenient and create a safer environment for cyclists on the road. While the city of Groningen has a well-established network of protected bike lanes, Berlin still faces the challenge of having the proper infrastructure to increase cycling levels to the desired amount.

While there is literature exploring the positive effects of bicycle lane implementation on safety in cities that lack bicycle infrastructure, it is interesting to explore if protected bicycle lanes still have an impact on safety even in a city like Groningen, where a bicycle culture is already established. This is essential as bike safety is arguably more important in a city where cycling is the main mode of transport. There are more users on the road, thereby requiring a higher-quality bicycle infrastructure in order to ensure safety and convenience. Moreover, as the EU Urban Mobility Framework of 2021 aims to promote sustainable modes of transport to decrease carbon emissions, aspects of cyclists' safety and the construction of separated bicycle infrastructure are key in the ongoing discussion. Lastly, the comparison of Berlin and Groningen serves as a useful way to pinpoint the elements of Groningen's bicycle infrastructure that work well and provide transferrable lessons that can help Berlin implement similar practises. Therefore, in this thesis, the aim is to investigate the following question:

How do protected bicycle lanes in Groningen affect cyclists' perceptions of safety and how can these lanes be implemented in Berlin?

In order to help answer the main research question, the following sub-questions have been formulated:

1. *What are the advantages of protected bicycle lanes compared to other types of bicycle lanes?*
2. *Do protected bicycle lanes create a more positively safe cycling experience for cyclists in Groningen?*
3. *How do cyclists currently feel about cycling in Berlin in terms of safety on the road?*
4. *What are the challenges that arise from the implementation of protected bicycle lanes in Berlin?*

1.3. Structure of the thesis

The research paper starts by exploring relevant concepts as part of the theoretical framework. Then, in the methodology section, the data collection and data analysis processes are explained. This is followed by the results section, in which the findings are discussed. Lastly, the conclusion section summarises the findings and identifies the main points that can be taken away from the research.

2. Theoretical Framework

2.1. Protected bike lanes

Building protected bike lanes is one way cities can expand their network of cycling infrastructure. What distinguishes these lanes is that they are physically separated from motor traffic and distinct from the sidewalk (McNeil, Monsere and Dill, 2015). Theoretically, this physical separation enhances the safety of cyclists as they are no longer put into vulnerable situations next to motorised vehicles (Becker et al., 2022). However, it is essential to define what constitutes a physical separation. There are different types of buffers that city planners use when separating the car road from the bicycle lane. Buffers can include a painted line on the street, bollards, cones, a curb, or other permeable or semi-permeable obstacles that impede cars from going in the bicycle lane (McNeil, Monsere and Dill, 2015). In a survey done in Portland by McNeil, Monsere and Dill, results revealed that buffer types without some sort of vertical protection had the lowest perceived safety rating among cyclists (2015). According to the same survey, a physical curb offers a higher level of comfort and safety than a bicycle lane that is marked with cones or is demarcated by a painted line (McNeil, Monsere, and Dill, 2015).

In Groningen, protected bicycle lanes can be in the form of a two-way lane on one side of the street or one-way lanes on both sides of the street. A "fietsstraat" is a special example where the bicycle has priority and the car is treated as a guest on the road (Gemeente Groningen, 2021). These lanes are an example of how the municipality of Groningen creates an incentive for cycling by providing cyclists with safe infrastructure and by putting the car in second place. Meanwhile, in Berlin, the temporary pop-up bike lanes are characterised by the addition of bollards, painted lines and bicycle pictograms on the specified section of the street (Becker et al., 2022). The choice of buffer has been questioned by some cyclists, as they continue to feel unsafe due to the close proximity of parked cars and the insufficient space in the lane (Becker et al., 2022). When planning for permanent bicycle infrastructure in Berlin, the Senate Department for Mobility, Traffic, Climate Protection and the Environment asserts that protected bicycle lanes should be at least two metres wide to give cyclists room to overtake (2018). Additionally, as seen in Figure 1, the guideline is that there should be a one-metre distance between the bicycle lane and the car parking space to ensure that cyclists are not in danger of parked vehicles or opened car doors.

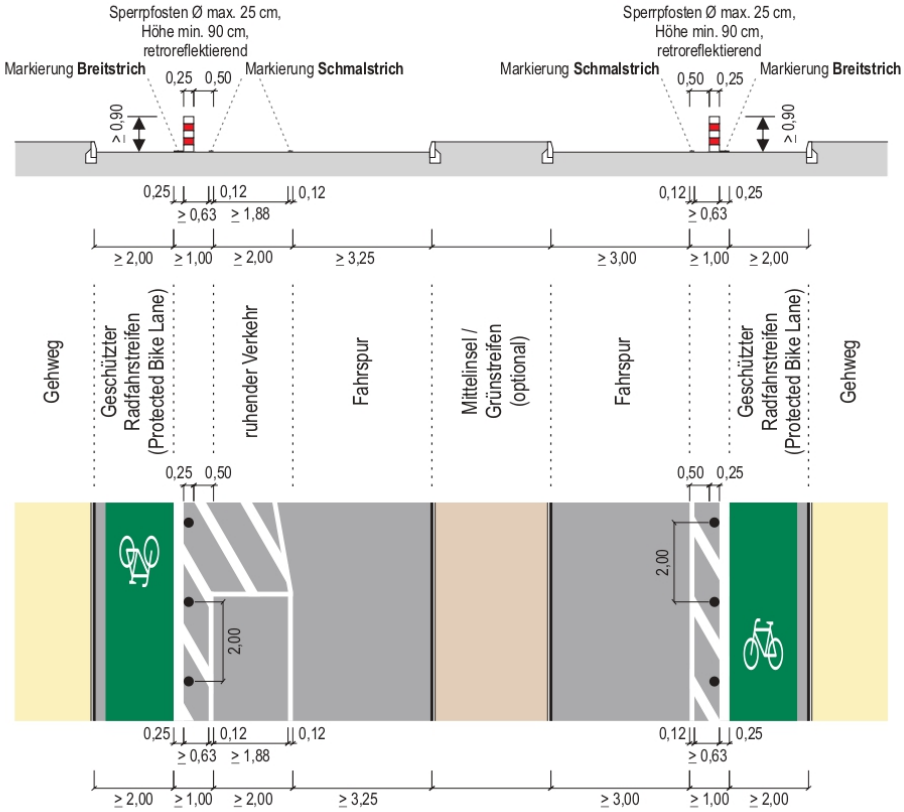

Figure 1: Protected bicycle lane measurements (www.berlin.de, 2022)

2.2. Cyclists' perceptions of safety

The perception of safety is, by definition, a subjective concept as it is affected by each individual's experiences and beliefs. However, the concept of safety is greatly associated with the exposure to accident risk that cyclists face when they commute by bike (Sanders, 2015). This perceived traffic risk is an understudied phenomenon, yet it has a significant impact on whether an individual will choose to commute by bicycle (von Stülpnagel and Binnig, 2022). Subjective risk perception can be explained as the way cyclists perceive the existence of hazards and risks. This is made up of several elements including perceived crash probability and consequences, the feeling of comfort when cycling and the capability of being in control of a situation (von Stülpnagel and Binnig, 2022). This perceived crash risk tends to be higher than the actual crash risk as people overestimate the dangers on the road (von Stülpnagel and Binnig, 2022). It is also noted that the influence of this perceived traffic risk decreases with cycling frequency (Sanders, 2015).

According to a study done by Teixeira et al., cyclists' comfort levels decrease with greater proximity to motorised traffic (2020). This is even more negatively affected when there is increased traffic on the street and when speed limits are high (Teixeira et al., 2020). A different study done by von Stülpnagel and Binnig, in which models of cycling situations were presented to people, showed that having sufficient space was one of the most impactful factors affecting people's perceptions of safety (2022). This meant that wide cycling

lanes had a much higher rating than narrow ones. Contrarily, vehicles parked along roads had a negative impact on the degree of subjective safety. The opening of car doors was considered a big risk and cyclists did not feel comfortable trapped between parked cars on one side and moving cars on the other (von Stülpnagel and Binnig, 2022). Overall, while the perception of safety can be influenced by certain attributes of a person, such as age, gender, cycling ability, cycling frequency and current mental and physical state, it remains a valuable factor to study and consider when designing bicycle infrastructure and policies to promote cycling.

2.3. Spatial redistribution

Streets in the city are multifaceted since they suit a variety of users' needs. The distribution of space dictates which functions have priority or are incentivized. It has been found that the car-oriented paradigm of urban development is still the most common one employed throughout cities (Creutzig et al., 2020). However, as cities begin to transition towards more sustainable and active modes of transport such as walking, cycling and public transport, street space needs to be repurposed to fit the new demand. Therefore, spatial redistribution is a strategy urban planners use to build new cycling infrastructure, like protected bicycle lanes. The government in Berlin implemented this action plan during COVID-19 to convert parking spaces and areas for vehicles into lanes for bicycles. The aim was to improve traffic safety and provide more space for pedestrians and cyclists (Becker et al., 2022).

The strategy of spatial redistribution also connects with the concept of fair street space allocation. This can be explored by investigating the current division of space between modes of transport, the modal share they each have, and the externalities they produce when using them (Creutzig et al., 2020). Fair street space allocation can guide urban planners by assessing how the current space is distributed and whether that needs to be changed to meet the intended outcome of the plan. For instance, only 3% of Berlin's traffic areas are designated for cycling, despite the fact that cycling accounts for 18% of all journeys made in the city (Becker et al., 2022). This shows how street space in Berlin seems to be unfairly allocated to favour motorised vehicles. Additionally, compared to bicycles, cars produce more negative externalities such as air pollution, noise pollution and adverse health effects (Creutzig et al., 2020). Therefore, it is reasonable to argue for efforts to be made in Berlin to reduce car space and make more room for bicycle lanes in the city.

2.4. Conceptual model

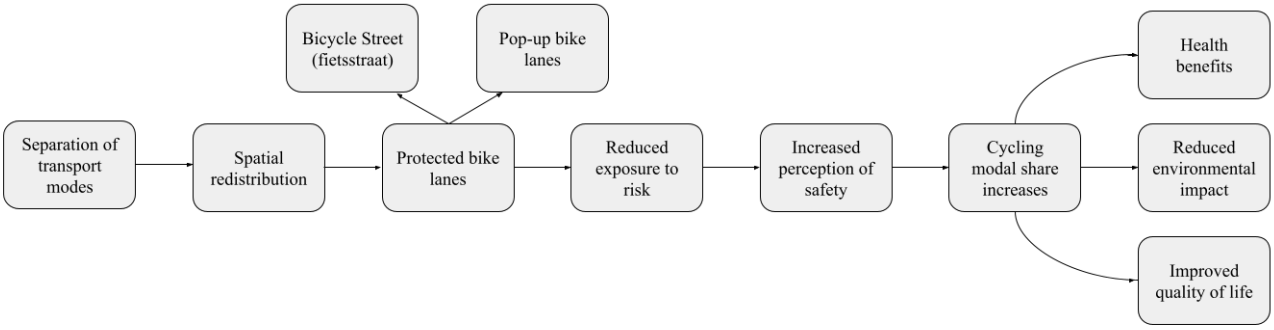

Figure 2: Conceptual model

The conceptual model in Figure 2 visually highlights the connections between the various concepts explored in the theoretical framework. The separation of transport modes is achieved through governmental policies set forth, for example, in mobility acts. This separation can be achieved through spatial redistribution, where more space is allocated to the desired transport mode, in this case, bicycles. Protected bicycle lanes are created, which reduce the exposure of cyclists to risk and, therefore, increase the perception of safety. Examples of protected bicycle lanes are "fietsstraats" in Groningen and pop-up bike lanes in Berlin. The heightened feeling of safety should, in theory, lead to an increase in the number of bike users. This, in turn, generates positive individual, social and environmental effects such as increased health benefits, improved quality of life and reduced environmental impact.

2.5. Expectations

As literature suggests, protected bicycle lanes are meant to increase cyclists' perceived level of safety (Foster et al., 2015). The expectation for this research is that they should have a positive effect on the perceived safety of cyclists in Groningen, yet it may not be as significant as in cities where cycling is not the main transportation mode, such as Berlin. As a cycling culture is already established in Groningen, it is expected that people will be more confident in their cycling abilities and feel safer cycling on any type of street. Thus, protected bike lanes would add more value in a context where cycling is not as prevalent. The expectation for Berlin is that people currently feel more unsafe while cycling in the city and that the implementation of protected bicycle lanes would have a significant impact on perceived safety and the willingness to cycle. However, the implementation of bicycle lanes is expected to come with multiple challenges, such as creating sufficient space for the lanes and achieving a well-connected network. Additionally, McNeil, Monsere and Dill found in their study that women's decision to cycle relies more heavily on their perception of safety and that they tend to prefer more separated facilities (2015). Thus, it is expected that perceptions of safety may be lower in female participants compared to male participants and in international cyclists compared to Dutch or German cyclists.

3. Methodology

3.1. Case studies

For this research, data is collected in two different locations, namely Groningen and Berlin. While Groningen has encouraged cycling as a primary means of transportation for the last fifty years, Berlin only began this transition five years ago. Comparing the two cities can reveal how much protected bicycle lanes affect cyclists' perceptions of safety based on how deeply engrained a cycling culture is in society and how frequently people bike there. Furthermore, Berlin can learn from Groningen's extensive cycling infrastructure development and successful integration of cycling as a primary mode of transportation in order to improve its own efforts to develop cycling infrastructure.

3.2. Survey design

Two surveys are created, one for Groningen and another for Berlin. A survey is a suitable way to gather data about cyclists' perceptions of safety, as perception is subjective. Thus, by allowing people to express their opinions, primary qualitative data adds to the research by revealing how people interpret safety and how this is affected by bicycle infrastructure when cycling. The target population for the surveys is university students as cycling tends to be their preferred mode of transport since it is efficient and affordable (De Paepe et al., 2018). This decision facilitates the data collection process by increasing the likelihood that there will not be a language barrier and allowing for the survey to be distributed widely to ensure more responses. However, one limitation is that the research will not be able to comment on how age impacts cyclists' perceptions of safety.

The survey created for data collection in Groningen is designed to answer the first two sub-questions. The survey consists of nineteen closed questions and one open question for comments (see Appendix 1). The closed questions facilitate the analysis of the data and maximise the chance that people will answer. Most of the survey questions are formulated as statements relating to how safe cyclists feel in certain situations. Participants are also asked to define what safety is for them when cycling, either by selecting predefined options drawn from a synthesised overview of literature or by offering their own response. Furthermore, inspiration is taken from the study of von Stülpnagel and Binnig where participants were asked to rate different types of bicycle lanes based on safety (2022). This is replicated in the Groningen survey, where participants are shown five different bicycle lanes in Groningen and asked to rank how safe they perceive them on a scale of one to four. The survey has been distributed online through large group chats containing a mix of international and Dutch university students over the course of a week. Participants were also asked to spread the survey to their fellow classmates. This has the limitation that the researcher does not have control over who ends up taking the survey, yet it assists in maximising responses. In the end, 86 responses have been recorded.

The survey created for data collection in Berlin is designed to answer the third and fourth sub-questions. It is also composed of seventeen closed questions and one open question for comments (see Appendix 2). The survey questions look into what safety entails for cyclists and how they currently feel about road safety in Berlin. Moreover, there are questions about the satisfaction of the government's current efforts to provide bicycle lanes and the potential challenges to implementing them. The response options regarding the

challenges of implementation have been formulated based on issues mentioned in Berlin's governmental documents and relevant literature. The survey has been distributed online through group chats. Additionally, throughout the STOURIE (Sustainable Transformation of Urban Regions in Europe) trip to Berlin, people have been approached on the streets and provided with a QR code or the possibility to fill out the survey on the spot with the researcher. Ultimately, 25 responses have been gathered.

3.3. Secondary data

Secondary data is used to complete the research for the fourth sub-question. As there was limited time to collect data in Berlin, it was not possible to get as many survey results as in Groningen. Therefore, information about the current strategies taken by the government to provide bicycle infrastructure and the challenges of implementing protected bicycle lanes in Berlin is taken from official government documents and websites.

3.4. Ethical considerations

Both surveys include a description at the start that informs the participants what the research is about and how the data will be used. It is made clear that participation in the survey is voluntary and that they can stop at any moment, should they wish to. In order to ensure the privacy of the participants, the surveys are made so that the responses recorded are anonymous and no personally identifying questions are asked. Only the nationality and gender are asked, yet for the gender, an option of "prefer not to say" is included. The researcher is the only one with access to the data, as it is stored in an Excel file on the researcher's device.

3.5. Data analysis

The primary data collected from the surveys is analysed using Excel and SPSS. When inputting the data from the surveys into SPSS, the variables are recoded from nominal values to scale variables in order to compare means. Moreover, in order to see if gender or nationality (whether the respondent is Dutch or international) influence the cyclists' perception of safety, statistical tests are undertaken. One-way ANOVA tests are conducted one by one between variables Q5, Q6, Q7, Q8 and Q9 and variables Q19 and Q20 (see Appendix 3). The same is investigated for the survey data from Berlin by running one-way ANOVA tests between variable Q12 and variables Q16 and Q17 (see Appendix 3). The data from the two surveys is also analysed using descriptive statistics. This is presented in the form of graphs and charts.

4. Results

4.1. Cyclists' perceptions of safety in Groningen

The 86 survey responses are composed of 53 female respondents and 33 male respondents, of whom 60 are internationals and 26 are Dutch. It is seen that 84% of respondents cycle almost every day, which matches the fact that cycling is the most convenient form of transport in Groningen, especially among university students (Gemeente Groningen, 2015). Additionally, 88% of respondents said they are either very confident or at least somewhat confident in their cycling abilities. This can also be traced to the dominant cycling culture in the city, and will be interesting to assess how protected bicycle lanes impact the perception of safety among experienced cyclists.

When asked to define what feeling safe while cycling means for them, as seen in Figure 3, 67% of participants chose the option of feeling comfortable and relaxed, while 64% also chose the option of having a lower risk of crashing or injury. This shows that safety is indeed associated with a perceived crash risk, yet even more so with a feeling of comfort and not having to worry while cycling.

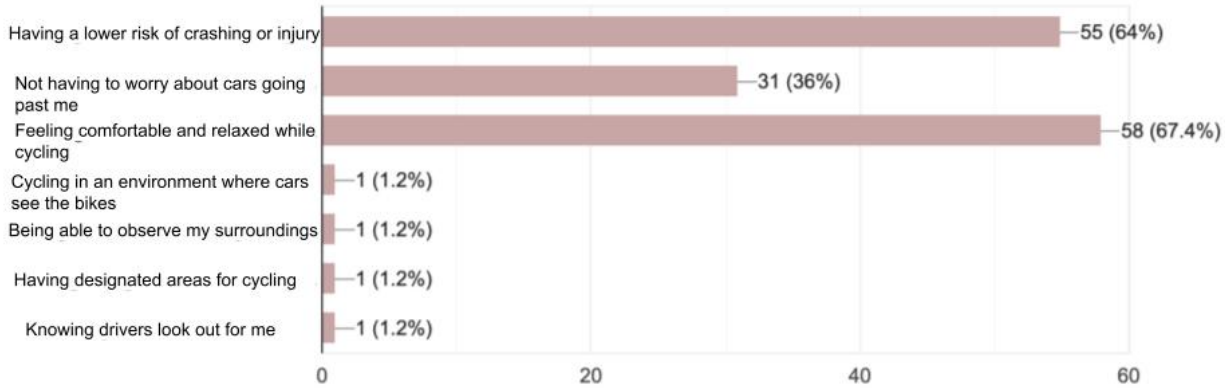

Figure 3: For me feeling safe when cycling means… (Q3 ~ multiple answers possible)

As seen in Table 1, the highest-ranking bicycle lane in terms of safety perception is the one on Eikenlaan that is protected from the car road by a physical and vertical separation (see Appendix 1 for original photos). Almost as highly ranked is the "fietsstraat" on Bessemoerstraat, which is the other protected bicycle lane where cars are considered guests. These findings confirm the expectation that cyclists' perception of safety is indeed higher when they cycle on a protected bicycle lane. The mean rank given to the Boterdiep bicycle lane shows how a vertical component to the separation of the lanes has an impact on the perceived safety of cyclists. When vehicles can still, in theory, enter the bicycle lane, this creates a more unsafe atmosphere for the cyclists (McNeil, Monsere and Dill, 2015). The Folkingestraat bicycle lane was ranked almost the same as the Boterdiep bike path, showing how, even though cars are not present there, pedestrians are also a concern for cyclists' safety. Lastly, the Nieuwe Ebbingestraat was ranked as the least unsafe. This follows the research's expectations, as it is a street where the bicycle lane is not separated from the car road and where cyclists are forced to bike next to moving vehicles.

Street name	Type of bicycle lane	Mean rank of perceived safety (1-4)
Bessemoerstraat	Protected bicycle lane where cars are considered guests (fietsstraat)	3.7
Boterdiep	Separated bicycle lane by a painted line	2.9
Eikenlaan	Protected bicycle lane separated by curb	3.8
Nieuwe Ebbingestraat	Bicycle lane not separated from car road	2.3
Folkingestraat	Bicycle lane not separated from pedestrian road but cars not present	2.8

Table 1: How safe would you feel cycling on this street? (Q5-Q9)

The expectation was that there would be a difference in perception of safety for female participants compared to male participants, as well as for international cyclists compared to Dutch cyclists (McNeil, Monsere and Dill, 2015). This was tested by using the mean ranks to perform one-way ANOVA tests (see Appendix 3). However, the only test that gave a significant result was the one comparing the Dutch survey respondents with the international survey respondents for the Folkingestraat. The test had a significant p value of 0.032, as the mean rank for the Dutch was 3.2, while for the internationals it was 2.7. What can be concluded from this is that the shared space of Folkingestraat is a Dutch phenomenon that international cyclists are not used to, causing a discrepancy in their safety perceptions. Besides this, surprisingly, there was no other difference between the female and male respondents or the internationals and Dutch. This may be attributed to the bias of the highly experienced cyclists in the survey sample or to the widespread cycling culture in Dutch society.

When asked whether the person had experienced an accident while cycling in Groningen, 29% of participants responded that they had one, while 16% of respondents experienced more than one. The most common stated cause of these accidents is colliding with an object or another cyclist and the type of lane on which it most frequently occurs is on bicycle lanes that are not separated from cars. This occurrence connects to the mean rank of perceived safety given to each bicycle lane, as the one not separated from the car road is ranked lowest. Moreover, it solidifies how accidents are more likely to happen when there is no separation, leading to a lower subjective perception of safety (von Stülpnagel and Binnig, 2022).

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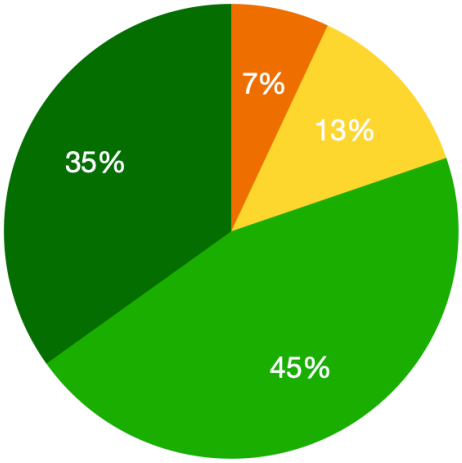

Figure 4: I feel more safe cycling on a bicycle lane that is physically separated from the pedestrian road than when there is no separation. (Q13)

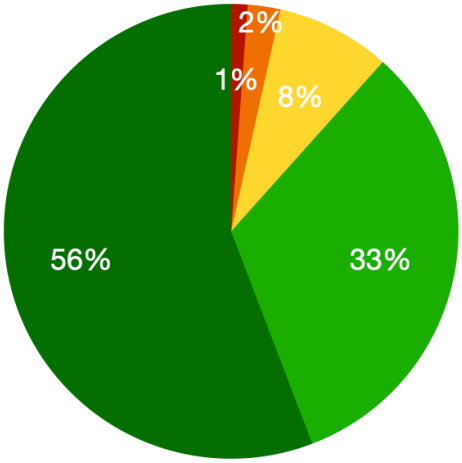

Figure 5: I feel more safe cycling on a bicycle lane that is physically separated from the car road than when there is no separation. (Q14)

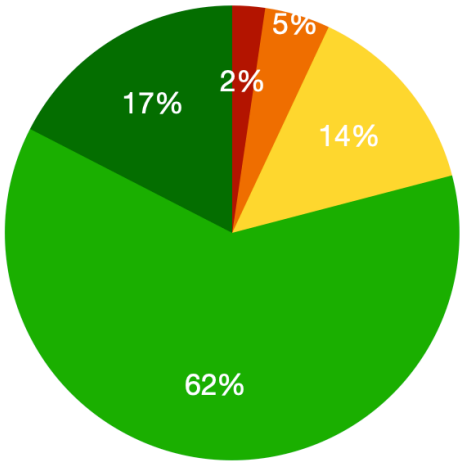

Figure 6: When I am cycling on a road where there is no separation between the bicycle lane and car road and cars are going past me, I feel more nervous and am more cautious of my movements. (Q15)

As seen in Figures 4 and 5, people are more concerned about bicycle lanes being separated from the car road than the pedestrian road, as a higher percentage of the respondents agree or strongly agree with the statement in Q14 compared to Q13. However, having the bicycle lane separated from pedestrians still seems like an important aspect, as 80% of the participants either agree or strongly agree with this. This can be traced back to the mean rank of safety given to the Folkingestraat, where there is no separation between pedestrians and bicycles, and the discrepancy between the Dutch and international rankings. Figure 6 also shows how 79% of people either agree or strongly agree with the fact that they feel more nervous when forced to cycle next to moving vehicles. This is bound to negatively impact their perception of safety, especially since the most common criteria for what they define safety as when cycling is “feeling comfortable and relaxed.” The finding is supported by a study done by Teixeira et al. which found a negative correlation between proximity to vehicles and cyclists’ comfort levels (2020).

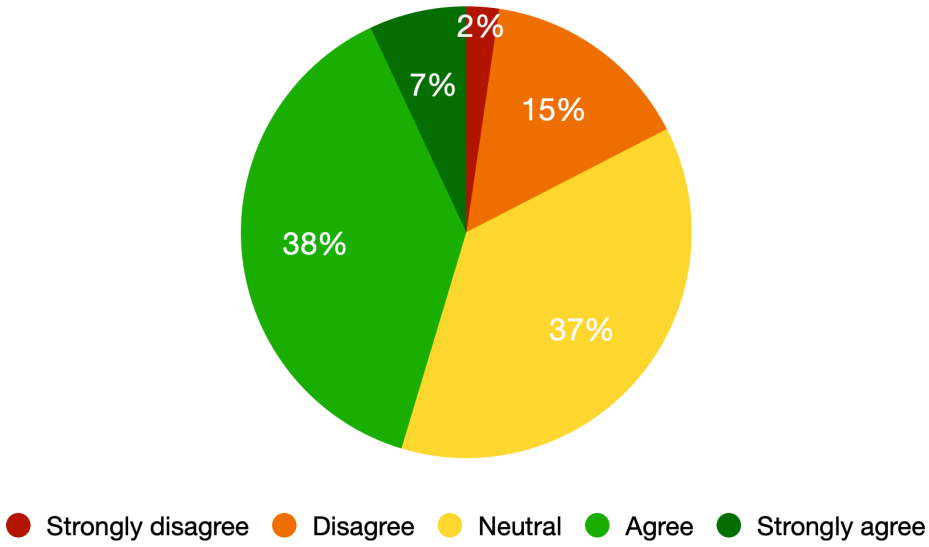

Figure 7: I believe that the municipality of Groningen should make more space for bicycles in the form of protected bicycle lanes to make me feel safer while cycling in the city. (Q17)

Participants were also asked whether they believed the municipality of Groningen should make more efforts to provide space for bikes in the form of protected bicycle lanes. As seen in Figure 7, 45% of participants either agree or strongly agree with the statement, while an additional 37% are neutral about it. What can be understood from this is that even in a city like Groningen, where bicycle infrastructure is already quite well established compared to other European cities, some residents may still feel like more can be done. One downside to making more space for bicycle infrastructure is highlighted by one of the respondents, who states, "I would like more physically separated bike lanes, but I do not want even more construction in Groningen." Indeed, this is a challenge connected to the construction of new bike infrastructure. A different concern that was brought up by a respondent is that bicycle lanes should be broader. This relates to another comment made by a participant: "I do wish that scooters were not always allowed on the bike paths, as I feel like the fact that they go with significantly higher speeds than cyclists makes it dangerous sometimes to bike." Having wider bicycle lanes is something that can be considered for future infrastructure plans, as this can further increase perceived safety levels among cyclists and deal with concerns about having scooters in the same space as bicycles.

4.2. Current safety perceptions of cyclists in Berlin

The 25 survey responses collected in Berlin are made up of fourteen female respondents and eleven male respondents, of whom thirteen are international and twelve are German. Out of the respondents, 96% rate their cycling skills as very confident or at least somewhat confident and the majority of them stated that they cycle almost every day. This sample is representative of more advanced cyclists and so the results may point to higher safety perceptions compared to the average Berlin population.

As seen in Figure 8, when asked what feeling safe when cycling means for them, 80% of the people answered that it means having a lower risk of crashing or injury. Additionally, 60% mentioned that it means to feel comfortable and relaxed while cycling. These results are similar to those collected in Groningen,

emphasising the importance of a relaxed environment for cyclists to fully feel safe as well as removing the risk of injuries or near-accidents. Moreover, 64% of respondents are neutral about feeling safe when cycling in Berlin, while 24% disagree that they feel safe. These percentages illustrate the current safety perception of cycling in Berlin, and while they are higher than expected, they provide a starting point from which improvements can be made. The percentages may also be influenced by the highly skilled cyclists in the survey sample.

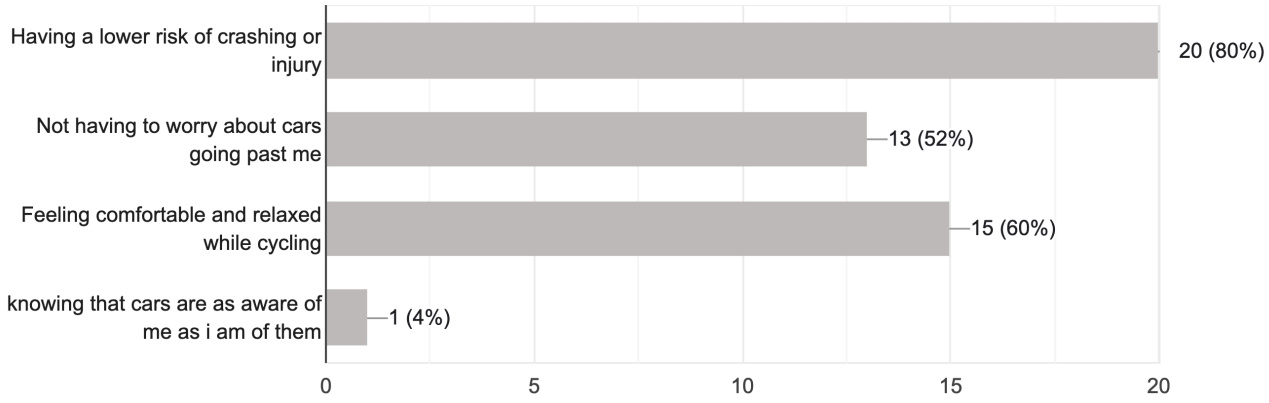

Figure 8: For me feeling safe when cycling means… (Q3 ~ multiple answers possible)

In the survey, 92% of the participants stated that they had cycled on a pop-up bicycle lane before. Out of those, only 16% of them were satisfied with their experience, while 67% were neutral and 17% were unsatisfied. Figure 9 illustrates that the most common improvement the participants wish to see is better protection between the bicycle lane and the car road. While most pop-up bicycle lanes are separated by painted lines or bollards, a larger, physical separation seems desirable to increase the perception of safety among cyclists (ADFC Berlin, n.d.).

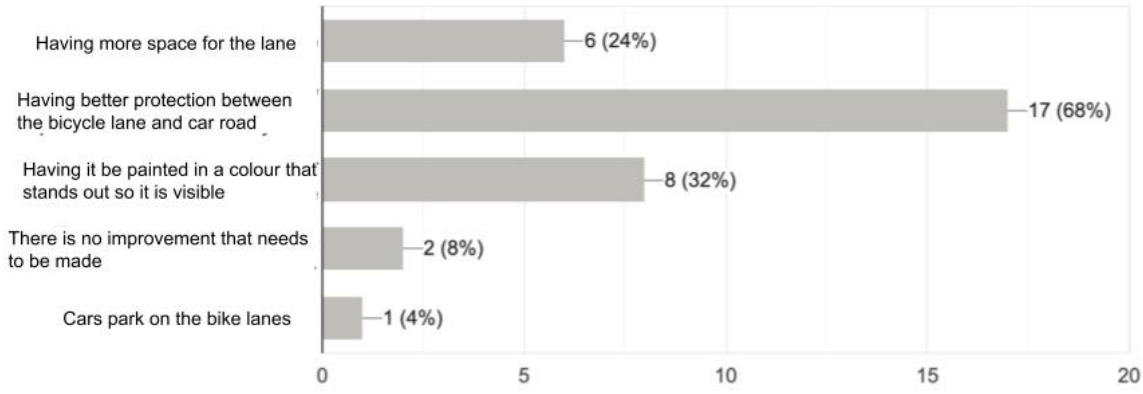

Figure 9: I believe that the pop-up bicycle lanes can be improved by… (Q8 ~ multiple answers possible)

Furthermore, it can be seen in Figure 10 that 96% of the participants would feel safer cycling on a bicycle lane that is physically separated from the car road. Additionally, Figure 11 depicts that 52% of respondents agree or strongly agree with the fact that they would feel more nervous when forced to cycle next to moving vehicles. These findings are aligned with the research's expectations that protected bicycle lanes have a significant impact on the safety perception of cyclists in Berlin. Interestingly enough, the percentage of people who would feel nervous is lower in Berlin than in Groningen, possibly indicating that people in Berlin are accustomed to cycling next to moving cars due to the lack of separated bicycle lanes in the city. Additionally, a one-way ANOVA test was conducted between variable Q12 and variables Q16 and Q17, nationality and gender, respectively (see Appendix 3). The tests came out insignificant, showing how gender or nationality appear to not affect the levels of caution and nervousness. However, a definitive conclusion cannot be drawn from this, as the small sample size may influence the outcome.

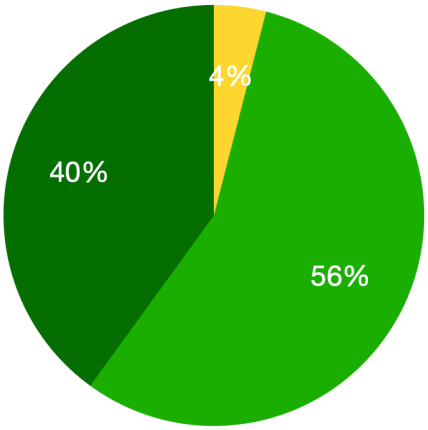

Figure 10: I feel more safe when cycling on a bicycle lane that is physically separated from the car road than when there is no separation. (Q11)

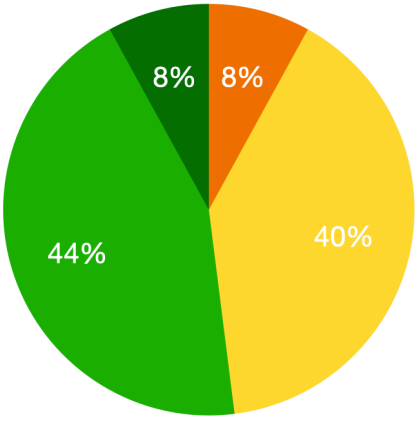

Figure 11: When I am cycling on a road where there is no separation between the bicycle lane and the car lane and cars are going past me, I feel more nervous and am more cautious of my movements. (Q12)

Lastly, Figure 12 depicts that 64% of the respondents would cycle more often if there were more bicycle lanes implemented in Berlin. This result showcases how safety can be viewed as an important motivator for someone when choosing cycling as their mode of transport (Sanders, 2015). It also emphasises the importance of adequate bike infrastructure as an incentive for people to choose cycling over other forms of transportation.

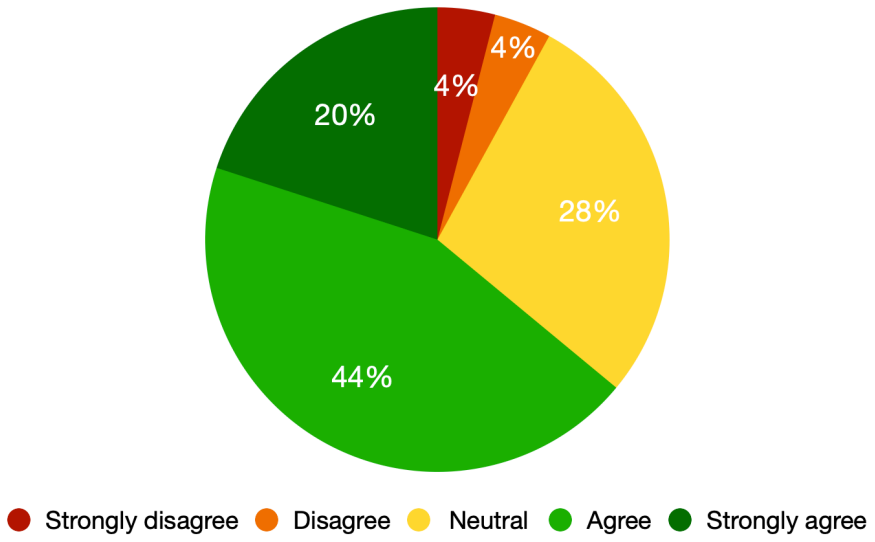

Figure 12: I would cycle more often if there would be more protected bicycle lanes implemented in Berlin. (Q14)

4.3. Challenges regarding the implementation of protected bicycle lanes in Berlin

As seen in Figure 13, when respondents were asked what they believe the biggest challenge is regarding the implementation of protected bicycle lanes in Berlin, the majority chose the option "insufficient space along the car roads." This problem is a valid concern, as protected bicycle lanes cannot be created on narrower streets where spatial redistribution cannot be achieved (Urban Sustainability Exchange, n.d.). Additionally, 32% of respondents believe that the biggest challenge is the difficulty in creating a network of bicycle lanes throughout the city. Considering Berlin's scale, this issue is also time-sensitive, as bicycle lanes may be implemented in certain points of the city, yet it will take years until a connected network is established.

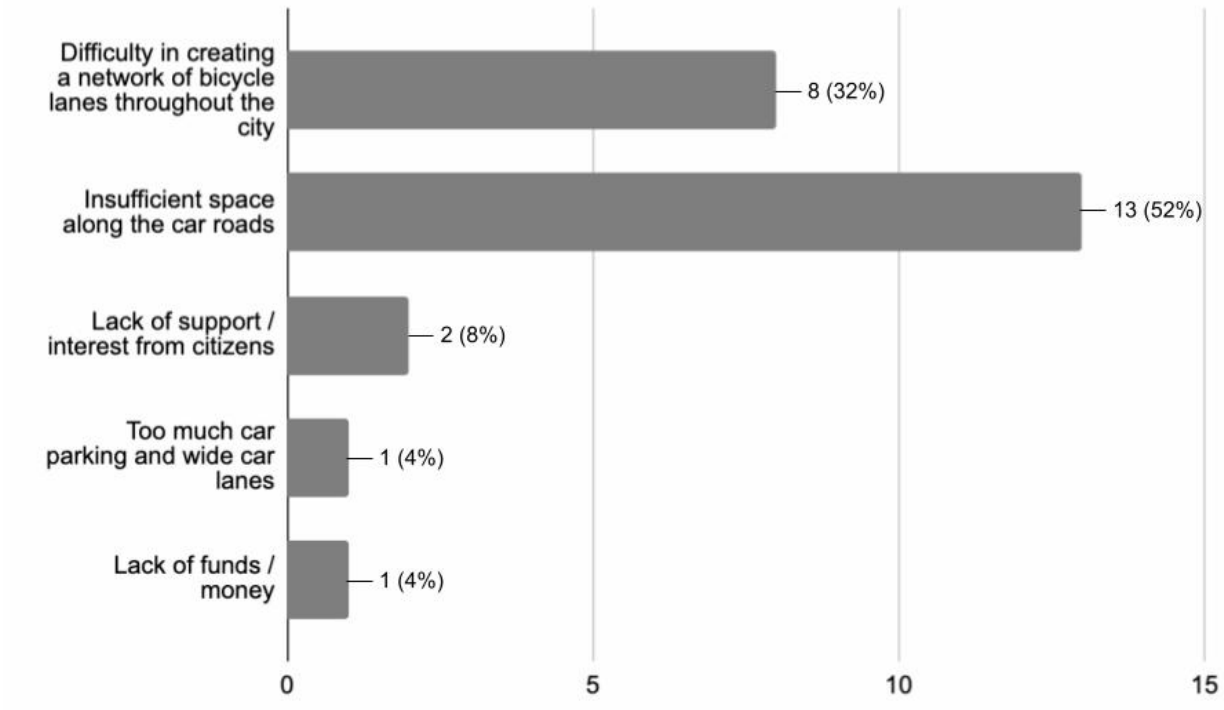

Figure 13: Which do you think is the biggest challenge regarding the implementation of protected bicycle lanes in Berlin? (Q15)

One challenge mentioned in the New Cycling Strategy for Berlin is that bicycle lanes are obstructed by different obstacles such as parked cars, trucks or taxis (Senate Department for Urban Development and the Environment, 2013). This increases accident risk, especially if the bicycle lanes are not wide enough to accommodate this lost space. A participant in the survey shares a similar concern as they state that the Berlin government should “convert car lanes into wide bicycle lanes. Many bike lanes are too close to parked cars and pedestrians which can be dangerous as pedestrians aren't watching out for cyclists. At night street lamps don't illuminate the bike lanes as good as the road for cars.” This shows how there needs to be more awareness about cyclists on the road and how street infrastructure is not designed with cyclists' needs in mind.

There is also the question of knowing which type of separating element is most efficient. While more protection is offered by stronger and larger elements, these can also lead to more severe accidents than semi-permeable elements (ADFC Berlin, n.d.). In the survey, when participants were asked whether they believe a painted line or the addition of cones is sufficient separation to make them feel safe while cycling, 44% were neutral, while 28% disagreed. This emphasises the necessity of a physical separation such as a curb, which maintains the cyclists' safety and does not endanger them by making them feel entrapped between cones or bollards.

Lastly, a challenge to implementing permanent bicycle lanes highlighted by the Urban Sustainability Exchange initiative in Berlin is creating a network (n.d.). This concern is addressed by the ADFC Berlin e.V as they argue that having them at random points throughout the city is almost equally as dangerous as not having them at all as people are still forced to cycle on non-separated lanes for most of their trip (n.d.). This is also reflected in the survey as one respondent stated that “on some big busy streets there is no bike lanes: neither on the road nor on the street. I find those streets the most dangerous as I need to cycle on the same lane as the cars. If there was a bike lane on every big street I would feel much safer.” Indeed, the indispensability of a network is something observed in Groningen that facilitates cycling and increases safety in all parts of the city (Gemeente Groningen, 2021). This is a crucial lesson Berlin can learn from Groningen as it pursues the implementation of cycle-friendly infrastructure to provide connections between streets and offer users secure cycling lanes throughout the city.

5. Conclusion

This paper has looked into how protected bicycle lanes can impact the perception of safety among cyclists in Groningen, as well as how these lanes can be implemented in Berlin. It has explored how perception of safety is an important aspect that influences a person's decision to choose cycling as their mode of transport. This motivates the need for proper bicycle infrastructure in cities, in the form of protected bicycle lanes, to increase safety and comfort for cyclists and reduce perceived accident risk. One way through which this can be achieved is spatial redistribution, where designated car space gets repurposed into space for bicycle infrastructure.

The two surveys conducted in Groningen and Berlin have gathered data about cyclists' perceptions of safety, the extent of the effect of protected bicycle lanes and the challenges of their implementation. Safety when cycling appears to be defined as feeling comfortable and relaxed and having a low chance of crashing. One conclusion drawn is that even in a city like Groningen, where a cycling culture is thoroughly established, road safety is still a concern people have. Data shows that improvements still need to be made to the current infrastructure to facilitate cycling as the main mode of transport. It is also seen that a separation in the form of a curb seems most widely embraced by cyclists as it contains a vertical component and does not leave them feeling entrapped. This insight is essential when designing new protected bicycle lanes and deciding which type of separation element is most suitable. Lastly, the main challenges identified when implementing protected bicycle lanes are making them wide enough to avoid obstacles and increase comfort, as well as creating a network throughout the city. These are both essential concerns that should be at the forefront of discussions between planners and stakeholders, as omitting them can lead to efforts not being as highly valued by the users. The key lesson Berlin can derive from Groningen is the significance of establishing an extensive network of bicycle lanes. Solely implementing them in particular areas of the city proves insufficient, leaving cyclists in danger for parts of their journey.

For the case study of Groningen, further research can be conducted to explore the impact of scooters on bicycle lanes. This is one concern that has risen from the survey data that can be meaningfully investigated, as currently there is no separate infrastructure for scooters, yet the large speed difference may impose risks for cyclists. Surveys or interviews can be conducted with cyclists specifically on this matter, and government documents can be analysed to understand if there are current policies in place dealing with this issue. Similarly, in the case study of Berlin, further research can be conducted into the effect e-scooters have on the established bicycle lanes. Just like in Groningen, there is a potential threat from the higher speed limits of these vehicles, yet currently they do not have their own lanes, forcing cyclists to share the space with them.

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Appendix 1: Groningen survey

Dear participant,

This is a survey that investigates the effect of protected bicycle lanes on the perceived safety of cycling among university students in Groningen. The survey should take less than 5 minutes and participation is voluntary. In order to ensure your privacy, the survey is anonymous and no personally identifying questions are asked. The data is encrypted and will only be accessed by the researcher and the supervisor, if needed. By filling out this survey, you consent to your answers being used as part of the data for my bachelor's thesis.

Thank you for taking the time to fill this out and for your contribution!
Dara Nitu

Q1: How often do you cycle?
- Never
- Once a month
- Once a week
- 2-3 times per week
- Almost everyday

Q2: How would you rate your cycling skills / confidence?
- **Not at all confident:** I am a beginner in cycling and do not feel confident in my cycling skills.
- **Not very confident**: I have limited experience with cycling and I do not feel very confident in my abilities, especially in traffic or on uneven roads.
- **Average**: I have an average level of cycling skills and I feel comfortable cycling on flat, well-paved roads.
- **Somewhat confident**: I am reasonably confident in my skills but there is room for improvement.
- **Very confident**: I am an experienced cyclist and I feel very confident in my cycling skills.

Q3: For me feeling ‘safe’ when cycling means…
- Having a lower risk of crashing or injury
- Not having to worry about cars going past me
- Feeling comfortable and relaxed while cycling
- Other: _____

Q4: I am aware of the concept ‘protected bicycle lane’
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q5: How safe would you feel cycling on this street?

(Bessemoerstraat bike path - protected bicycle lane where cars are considered 'guests') Google Maps (2022). 29 Bessemoerstraat, Groningen. Available at: https://goo.gl/maps/tZhycFwtSFfEVQc6A (Accessed: 7 April, 2023).

- 1 = unsafe
- 2 = somewhat unsafe
- 3 = somewhat safe
- 4 = safe

Q6: How safe would you feel cycling on this street?

(Boterdiep bike path - painted but not physically separated) Google Maps (2022). 59 Boterdiep, Groningen. Available at: https://goo.gl/maps/tTMBYfRUPTJYRvxa8 (Accessed: 7 April, 2023).

- 1 = unsafe
- 2 = somewhat unsafe
- 3 = somewhat safe
- 4 = safe

Q7: How safe would you feel cycling on this street?

(Eikenlaan bike path - physically separated from the car road by curb) Google Maps (2022). 288 Eikenlaan, Groningen. Available at: https://goo.gl/maps/oAFzxvtU3hgpggRg8 (Accessed: 7 April, 2023).

- 1 = unsafe
- 2 = somewhat unsafe
- 3 = somewhat safe
- 4 = safe

Q8: How safe would you feel cycling on this street?

(Nieuwe Ebbingestraat bike path - not separated from car road) Google Maps (2022). 11 Nieuwe Ebbingestraat, Groningen. Available at: https://goo.gl/maps/e1dP3jh4GTQHKg8p9 (Accessed: 7 April, 2023).

- 1 = unsafe
- 2 = somewhat unsafe
- 3 = somewhat safe
- 4 = safe

Q9: How safe would you feel cycling on this street?

Folkingestraat bike path (not separated from pedestrian road but cars not present) Google Maps (2022). *15 Folkingestraat, Groningen.* Available at: https://goo.gl/maps/42eKJXhTWUXMsisj7 (Accessed: 7 April, 2023).

- 1 = unsafe
- 2 = somewhat unsafe
- 3 = somewhat safe
- 4 = safe

Q10: Did you ever have an accident when cycling in Groningen?

- No
- Yes, I had one
- Yes, I had more than one

Q11: If yes, on which type of bicycle lane did it/they occur?

- Bicycle lane where cars act as 'guests'
- Bicycle lane separated from cars through a painted line on the street
- Bicycle lane separated physically from cars
- Bicycle lanes not separated from cars
- Other: _____

Q12: What was the cause of the accident/s?
- Loss of balance
- Collision with an object / other cyclist
- Mechanical failure of the bicycle
- Collision with a vehicle
- Other: _____

Q13: I feel more safe cycling on a bicycle lane that is physically separated from the pedestrian road than when there is no separation.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q14: I feel more safe cycling on a bicycle lane that is physically separated from the car road than when there is no separation.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q15: When I am cycling on a road where there is no separation between the bicycle lane and the car lane and cars are going past me, I feel more nervous and am more cautious of my movements.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q16: I believe that there are sufficient bicycle lanes in Groningen that are separated from car roads.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q17: I believe that the municipality of Groningen should make more space for bicycles in the form of protected bicycle lanes to make me feel safer while cycling in the city.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q18: What nationality are you?

- Dutch
- International

Q19: What is your gender?

- Male
- Female
- Prefer not to say
- Other

Q20: Do you have any final comments or ideas for what the municipality of Groningen can do to further improve the safety of cyclists in the city?

Appendix 2: Berlin survey

Dear participant,

My name is Dara Nitu and I am a student at the University of Groningen in the Netherlands. I am currently writing my bachelor's thesis and this is a survey that investigates the effect of protected bicycle lanes on the perceived safety of cycling among people in Berlin. The survey should take less than 5 minutes and participation is voluntary. In order to ensure your privacy, the survey is anonymous and no personally identifying questions are asked. The data is encrypted and will only be accessed by the researcher and the supervisor, if needed. By filling out this survey, you consent to your answers being used as part of the data for my bachelor's thesis.

Thank you for taking the time to fill this out and for your contribution!
Dara Nitu

Q1: How often do you cycle?
- Never
- Once a month
- Once a week
- 2-3 times per week
- Almost everyday

Q2: How would you rate your cycling skills/confidence?
- **Not at all confident:** I am a beginner in cycling and do not feel confident in my cycling skills.
- **Not very confident**: I have limited experience with cycling and I do not feel very confident in my abilities, especially in traffic or on uneven roads.
- **Average**: I have an average level of cycling skills and I feel comfortable cycling on flat, well-paved roads.
- **Somewhat confident**: I am reasonably confident in my skills but there is room for improvement.
- **Very confident**: I am an experienced cyclist and I feel very confident in my cycling skills.

Q3: For me feeling ‘safe’ when cycling means…
- Having a lower risk of crashing or injury
- Not having to worry about cars going past me
- Feeling comfortable and relaxed while cycling
- Other: _____

Q4: I feel safe when cycling in Berlin.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q5: I am aware of the concept of pop-up bike lanes that were implemented in Berlin during COVID-19 times.

Broytman, P. (2020) *Pop-up bike lanes.* Available at: https://use.metropolis.org/case-studies/pop-up-bike-lanes (Accessed 28 April 2023).

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q6: I have cycled on a pop-up bike lane in Berlin.

- Yes
- No
- I don't know

Q7: If yes, I am satisfied with my experience of cycling on pop-up bike lanes in Berlin.

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q8: I believe that the pop-up bicycle lanes can be improved by…

- Having more space for the lane
- Having better protection / separation between the bicycle lane and the car road
- Having it be painted in a color that stands out so it is visible

- There is no improvement that needs to be made to the current pop-up bicycle lanes
- Other _____

Q9: I believe that the painted line or the addition of cones is sufficient separation between the bicycles and the cars to make me feel safe when cycling.

Broytman, P. (2020) *Pop-up bike lanes.* Available at: https://use.metropolis.org/case-studies/pop-up-bike-lanes (Accessed 28 April 2023).

- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q10: I am familiar with the term 'protected bicycle lane' (geschützter radweg).
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q11: I feel more safe cycling on a bicycle lane that is physically separated from the car road than when there is no separation.
- Strongly disagree
- Disagree
- Neutral
- Agree

- Strongly agree

Q12: When I am cycling on a road where there is no separation between the bicycle lane and the car lane and cars are going past me, I feel more nervous and am more cautious of my movements.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q13: I believe that the implementation of protected bicycle lanes will increase safety for cyclists.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q14: I would cycle more often if there would be more protected bicycle lanes implemented in Berlin.
- Strongly disagree
- Disagree
- Neutral
- Agree
- Strongly agree

Q15: Which do you think is the biggest challenge regarding the implementation of protected bicycle lanes in Berlin?
- Lack of funds / money
- Insufficient space along the car roads
- Lack of support / interest from citizens
- Difficulty in creating a network bicycle lanes throughout the city
- Other _____

Q16: What nationality are you?
- German
- International

Q17: What is your gender?
- Male
- Female
- Other
- I prefer not to say

Q18: Do you have any final comments or ideas for how the safety of cyclists can be improved in the city of Berlin?

Appendix 3: SPSS statistical tests

[Groningen survey Q5 tested with Q18 (nationality) and Q19 (gender)]

Descriptives

Q5_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Dutch	26	3.6923	.54913	.10769	3.4705	3.9141	2.00	4.00
International	60	3.7000	.46212	.05966	3.5806	3.8194	3.00	4.00
Total	86	3.6977	.48676	.05249	3.5933	3.8020	2.00	4.00

ANOVA

Q5_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.001	1	.001	.004	.947
Within Groups	20.138	84	.240		
Total	20.140	85			

Descriptives

Q5_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
male	33	3.7576	.43519	.07576	3.6033	3.9119	3.00	4.00
female	53	3.6604	.51677	.07098	3.5179	3.8028	2.00	4.00
Total	86	3.6977	.48676	.05249	3.5933	3.8020	2.00	4.00

ANOVA

Q5_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.192	1	.192	.809	.371
Within Groups	19.947	84	.237		
Total	20.140	85			

[Groningen survey Q6 tested with Q18 (nationality) and Q19 (gender)]

Descriptives

Q6_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Dutch	26	2.9231	.79614	.15614	2.6015	3.2446	2.00	4.00
International	60	2.9333	.66042	.08526	2.7627	3.1039	1.00	4.00
Total	86	2.9302	.69942	.07542	2.7803	3.0802	1.00	4.00

ANOVA

Q6_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.002	1	.002	.004	.951
Within Groups	41.579	84	.495		
Total	41.581	85			

Descriptives

Q6_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
male	33	3.0000	.70711	.12309	2.7493	3.2507	1.00	4.00
female	53	2.8868	.69781	.09585	2.6945	3.0791	1.00	4.00
Total	86	2.9302	.69942	.07542	2.7803	3.0802	1.00	4.00

ANOVA

Q6_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.261	1	.261	.530	.469
Within Groups	41.321	84	.492		
Total	41.581	85			

[Groningen survey Q7 tested with Q18 (nationality) and Q19 (gender)]

Oneway

Descriptives

Q7_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Dutch	26	3.9615	.19612	.03846	3.8823	4.0408	3.00	4.00
International	60	3.6833	.79173	.10221	3.4788	3.8879	1.00	4.00
Total	86	3.7674	.68039	.07337	3.6216	3.9133	1.00	4.00

ANOVA

Q7_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.404	1	1.404	3.108	.082
Within Groups	37.945	84	.452		
Total	39.349	85			

Descriptives

Q7_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
male	33	3.8788	.41515	.07227	3.7316	4.0260	2.00	4.00
female	53	3.6981	.79867	.10971	3.4780	3.9183	1.00	4.00
Total	86	3.7674	.68039	.07337	3.6216	3.9133	1.00	4.00

ANOVA

Q7_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.664	1	.664	1.442	.233
Within Groups	38.685	84	.461		
Total	39.349	85			

[Groningen survey Q8 tested with Q18 (nationality) and Q19 (gender)]

Descriptives

Q8_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Dutch	26	2.3846	.89786	.17608	2.0220	2.7473	1.00	4.00
International	60	2.2333	.83090	.10727	2.0187	2.4480	1.00	4.00
Total	86	2.2791	.84924	.09158	2.0970	2.4611	1.00	4.00

ANOVA

Q8_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.415	1	.415	.573	.451
Within Groups	60.887	84	.725		
Total	61.302	85			

Descriptives

Q8_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
male	33	2.3636	.85944	.14961	2.0589	2.6684	1.00	4.00
female	53	2.2264	.84675	.11631	1.9930	2.4598	1.00	4.00
Total	86	2.2791	.84924	.09158	2.0970	2.4611	1.00	4.00

ANOVA

Q8_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.383	1	.383	.528	.469
Within Groups	60.919	84	.725		
Total	61.302	85			

[Groningen survey Q9 tested with Q18 (nationality) and Q19 (gender)]

Descriptives

Q9_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Dutch	26	3.1538	.92487	.18138	2.7803	3.5274	1.00	4.00
International	60	2.7000	.86944	.11224	2.4754	2.9246	1.00	4.00
Total	86	2.8372	.90567	.09766	2.6430	3.0314	1.00	4.00

ANOVA

Q9_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.736	1	3.736	4.756	.032
Within Groups	65.985	84	.786		
Total	69.721	85			

Oneway

Descriptives

Q9_ratio

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
male	33	3.0303	.91804	.15981	2.7048	3.3558	1.00	4.00
female	53	2.7170	.88529	.12160	2.4730	2.9610	1.00	4.00
Total	86	2.8372	.90567	.09766	2.6430	3.0314	1.00	4.00

ANOVA

Q9_ratio

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.997	1	1.997	2.476	.119
Within Groups	67.724	84	.806		
Total	69.721	85			

[Berlin survey Q12 tested with Q16 (nationality) and Q17 (gender)]

Descriptives

Q12_recoded

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
german	12	3.2500	.75378	.21760	2.7711	3.7289	2.00	4.00
international	13	3.7692	.72501	.20108	3.3311	4.2074	3.00	5.00
Total	25	3.5200	.77028	.15406	3.2020	3.8380	2.00	5.00

ANOVA

Q12_recoded

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.682	1	1.682	3.081	.093
Within Groups	12.558	23	.546		
Total	14.240	24			

Descriptives

Q12_recoded

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
male	11	3.3636	.92442	.27872	2.7426	3.9847	2.00	5.00
female	14	3.6429	.63332	.16926	3.2772	4.0085	3.00	5.00
Total	25	3.5200	.77028	.15406	3.2020	3.8380	2.00	5.00

ANOVA

Q12_recoded

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.480	1	.480	.803	.380
Within Groups	13.760	23	.598		
Total	14.240	24			