The effect of lane division due to Covid-19 in a shared space

A research at the Jacob Gerritstraat in Delft

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TUDelft

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by

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to obtain the degree of Bachelor of Science

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Preface

This report investigates the effect of lane division due to Covid-19 in a shared space. It has been written to obtain the degree of Bachelor of Science for Civil Engineering at the Delft University of Technology. The subject of this research is chosen within the department Transport & Planning. The research and writing of this report has taken place from April to June 2021.

Evelien Knopper
Delft, June 2021

Summary

With the outbreak of the Covid-19 virus the whole world was undergoing some major changes. Walking areas became more structured as contact between people needed to be reduced. The focus of this research is on lane division which is applied in some pedestrian areas. The streets are split into two lanes, both allowing traffic in only one direction. To specify the research focus, the Jacob Gerritstraat in Delft was chosen to investigate. The goal of this research is to investigate if the lane division improves the experience of safety and comfort of the users of the Jacob Gerritstraat. The situation before and during Covid-19 were compared to see how the lane division affects this experience.

The main research question of this report is: *"How does the lane division in the Jacob Gerritstraat affect the road users' experience of safety and comfort?"*

For this research, a survey was used as the focus lies on the experience of the road users. It was spread through WhatsApp and by delivering QR codes to residents in Delft. As the experience of a road user can be influenced by many characteristics, the influential factors were identified. They were divided into three categories: respondent, context and traffic composition. Each category can be found in a part of the survey. The survey existed of three parts. The first part was focused on the category respondent and was related to the demographic characteristics of the participant. The second part covered the category context. It asked questions comparing the Jacob Gerritstraat before and during Covid-19, so with and without lane division. The third part focused on the categories context and traffic composition. In this part different scenarios at the Jacob Gerritstraat were outlined. The scenarios showed the Jacob Gerritstraat with different traffic compositions and each scenario was given with and without lane division. In this way a comparison could be made. The responses of the survey were analysed with the use of statistical significance tests. These were the Mann-Whitney U test and the Wilcoxon signed-rank test.

The survey was closed with 69 responses. Most participants seem to stick to the line which is now applied in the Jacob Gerritstraat. The hypotheses were tested with statistical significance tests. The Mann-Whitney U test showed that there was no statistical difference in experience of safety and comfort with different genders and ages. The Wilcoxon signed-rank test of part 2 of the survey confirmed that for the situation during Covid-19, with lane division, the safety was ranked higher and the crowdedness lower. However, the spreading of the virus might have influenced this outcome as less people might have used the street during Covid-19. Lastly, different scenarios in the Jacob Gerritstraat were compared for with and without lane division. Except for the scenario where all pedestrians were walking in the same direction as the participant, all

scenarios had a statistical difference between the situation with and without lane division. These were scenarios with pedestrians walking in different directions, a cyclist intermingling and the entering of a shop on the other side of the line. For all of these, the Wilcoxon signed-rank test showed that the safety and comfort were ranked higher for the situations with lane division.

Regarding the analysis of the results, it was concluded that the lane division in the Jacob Gerritstraat is experienced as more safe and more comfortable. The results indicated that the street with lane division is preferred over the street without. Despite the fact that this research was only focused on the Jacob Gerritstraat, the outcome could be of interest for other streets as well. The research showed that a small measure, just a line on the street, can ensure a more safe and more comfortable surrounding notwithstanding a shared space is assumed to be without any traffic measures. Based on these conclusions, the municipality of Delft and other municipalities could consider applying lane division in busy streets like the Jacob Gerritstraat.

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Chapter 1

Introduction

With the outbreak of the Covid-19 virus begin 2020 the world is undergoing major changes. Social distancing has become part of our live styles, preventing the virus to spread (RIVM, 2021b). Contact between people needed to be reduced which resulted in walking areas becoming more structured. The appearance of areas has changed due to stickers, signs and lines, all creating guidance in peoples behavior. This has effect on the experience people have outside on the streets. As this pandemic is something new for all of us, it will be interesting to see what can be learned from it.

The focus of this research will be on lane division which is applied in some pedestrian areas due to Covid-19. The streets are then split into two lanes, both only allowing traffic in one direction. It would be interesting to see how this affects the experience of the road users, focused on safety and comfort. To specify this research focus, one street will be chosen to focus on. This street needs to be well known and commonly used by enough people so a survey can be done among them. As a citizen of Delft, choosing a street in this city seems approachable. Furthermore, a street which is accessible for both pedestrians and cyclists would be interesting to investigate.

(a) with lane division (Funda, n.d.)   (b) without lane division (indebuurt Delft, 2020)

Figure 1.1: Jacob Gerritstraat

The street chosen for this research is the Jacob Gerritstraat, situated between the Markt and the Brabantse Turfmarkt. This is a commonly used street in the centre of Delft where lane

division is applied now. Figure 1.1 shows two pictures of the Jacob Gerritstraat with and without the lane division. It is a pedestrian area where cyclists are allowed as a guest. This street could be interesting as on Thursday and Saturday there is market on either the Markt or the Brabantse Turfmarkt. This means a lot of pedestrians are using this street. The location of the Jacob Gerritstraat has been outlined in figure 1.2. Section 2.1 will provide more details about the street.
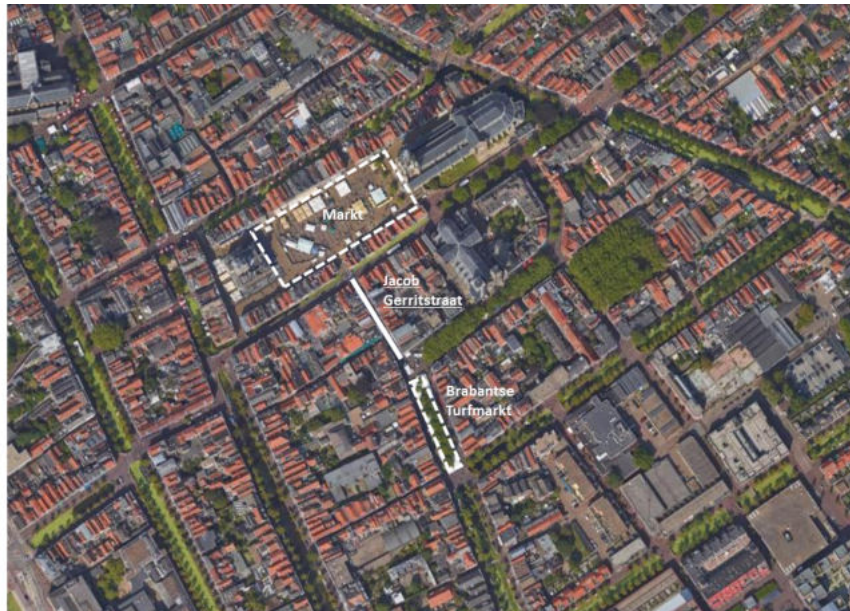
Figure 1.2: Location Jacob Gerritstraat (*Google Maps*, n.d.)

1.1 Problem statement

Even though in many cases the objective safety is increased by a shared space compared to the old situation, the subjective safety is still questioned (Methorst et al., 2007). This also applies for the Jacob Gerritstraat. It is a busy street with pedestrians and cyclists intermingling as they can both use the entire street. It might raise the question if the subjective safety is still assured or if it can be improved. Due to Covid-19, the shared space in this street has changed into a two-way traffic street. This was done to reduce the spreading of Covid-19 but it might have changed the experience of road users on the feeling of safety and comfort as well. Therefore, it can be investigated whether this lane division would be an improvement in the street, even after Covid-19.

1.2 Objective

The goal of this research is to investigate if the lane division improves the experience of safety and comfort of the users of the Jacob Gerritstraat, even after Covid-19.

1.3 Stakeholders

The research at the Jacob Gerritstraat effects different groups of stakeholders. All the stakeholders will be discussed below.

- Pedestrians
  The first group of stakeholders are the pedestrians. Normally, they were able to walk the street in any direction they wanted. This situation changed due to Covid-19. A blue line is placed in the centre of the street creating two lanes with one-way traffic on each lane. The pedestrians are now suggested to stay within their lane and walk in one direction. To visualize the effects of this lane division, the opinions of the pedestrians need to become known. The lane division could be experienced differently for each pedestrian. Their opinions are of big influence for subjectively judging the safety and comfort in the street.

- Cyclists
  The cyclists are also affected by the change in situation due to Covid-19. The lane division might influence the way they use the road. Also, the pedestrians walking in two lanes with opposite directions might affect their experience. Just like the pedestrians, the opinions of the cyclists need to become known. Together with the pedestrians, they form the two types of road users in the Jacob Gerritstraat.

- Municipality of Delft
  The Jacob Gerritstraat is situated in the inner city of Delft. Therefore, the municipality of Delft is also a stakeholder. They conduct the policy of how the streets in Delft can be used. The outcome of this research could be of their interest. They could consider keeping the lane division even if it is not needed anymore for counteracting the spreading of the virus.

- Shop keepers and market vendors
  The shop keepers in the Jacob Gerritstraat and market vendors at the Markt and the Brabantse Turfmarkt also have interest in how the street is used and how people feel about it. The lane division makes it more difficult to enter a shop on the other side of the line. If people do not have a good experience on the street, the street might be avoided which means less customers for the shops and market.

- Residents
  The last stakeholders are the people living above the shops in the street. They use the street daily and have interest in the policy of the street. For them it needs to be a safe environment where they can enter their homes easily.

1.4 Research questions

The following research question has been defined:

How does the lane division in the Jacob Gerritstraat affect the road users' experience of safety and comfort?

To answer this question, five sub-questions have been formulated. For each sub-question, the relation to the research question is described. The five sub-questions are:

- *How do other cities deal with crowded streets during Covid-19?*

  This is related to the research question as it compares the lane division to other solutions. It questions whether the lane division is the best option here.

- *Why is lane division applied in the Jacob Gerritstraat?*

  This is related to the research question as it refers to the origin of the lane division. It clarifies the first reason for the appliance.

- *How did people experience the Jacob Gerritstraat before the lane division?*

  This is related to the research question as it enlightens the old situation. It compares the old situation to the new one, outlining a possible difference in experience.

- *How do road users respond to the lane division?*

  This is related to the research question as the experience is affected by the respond. It clarifies the usefulness of the lane division, which depends on the road users.

- *What influences the experience of safety and comfort for pedestrians and cyclists?*

  This is related to the research question as it examines the factors influencing the experience. It describes the meaning of the experience of safety and comfort.

It is expected that the lane division in the Jacob Gerritstraat will positively contribute to both the road users' experience of safety and comfort.

1.5 Scope

The focus of this research will be on the difference of road users' experience of safety and comfort, with and without the lane division. The situation before Covid-19 and during Covid-19, the current situation, will be compared to see how the lane division affects this experience.

1.6 Outline

The report will be structured as follows. In chapter 2 the literature review is provided. It provides background information about shared spaces, the change of situation due to Covid-19 and the experience of safety and comfort. In chapter 3 the methodology is described. The method used to conduct the survey and the influential factors are explained. Also, the survey design and how it will be analysed, is described. Chapter 4 covers the results from the survey. The tests described in chapter 3 will be executed and analysed. In chapter 5 the method and outcome of the research is discussed. Chapter 6 will draw a conclusion of the research.

Chapter 2

Literature Review

This chapter gives some background information that is needed for the research. First some literature about shared spaces will be discussed in section 2.1. The pedestrian network in Delft will be enlightened as well. Section 2.2 will cover changes which occurred as a result of the outbreak of Covid-19. This will be focused on the city Delft but also changes in other cities will be discussed. In the last section, 2.3, the meaning of the terms safety and comfort for this research will be explained.

2.1 Shared spaces

A shared space is a concept which has arisen over the years. It describes a street space where traffic control devices have been removed. The idea is that people use eye contact and communication to pass the space in a safe way. Shared spaces can be identified by low speed traffic and less traffic control (Project for Public Spaces, 2009). It encourages people to take responsibility for their own behavior. Whom the space is shared with, can vary per situation. This research will focus on a shared space between pedestrians and cyclists.

The concept of a shared space seems a new discovery but exactly, if we look back in time, many streets functioned as shared spaces. So what made it change? As the car was invented and the use of it increased, the safety on the street was no longer preserved. The speed difference between traffic increased with a separation of road users as a result. Traffic measures where therefore needed to ensure a safe environment. Different modes of transport needed different types of roads and traffic lights and signs filled the streets (Project for Public Spaces, 2017).

A new approach was discovered by Hans Monderman, a Dutch traffic engineer. He believed that taking out traffic measures and reducing guidance would create a safer space. A well known quote of him states: "if you treat people like idiots, they will behave like idiots" (Project for Public Spaces, 2008). He experimented on how people would react to spaces without any traffic measures. He observed that traffic slowed down, the number of incidents dropped and people reclaimed the street.

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This research will focus on the Jacob Gerritstraat in the centre of Delft. Delft is known as a city for cyclists as more than 50 percent of all movements within the city are made by bicycle (Gemeente Delft, 2021). However, pedestrians are central in the city centre. The inner city is car-free since the 90s to reduce the car traffic and the city is designed for pedestrians. Figure 2.1 shows the pedestrian network in Delft. The Jacob Gerritstraat is situated in the biggest pedestrian zone. Even though there are no cycling routes in the inner city, cycling in the city centre of Delft is allowed. There are no recognizable cycle lanes as the municipality of Delft states this does not relate well to the historical value of the area and the presence of many pedestrians, most of them not aware of cyclists with a relatively high speed (Gemeente Delft, 2021). The traffic space is limited in many areas of Delft. Therefore, the municipality of Delft has to decide the function of a street and which road users come together. They determined a priority in mode of transport: first the needed space for pedestrians is given, then cyclists, public transport and cars.
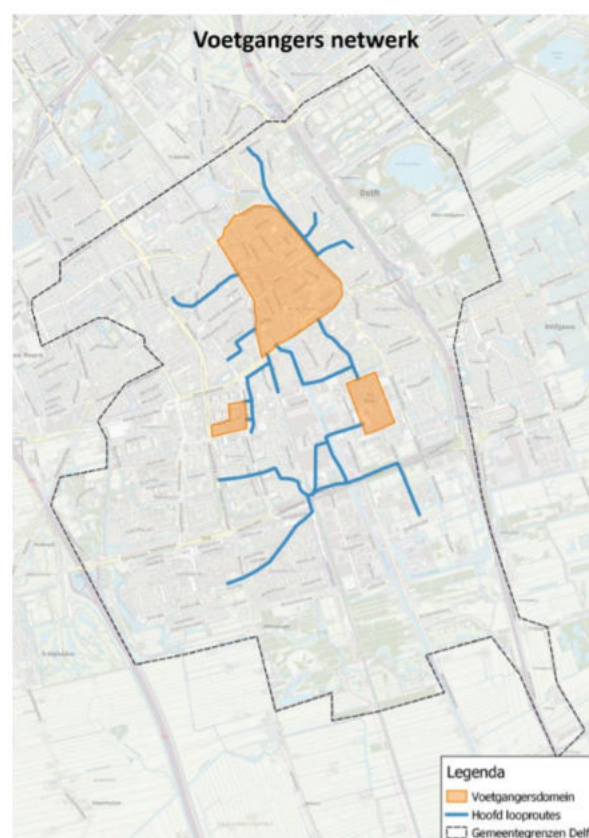
Figure 2.1: Pedestrian Network Delft (Gemeente Delft, 2021)

2.2 Change of situation due to Covid-19

The outbreak of the Covid-19 virus has affected the whole society. As the virus spread rapidly, social distancing became the new normal. The 1,5 meter distance rule was introduced and became an understanding (Ministerie van Algemene Zaken, 2021). Public spaces like shops, streets and stations were transformed with the use of stickers and lines saying "keep distance" and "keep right". With all these measurements, the behavior of people changed. People became

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more aware of their surroundings and started keeping distance from other people and avoiding crowded areas (RIVM, 2021a). All the signs are important for reminding people of the Covid-19 situation and reducing contact between people to counteract the spreading.

Figure 2.2: Stickers at stations (de Gelderlander, 2020)

The government needed to react quickly on the spreading of the virus; ways to prevent the spreading needed to be conceived. Municipalities had to take action to protect their citizens at public spaces throughout their city. In Delft this quickly resulted in markings on the street and signs at crowded areas. Even a map was designed showing mobility measures throughout the city, as can be seen in figure 2.3. It tells the rules applied in different streets and areas in the inner city of Delft. Furthermore, at the Markt and the Brabantse Turfmarkt one-way traffic is maintained during market days. Enforcers are there to make sure everyone follows the restrictions.
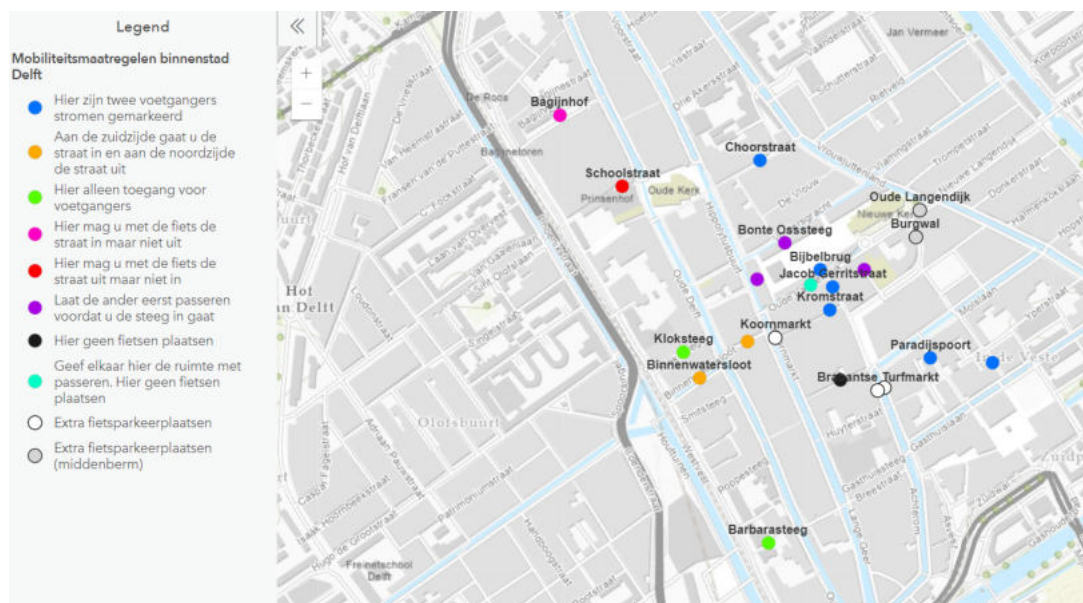

Figure 2.3: Map with mobility measures in Delft (ESRI Nederland, n.d.)

Some different measurements were taken in other cities in the Netherlands. In Utrecht many small streets were changed into one-way traffic. This was not appreciated by many pedestrians as they had to go around. Also shop keepers in the streets were not amused as it led to

fewer customers (RTV Utrecht, 2020). Moreover, crowded streets were provided with information signs, and traffic lights for pedestrians stayed green for a longer time period (de Volkskrant, 2020). In Den Bosch another kind of sign was spread in the city. The sign said: "Busy? Go home" and it has either a forbidden entry or one way entry symbol on it. The fact that not every street could be entered anymore, created a lot of confusion (Hamacher, 2020). Based on this knowledge, a one-way traffic street is not assumed to improve the experience of road users. The reactions on this change in other cities show that pedestrians do not like to walk around. As lane division still allows road users to enter the street from both directions, this will not be a problem. Besides that, this information indicates the interest of the shopkeepers: they want their shops to stay accessible. Therefore, it is important to take this interest into account. The research should investigate the effect of the lane division on the experience of the road users for entering a shop. The line could affect the experience of people as crossing the line is needed for entering a shop on the other side of the street.

For Amsterdam a project was set up by the TU Delft and the AMS institute. They created a Social Distancing Dashboard, a map telling you where it is easy to keep distance and where it is not. Later, they also created maps for other cities including Delft. So actually this map shows the width of almost every street in the city and this could be of interest for this research. If the results of this research show that the experience of road users in the Jacob Gerritstraat is improved by the lane division, it could be considered to apply the lane division in more busy streets. Then this map could be consulted to see which streets are wide enough to create two-way traffic. Figure 2.4 shows the Social Distancing Dashboard of Delft, with the information about the Jacob Gerritstraat.

Figure 2.4: Social Distancing Dashboard of Delft (Baron & Psyllidis, 2020)

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2.3 Experience of safety and comfort

To research the experience of safety and comfort, the meaning of these terms have to become clear. According to Cambridge Dictionary (n.d.), safety is defined as: "a state in which or a place where you are safe and not in danger or at risk". This is a clear definition but safety can be interpreted in different ways. Safety can be distinguished in objective or subjective safety. As this research focuses on traffic, safety will here be defined as traffic safety. Objective safety is then described as an actual number of road accidents or injuries whereas subjective safety describes the feeling of safety in traffic.

Figure 2.5: Two ways of safety

A research has been done by Beitel et al. (2018) on the objective safety of a shared space between cyclists and pedestrians. It concluded two relations between speed and pedestrian density, and conflict rate and density. Whereas high pedestrian density reduces cyclists speed, it increases the likelihood of conflict (Beitel et al., 2018). This is an interesting relation affecting the safety of the road users. From this can be retrieved that the density is a considerable factor for determining the safety in a shared space. However, this might affect the safety differently when looking at the subjective safety. This research will be focused on the subjective safety of road users in the Jacob Gerritstraat.

Comfort can be defined as: "a state of physical ease and freedom from pain or constraint" (Oxford Languages, n.d.). This definition is very general so the definition of comfort in traffic needs to be reconsidered. For this research needs to be questioned: what does comfort for a pedestrian or cyclist in a street define? In this research the comfort will be defined by three aspects: flow, speed and space. Although these are different aspects, all of them are interrelated.
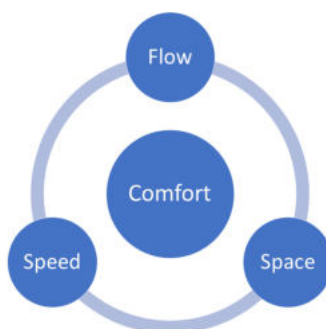
Figure 2.6: Aspects defining comfort

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The relation between these aspects, as can be seen in figure 2.6, will be described. The suppleness of the flow depends on the number of road users. Kang et al. (2013) suggests that bigger numbers of pedestrians deteriorate the flow, resulting in a lower appreciation of comfort. This is caused by the reduction of personal space, the space for people to move around (Gehl, 1987). Space contributes to comfort as people do not like to be held up. Therefore, space for passing is needed which then improves the flow. In addition, crowded areas are not assumed to be comfortable as people loose the feeling of freedom. Speed contributes to comfort in traffic as well. Changes in speed must be possible to give pedestrians time to enter a shop or look at shop windows (Sarkar, 1993). People want to move at their own pace and not have the feeling of being propelled by the crowd. This again refers to the aspects space and flow. As mentioned before, all aspects are correlated and define the feeling of comfort in traffic.

So, for comfort the following can be considered:

- Flow: can you move through the street easily or are you held up?
- Speed: can you pass the street at your own pace or do you feel propelled by the crowd?
- Space: do you experience crowdedness or can you pass others easily?

2.4 Summary

Shared spaces are identified by low speed traffic and less traffic control. Delft is known as a city for cyclist but pedestrians are central in the city centre. The Jacob Gerritstraat is situated in the biggest pedestrian zone. Even though there are no cycling routes in the inner city, cycling in the city centre of Delft is allowed.

With the outbreak of the Covid-19 virus, the government needed to react quickly on the spreading of the virus. Many measurements were taken to counteract the spreading which influenced the layout of the streets in Delft and other cities. In Utrecht some streets were transformed into one-way traffic. This was not appreciated as people had to walk around and shops were less likely to be visited. Furthermore, a Social Distancing Dashboard was created showing the width of streets and whether social distancing is easy.

To research the experience of safety and comfort, the meaning of these terms need to become clear. This research will be focused on the subjective traffic safety, describing the feeling of safety. Comfort will be defined by three aspects: flow, speed, and space. Although these are different aspects, all of these are interrelated. Flow raises the question can you move through the street easily or are you held up. For space you could ask do you experience crowdedness or can you pass others easily. Lastly speed questions whether you can pass the street at your own pace or whether you feel propelled by the crowd.

Chapter 3

Methodology

This chapter will discuss the methodology used for this research. The first section, 3.1, will describe the method used and the distribution. Section 3.2 will enlighten the influential factors of the research. All factors will be clarified and from these the control variables will be chosen. In section 3.3 the design of the survey will be provided. Section 3.4 will describe how the survey is analysed. The statistical significance tests will be explained and some hypotheses will be formulated.

3.1 Method

For this research, the focus lies on the experience of the road users. As this is very subjective, the road users' opinion and feeling about this street need to become known. The best way to receive these opinions, is by doing surveys among the road users. However, due to Covid-19 it is not feasible to hand out surveys to people on the street. Therefore, an online survey will be made. Google Forms has been chosen as tool to create and spread the survey.

The risk of an online survey could be not reaching the right respondent group. The right respondent group exists of road users who are familiar with the Jacob Gerritstraat. Luckily, most people living in Delft know this street and pass it often. Accordingly, the survey could be sent to residents of Delft. To reach this respondent group, WhatsApp will be used. In this way it could only be sent to people living in Delft. As this will only include people from my inner circle, all participants will be asked to forward the survey to people they know in Delft. In this way it can be spread quite easily. However, a risk occurs that the survey will only be spread among young people. Therefore, a way to reach elder people living in Delft needs to be contrived. A QR code of the survey will be created and delivered in mailboxes of nearby residences. Moreover, several news platforms from Delft will be mailed to ask if the survey could be posted on their channel. This includes the following platforms: indebuurt Delft, Delftse Post en Delft op Zondag.

Next, the goal of the target sample size needs to be determined. This will be done based on the number of residents in Delft which is approximately 100,000 from which approximately 10,000 in the inner city (van Bijsterveld, 2021). A size of 100 is chosen to be sufficient for this survey. To balance the participants, the target is to reach half of the group via WhatsApp and the other half via delivering of QR codes and the news platforms. As not everyone will want to

complete the survey, one hundred QR codes will be printed and delivered to residents of Delft. The spreading via social media is more difficult to control but a minimum of fifty respondents will be feasible.

3.2 Influential Factors

The experience of a road user can be influenced by a lot of characteristics. In consequence, the influential factors need to be identified. With the presence of these factors, different situations can be outlined with only one parameter changing. The feeling of safety and comfort can then be linked to this parameter. A mind map is made to determine all influential factors of the experience of safety and comfort. There has been chosen to make one mind map for both safety and comfort. This was considered to be plausible as the factors influencing these two terms in this research are about the same. The mind map can be seen in figure 3.1.
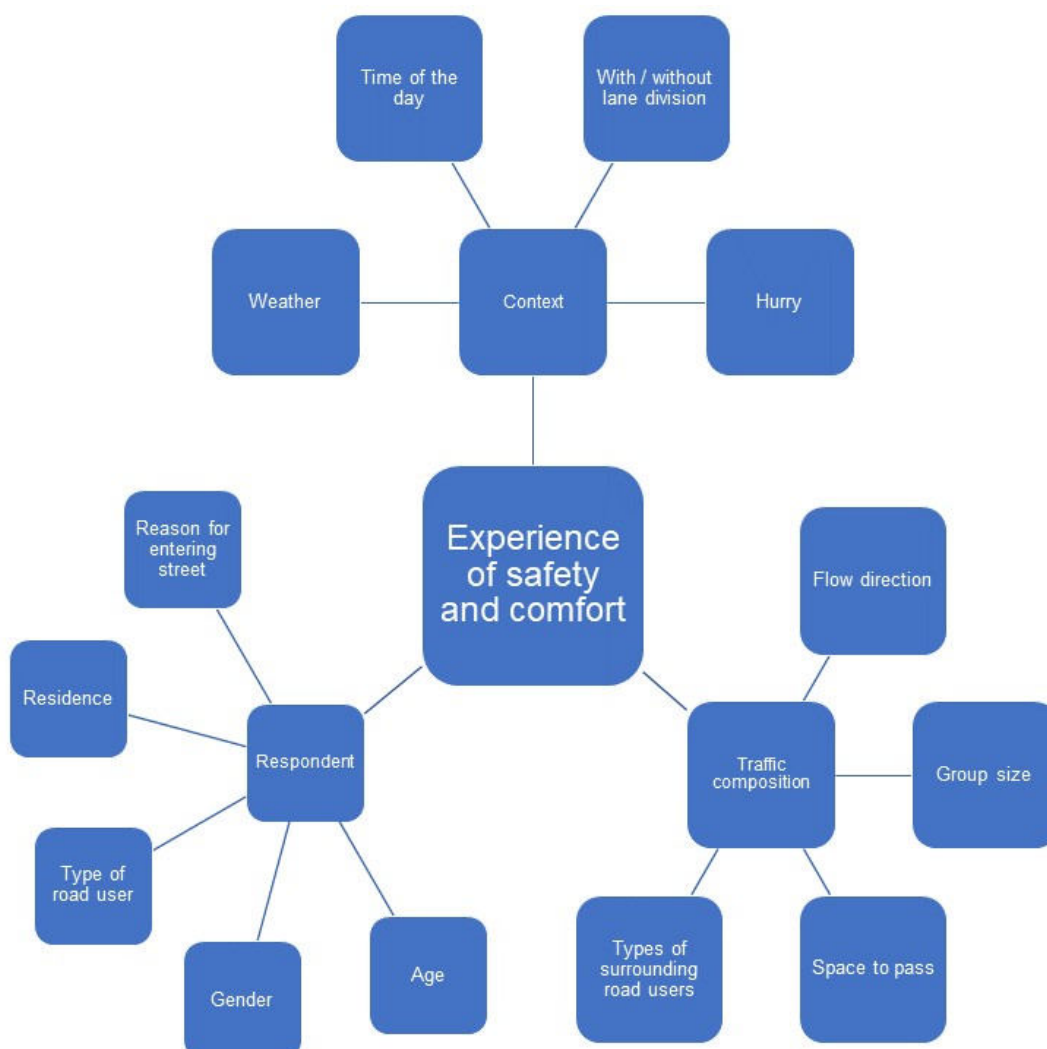

Figure 3.1: Mind map influential factors

All these influence factors are too many to focus on for this research. Therefore, a selection of these factors will be made. To make this selection, more information needs to be provided for all categories. Tables 3.1, 3.2 and 3.3 will give this information respectively for the categories respondent, context and traffic composition.

Influential factor	Information
Age	People from different ages might have different feelings of safety and comfort.
Gender	Men and women might have different feelings of safety and comfort.
Type of road user	Entering the street as a pedestrian or cyclist could affect the feeling of safety and comfort.
Residence	People living in a busy area might have different feelings of safety and comfort compared to people living in a remote area.
Reason for entering street	People entering the street with different reasons might have different feelings of safety and comfort.

Table 3.1: Influential factors - Respondent

Influential factor	Information
Weather	A sunny or a rainy day could affect the feeling of safety and comfort.
Time of the day	During the day (when it is light) and in the evening (when it is darker) could effect the feeling of safety and comfort.
With / without lane division	The presence or absence of the line could effect the feeling of safety and comfort.
Hurry	People in a rush could have different feelings of safety and comfort compared to people at ease.

Table 3.2: Influential factors - Context

Influential factor	Information
Flow direction	People walking in the same direction or the opposite direction as you could affect the feeling of safety and comfort.
Group size	One person passing could create different feelings of safety and comfort compared to a group of people passing.
Space to pass	The dimension of space in the street for passing could affect the feeling of safety and comfort.
Types of surrounding road users	Pedestrians passing the street could create different feelings of safety and comfort compared to cyclists passing.

Table 3.3: Influential factors - Traffic composition

Based on this information, the control variables for the survey can be selected. First, the influential factors of the respondent are evaluated. The residence will not be chosen as a variable as all participants live in Delft and thus come from an about the same environment. Moreover, the reason for entering the street will not be included. This decision has been made as it will not contribute to answering the main research question. Furthermore, the privacy of the participants needs to be considered. The other three variables are sufficient as no confidential information is asked. Thus, the variables age, gender and type of road user will be taken into account.

Second, the influential factors of the context are evaluated. There has been chosen not to make the weather and time of the day a variable. This would create too many different scenarios to be tested. To exclude these variables, all scenarios will have the same weather condition and lighting. The hurry people might be in, is likely to be affected by the reason for entering the street. As mentioned before, this is not included because of the lack in relevance to the research question. For the outlined scenarios the hurry will not be taking into account. To achieve this, the survey will state that it can be assumed that the participant is not in a rush. The lane division is an important variable in this research and will be taken into account.

Last, the influential factors of the traffic composition are evaluated. For outlining different scenarios in the street, different traffic compositions will be tested. However, these four influential factors are too many for keeping the survey accessible. The types of surrounding road users and flow direction are chosen to be control variables. As the street can be used by pedestrians and cyclists, the variable types of surrounding road users is useful for this research. The flow direction is also useful because the lane division forces people to keep right. So, the location where people are on the street depends on the direction of walking. The group size and space to pass will be unchangeable variables. An equal group size will be used for the different scenarios. The space to pass will not differ much as the size of the street is fixed and now the group size is too. An overview of the chosen control variables can be seen in table 3.4.

Category	Control variables
Respondent	Age
	Gender
	Type of road user
Context	With / without lane division
Traffic composition	Flow direction
	Types of surrounding road users

Table 3.4: Overview of chosen control variables

3.3 Survey Design

The survey will be provided in both an English as a Dutch version. English is provided as there are many internationals living in Delft. There is chosen to not make the entire survey in English as some people might prefer and better understand the questions in Dutch. The first question of the survey provides the choice in language. The survey consists of three parts. All three parts will be discussed in this section.

The first part will contain some questions concerning the demographic characteristics of the participant. These will be about gender, age and type of road user. This part covers the control variables for the category respondent. People can choose to fill in the survey from the perspective of a pedestrian or a cyclist or both. Next, it will be questioned whether people stick to the line applied now. This is done to gain insight whether the line is clear enough to ensure lane division.

In the second part, a comparison will be made between the situation before Covid-19, when there was no lane division and during Covid-19 (the current situation), when there is lane division. Some questions will be asked for both situations focusing on the experience of the participants. This includes the feeling of safety, crowdedness, bother and being held up. This part covers the control variable for the category context. As this research focuses on the feeling of traffic safety, it has to become clear to the participants that this safety is meant. Therefore, in the survey it will be stated that contamination risk of the Covid-19 virus is disregarded.

The last part will outline some scenarios at the Jacob Gerritstraat. These scenarios will be visualised with sketches of the street with pedestrians and/or a cyclist in it. It will contain questions asking the participants how they feel about it in terms of safety and comfort. At the top of this part, the definition of the terms safety and comfort for this research will be clarified. For safety it will state that safety in traffic is meant and contamination risk for Covid-19 is disregarded. For comfort it will state that the participant can think of the following: the flow (can you move through the street easily or are you held up?), the space (do you experience crowdedness or can you pass others easily?) and the speed (can you pass the street at your own pace or do you feel propelled by the crowd?). These answers can be rated between 1 (very unsafe/uncomfortable) and 10 (very safe/comfortable). This scale is chosen as it is an even number, making sure participants can not choose something in the middle. Also, a rating from 1 to 10 is quite familiar in the Netherlands so easy to use.

The different scenarios need to be sketched with clearly outlining the control variables. The focus will be on pedestrians as the participant enters the street as a pedestrian. The most important control variable is the context: the lane division. Each scenario needs to be outlined for both with and without lane division. For the scenarios with the lane division, it can be assumed that people abide by this rule. The sketches will clarify this as people walk and cycle on the right side of the line. The other control variables used in this part are from the category traffic composition. To make a fair comparison, these control variables should be about equal for the two scenarios being compared. However, they will not be exactly the same as the ones with lane division will enforce people to walk on the right whereas without lane division people can walk everywhere.

So, first different scenarios will be created with different control variables from traffic composition and then all these scenarios will be doubled by creating one with and one without the lane division, the control variable from context. These control variables are discussed in section 3.2. With these variables different scenarios are created which can be found in table 3.5. These concern different flow directions and types of surrounding road users. In the end there will be twelve scenarios as each scenario of table 3.5 will be outlined for the situation with and without lane division. Two of the sketches can be found in figure 3.2 as an example. Also, a short description will be given per sketch to clarify the control variables. All the sketches can be found in the survey which is attached in appendix B.

(a) Without the lane division   (b) With the lane division

Figure 3.2: Sketches scenario 1 for part 3 of the survey

Scenario	Type(s) of surrounding road users	Flow direction	Your action
1	Pedestrians	One group same direction as you, other group opposite direction	Passing street
2	Pedestrians	Two groups opposite direction of you	Passing street
3	Pedestrians	Two groups same direction as you	Passing street
4	Pedestrians	Some same direction as you, some opposite direction	Go to shop other side of street
5	Pedestrians and a cyclist	One group pedestrians same direction as you, other group pedestrians opposite direction and cyclist opposite direction	Passing street
6	Pedestrians and a cyclist	One group pedestrians same direction as you, other group pedestrians opposite direction and cyclist same direction	Passing street

Table 3.5: Overview of different scenarios for part 3 of the survey

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3.4 Analysis

After the survey has been conducted, the results need to be analysed. This will be done using statistical significance tests. From multiple statistical tests, the most appropriate ones need to be chosen. For this, the number of variables and measurement scale need to be determined. For this research the Mann-Whitney U test and the Wilcoxon signed-rank test are considered. In the following subsections, these tests will be explained. The analysis will be performed using IBM SPSS. This is a software platform which offers advanced statistical analysis. A level of significance of 0.05 is chosen, this means there is a 5% chance of drawing the wrong conclusion. The null hypothesis will be rejected when the significant level is lower than 0.05, with a reliability of 95%.

3.4.1 Mann-Whitney U test

The firsts test is the Mann-Whitney U test. This test test compares the differences between two independent groups. These two independent groups should be two categorical groups, for example male and female. For comparing more than two groups, the Kruskal-Wallis test should be consulted.

For executing this test, the scores first need to be ranked. Then the ranked numbers will be split out over the two groups and the scores per group are summed up. There is a difference when the sum of the ranked scores for one group is higher or lower than for the other group (van der Zee, 2017). If there is a difference, this difference should be examined to be statistical significant.

Before using the test, it needs to be checked whether the data can be analysed using the Mann-Whitney U test. There are three assumptions required for the data to use this test (Statistics Solutions, n.d.):

1. The sample drawn from the population is random.
2. The samples are independent.
3. The measurement scale is ordinal.

The test can be used for this data if the assumptions are complied. It is used to compare the differences between the experience of the street for two different groups. The sample drawn is not completely random due to the way it will be spread. However, it can be assumed to be sufficient for using this test. The samples which are compared are independent of each other and the data is ordinal as the experience is given on a likert scale. Consequently, the test can be used with the data of the survey.

Three groups will be tested based on gender, age and type of road user. Gender will exist of the groups male and female. For age, younger and older people will be compared. To create two groups based on the age, the respondents are split into two groups. One group exist of participants younger than 25 and one older than 25. This is based on the life cycle groupings, defining children and youth as younger than 25 and adults and seniors as older than 25 (Government of Canada, 2017). The type of road user will be divided into cyclists and pedestrians. However, as the survey had the option "both", this only will be done when there are enough answers for just

cyclist and just pedestrian. The following hypotheses will be tested with this test. H_0 defines the null hypothesis and H_1 the alternative hypothesis. As mentioned before, the null hypothesis will only be rejected when the significant level is lower than 0.05.

- H_0: There is no statistical difference in experience of **safety** regarding lane division with different **genders**.
- H_1: There is a statistical difference in experience of **safety** regarding lane division with different **genders**.

- H_0: There is no statistical difference in experience of **comfort** regarding lane division with different **genders**.
- H_1: There is a statistical difference in experience of **comfort** regarding lane division with different **genders**.

- H_0: There is no statistical difference in experience of **safety** regarding lane division with different **ages**.
- H_1: There is a statistical difference in experience of **safety** regarding lane division with different **ages**.

- H_0: There is no statistical difference in experience of **comfort** regarding lane division with different **ages**.
- H_1: There is a statistical difference in experience of **comfort** regarding lane division with different **ages**.

- H_0: There is no statistical difference in experience of **safety** regarding lane division with different **types of road user**.
- H_1: There is a statistical difference in experience of **safety** regarding lane division with different **types of road user**.

- H_0: There is no statistical difference in experience of **comfort** regarding lane division with different **types of road user**.
- H_1: There is a statistical difference in experience of **comfort** regarding lane division with different **types of road user**.

3.4.2   Wilcoxon signed-rank test

The second test is the Wilcoxon signed-rank test. The Wilcoxon signed-rank test is suitable for comparing two dependent samples that come from the same participants (Laerd Statistics, n.d.). This is used for ordinal data and suitable for this survey as it includes a likert scale. The goal of the test is to determine if the two variables have a statistical significant difference.

For executing this test, the difference between the two dependent samples needs to be determined. These samples are corresponding pairs, they are both ranked by the same participant. Next, the sign of the difference, positive or negative, is allocated to each pair. The positive and negative ranks are summed up separately, the smallest one forms the test statistics.

This test is used for part 2 of the survey where the situation with and without the lane division is compared. It tests whether there is a significant difference between these situations. The following hypotheses will be tested with this test. H_0 defines the null hypothesis and H_1 the alternative hypothesis.

- H_0: There is no statistical difference in the feeling of **safety** between the situation with and without the lane division.
- H_1: There is a statistical difference in the feeling of **safety** between the situation with and without the lane division.

- H_0: There is no statistical difference in the experience of **crowdedness** between the situation with and without the lane division.
- H_1: There is a statistical difference in the experience of **crowdedness** between the situation with and without the lane division.

- H_0: There is no statistical difference in having **bother** of other road users between the situation with and without the lane division.
- H_1: There is a statistical difference in having **bother** of other road users between the situation with and without the lane division.

- H_0: There is no statistical difference in the feeling of being **held up** between the situation with and without the lane division.
- H_1: There is a statistical difference in the feeling of being **held up** between the situation with and without the lane division.

Furthermore, this test will be used to analyse part 3 of the survey. It will examine if there is a significant difference between the corresponding scenarios comparing the street with and without the lane division. For example, when scenario one from table 3.5 needs to be tested, the rates of safety and comfort for figure 3.2a will be compared to figure 3.2b. For outlining the hypotheses, "X" will refer to the number of the scenario from table 3.5 and "a" and "b" will respectively refer to without and with lane division. The hypotheses will then be as followed.

- H_0: There is no statistical difference in experience of **safety** between scenario Xa and scenario Xb.
- H_1: There is a statistical difference in experience of **safety** between scenario Xa and scenario Xb.

- H_0: There is no statistical difference in experience of **comfort** between scenario Xa and scenario Xb.
- H_1: There is a statistical difference in experience of **comfort** between scenario Xa and scenario Xb.

When the Wilcoxon signed-rank test is done for all scenarios, a conclusion can be made if there is a statistical difference in experience of safety and comfort between the situation with and without the lane division.

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3.5 Summary

The method for this research will be a survey. This is useful as the opinion of the road users needs to be known. Due to Covid-19, the survey will be completely online. It will be spread through WhatsApp and by delivering of QR codes to residents in Delft. As the experience of a road user can be influenced by many characteristics, the influential factors are identified. They are divided into three categories: respondent, context and traffic composition. All the factors are too many to focus on so a selection has been made. The survey will exist of three parts. The first part will contain some questions concerning the demographic characteristics of the participant. The second part will ask questions comparing the situation with and without lane division. The third part will contain some scenarios at the Jacob Gerritstraat. Each scenario will be outlined with and without lane division so a comparison can be made.

The responses of the survey will be analysed with the use of statistical significance tests. These will be the Mann-Whitney U test and the Wilcoxon signed-rank test. A level of significance of 0.05 is chosen. The Mann-Whitney U test is used to compare differences between the experience of the street for two different groups. The Wilcoxon signed-rank test will analyse the results of part 2 and 3 of the survey. It tests if there is a difference in experience between the situation with and without lane division.

Chapter 4

Results

This chapter covers the results of the survey. In section 4.1, a descriptive analysis will be done and an overview of the responses of part 1 will be given. Next, in section 4.2, the analysing will be done using the tests described in section 3.4.

4.1 Descriptive analysis

The survey went online on May 13 by spreading it through Whats App and delivering 200 QR codes to residences in Delft. Unfortunately, the target goal of 100 respondents is not reached. In chapter 5 this will be further discussed. The survey was closed on May 27, 2021 with 69 responses.

Figure 4.1 shows the variety in gender among the participants. The responses are almost equally divided. There are a few more females but the difference is relatively small. Male and female could rate safety and comfort in a different way. As the groups are about equal, it is not likely to affect the results of the survey. Figure 4.2 shows the ages of the participants. The bar plot of the age has some peaks for people under the 25 but there are also multiple people of older age. The cause for this spread in age will be discussed in chapter 5. Age could influence the outcome as younger people might experience safety and comfort differently than older people. There are some big gaps for the ages between 29 to 36 and 37 to 49. People of these ages could rate safety and comfort differently than the people both older and younger. This could lead to not perfectly representative data.
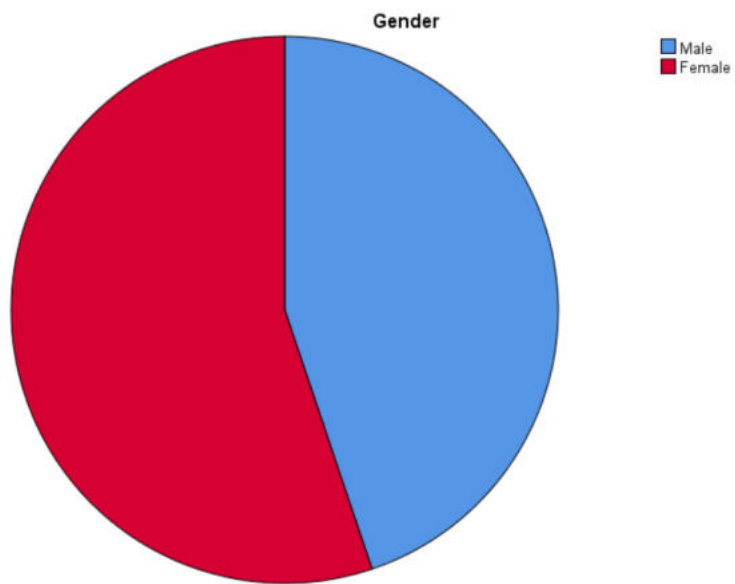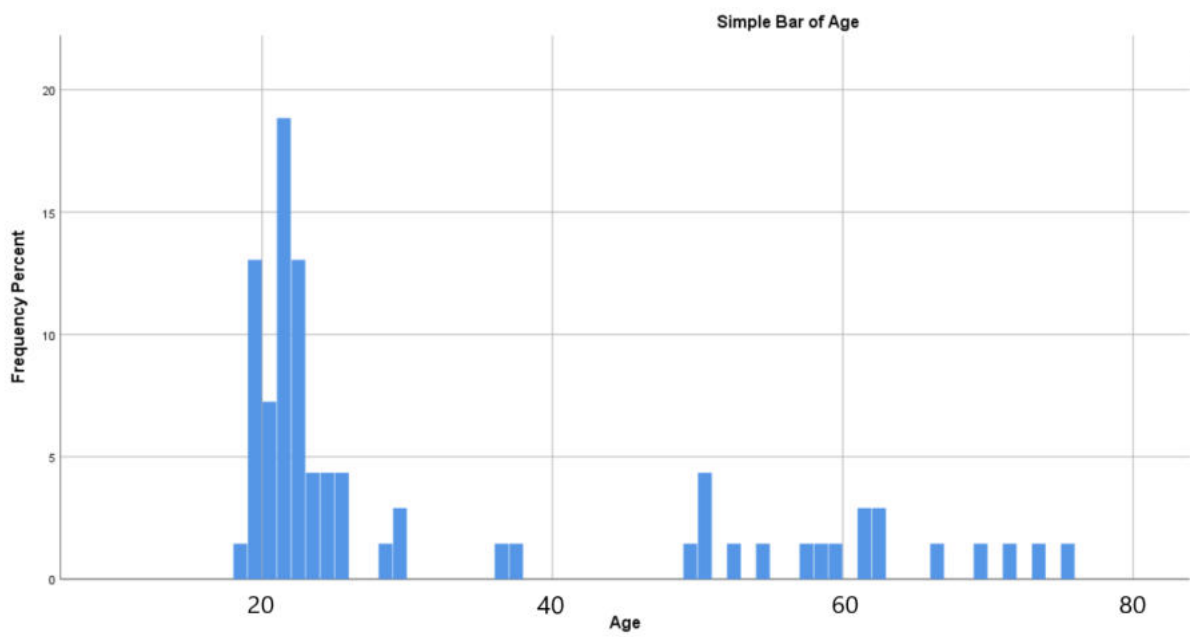
Figure 4.1: Gender

Figure 4.2: Age

Figure 4.3 shows the type of road users among the responses. This represents how the participant enters the Jacob Gerritstraat. It shows that the Jacob Gerritstraat is used by both pedestrians and cyclists regularly. This confirms that the street is a shared space. Pedestrians and cyclists could rate the safety and comfort in the street differently. As many participants experience the street as both pedestrian and cyclist, this could influence the outcome of the research. Their opinion might be different than someone entering the street as just a cyclist or pedestrian. For the Mann-Whitney U test, it was planned to make a comparison between the types of road users. So, the experience of cyclists would have been compared to the experience of pedestrians. However, the type of road users is mostly defined by people entering the street as both road users. The groups existing of only pedestrians or only cyclists are too small to compare to each other. Therefore, it has been decided to not make a comparison between cyclists and pedestrians for those two tests.
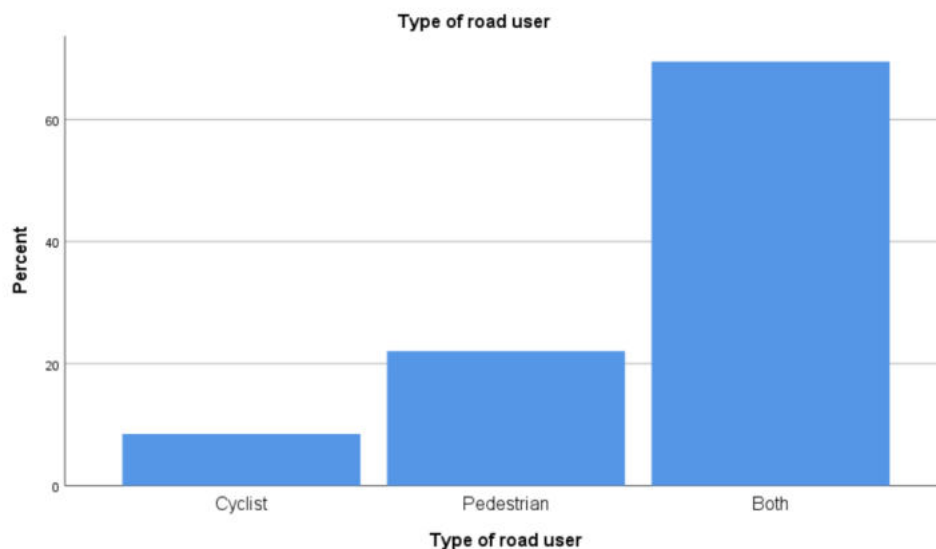
Figure 4.3: Type of road user

The participants were asked whether they stick to the currently used line. In other words, whether they walk or cycle on the right side of the line. The answers to this question can be seen in figure 4.4. 55.1% of the participants say they do stick to the line, except when they are overtaking someone and 15.9% say they always stick to the line. As the exception still means people are aware of the line and stick to it when no one gets in their way, it can be said that 71% abide by the lane division. A smaller part of the participants, 13%, say they stick to the line depending on how they enter the street, as cyclist or pedestrian. Another 10.1% answers sometimes. Only a very small part, 5.8%, does not stick to the line at all. As the number of people sticking to the line is much bigger, it can be said that the line is effective for dividing the street into two lanes. This is important to the research as the experience of the lane division would not make any sense if people would not abide to it. This information ensures that the questions comparing the situation with and without lane division are useful for the research.

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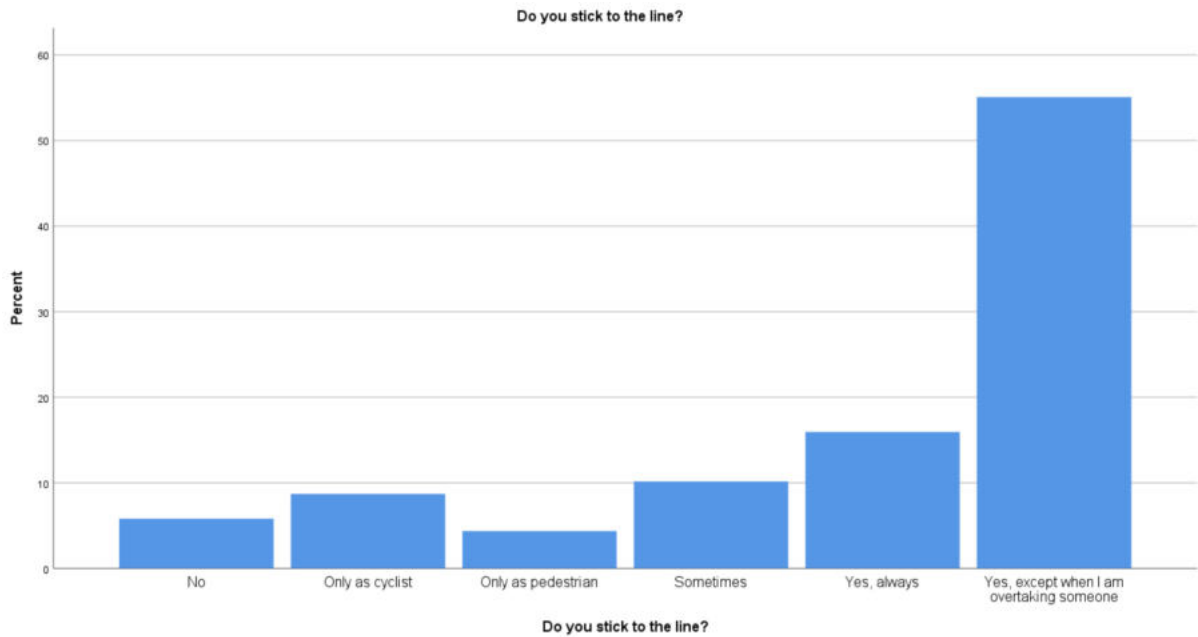
Figure 4.4: Sticking to the line

4.2 Statistical significance tests

The statistical significance tests are done with the IBM SPSS software to test the hypotheses from section 3.4. These are the Mann-Whitney U test and the Wilcoxon signed-rank test. Each test will be discussed in this section.

4.2.1 Mann-Whitney U test

The following hypotheses, retrieved from subsection 3.4.1, are tested with the Mann-Whitney U test.

- H_0: There is no statistical difference in experience of **safety** regarding lane division with different **genders**.
- H_1: There is a statistical difference in experience of **safety** regarding lane division with different **genders**.

- H_0: There is no statistical difference in experience of **comfort** regarding lane division with different **genders**.
- H_1: There is a statistical difference in experience of **comfort** regarding lane division with different **genders**.

- H_0: There is no statistical difference in experience of **safety** regarding lane division with different **ages**.
- H_1: There is a statistical difference in experience of **safety** regarding lane division with different **ages**.

- H_0: There is no statistical difference in experience of **comfort** regarding lane division with different **ages**.
- H_1: There is a statistical difference in experience of **comfort** regarding lane division with different **ages**.

As mentioned before, the comparison between the types of road user is not included. Two age groups were created by drawing a line at the age of 25. The reason for this age has already been discussed in section 3.4.1. Figure 4.5 shows the distribution in these age groups. As can be seen, the group younger than 25 is a bit bigger than the group older than 25. As both groups exist of a sufficient number, 43 and 26, this can be included in the test. The hypotheses comparing different genders and ages will be tested.
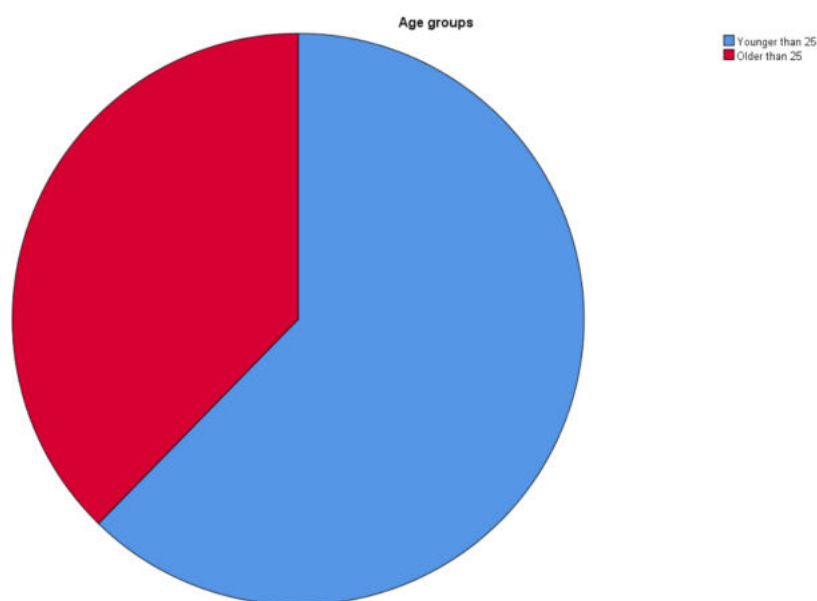
Figure 4.5: Age groups

For this test, part 3 of the survey is used. The average rating on safety/comfort are calculated for both the scenarios with as without the lane division. This creates the following four variables:

1. Average rated safety without lane division
2. Average rated safety with lane division
3. Average rated comfort without lane division
4. Average rated comfort with lane division

The significant levels for all variables can be found in table 4.1. As none of them is below 0.05, the null hypotheses can not be rejected. This means that there is no statistical difference in experience of safety and comfort regarding lane division with different genders and age groups. The complete outcomes of the test can be found in appendix A.

Test variable	Grouping variable	Significant level
Average rated safety without lane division	Gender	0.906
Average rated safety with lane division	Gender	0.510
Average rated comfort without lane division	Gender	0.455
Average rated comfort with lane division	Gender	0.567
Average rated safety without lane division	Age group	0.138
Average rated safety with lane division	Age group	0.324
Average rated comfort without lane division	Age group	0.351
Average rated comfort with lane division	Age group	0.413

Table 4.1: Significant level for each test variable and grouping variable

4.2.2 Wilcoxon signed-rank test

The following hypotheses, based on part 2 of the survey and retrieved from subsection 3.4.2, are tested with the Wilcoxon signed-rank test.

- H_0: There is no statistical difference in the feeling of **safety** between the situation with and without the lane division.
- H_1: There is a statistical difference in the feeling of **safety** between the situation with and without the lane division.

- H_0: There is no statistical difference in the experience of **crowdedness** between the situation with and without the lane division.
- H_1: There is a statistical difference in the experience of **crowdedness** between the situation with and without the lane division.

- H_0: There is no statistical difference in having **bother** of other road users between the situation with and without the lane division.
- H_1: There is a statistical difference in having **bother** of other road users between the situation with and without the lane division.

- H_0: There is no statistical difference in the feeling of being **held up** between the situation with and without the lane division.
- H_1: There is a statistical difference in the feeling of being **held up** between the situation with and without the lane division.

First, the tests for this part of the survey will be done. The following variables will be compared:

1. Safety without lane division and safety with lane division
2. Crowdedness without lane division and crowdedness with lane division
3. Bother without lane division and bother with lane division
4. Being held up without lane division and being help up with lane division

The significance levels of safety and crowdedness are respectively 0.008 and 0.001, so lower than 0.05. This means there is a statistical difference between the situation with and without lane division when these variables are considered.

For the safety, there are 33 positive ranks and 11 negative ranks. The positive ranks are the number of occasions when safety in the street with the lane division was ranked higher in comparison to the street without lane division. As there are more positive ranks than negative ranks, it can be concluded that people feel more safe with the lane division in the Jacob Gerritstraat. For the crowdedness, there are 39 negative ranks and 14 the positive ranks. The negative ranks are the number of occasions when crowdedness in the street with the lane division was ranked lower in comparison to the street without lane division. As there are more negative ranks than positive ranks, it can be concluded that people experienced the street less crowded with the lane division.

For the other two variables, bother and being held up, the significance levels were respectively 0.370 and 0.292. As they are not below 0.05, there is no statistical difference for these variables between the situation with and without lane division. The complete outcomes of the test can be found in appendix A.

Next, the other hypotheses from subsection 3.4.2 are tested with the same test. The following hypotheses are based on part 3 of the survey. "X" will refer to the number of the scenario from table 3.5 and "a" and "b" will respectively refer to without and with lane division.

- H_0: There is no statistical difference in experience of **safety** between scenario Xa and scenario Xb.
- H_1: There is a statistical difference in experience of **safety** between scenario Xa and scenario Xb.

- H_0: There is no statistical difference in experience of **comfort** between scenario Xa and scenario Xb.
- H_1: There is a statistical difference in experience of **comfort** between scenario Xa and scenario Xb.

The difference between with and without lane division per scenario will be tested. The different scenarios can be seen in figure 4.6 until figure 4.11. Each scenario contains a small description explaining the situation. Table 4.2 shows the significant levels for each scenario comparing the experience of safety/comfort for the situations with and without lane division. For both safety and comfort, all scenarios except for scenario three, the significant level is also below 0.05. This means for scenario 3 the difference is not statistical significant. However, for the other five scenarios there is a statistical difference. For the other scenarios, it can be concluded that there is a statistical difference in experience of safety and comfort between the scenarios with and without lane division.

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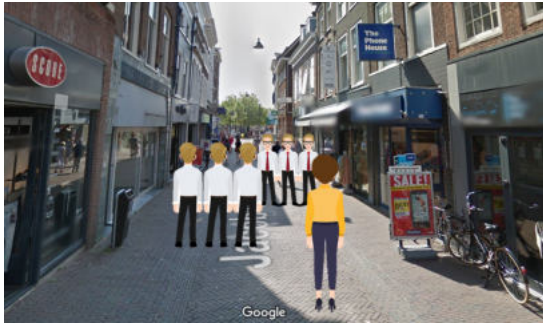
(a) without lane division

(b) with lane division

Figure 4.6: Scenario 1: Pedestrians walking in two directions

(a) without lane division

(b) with lane division

Figure 4.7: Scenario 2: Pedestrians walking in opposite direction
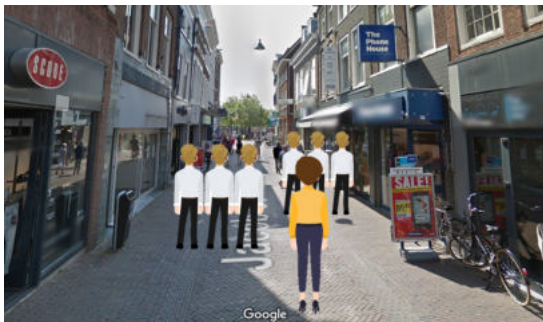
(a) without lane division

(b) with lane division

Figure 4.8: Scenario 3: Pedestrians walking in same direction
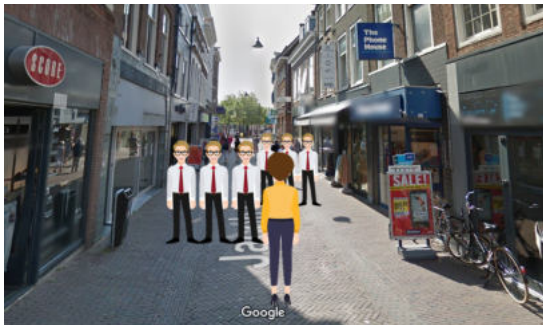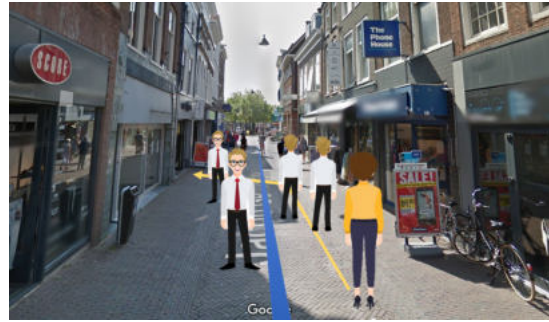
(a) without lane division   (b) with lane division
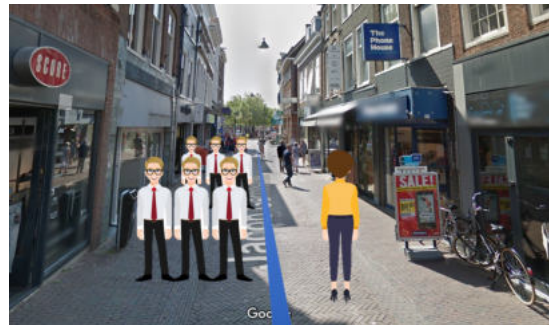
Figure 4.9: Scenario 4: Entering shop

(a) without lane division   (b) with lane division

Figure 4.10: Scenario 5: Pedestrians two directions, cyclist opposite direction
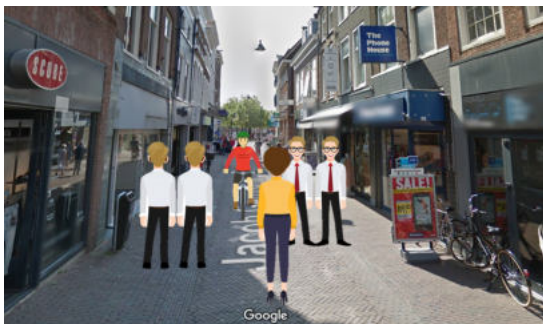
(a) without lane division   (b) with lane division

Figure 4.11: Scenario 6: Pedestrians two directions, cyclist same direction

Scenario	Significant level - safety	Significant level - comfort
1: Pedestrians walking in two directions	0.000	0.000
2: Pedestrians walking in opposite direction	0.000	0.000
3: Pedestrians walking in same direction	0.106	0.607
4: Entering shop	0.000	0.000
5: Pedestrians two directions, cyclist opposite direction	0.000	0.000
6: Pedestrians two directions, cyclist same direction	0.000	0.000

Table 4.2: Significant levels for each scenario

Subsequently, the ranks for each scenarios will be looked into. Scenario 3 is not taken into account for the experience of both safety comfort as the null hypothesis could not be rejected. Table 4.3 shows the ranks for safety and comfort. A positive rank means that the safety/comfort is ranked higher for the situation with lane division than without whereas for the negative rank it is just the other way around. For all scenarios, there are more positive ranks than the negative ranks.

Scenario	Safety		Comfort	
	Positive ranks	*Negative ranks*	*Positive ranks*	*Negative ranks*
1	44	4	49	4
2	60	2	61	3
3	-	-	-	-
4	42	8	43	14
5	52	3	45	9
6	36	14	41	7

Table 4.3: Ranks for each scenario

4.3 Summary

The survey was closed with 69 responses. For gender, the responses were almost equally divided. The bar plot of the age has some peaks under the 25 but there are also multiple people of older age. The type of road users was mostly defined by people entering the street as both road users so there has been decided to not compare the types of road users. Most participants seem to stick to the line which is now applied in the Jacob Gerritstraat. The hypotheses were tested with statistical significance tests. These are the Mann-Whitney U test and the Wilcoxon signed-rank test. The significant levels for the Mann-Whitney U test were too high so none of the null hypotheses could be rejected. For the Wilcoxon signed-rank test many null hypotheses could be rejected as the significant level was lower than 0.05. It showed that the scenarios with lane division scored higher on experience of safety and comfort than without lane division.

Chapter 5

Discussion

In this chapter the methodology and results will be discussed. A critical look will be taken at different choices that have been made for this research. Section 5.1 will discuss the results and the interpretation of them. In section 5.2 the method will be discussed, mainly focusing on the limitations. Lastly, in section 5.3, the survey itself will be reviewed.

5.1 Interpretation of the results

Two statistical significance tests were used to analyse the results. The Mann-Whitney U test showed that there was no statistical difference in experience of safety and comfort with different genders and ages. There was no relationship to be found between these variables.

For part 2 of the survey, the Wilcoxon signed-ranked test showed there is a statistical difference in the feeling of safety and the experience of crowdedness between the situation with and without lane division in the Jacob Gerritstraat. The situation with lane division turned out to be ranked as more safe and less crowded. However, it can not be said with certainty that this outcome was only effected by the lane division. The crowdedness could also have been affected by the Covid-19 virus and the request to stay home as much as possible. For having bother and feeling held up there were no statistical difference.

The analysed results of part 3 of the survey showed there is a statistical difference between the scenarios with and without lane division. Except for the scenario where everyone was walking in the same direction as the participant, all scenarios showed a difference for the two situations. From these scenarios, all situations with lane division were ranked higher on safety and comfort. This shows that the line has an positive effect on the experience of the road users.

5.2 Limitations of the method

For this research, a survey was used as the focus lies on the experience of the road users. Their opinion about the street needed to become known. However, there were some limitations concerning the spreading of the survey. The target goal of 100 respondents was not reached. It was difficult to spread the survey as only people who know the Jacob Gerritstraat could fill

it in. All people living in Delft were expected to be able to fill in the survey but this might have been an incorrect assumption. Not everyone living in Delft might pass this street often enough to compare the situation before and during Covid-19. The best way would have been to stand on the street and hand out surveys to people passing by. However, the spreading of the Covid-19 virus made this an inappropriate way of approaching road users.

Many respondents were received from close friends living in Delft as they were easy to approach. They are mainly students living in the centre of Delft. This might have caused a biased outcome of the survey. The delivering of the QR codes to residences in Delft has been helpful to reach out to a different respondent group. First, 100 QR codes were delivered but as not many filled in the survey, another 100 were sent out. It did provide more respondents of different ages but more reactions was hoped for. An attempt was made to place the QR code on platforms or in small newspapers in Delft. Unfortunately, none of them react on the mail which was sent so this idea did not work out. The way the survey was spread might have caused that the data was not well balanced.

With the limitations identified, a couple things can be learned from them. Receiving enough responses on the survey has been underestimated as less people filled in the survey than was expected. Looking at the data and particularly the answers to age, the number of scanned QR codes are estimated to be around 25. This means that only 12.5% of the delivered QR codes were filled in. It shows the importance of reaching out to the right target group. People having an interest in the outcome of the survey will be more likely to fill in the survey. Therefore, it is important to think carefully about which residences the QR codes should be delivered to. Besides that, older people might be less familiar with new technology like scanning a QR code. A URL-link was placed underneath the QR code so copying this would work as well. However, this means some extra effort needs to be taken which is not favorable. Providing an offline survey for older people could have been a solution for this.

5.3   Review of the survey

Now, the survey itself will be discussed. Filling in the survey took around ten minutes, especially the last part took some time. This might have been a bit too long for encouraging people to complete the survey and to stay focused on the questions. The length of the survey could have been a reason for not achieving the target goal for responses. It could be questioned whether it was necessary to have a survey of ten minutes length.

Looking back, part 2 and 3 might have been too extended. With the results in mind, part 2 did not give many more new insights than part 3 already did. With each question asked for both before and during Covid-19, part 2 was pretty time consuming. However, it did question the comfort more focused on particular aspects like crowdedness, bother and being held up. Part 3 consisted of six different scenarios, each doubled as both situations with and without lane division were questioned. This resulted in twelve scenarios which needed to be rated on safety and comfort. In hindsight, less scenarios might have been better for keeping the survey attracting. But which scenario could have been left out? It was remarkable that only scenario 3 had a higher significant level for both safety and comfort than the other scenarios. This is the

scenario where two groups are walking in the same direction as the participant. As everyone is walking in the same direction, it does make sense that the line will not make much difference for the experience of safety and comfort. This scenario could have been taken out.

Some assumptions needed to be made to steer the survey in the right direction. Part 2 covered the questions comparing the Jacob Gerritstraat before and during Covid-19, so without and with lane division. For this part, the experience was assumed to only be influenced by the line but the spreading of the Covid-19 virus probably had an effect on this too. Due to Covid-19 there might be less people on the streets which could affect the experience as well. The questions about safety, crowdedness, bother and being held up could depend on the usage frequency of the street. This means the answers of the participants could be based on this instead of just the lane division.

An attempt to counteract this was done by stating in the survey that the focus lies on the traffic and that contamination risk of Covid-19 was disregarded. However, there is a risk that these answers will not be fully representable for the research. This could have been improved by clearly outlining that the situations only differ in the presence of the line. Maybe the questions should not have included Covid-19 at all. Still, it is difficult to make this comparison without taking into account the effect of the spread of Covid-19. Part 3 was considered to be more clear on this topic. Again, it was clearly stated that contamination risk of Covid-19 was disregarded but this time situations could be judged on their appearance. In this way the focus could be fully on the line and not on the effects of Covid-19. For this part, the usage frequency of the street was equal for the scenarios comparing with and without lane division. Therefore, it was a good option for equally comparing the experience of safety and comfort for situations with and without the line. Regarding this, the conclusions will mostly be based on the results of part 3 of the survey.

Chapter 6

Conclusion

This chapter aims to draw a conclusion on the analysis of the results (chapter 4) and the discussion (chapter 5). The goal of this chapter is to answer the main research question: *"How does the lane division in the Jacob Gerritstraat affect the road users' experience of safety and comfort?"*.

This research aimed to investigate if the lane division in the Jacob Gerritstraat improves the experience of safety and comfort of the road users. With the findings of this research, it could be considered to keep the lane division in the Jacob Gerritstraat, even after Covid-19. Moreover, the findings could possibly suggest to apply lane division in other shared spaces.

First, it was questioned whether the users of the Jacob Gerritstraat stick to the lane division. As majority of the participants follows this rule, the line can be considered as effective. Next, it was tested whether there is a relationship between the characteristics of the participants and their ratings on the survey. The Mann-Whitney U test showed that there was no statistical significant difference in experience of safety and comfort with different genders and ages.

Subsequently, the feeling of safety, crowdedness, bother and being held up in the Jacob Gerritstraat were compared for the situation with and without the lane division. This was done using the Wilcoxon signed-rank test. For the situation during Covid-19, with lane division, the safety was ranked higher and the crowdedness lower. However, the spreading of the Covid-19 virus might have influenced this outcome.

Lastly, different scenarios in the Jacob Gerritstraat were compared for with and without lane division. Scenario 3, where two groups are walking in the same direction as the participant, was the only scenario not having a statistical significant difference between the situation with and without lane division. All the other scenarios had a statistical significant difference when comparing the two situations. These scenarios were:

- Scenario 1: Pedestrians walking in two directions
- Scenario 2: Pedestrians walking in opposite direction
- Scenario 4: Entering shop
- Scenario 5: Pedestrians two directions, cyclist opposite direction
- Scenario 6: Pedestrians two directions, cyclist same direction

For all of them, the Wilcoxon signed-rank test showed that the safety and comfort were ranked higher for the situations with lane division.

Regarding the analysis of the results, it can be concluded that the lane division in the Jacob Gerritstraat is experienced as more safe and more comfortable. The results indicate that the street with lane division is preferred over the street without. Despite the fact that this research was only focused on the Jacob Gerritstraat, the outcome could be of interest for other streets as well. The research has showed that a bit of structure in a shared space can lead to an improved experience of the road user. Even though a shared space is assumed to be without any traffic measures, this research has showed that a small measure, just a line on the street, can ensure a more safe and more comfortable surrounding. Based on these conclusions, the municipality of Delft could consider keeping the line in the Jacob Gerritstraat. Furthermore, municipalities of different cities in the Netherlands could consider applying lane division in busy streets like the Jacob Gerritstraat in Delft.

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Appendix A: Outcomes statistical significance tests

Ranks

	Gender	N	Mean Rank	Sum of Ranks
Average_safety_a	Male	29	34,17	991,00
	Female	39	34,74	1355,00
	Total	68		
Average_safety_b	Male	29	32,67	947,50
	Female	39	35,86	1398,50
	Total	68		
Average_comfort_a	Male	29	36,57	1060,50
	Female	39	32,96	1285,50
	Total	68		
Average_comfort_b	Male	29	32,91	954,50
	Female	39	35,68	1391,50
	Total	68		

Test Statistics[a]

	Average_safety_a	Average_safety_b	Average_comfort_a	Average_comfort_b
Mann-Whitney U	556,000	512,500	505,500	519,500
Wilcoxon W	991,000	947,500	1285,500	954,500
Z	-,118	-,658	-,748	-,572
Asymp. Sig. (2-tailed)	,906	,510	,455	,567

a. Grouping Variable: Gender

Figure 1: Mann-Whitney U test for different genders

Ranks

	Age groups	N	Mean Rank	Sum of Ranks
Average_safety_a	Younger than 25	43	37,78	1624,50
	Older than 25	26	30,40	790,50
	Total	69		
Average_safety_b	Younger than 25	43	36,85	1584,50
	Older than 25	26	31,94	830,50
	Total	69		
Average_comfort_a	Younger than 25	43	36,74	1580,00
	Older than 25	26	32,12	835,00
	Total	69		
Average_comfort_b	Younger than 25	43	36,53	1571,00
	Older than 25	26	32,46	844,00
	Total	69		

Test Statistics[a]

	Average_safety_a	Average_safety_b	Average_comfort_a	Average_comfort_b
Mann-Whitney U	439,500	479,500	484,000	493,000
Wilcoxon W	790,500	830,500	835,000	844,000
Z	-1,483	-,986	-,933	-,819
Asymp. Sig. (2-tailed)	,138	,324	,351	,413

a. Grouping Variable: Age groups

Figure 2: Mann-Whitney U test for different age groups

Ranks

		N	Mean Rank	Sum of Ranks
Safety_with - Safety_without	Negative Ranks	11[a]	24,64	271,00
	Positive Ranks	33[b]	21,79	719,00
	Ties	25[c]		
	Total	69		
Crowdedness_with - Crowdedness_without	Negative Ranks	39[d]	27,95	1090,00
	Positive Ranks	14[e]	24,36	341,00
	Ties	16[f]		
	Total	69		
Bother_with - Bother_without	Negative Ranks	20[g]	21,95	439,00
	Positive Ranks	25[h]	23,84	596,00
	Ties	24[i]		
	Total	69		
Heldup_with - Heldup_without	Negative Ranks	18[j]	12,75	229,50
	Positive Ranks	9[k]	16,50	148,50
	Ties	42[l]		
	Total	69		

Figure 3: Wilcoxon signed-rank test of part 2 - Ranks

Test Statistics[a]

	Safety_with - Safety_without	Crowdedness_with - Crowdedness_without	Bother_with - Bother_without	Heldup_with - Heldup_without
Z	-2,673[b]	-3,403[c]	-,897[b]	-1,053[c]
Asymp. Sig. (2-tailed)	,008	,001	,370	,292

a. Wilcoxon Signed Ranks Test

b. Based on negative ranks.

c. Based on positive ranks.

Figure 4: Wilcoxon signed-rank test of part 2 - Test Statistics

Ranks

		N	Mean Rank	Sum of Ranks
Safety_1b - Safety_1a	Negative Ranks	4[a]	13,00	52,00
	Positive Ranks	44[b]	25,55	1124,00
	Ties	21[c]		
	Total	69		
Safety_2b - Safety_2a	Negative Ranks	2[d]	7,75	15,50
	Positive Ranks	60[e]	32,29	1937,50
	Ties	7[f]		
	Total	69		
Safety_3b - Safety_3a	Negative Ranks	15[g]	18,43	276,50
	Positive Ranks	24[h]	20,98	503,50
	Ties	30[i]		
	Total	69		
Safety_4b - Safety_4a	Negative Ranks	8[j]	12,06	96,50
	Positive Ranks	42[k]	28,06	1178,50
	Ties	19[l]		
	Total	69		
Safety_5b - Safety_5a	Negative Ranks	3[m]	13,83	41,50
	Positive Ranks	52[n]	28,82	1498,50
	Ties	14[o]		
	Total	69		
Safety_6b - Safety_6a	Negative Ranks	14[p]	17,36	243,00
	Positive Ranks	36[q]	28,67	1032,00
	Ties	19[r]		
	Total	69		

a. Safety_1b < Safety_1a
b. Safety_1b > Safety_1a
c. Safety_1b = Safety_1a
d. Safety_2b < Safety_2a
e. Safety_2b > Safety_2a
f. Safety_2b = Safety_2a
g. Safety_3b < Safety_3a
h. Safety_3b > Safety_3a
i. Safety_3b = Safety_3a
j. Safety_4b < Safety_4a
k. Safety_4b > Safety_4a
l. Safety_4b = Safety_4a
m. Safety_5b < Safety_5a
n. Safety_5b > Safety_5a
o. Safety_5b = Safety_5a
p. Safety_6b < Safety_6a
q. Safety_6b > Safety_6a
r. Safety_6b = Safety_6a

Figure 5: Wilcoxon signed-rank test for safety of part 3 - Ranks

Test Statistics[a]

	Safety_1b - Safety_1a	Safety_2b - Safety_2a	Safety_3b - Safety_3a	Safety_4b - Safety_4a	Safety_5b - Safety_5a	Safety_6b - Safety_6a
Z	-5,548[b]	-6,768[b]	-1,618[b]	-5,274[b]	-6,145[b]	-3,881[b]
Asymp. Sig. (2-tailed)	,000	,000	,106	,000	,000	,000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

Figure 6: Wilcoxon signed-rank test for safety of part 3 - Test Statistics

Ranks

		N	Mean Rank	Sum of Ranks
Comfort_1b - Comfort_1a	Negative Ranks	4[a]	7,25	29,00
	Positive Ranks	49[b]	28,61	1402,00
	Ties	16[c]		
	Total	69		
Comfort_2b - Comfort_2a	Negative Ranks	3[d]	4,67	14,00
	Positive Ranks	61[e]	33,87	2066,00
	Ties	5[f]		
	Total	69		
Comfort_3b - Comfort_3a	Negative Ranks	25[g]	20,60	515,00
	Positive Ranks	18[h]	23,94	431,00
	Ties	26[i]		
	Total	69		
Comfort_4b - Comfort_4a	Negative Ranks	14[j]	13,86	194,00
	Positive Ranks	43[k]	33,93	1459,00
	Ties	12[l]		
	Total	69		
Comfort_5b - Comfort_5a	Negative Ranks	9[m]	14,17	127,50
	Positive Ranks	45[n]	30,17	1357,50
	Ties	15[o]		
	Total	69		
Comfort_6b - Comfort_6a	Negative Ranks	7[p]	13,07	91,50
	Positive Ranks	41[q]	26,45	1084,50
	Ties	21[r]		
	Total	69		

a. Comfort_1b < Comfort_1a
b. Comfort_1b > Comfort_1a
c. Comfort_1b = Comfort_1a
d. Comfort_2b < Comfort_2a
e. Comfort_2b > Comfort_2a
f. Comfort_2b = Comfort_2a
g. Comfort_3b < Comfort_3a
h. Comfort_3b > Comfort_3a
i. Comfort_3b = Comfort_3a
j. Comfort_4b < Comfort_4a
k. Comfort_4b > Comfort_4a
l. Comfort_4b = Comfort_4a
m. Comfort_5b < Comfort_5a
n. Comfort_5b > Comfort_5a
o. Comfort_5b = Comfort_5a
p. Comfort_6b < Comfort_6a
q. Comfort_6b > Comfort_6a
r. Comfort_6b = Comfort_6a

Figure 7: Wilcoxon signed-rank test for comfort of part 3 - Ranks

Test Statistics[a]

	Comfort_1b - Comfort_1a	Comfort_2b - Comfort_2a	Comfort_3b - Comfort_3a	Comfort_4b - Comfort_4a	Comfort_5b - Comfort_5a	Comfort_6b - Comfort_6a
Z	-6,117[b]	-6,887[b]	-,515[c]	-5,071[b]	-5,342[b]	-5,155[b]
Asymp. Sig. (2-tailed)	,000	,000	,607	,000	,000	,000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.
c. Based on positive ranks.

Figure 8: Wilcoxon signed-rank test for comfort of part 3 - Test Statistics

Appendix B: Survey

On the next page the survey can be found.

Onderzoek Jacob Gerritstraat, Delft

Voor mijn Bachelor Eindwerk voor de studie Civiele Techniek aan de TU Delft doe ik onderzoek naar de belevenis van weggebruikers in de Jacob Gerritstraat in Delft. Hierbij ga ik kijken naar de invloed van een rijstrookverdeling op zowel het gevoel van veiligheid als comfort van de weggebruiker. Voor het invullen van deze enquête dient u redelijk bekend te zijn met de Jacob Gerritstraat. Dit is de straat gelegen tussen de Markt en Brabantse Turfmarkt, zoals te zien in de afbeelding hieronder. De enquête bestaat uit drie korte delen. Het invullen van de gehele enquête zal ongeveer 10 minuten duren en is volledig anoniem.

Voor vragen of opmerkingen rondom dit onderzoek kunt u contact met mij opnemen via het volgende mailadres:
e.a.m.knopper@student.tudelft.nl

Alvast hartelijk dank voor het invullen van deze enquête.

For my Bachelor Thesis for the study Civil Engineering at the TU Delft, I'm researching the experience of road users in the Jacob Gerritstraat in Delft. I will look into the influence of lane division on the feeling of safety and comfort of the road user. To complete this survey, you should be reasonably familiar with the Jacob Gerritstraat. This is the street situated between the Markt and the Brabantse Turfmarkt, as can be seen in the picture below. The survey exists of three short parts. Completing the entire survey will take approximately 10 minutes and is completely anonymous.

For questions or remarks about this research, you can contact me via the following email address:
e.a.m.knopper@student.tudelft.nl

Thank you very much for completing this survey.

Locatie Jacob Gerritstraat

TUDelft
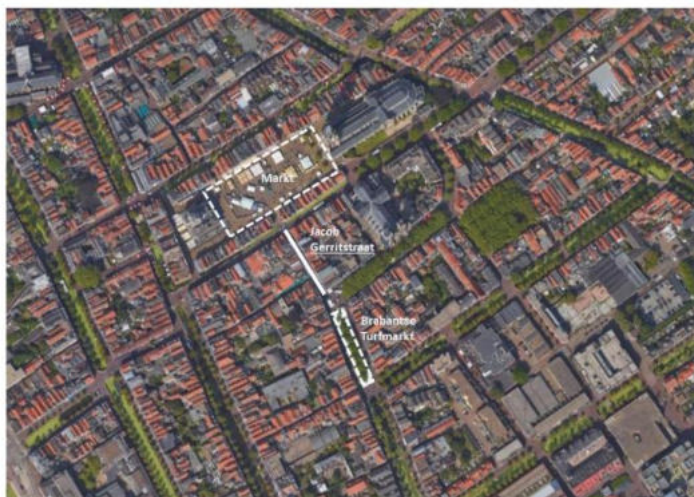
Next

Onderzoek Jacob Gerritstraat, Delft

* Required

Taal / Language

Welke taal heeft uw voorkeur? / What language do you prefer? *

○ Nederlands

○ English

Back   Next

Onderzoek Jacob Gerritstraat, Delft

* Required

Part 1

Gender *

○ Male

○ Female

○ Prefer not to say

Age *

Your answer

To what type of road users do you belong when passing the Jacob Gerritstraat? *

○ Pedestrian

○ Cyclist

○ Both

Back   Next

Onderzoek Jacob Gerritstraat, Delft

* Required

Part 1 (continued)

As a result of the spread of Covid-19, a blue line has been placed in the Jacob Gerritstraat that suggests road users to walk/cycle on the right.

Picture Jacob Gerritstraat with lane division

Do you stick to the currently used line, in other words are you walking/cycling on the right side of the line? *

○ Yes, always

○ Yes, except when I am overtaking someone

○ Sometimes

○ No

○ Only as pedestrian

○ Only as cyclist

○ Other: _____

Back   Next

Onderzoek Jacob Gerritstraat, Delft

* Required

Part 2

In this part a comparison will be made between the situation before Covid-19 and during Covid-19, in other words, the current situation. As a result of Covid-19, the Jacob Gerritstraat is divided into two lanes by the placing of a blue line in the middle of the street. The line suggests road users to always keep right in the street. In the situation before Covid-19, this line was not there and people could make use of the whole street. The questions will be about your feeling of safety and comfort. This concerns safety in traffic and contamination risk for Covid-19 is disregarded.

Picture Jacob Gerritstraat with lane division

How safe did you feel as a participant in the traffic in the Jacob Gerritstraat before Covid-19, without the lane division? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How safe do you feel as a participant in the traffic in the Jacob Gerritstraat during Covid-19, with the lane division? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How did you experience the crowdedness in the Jacob Gerritstraat before Covid-19, without the lane division? *

	1	2	3	4	5	6	7	8	9	10	
Very empty	○	○	○	○	○	○	○	○	○	○	Very crowded

How do you experience the crowdedness in the Jacob Gerritstraat during Covid-19, with the lane division? *

	1	2	3	4	5	6	7	8	9	10	
Very empty	○	○	○	○	○	○	○	○	○	○	Very crowded

How much bother did you have of cyclists/pedestrians passing before Covid-19, without the lane division? *

	1	2	3	4	5	6	7	8	9	10	
No bother	○	○	○	○	○	○	○	○	○	○	Lot of bother

How much bother do you have of cyclists/pedestrians passing during Covid-19, with the lane division? *

	1	2	3	4	5	6	7	8	9	10	
No bother	○	○	○	○	○	○	○	○	○	○	Lot of bother

Did you feel held up in the Jacob Gerritstraat before Covid-19, without the lane division? *

○ Yes

○ No

○ Sometimes

Do you feel held up in the Jacob Gerritstraat during Covid-19, with the lane division? *

○ Yes

○ No

○ Sometimes

Back   Next

Onderzoek Jacob Gerritstraat, Delft

* Required

Part 3

In this last part, twelve situations will be sketched. For the situation with the line on the street you can assume that road users will stick to it. For each situation your feeling of safety and comfort will be asked. This concerns safety in traffic and contamination risk for Covid-19 is disregarded. For comfort you could think of the flow (can you move through the street easily or are you held up), the space (do you experience crowdedness or can you pass others easily?) and the speed (can you pass the street at your own pace or do you feel propelled by the crowd?). In addition, you can assume that you are not in a hurry.

Scenario 1 - Without the lane division
In this scenario the type of road user is pedestrians. There are two flow directions; one group walks in the same direction as you and the other group walks the opposite direction, towards you.

How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 2 - With the lane division
In this scenario the type of road user is pedestrians. There are two flow directions; one group walks in the same direction as you and the other group walks the opposite direction, towards you.
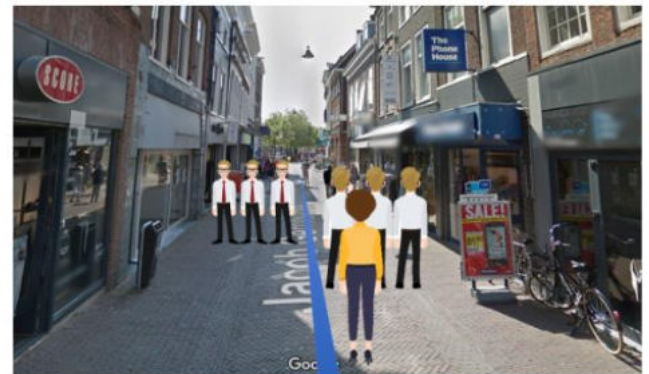
How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 3 - Without the lane division
In this scenario the type of road user is pedestrians. There is one flow direction; two groups walk in opposite direction, towards you.
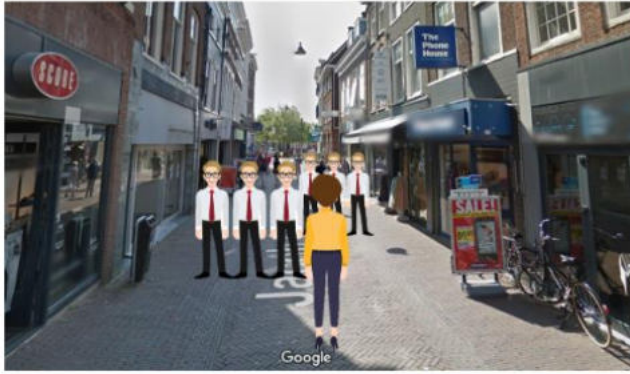
How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 4 - With the lane division
In this scenario the type of road user is pedestrians. There is one flow direction; two groups walk in opposite direction, towards you.
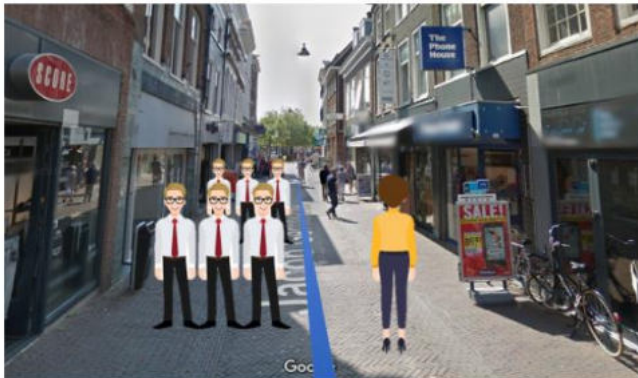
How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 5 - Without the lane division
In this scenario the type of road user is pedestrians. There is one flow direction; two groups walk in the same direction as you.

How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 6 - With the lane division
In this scenario the type of road user is pedestrians. There is one flow direction; two groups walk in the same direction as you.

How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 7 - Without the lane division

In this scenario the type of road user is pedestrians. There are two flow directions; some walk in the same direction as you and some walk in opposite direction, towards you. You want to go to the shop on the other side of the street, as indicated with the yellow arrow.
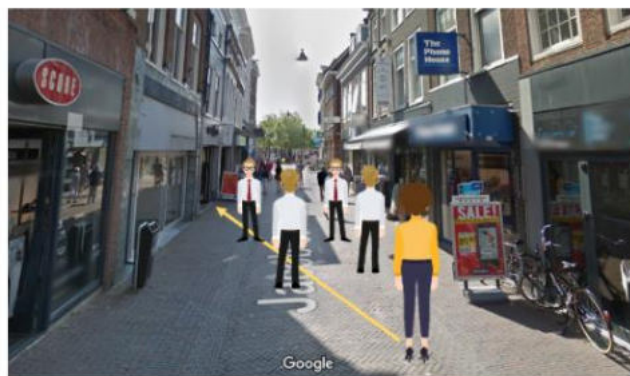
How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 8 - With the lane division

In this scenario the type of road user is pedestrians. There are two flow directions; some walk in the same direction as you and some walk in opposite direction, towards you. You want to go to the shop on the other side of the street, as indicated with the yellow arrow.
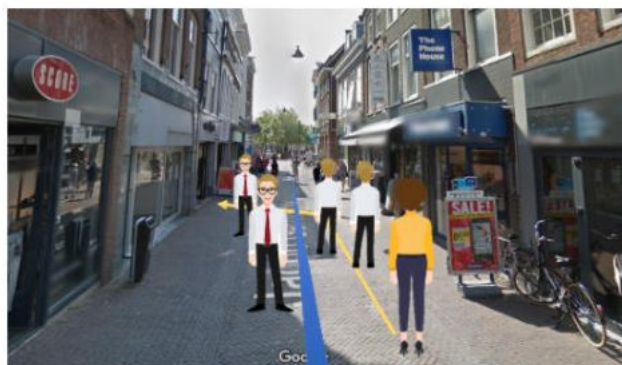
How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 9 - Without the lane division

In this scenario there are two types of road user: pedestrians and a cyclist. There are two flow directions; one group pedestrians walk in the same direction as you and the other group pedestrians walks in the opposite direction, towards you. The cyclist also cycles in the opposite direction.
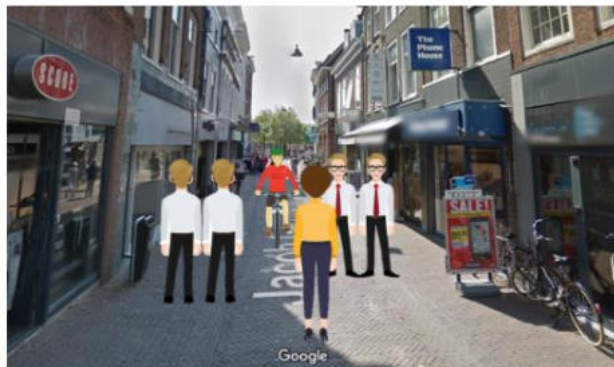
How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 10 - With the lane division

In this scenario there are two types of road user: pedestrians and a cyclist. There are two flow directions; one group pedestrians walk in the same direction as you and the other group pedestrians walks in the opposite direction, towards you. The cyclist also cycles in the opposite direction.

How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 11 - Without the lane division

In this scenario there are two types of road user: pedestrians and a cyclist. There are two flow directions; one group pedestrians walk in the same direction as you and the other group pedestrians walks in the opposite direction, towards you. The cyclist cycles in the same direction.

How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Scenario 12 - With the lane division

In this scenario there are two types of road user: pedestrians and a cyclist. There are two flow directions; one group pedestrians walk in the same direction as you and the other group pedestrians walks in the opposite direction, towards you. The cyclist cycles in the same direction.

How would you rate the level of safety for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very unsafe	○	○	○	○	○	○	○	○	○	○	Very safe

How would you rate the level of comfort for this situation? *

	1	2	3	4	5	6	7	8	9	10	
Very uncomfortable	○	○	○	○	○	○	○	○	○	○	Very comfortable

Do you have any general feedback or comments about the research?

Your answer

This is the end of the survey, thank you for completing it.

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