

The behaviour of pedestrians in public spaces and sense of security during the corona crisis

A study focussing on determining influential route adjustment factors; age, health situation and context.



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The behaviour of pedestrians in public areas and sense of security during the corona crisis

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Cover image: (Johnson, 2018)



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Vitali Jari van Elk

Summary

Our current world is heavily impacted by the Covid-19 (Corona) virus. The 1,5-meter rule was one of the earliest big restriction made by the Dutch government. It was a constraint aimed at decreasing the amount of interaction between multiple persons so that the spread of the virus would be heavily reduced. This meant that the amount of people that could visit supermarkets and stores were capped off. And quickly people came up with new ways to restore our daily life into a restricted new version. In most places' indications would show the required distance between you and the person in front of you, signs would draw your attention and tell the desired walking direction. This all has a massive impact on how people behave in certain places. But what about the places where these indications are not quite so easy to place or to maintain these regulations, what is the behaviour of pedestrian in these public spaces.

This thesis is about the influential factors on path adjustment and sense of security of pedestrians in public spaces during the COVID-19 virus crisis. At the end of this assignment an answer to the main research question " *What is the response of pedestrians during a close-by interaction with another pedestrian in public areas as part of their behaviour in times of the COVID-19 virus outbreak?*" will be given. And tell with more certainty how people behave in these situations and the characteristics that cause a change in intended path adjustment. Four sub-questions have been made in order to help form an answer for this research. These questions cover topics as: influential personal characteristics, influential characteristics of the approaching pedestrian, context related influences and a sense of security and feeling of safety in these situations.

First, a pool of influential factors has been made. The pool of factors has been reduced based on several criteria such as privacy, workability and expected outcome. The factors that have been chosen in the survey are age, group size, and whether they are in a hurry. From these factors, 8 different scenarios have been created to cover the entire range of combinations. These factors were transferred into an image from which the respondents preferred path adjustment was asked and whether the respondent based his answer on a sense of health threat. Apart from that several personal questions have been made with the goal to give insight on our respondents. This includes questions about their age, gender, health situation, main reasoning for walking in public areas and whether they changed their routes and/or time of the day in which they visit public areas. In total we received a sample group of 516 respondents. Links and conclusions have been made about both the impact of influential factors of the respondent as well as the influence of characteristics differences of the approaching pedestrians. Two tests were used to show the statistical significance of these values, the chi squared test and the Wilcoxon signed-rank test.

The outcome of the analysis was that based on the respondents gained in the time frame of 21 September 2020 to 04 October 2020 we have a reason to believe that:

- Respondents in the early adulthood take a smaller path adjustment than respondents in the late adulthood. Due to the distribution of the responses possible closely related to this statement is the fact that we saw that the gender influences the path adjustment. Further research is needed to prove or disprove this so no premature claims are made. In general males took smaller path adjustments. It was also seen that the respondents from within one of the RIVM risk groups took bigger path adjustments.

- Both the age and the group size will cause a difference in path adjustment. An older approaching pedestrian or a group instead of a single pedestrian will both lead to a bigger path adjustment. However, if the respondent is in a hurry, he will take a smaller path adjustment.
- Respondents will take a bigger path adjustment if he assesses the situation based on a health risk. The thinking behind this health risk has no further influence.

For follow-up research it is suggested to start diving into it as soon as possible. The virus is still amongst us and it is still a very trending topic of conversation. We might still not fully realise the impact of the current situation and we should analyse every aspect as soon as possible. Especially concerning the behaviour of people, this behaviour is related to the current state of mind. People might react differently in a year or so. That is why it is highly suggested that for example the matter of wearing mouth masks and the influence of this on the behaviour of respondents is analysed. This thesis can serve as a base and provides a reason to apply follow-up research into areas where people often walk in a hurry, such as on and around public transport. It should be noted that the time stamp of each research is important.

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1. Introduction

This chapter will introduce the topic and will cover the significance of this research. Section 1.1 will give the reason for the investigation and in section 1.2 the gap in the current pool is given. The objective of this research is given in section 1.3. The thesis might be of importance to multiple stakeholders and are given in section 1.4. The hypotheses with accompanying research questions are given in section 1.5 and 1.6. Section 1.7 gives the boundaries of this research and in section 1.8 the setup of this thesis will be given.

1.1 Problem statement

In 1900 a bit over 5 million people lived in the Netherlands, as of now almost a century later we have passed the number of 17.4 million. Although people always tend to see The Netherlands as a smaller country, with the increase of population we see big regional differences occur. The four big cities of the Netherlands (Amsterdam, Rotterdam, Den Haag and Utrecht) are growing while at the same time smaller, more remote area's at the borders of Germany and Belgium are seeing their population decrease (de Jong, 2014). This phenomenon called urbanization puts pressure on the existing urban region. Especially in our cities which are focussed around combining residential area's with offices, spatial facilities and generic commercial all within cycling distance or accessible by public transport (Maat, 2010).

The COVID-19 virus tested the current setup of our society and open spaces. The 1,5-meter rule made by the Dutch government is still active, the day that this thesis was completed (19-10-2020), and has big impact on our social life and behaviour. Everywhere on the streets we find signs, symbols, indications and markings to serve both as a reminder as well as influence the behaviour in desired way. The Dutch government tried to create awareness to achieve the goal of really changing the mindset of the crowd. Therefore, the main goal of this assignment is to investigate the behaviour of pedestrians in public places during corona. The behaviour will be looked at through means of the intended path adjustment behaviour to a near-by collision with an approaching pedestrians and the sense of security in these situations. Public spaces is a collective name for all the open area openly accessible, so without any restrictions, to strangers and citizens (Madanipour, 1999) including places like streets, alleys, plazas and malls. A clear description of what areas of public spaces will be investigated will be given later.

1.2 Knowledge gap

This thesis is written in a situation in which corona is still amongst us. Currently over 6200 deaths have been counted in the Netherlands alone (Rijksinstituut voor Volksgezondheid en Milieu, 2020). We need to regain control over the virus and in order to do so we need knowledge on both the virus itself and people's behaviour related to the virus. It is crucial that the current situation is analysed as quickly as possible in order gain knowledge on our current corona behaviour as well as learn from the current approach of how we tackled the virus. Only this way the next pandemic can be entered with improved knowledge on the subject. This thesis is part of the analysis of the pandemic in the Netherlands and focusses on the interaction of pedestrians in public spaces. It focussed on which factors trigger a specific intended path adjustment and a possible reasoning behind it.

1.3 Objectives

The importance of this research is to give new information about the behaviour of pedestrians in times of corona, what characteristics influence this and how does a person feel about the safety of certain situations. A better understanding of the behaviour of pedestrians in times of a global virus outbreak can be used in future situations. And can improve the future approach and measurements in the battle against spreading a virus outbreak.

There are three main objectives in this research:

1. Determine whether pedestrians respond to approaching pedestrians crossing their intended path.
2. Determine influencing factors that trigger these responses.
3. Determine whether the feeling of safety is related to these responses.

1.4 Stakeholders

City planners, municipalities, the Dutch governments and other organisations that guarantee the safety of the population benefit from this thesis. It could help in aiming precautions at the right people. It is presumed that the information from this thesis can contribute in the next possible virus outbreak as well as teach us something about human behaviour. It can be used as a stepping stone to a large-scale study of the Dutch population with the focus on mapping the behaviour of the Dutch in times of Covid-19, in order to redesign public space in an efficient, smart and substantiated way to reduce the spread of a virus, without the immediate need for sanctions and restrictions. The influential factors can show us where the weak spots are. The aim is that the measures are ultimately implemented in a targeted manner so that too many unnecessary limitations do not have to take place

1.5 Hypothesis

Based on the objectives of the research a hypothesis has been formulated. The hypothesis gives an indication on the chosen direction of the investigation.

1. The expectation is that people will adjust their intended path differently in different situations. They could alter their intended path according to a given scenario.
2. People will most likely be more careful if they form a threat to the other or feel like the other can be a threat to them. If they do not feel this threat as described before they are probably more likely to stick to their intended path.
3. It is expected that the personal health situation has a major influence on whether people are likely to change their current movement. If a person belongs to one of the risk groups, described later, he or she is expected to differ from the rest of the sample group. Older people are possibly more likely to react to situations.
4. It is expected that some characteristics of the approaching pedestrians influence the path adjustment of a person. Especially if the age of the approaching pedestrian is higher, it is expected that people avoid them more than for younger persons.
5. If the context of the interaction changes people will most likely step away from their normal behaviour. For example, if it rains outside or if the person is in a hurry. The context of the situation can create new rules in which the old behaviour does not apply.

1.6 Research question

This thesis is written with the goal to answer the following research question:

What is the response of pedestrians during a close-by interaction with another pedestrian in public areas as part of their behaviour in times of the COVID-19 virus outbreak?

Each sub-question should add value to the main research question and should cover a different perspective of the topic. Several sub-questions have been made in order to give answer to this question. In addition to that, the approach and goal of each specific question is made clear.

Sub-questions

1. *How do pedestrians adjust their intended path?*

This sub-question is the base in answering the main research question. It defines if there is in fact a difference in how pedestrians adjust their intended path in multiple situations.

2. *Why do people adjust their intended path?*

This question will give a possible reasoning behind the fact whether a certain reaction is made. With this knowledge measures can be aimed into the right direction if a link between the path adjustment and a certain mindset is made.

3. *What personal characteristics cause the adjustment?*

These are the first set of characteristics that give information about the respondent. The data set can be grouped according to these parameters and conclusions can be made for each group.

4. *Under which context do they adjust their intended path?*

These are the second set of characteristics that gives an answer to the question what triggers a respondent's behaviour change. This sub-question includes the in the hypothesis made parameters 4 and 5. Factors related to both the context and the approaching pedestrian can be a trigger to adjust their intended path.

1.7 Scope

This research will try to reflect the real-life behaviour of pedestrians in open spaces in times of Corona. It will do so by looking at possible influencing characteristics and changing these one at the time. The answer will be made based of the survey without the use of field surveys, video data analyses or any other mathematical tools. The outcome of the survey will be a suggestion of expected behaviour which gives room for further research. The survey will only be sent out to people living in The Netherlands and will focus on the current Corona-behaviour only. A comparison between the pre-Corona behaviour and the current Corona-behaviour will be out of the scope of this research. Follow up research is needed to dive deeper into this.

1.8 Report outline

The setup of the thesis will be discussed in chapter 2, it provides information about the method used to conduct the research. Chapter 3 expands on the survey that was being conducted. The setup and choices made within the survey will be further explained here. Chapter 4 examines the results of the survey. Relationships are sought and statistically substantiated. Chapter 5 discusses the results of the investigation. While making certain choices, a certain deviation in the results may arise. Before drawing any conclusions, it is important to consider possible deviations within these conclusions. In chapter 6 the conclusions will be made, taking the previously made discussion into consideration. Chapter 7 closes the thesis with recommendations for further research.

2. Methodology

The used methodology and project phases followed in order to answer all the sub-questions and thus the main question will be discussed in this chapter. Section 2.1 will give information about the methodology used, section 2.2 will go into depth on the chosen influential factors, section 2.3 shows the different methodologies used to proof statistical significance, section 2.4 gives information about how the thesis is held ethically responsible.

2.1 Method

The purpose of this project is to reveal characteristics and to which extent they influence the behaviour of pedestrians in public spaces. They could be linked to personal, situational or both properties. The first step is to extract these properties out of the situation and bundle them into groups. The most important properties can now be highlighted from this collection of characteristics. This is done by means of various criteria, and an assessment is also made as to which information can or cannot add value to the research.

From this a draft survey can be made. The main purpose of this survey is to test whether the questions are clearly formulated and whether we do in fact see a change in behaviour. With the feedback from the draft survey a new survey will be setup and send out to gain responses. There are two ways to setup this survey; Revealed Preference (RP) and Stated Preference (SP) see Figure 2.1. When an individual is observed or asked what his actual behaviour was, which can be expected to be reliable information, it is called a Revealed Preference data. If, on the other hand, the individual is faced with a hypothetical situation and asked what his/her behaviour would be, it is called a Stated Preference data. This type of survey might not fully reflect reality, and thus the actual behaviour.

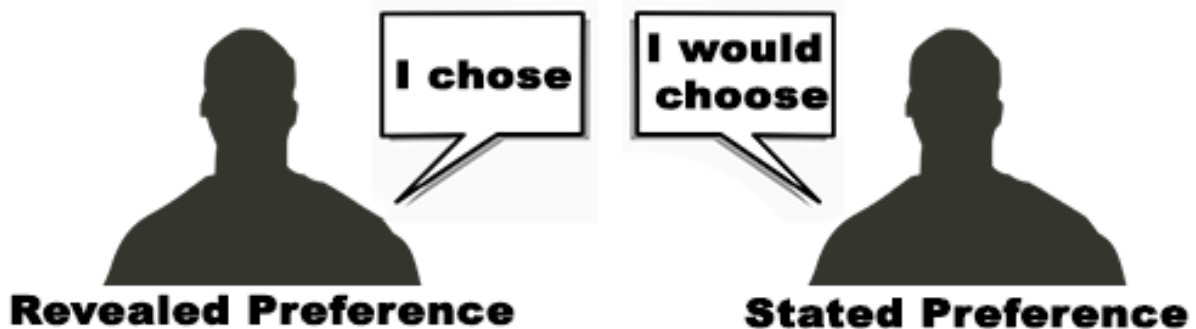


Figure 2.1: Revealed preference vs Stated preference

Demographic questions will be used in gaining background characteristics of the respondent. SP will be used to create imaginary scenarios. The respondent can give their rating to each of the questions in a quantitative way. This gives more control over the outcome of the survey and in addition to that this way it is easier to monitor different influential factors, since non-existing alternatives can be tested. A disadvantage of this type of survey is that it includes some biases; respondents justify their actual behaviour and respondents try to control policies (Sanko, 2001). This will be considered in the discussion of the analysis. The conclusion will take this into account.

Google forms will be the online tool used for the creation and spreading of the survey. It will be spread within my own network by means of WhatsApp, Facebook, LinkedIn and in addition to that people around me will be asked to spread the survey to reach new people. It is noted that this way of spreading the survey will cause a certain bias. The respondents will probably be highly educated younger people and will not be a correct representation of society. This will be considered in the final conclusions. The target audience of the draft survey will be fellow students, the two supervisors and people from within my inner circle. These people have some insight on the topic of the research and are thus biased. The main benefit from this is that they can give critical feedback on the survey. The audience of the final survey will be the entire Dutch population except for the participants of the draft survey.

Given the fact that the survey concerns the entire Dutch population, around 17 million people, the required amount of responses can be determined. First, the margin of error should be chosen. This tells you the percentage points your results will differ from the real group size. You can be 'sure' that when asked the same question to the entire population the results will be only differ by this margin of error. The confidence level tells you how certain you can be that the current outcome is correct. The chosen value for the margin of error is 5% and for the confidence level is 95%. This requires us a minimal total sample size of 385 responses (Checkmarket, 2020).

Next a framework will be built so that the data can be easily implemented into this later. When all the data is collected and filled into the framework it can be analysed. Figures, plots and graphs are tools to help in simplifying this in addition to this a statistical analysis will be made. In the end conclusions are drawn based of the graphs and information. The method as presented is translated into the project phases.

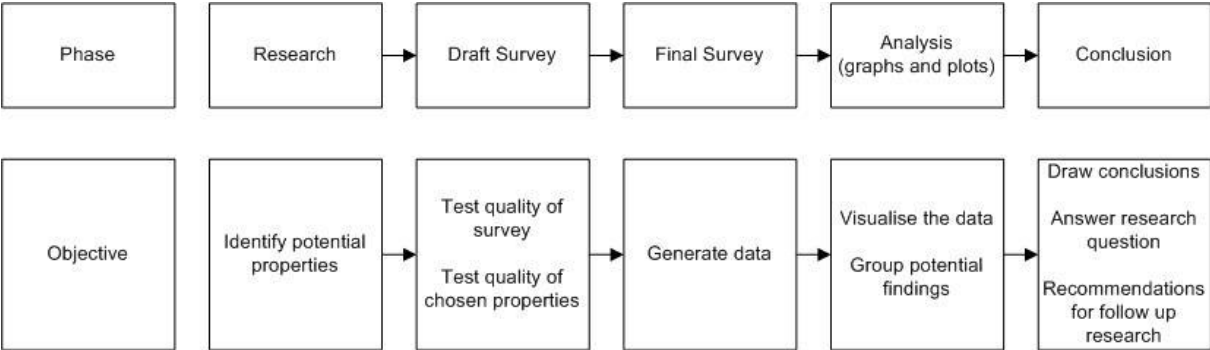


Figure 2.2: Project phases

2.2 Influential factors

A close-by interaction between 2 pedestrians has a lot of characteristics that might influence the behaviour of both participants. In order to create a clear description of the situation we need to extract these influential factors. With this knowledge a new situation can be created in which each parameter can be controlled individually. A change in intended path can thus be linked with the change in the parameter. Figure 2.3 shows us a situation sketch from which we can extract these parameters. The sub-questions were made based of this figure.

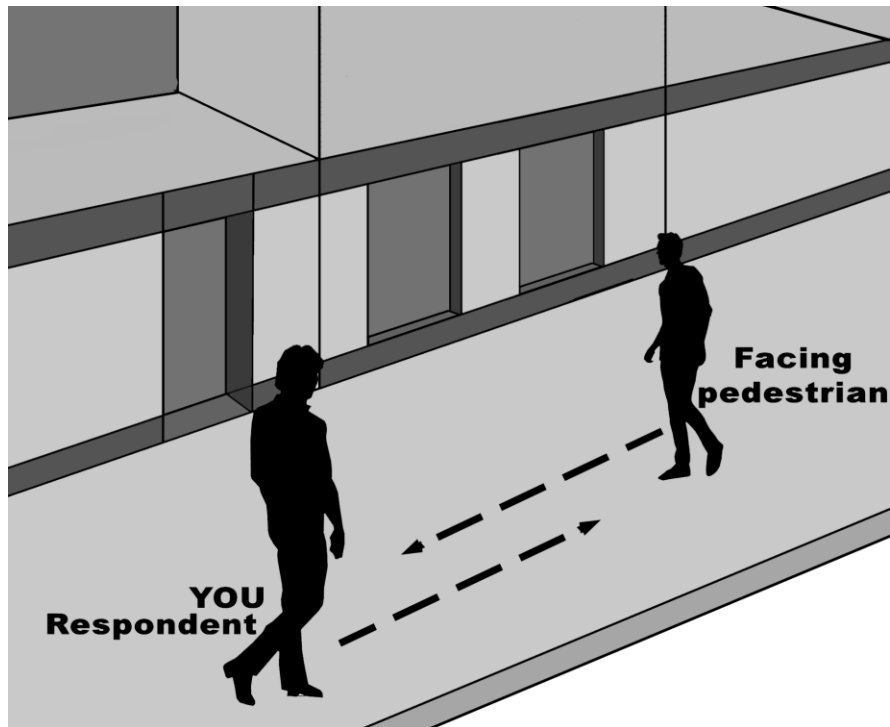


Figure 2.3: Situation sketch

Figure 2.3 shows a simple yet effective version of the situation which is attempted to mimic reality. The parameters have been separated in three main groups. The first tells us something about the respondent of the survey. Second, we have the characteristics of the approaching pedestrian. And finally, we have the context related information like for example the weather at that time. Figure 2.4 gives us an overview of a selection of influential factors that were made up. This list might be incomplete, as there could be way more factors regarding these groups, but these factors are further discussed in this thesis.

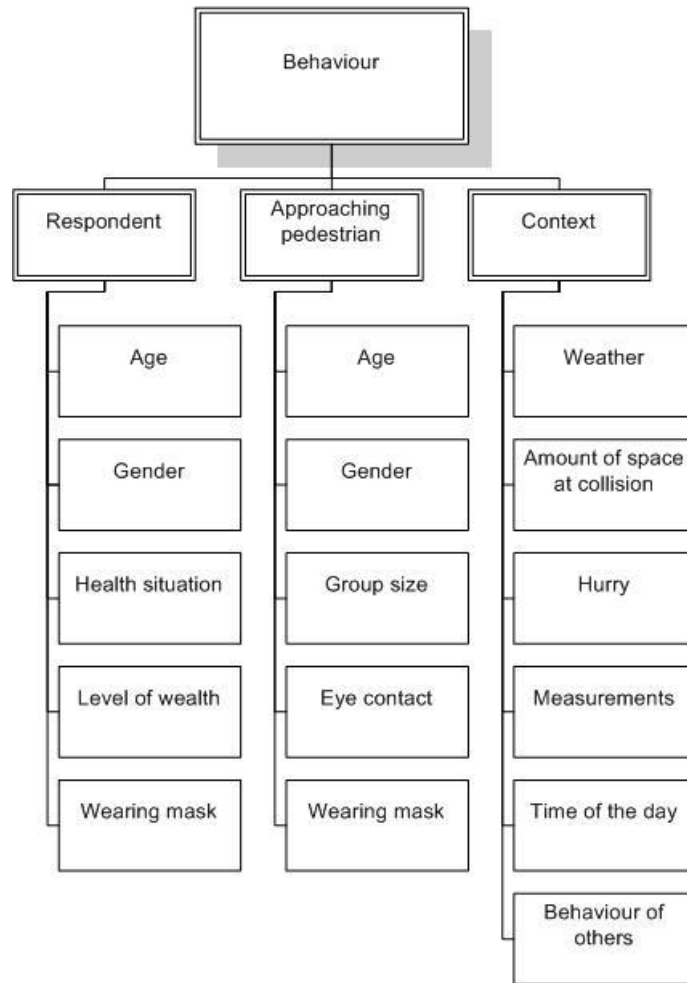


Figure 2.4: Behaviour influencing factors diagram

This entire list would be too much information to focus on. Assuming that there are 2 possibilities per parameter for the respondent alone, already more than 2^5 possible combinations for the respondent will have to be checked. The same goes for the approaching pedestrians. This may not necessarily be a problem, but control over the actual outcomes can still be lost. This can also cause us to lose quality due to the increase in quantity. A selection should be made in order to keep the information focussed and manageable. Before a choice can be made, we first need more information about the three main categories; the respondent, approaching pedestrian and context are given consecutive in Table 2.1, Table 2.2 and Table 2.3.

Table 2.1: List of influential factors respondent

Survey respondent	
Influential factor:	The survey could give us information on...
<ul style="list-style-type: none"> • Age 	the possible difference between people of different ages. Younger people are all dealing with the measures in a different way and the infections are growing fastest among young people (Dorlo & Melvin, 2020). The outcome could be used by the government to start targeted awareness campaigns.
<ul style="list-style-type: none"> • Gender 	The possible difference between men and women. Based on their gender we can possibly see that they adjust their intended path in a different way.
<ul style="list-style-type: none"> • Health situation 	Whether or not the risk groups as described by the RIVM react differently since their own health is at stake. Adults of over 18 years old with certain diseases or underlying conditions have a greater risk of serious course of the COVID-19 (RIVM, 2020).
<ul style="list-style-type: none"> • Level of wealth 	Whether or not we can make a clear distinguish between rich people and poor people. We could translate this outcome into urban regions with either a less or more wealthy population.
<ul style="list-style-type: none"> • Wearing mask 	This could give information about the fact whether people react differently when wearing a mask. If a difference is found, this could lead to new insights and possible follow up research for places where a mask is compulsory for example

The different factors of approaching pedestrian are now further elaborated:

Table 2.2: List of influential factors approaching pedestrian

Approaching pedestrian	
Influential factor:	The survey could give us information on...
<ul style="list-style-type: none"> • Age 	Whether or not people react differently to people of different ages. Do people keep in mind that they might cause a danger to the opposing person, and is this mindset fixed or does it depend on the age of the other.
<ul style="list-style-type: none"> • Gender 	The possible difference between men and women.
<ul style="list-style-type: none"> • Group size 	Whether or not bigger groups lead to a more distinctive reaction. Especially useful in dense areas where one interaction is immediately followed by the next one and bigger groups are more common.
<ul style="list-style-type: none"> • Eye contact 	whether people react differently if eye contact is made. Without eye contact it is expected that people react more in comparison to a situation where both pedestrians have eye contact. In that case you are completely dependent on yourself to avoid an unwanted situation without the other having influence on it.
<ul style="list-style-type: none"> • Wearing mask 	Whether or not people see a mask as a license to alter their own behaviour compared to the situation where the other is not wearing a mask.

The different possible influential context related factors are now further elaborated:

Table 2.3: List of influential factors context

Characteristic:	Context
	The survey could give us information on...
<ul style="list-style-type: none"> • Weather 	Whether or not people react differently if the weather situation is bad. Do people prioritise speed over safety on a day on which it rains and are thus more likely to respond less carefully.
<ul style="list-style-type: none"> • Amount of space at collision 	Whether or not people react differently if there is room for a possible different solution. For example, instead of slowing down you could just go around it with a big curve.
<ul style="list-style-type: none"> • Hurry 	Whether or not people react differently if they are in a hurry. The same principal applies as for the weather situation.
<ul style="list-style-type: none"> • Measurements 	Whether or not indications, markings and rules made with the purpose to influence the behaviour of pedestrians really show of to be beneficial.
<ul style="list-style-type: none"> • Time of the day 	Whether or not people are influenced by the time of the day. Do they react different early in the morning compared to later during the day and how does night-time influence the behaviour?
<ul style="list-style-type: none"> • Behaviour of others 	Whether or not pedestrians copy the behaviour of other pedestrians around them. Humans see a deviation of their behaviour from the group as a mistake and feel it as a punishment (Smidts, Kluchaver, & Fernández, 2012).

The influential factors are now tested based on several criteria. The first one is privacy related. The focus of the research is based around gaining knowledge on the behaviour of pedestrians. For each factor it is necessary to consider whether it adds enough to the research that the requested information is justified. Both the wealth level and the health situation are sensitive information to request for this research. It is assumed that the health risk group has such value and connection with the research that it can be included. The wealth is not considered since requesting this sensitive information is not justifiable.

The next decision has been made based of literature. In previous research it was found that eye contact and group size have a strong impact on the conflict avoidance behaviour. However, the research did not capture it in an effective way (Dumont-Freixo, 2018). As Dumont-Freixo stated in his conclusion "eye contact and group size are attributes that are processed physiologically rather than rationally, meaning that the simple depiction of eye contact and group size in an image does not trigger the physiological process that would affect behaviour effectively in real life". For this reason, eye contact is left out of the survey and thus research, while the group size will be taken into consideration. In addition to this it should be made clear that the pedestrian is operating alone, and his actions will thus be distinctive for his personality and not based on others around him. The "behaviour of others" as described in the main group context will subsequently be left out of the research since this goes against the principal of the respondent acting alone.

Within the survey each answer option should have equal value. There should be no premade wrong answer or any indication of this. If the context related measurements are considered in the research it will give an indication of preferred behaviour. The question that will be answered this way will be more towards "How well do people follow the corona virus safety guidelines" this indication guides the users towards a certain answer. It takes away from the focus on distinctive pedestrian behaviour, apart from that it is questionable how the survey outcome relates to the reaction of pedestrians in real life. The last statement also applies to whether the pedestrian is wearing a mask. It is hard to

transfer this message through an online survey, since you cannot sketch the situation properly and people have little experience with this situation in real-life. This will lead to respondent guessing a certain action leading to it being further away from reality. The same goes for the time of the day, it would be hard to distinguish different times within the survey and if the point is made clear, the results should be critically looked at whether these are linked to corona.

The amount of space at the collision is left out since each answer option will allow for more than enough room to alter their intended path. In addition to this statement it should be made clear that each option allows for a safe travel. This includes the fact that the pedestrian never has to leave the sidewalk within its manoeuvre and never faces neither pedestrians nor other traffic within its manoeuvre.

The draft survey will consist of the following influencing parameters, Table 2.4, with the groups as given above.

Table 2.4: Final choice influential factors

Group	Influential factors
Respondent	Age Gender Health situation
Approaching pedestrian	Age Group size
Context	Hurry

The respondent's factors will be gained through direct questions. The other factors will be implemented in situation sketches from which the respondents preferred action will be gained.

2.3 Statistical significance test

For the analysis multiple formula's will be used obtained from (Field, 2009). The chosen significance test depends on the data that will be researched. First, it is important to determine the number of variables that will be compared. The next step will be the definition of the measurement scale of the data. For data with one number of variables this can be: nominal, ordinal or interval/ratio. We have two sorts of categorical data. Nominal data is qualitative data with no ordering or direction, ordinal data is still qualitative data but with a certain order or scaling. Interval and ratio are quantitative data or numerical data and give the difference between measurements (Stevens, 1946). If there are two variables the measurement scale of both variables can be categorical or continuous. The last characteristic of the data set is whether the compared data is dependent or independent. Dependent data has some sort of relation with each other. For example, the same group is asked the same question twice, or we can find a relation between the two compared data sets.

2.3.1 Chi squared test

For our analysis two test are used. The first test is the chi-squared test. It is used to compare the frequencies between two nominal data sets. In this test it is important that the first assumption is that both sets of data are independent. The formula used for the chi-squared test for independence:

$$\chi_c^2 = \sum \frac{(O_i * E_i)^2}{E_i} \quad (2.1)$$

In which O_i is the observed count and E_i is the expected count which can be calculated with formula (2.2).

$$E_{ij} = \frac{\text{row total}_i * \text{column total}_j}{\text{total count}} \quad (2.2)$$

The outcome of the chi-squared test is a number that can be compared with a number given you p-value. The p-value will tell if the outcome of the test is statistically significant or not. The p-value depends on the degrees of freedom of the comparison. The degree of freedom is the number of categories minus one multiplied with each other. The second factor that influences the p-value is the alpha level, also called the significance level. The alpha level is the probability of making a wrong rejection of the hypothesis. In this case .05 is used for this, in line with the margin of error as described in the survey size significance formulation. Before the calculation of the chi-squared can be made a hypothesis is formed.

H_o : *There is no statistical difference between the different scenarios*

H_1 : *There is a statistical difference between the different scenarios*

Important to note is that the chi-squared only applies in a situation in which two criteria are met:

The first one is that no more than 20% of the expected counts can be lower than 5.

The second one is that no minimum expected count can be lower than 1.

If $\chi_c^2 > p\text{-value}$, the H_o hypothesis can be rejected and thus the H_1 is the correct hypothesis. These categories are thus dependent upon each other in a certain way. To find out more information about this co-relation we can look at the standardized residual, calculated with formula 2.3.

$$E_{ij} = \frac{\text{observed}_{ij} - \text{expected}_{ij}}{\sqrt{\text{expected}_{ij}}} \quad (2.3)$$

If the residual is more than 1.96, for a significance level of .05, the counted amount of responses is statistically higher than the expected amount of responses. If the residual is less than -1.96, for a significance level of .05, the counted amount of responses is statistically lower than the expected amount of responses. With this we can look at trends in the standardized residuals to see where the co-relation comes from.

2.3.2 Wilcoxon signed-rank test

The second used test is the Wilcoxon signed-rank test. It is used to compare the frequencies between two nominal data sets. In this test it is important that the first assumption is that both sets of data are dependent thus have been filled in by the same participants. Before the test will be executed, two hypotheses will be formed.

H_o : *There is no statistical difference between A and B*

H_1 : *There is a statistical difference between A and B*

The level of significance $\alpha = .05$, confidence level of 95% so that H_o gets rejected when

$$z_{critical} = 1.96 < |z|$$

The first step is to calculate the differences between reaction in situation A and situation B, and in addition calculate the absolute difference between these two. The next step is to sort them based on their absolute value. This rank is then multiplied by -1 for cases in which the difference was negative.

- For the positive differences the ranks are summed up to get T+
- For negative differences the ranks are summed up to get T-

For the statistical test the smallest of the T values is used ($T = \text{MIN}(T-, T+)$). The mean (\bar{T}) and standard error ($SE_{\bar{T}}$) can be calculated with the sample size (n).

$$\text{mean} = \bar{T} = \frac{n(n+1)}{4} \quad \text{standard error} = SE_{\bar{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24}}$$

If it happened to occur that there are double absolute values than we must apply a correction to the standard error for these, with t= group number of ties and f_t =number of values in group t:

$$C_{ties} = \sum_{i=1}^t \frac{f_i^3 - f_i}{48} \quad SE_{\bar{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24} - C_{ties}}$$

Finally, the z-score is calculated which can be compared with the critical z-value.

$$z = \frac{T - \bar{T}}{SE_{\bar{T}}}$$

$$z_{critical} = 1.96 < |z|$$

The H_0 , null hypothesis, can be rejected if this is true. The Wilcoxon signed-rank test showed that there was a significant difference in between situation A and B.

2.4 Ethics

The ethics of this report are mainly found at the side of social aspects. It is important that when using a survey that the integrity of the research is protected. Openness in the collection, processing and interpretation of the data is necessary in order to make the research transparent to others to be able to check the authenticity of the data. This also ensures that the tests and data are used correctly. However, it must be considered that the data remains protected. People who complete the survey must be sure that the information provided is only used for this survey and not otherwise. Insight must therefore be given into the purpose of collecting the data, the processing of the data and possibly also how long this data is stored. The use of the data by unqualified persons, like any other misuse of the data, must be prevented. Reasonable steps must be taken to keep individuals' results confidential. Therefore, no names, email addresses or similar data are collected in this study with which the identity of the respondent can be traced. The survey is therefore considered completely anonymous. There is also the option not to answer certain personal questions if the respondent prefers not to share this information (The Myers-Briggs Company, 2018). Finally, the results will be examined so that decisions and outcomes are not rushed into generalization. Based on the AVG (Algemene VerordeningWet) and the Gedragscode voor Onderzoek en statistiek there are strict regulations when surveying children. Children younger than 12 need to be supervised by their legal representative. Children between 12 and 16 need permission from their legal representative (MarktOnderzoekAssociatie, 2010). To prevent issues from occurring the decision has been made to only question people above the age of 18. In addition to this ethical aspect, the entire project should comply to the rules of the TU Delft Code of Conduct.

3. Stated preference survey creation

In this paragraph the steps taken in the creation of the final survey are elaborated. The creation of a survey is not a linear process, it requires going back and forth and improving your work on the way. Section 3.1 shows the draft survey that has been made as a proof of concept. Section 3.2 reflects on the draft survey and gives point of improvement based on the feedback and preliminary responses. Section 3.3 gives the survey as it is distributed.

3.1 Draft survey

After the final survey has been distributed it cannot be changed due to inconsistency in answers. Flaws and unclarities should be filtered out beforehand. The draft survey is made to test formulation, design and the length of the survey and will be adjusted by means of feedback. The survey starts with a list of general questions as described in section 3.1.1, section 3.1.2 elaborates the situation related questions and section 3.1.3 gives information on the images used. The draft survey has been online for 3 days. The respondents will go over the survey one by one each. Fellow students and the thesis supervisors will see if the research is well structured. This mainly concerns the design, research question and depth of the research. Together with people from my private circle they will look at the front-end design of the survey. Are the questions well-structured and do we get the influential factor across in a right way with the current questions?

3.1.1 General questions

These questions give information on the personal characteristics of the respondent. The questions will cover topics as age, gender and health situation. These can later be used to link groups of respondents with similar personal characteristics to determine whether they respond in the same way. It also includes some corona behaviour related questions about the reasoning for people to walk in public spaces and whether they have changed their visits to public spaces.

3.1.2 Situation related questions

The following step will be asking the situation related questions. Each situation is introduced with an image and contextual information. Throughout the survey different combinations of influential factors are tested, the influential factors with their levels are:

Table 3.1: Influential factors draft survey

Influential factor	level
Age	Young ↔ Old
Group size	Single person ↔ Three persons
Hurry	With ↔ Without

Each influential factor has 2 levels as given in Table 3.1. A full factorial survey will be designed, in which each possible combination is tested, this brings the total down to 8 questions. This is the reasoning behind the small number of factors since the amount of questions will be multiplied by 2 for each additional factor. Not every influential factor can be shown as easily within a picture. The factor "hurry" is not shown within the picture, but the decision has been made to get this point across through the added contextual information. The other two factor are indeed implemented in the situation sketch, more on that later.

The draft survey allows for three different path alternatives and the respondent should choose their preferred path, in line with the SP survey setup as described in the methodology. Figure 3.1 shows the different path alternatives. The question setup with additional information between brackets, this information will not be shown to the respondent, will be like:

Which path would you choose:

- A (No adjustment in intended path)
- B (Minor adjustment in intended path)
- C (Bigger adjustment in intended path)

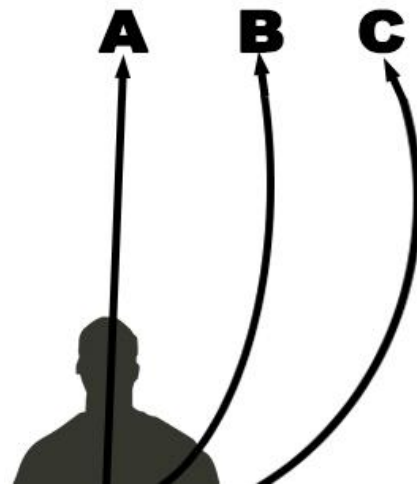


Figure 3.1: Path alternatives

For each situation, a single answer of the preferred path alternation, or as in the case of option A no adjustment, is asked from the respondent.

In order to find a possible reasoning behind the choices made in the question as described above, an additional question has been added. The goal of this question is to cover the knowledge gap on why people adjust their intended path. The question focuses on the sense of security in these situations. Especially in the current corona society people are possibly more aware of the possible health threat that physical interaction brings. A distinction is made between the fact that the respondent could see themselves as a threat to the approaching pedestrian and the fact that they might see the other person as a threat to themselves, at least, if they see the connection between these two. It should be considered that with the current question setup a bias is added. The open question does not allow for an own formulation of the answer, instead the respondent is presented with a few prescribed answers to choose from. With this way of formulating the question, there is a margin of error because the respondent may give this interpretation after reading the answer, without having thought of this in advance.

3.1.3 Images

The image should tell the correct story in order to get the point across without too much contextual information. On top of that each image should limit the number of unwanted factors. Consistency throughout the survey prevents that other possible influential factors determine the path adjustment of the respondent. Each image should give a clear sketch of the situation without adding unwanted additions. The program Adobe Photoshop was used as tool to create and adjust each image in the desired way.

The background image used to create the desired effect is one made by (Tompkins, 2014). It is used because it depicts a situation in which all unwanted possible factors are left out. It shows no general information related to the context but is still recognizable. It has bright daylight, no traffic signs, a clear and open field of view, more than enough space for any route adjustment, a sunny sky and

nothing is happening in the picture that might influence the decision of the pedestrian. All of this creates the perfect condition in which the experiment can be tested.

For the approaching pedestrian two images have been chosen. Figure 3.2 is the original image of an old man and Figure 3.3 is the base used for the younger pedestrian. Both images are cartoons rather than pictures of actual people. This has been chosen because cartoons are easier to adapt to your wishes and because cartoons convey the desired image in a simple yet clear way. These images are chosen since they both represent a male character and have the same characteristics. For example, both persons are holding something in their hand.

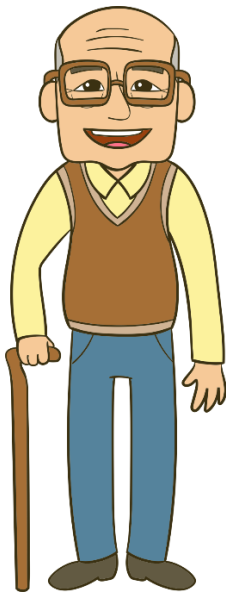


Figure 3.2: Original image old man (588KU, 2018)



Figure 3.3: Original image young man (千图网, 2017)



Figure 3.4: New image young and old man



In order to filter out as much as possible unwanted influencing factors the images have been changed in such a way that these differences have been reduced. As can be seen in Figure 3.2 and Figure 3.3 in comparison to the new Figure 3.4. Quite a few changes have been made to make the images more similar. The skin colour, colour of the clothes, posture and details have been edited to make both images look more similar.

3.2 Feedback on draft survey

The draft survey served as tool to gain knowledge on the formulation, clarity and design. The feedback from early respondents is used to improve the current setup of the survey. The preliminary results of the draft survey test whether the desired answers are given. Based on these two, some improvements have been made to form the final survey:

- Privacy of the respondent

Privacy should be an important aspect within the survey. The respondent must be able to assume that his or her information will be handled with care. Adjustments have been made to protect the privacy of the respondent. The option to keep certain information private has been added by adding the answer option "I would rather not say" in each of the open-ended questions. In addition to that a contextual bit of information has been added regarding the privacy of the respondent. It is made clear that the information will only be used with the

purpose of this current research. And that all questions regarding name, email or other personal information that could possibly track down the respondent have been removed.

- Content

The question concerning the main reason for pedestrians to enter the public area has been altered so that the respondent can give a top three instead of a singular option. This is done since most people had the same singular answer option and the research should look beyond that single option.

The current setup of the path alternation options allows for little to no stepwise deviation. Option C served both as the “right option” when looking at the 1,5 meter rule as well as the furthest option. An overlap in answers would be gained this way. There would be people who chose the answer because it was farthest away as well as people who saw it as their intended option. That is why another option D has been added which is even further away from the approaching pedestrian(s). It is expected that a better separation between different answers can be given this way.

- Feedback option

The current setup of the open questions did not allow for a personal interpretation and answer formulation of the respondent. In addition to the current answer possibilities the option has been added to give an own formulation of the answer. This prevents the fact that filtered out answer options are in reality a chosen option. It will give additional information and possibly even options that have been overlooked.

On top of that in the end of the survey two questions have been added. One is covering the chosen influential factors and whether the respondent feels like the survey overlooked a possible key factor. This information is especially useful for follow up studies and will be given in the recommendation. The second question gives feedback on the survey in general and can be useful when creating new surveys in general.

Apart from everything above some minor improvements have been implemented to increase the clarity of the survey.

3.3 Final survey

The improvements as described above have taken care of the latest changes to the survey. After this the final survey could be distributed and from that moment on no more changes could be made. The final survey can be found in appendix A.

More care is taken in the prevention of a suggestive answer formulation. In the old setup people could look back at previous situations and act accordingly. They could compare the alternatives and react accordingly. To prevent this from occurring the questions have been randomised. Because the context related factors were only made clear using contextual information it is chosen to keep these two groups together. It was expected that people might overlook this minor change withing the text. The order in which the factors are combined can be found in Table 3.2

Table 3.2: The order of the expected influential factors in the questions of the final survey

Question	Context	Group size	Age approaching pedestrian
1	Normal	Single person	Young
2	Normal	Three persons	Old
3	Normal	Three persons	Young
4	Normal	Single person	Old
5	Hurry	Three persons	Young
6	Hurry	Single person	Old
7	Hurry	Single person	Young
8	hurry	Three persons	Old

The final images as used in the survey, see Figure 3.5, contain the following properties:

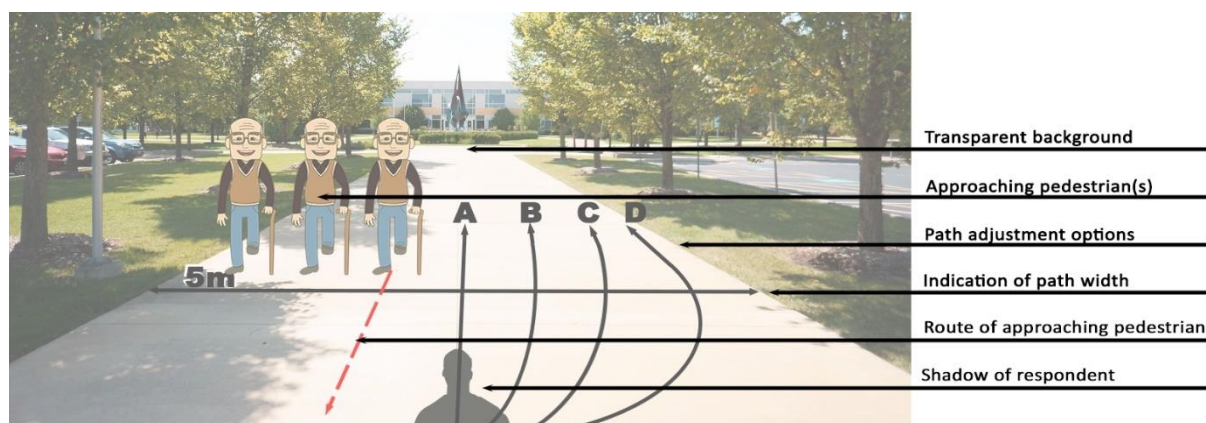


Figure 3.5: Setup of situation sketches

- Transparent background
Clear recognizable image that does not distract from the key topics of the question but does substantiate imaging of the respondent without adding unwanted influential factors.
- Approaching pedestrian(s)
The variable part of each image. Changes with the questions and the difference is clearly visible between multiple variations.
- Path adjustment options
Indication of path adjustment options. Option A is chosen as the option in which no adjustment is made, working towards option D which has the greatest deviation from the oncoming pedestrians. There is no indication of size, since we are working with quantitative questions.
- Indication of path width
In order to give some indication of size to the respondent the width of the path has been added. This is an estimate and should serve more as a reference that some of the options are

below the 1,5-meter rule and some are possibly be above. Any statements indicating the proper sizes have been left out of this research.

- Route of approaching pedestrian

The route of the pedestrians is added to give information on their intended path. This cannot be obtained from just looking at a still image so is added to help form the correct imaginary scenario.

- Shadow of respondent

The shadow is added to strengthen the image and give an indication of where the respondent is within the scenario.

4. Analysis

This chapter will describe the methodology used to analyse the survey results and presents the results of the analysis. With this analysis an attempt is made to give an answer to the main research question.

Various graphs were used to process the data in order to provide a visual picture of the answers obtained. In this way, the information is easier to compare with each other, so that connections can be made more easily. Within these graphs, certain terms have been used for simplicity. The abbreviations used in the graphs are explained here in Table 4.1.

- The first letter of the abbreviation is linked with the age of the approaching pedestrian, it can be either Jxx or Oxx. The 'J' from the Dutch word jong meaning young and the 'O' from the Dutch word oud meaning old.
- The second letter, either xEx or xMx, is from the Dutch enkelvoud meaning single or meervoud meaning multiple. It tells us something about the group size of the approaching pedestrians.
- The last letter tells us something about the pace in which the respondent is walking. It can be either xxR or xxH. The is letters are from the Dutch rust meaning calmly or haast meaning in a hurry.

Table 4.1: Abbreviations used in graphs

Abbreviation used in graphs	Meaning
JER	Single young approaching pedestrian The respondent is walking calmly
OER	Single old approaching pedestrian The respondent is walking calmly
JMR	Multiple young approaching pedestrians The respondent is walking calmly
OMR	Multiple old approaching pedestrians The respondent is walking calmly
JEH	Single young approaching pedestrian The respondent is in a hurry
OEH	Single old approaching pedestrian The respondent is in a hurry
JMH	Multiple young approaching pedestrians The respondent is in a hurry
OMH	Multiple old approaching pedestrians The respondent is in a hurry

To start the analysis a link with the sub questions has been made. The analysis will be guided by these questions. The sub-questions are:

- Sub-question 1: How do pedestrians adjust their intended path.
- Sub-question 2: Why do pedestrians adjust their intended path.
- Sub-question 3: What personal characteristics cause the adjustment
- Sub-question 4: When do pedestrians adjust their intended path.

Section 4.1 gives an descriptive domestic analysis based of the sample group, followed by an analysis of sub-question 1 in section 4.2 in which the difference between multiple scenarios is observed.

Section 4.3 gives answer to the possible reasoning behind this change of path adjustment. Section 4.4 looks at the personal characteristics of the respondents that are related with the path adjustment and is split into three analyses; age, gender and risk groups. Section 4.5 looks at the influential factors that might trigger this change in intended path.

In the analysis of section 4.3, 4.4 and 4.5 option “A” will be left out since it doesn’t take a path adjustment into consideration. In addition, the amount of responses that filled in “A” were too low and will cause the expected count lower than 5 to be more than 20% of our results and thus make the claims inaccurate. The sample size, N, will differ for each calculation. As a tool to limit the amount of comparisons the situation JER was chosen as the centre of the analyses. With this the situation in which the age, gender and context were change, were also used in the analyses. This comes down to the usage of JER as the centre point and OER, JMR and JEH as a test in which the influential factor is changed.

4.1 Descriptive domestic analysis of the sample group

The survey went online to get responses on 21 September 2020 and offline on 04 October 2020 in this total timespan of 14 days we received 516 responses. An overview of the domestic information of the sample group can be found in appendix B. A summary is given below:

The sample group consisted of 28.7% males and 71.1% females. Diving deeper into the numbers we see that there is a clear difference in ages of both male and female. Figure 4.1 clearly shows this.

Of the 516 respondents 109 have stated that they are within one of the risk groups as described by the RIVM. This comes down to 21.1% of the total respondents. The respondents in the risk groups based their path adjustment on sense of health threat in 91% of the cases versus 86% for the other group.

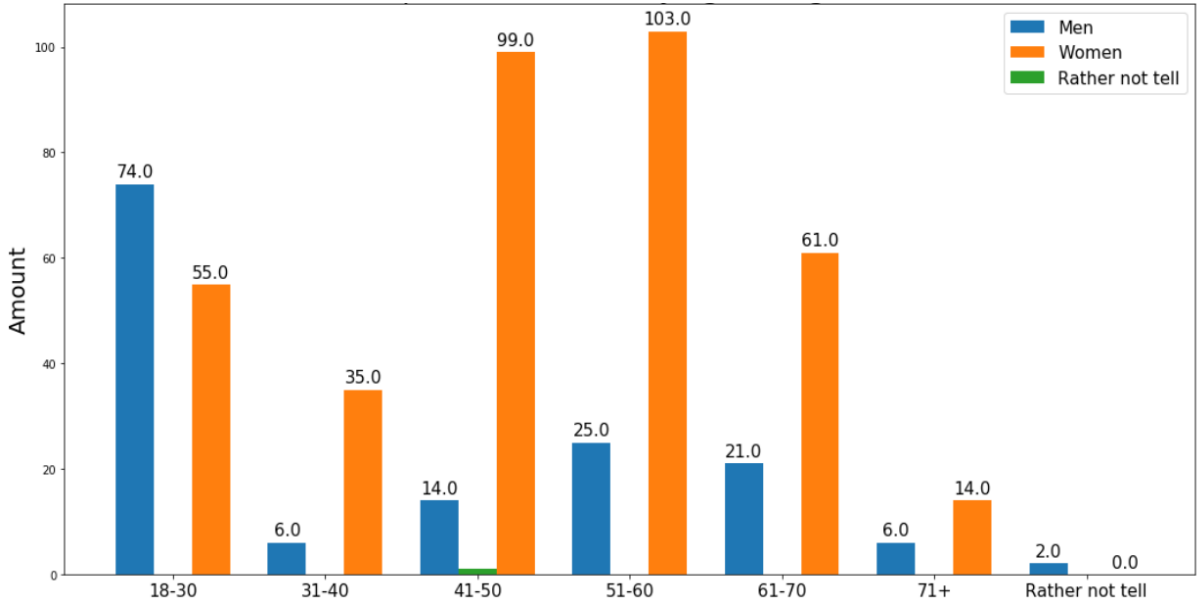


Figure 4.1: Respondents sorted by age and gender

4.1.1 Main reason for walking in public area’s

Figure 4.2 shows a graph with the absolute values of the main reasons for people to go out and walk in public areas. They could fill in up to three options. The values have been converted to percentages for a better overview in the contextual description. The graph shows that the main reason for

pedestrians to be in public spaces is for groceries shopping, 81.6% of the respondents chose this as an option. The second most chosen option with 70.2% is sport & exercise (which includes walking, jogging, walking the dog, etc). Next in the list is work with 39%, recreation (cinema, cafes, visiting friends, etc) with 32.8% and school with 10.3%. Figure 4.2 shows an overview of this. Since they could each enter a total of three answer options the total percentage is over 100%. No statements can or will be made based on these numbers since we do not have the numbers to the same question in a situation before COVID-19 and it is outside the main scope of this research. These numbers are primarily useful in follow up studies.

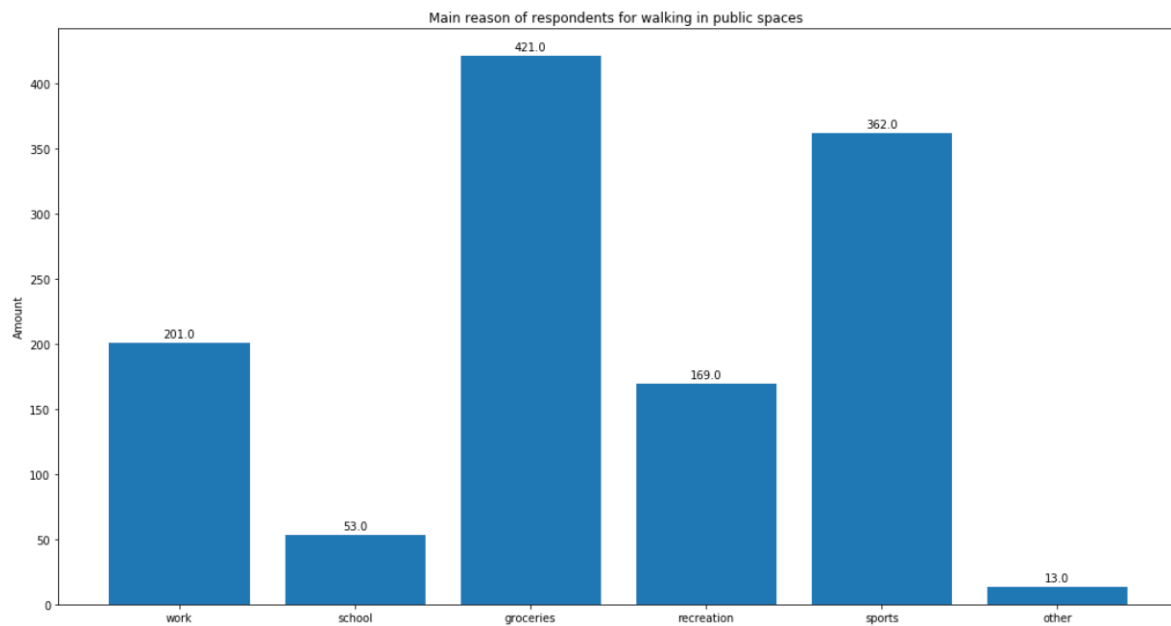


Figure 4.2: Main reason for walking in public spaces

4.1.2 Avoidance of busy places since corona

The aim of this question was to determine whether a distinction could be made between pedestrians who do avoid busy places and pedestrians who do not. Out of all the responses 14% state that they do not avoid busy places since COVID-19. The respondents who do avoid busy places have several methods of avoiding this. The biggest group, with 34.1%, say they do so by choosing both a different time and a different route. 25% of the respondents say they do so by only taking a different route and 16.9% avoid busy places by visiting at different times. 10% of the respondents manually filled in the answer. Some of these answers could be implemented in the groups as described before, one additional multiple occurring answer was visiting the hospital, apart from that no new groups could be distinguished.

4.2 Analysis of how pedestrians adjust their intended path

Before the analysis can be made, we need some general information concerning the path adjustment of each respondent. As described in the caption of sub question 1, this forms the basis for the answer to the main question. Namely, it answers the question whether there really is a difference in how people change their original path between multiple situations. An overview of the chosen path adjustment alternatives obtained from the research group is first looked at.

Based on Figure 4.3, it can be noted that not every bar has an equal height and thus the hypothesis is formed that there is a difference in people's reaction to different scenarios. The next question is

therefore where these differences come from and whether these differences are statistically significant. To demonstrate this, the subject is viewed in a different ways. This will be done in the next sections. Additional information on the numbers used to create this figure can be found in appendix C.

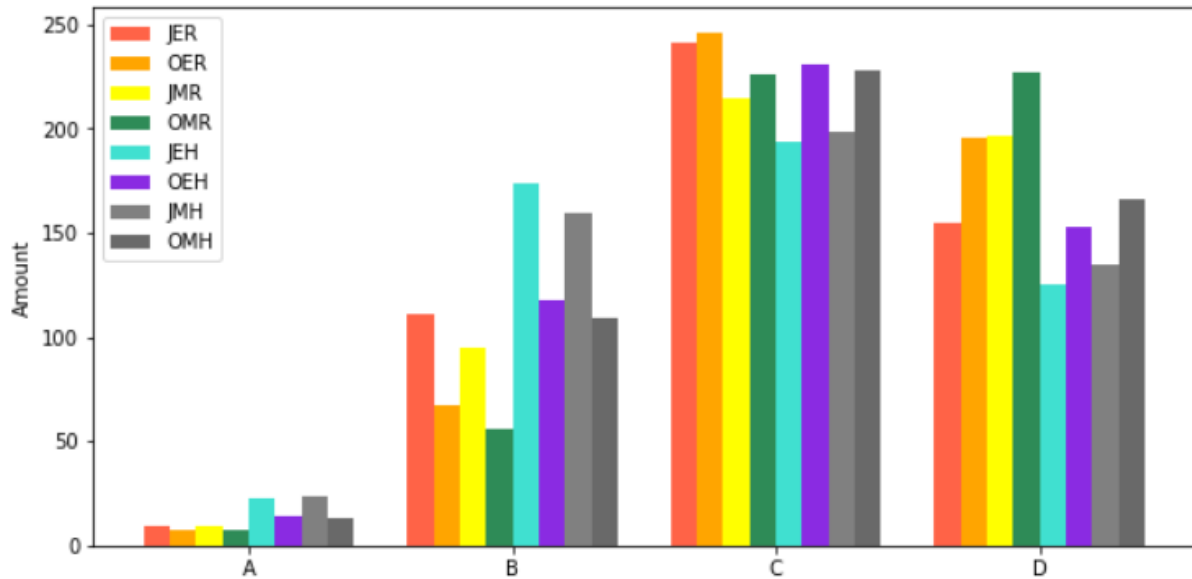


Figure 4.3: Comparison of the distribution of path adjustment for each scenario

4.3 Analysis of why pedestrians adjust their intended path

We look at the question why people change their original path. Does safety play a role in this? This is an interesting relation, because the virus can be spread within a short distance and the fact that the Dutch government is sticking to its 1.5m society. Is the behaviour of pedestrians possibly driven by a sense of health threat and can we demonstrate this in our research? The relation between the chosen path alternative and the possible reasoning behind their choice is illustrated in appendix D.

The first relation that is looked into is the relation between people who did say their path adjustment was due to any kind of sense of health threat (the other pedestrian forms threat to them, they for a threat to the other pedestrian or both) and on the other hand people who said there was no relation between those two. The path adjustment results of both groups have been investigated.

The chi squared method is used to investigate whether the differences between these two groups are statistically significant. The execution will be performed on four situations.

H_0 : There is no statistical difference between respondents who based their path adjustment on a health threath and those who did not

H_1 : There is a statistical difference between respondents who based their path adjustment on a health threath and those who did not

$\alpha = 0.05$, degrees of freedom = 2, so that H_0 gets rejected when $\chi^2 > 5.991$

For the following situations the null hypothesis was rejected. The chi-square test of independence showed that there was a significant association between respondent who based their path adjustment on a health threat and the chosen path adjustment:

- without hurry with a single young pedestrian (JER), $\chi^2 (2, N = 507) = 8.70, p < 0.05$.
- without hurry with a single old pedestrians (OER), $\chi^2 (2, N = 509) = 6.00, p < 0.05$.
- without hurry with multiple young pedestrians (JMR), $\chi^2 (2, N = 508) = 11.88, p < 0.05$.
- with hurry with a single young pedestrian (JEH), $\chi^2 (2, N = 491) = 20.17, p < 0.05$.

For the lower path adjustment option, option B, the respondents that did not base their path adjustment on a health threat have a statistical higher residual value for three out of the four situations (Table 4.2).

Table 4.2: Residuals of the path adjustment for different views on the health risks compared in multiple situations

JER		Health risks	
		Yes	No
Path adjustment alternative			
B	residual	-0.93	2.36
C	residual	0.23	-0.58
D	residual	0.50	-1.27

OER		Health risks	
		Yes	No
Path adjustment alternative			
B	residual	-0.51	1.60
C	residual	-0.19	0.59
D	residual	0.50	-1.60

JMR		Health risks	
		Yes	No
Path adjustment alternative			
B	residual	-0.94	2.53
C	residual	-0.08	0.22
D	residual	0.74	-1.99

JMR		Health risks	
		Yes	No
Path adjustment alternative			
B	residual	-1.31	3.35
C	residual	0.66	-1.70
D	residual	0.72	-1.84

Now that it has been proven that there is a relation between the sense of health threat and the path adjustment of the respondent we can look at each individual health threat option and see if they are statistically different from each other (the other pedestrian forms threat to them, they for a threat to the other pedestrian or both). The chi squared method is again used to investigate whether the differences between these now three groups are statistically significant. The execution will be performed on the same four situations.

H_0 : There is no statistical difference in path adjustment between respondents who based their answer on the fact that they could be a threat to the other, the other could be a threat to them or both

H_1 : There is a statistical difference in path adjustment between respondents who based their answer on the fact that they could be a threat to the other, the other could be a threat to them or both

$\alpha = 0.05$, degrees of freedom = 4, so that H_0 gets rejected when $\chi^2 > 9.488$

For the following situations the null hypothesis was rejected. The chi-square test of independence showed that there was a significant association between the different health risk options and the chosen path adjustment:

- without hurry with multiple young pedestrians (JMR), $\chi^2 (4, N = 446) = 14.52, p < 0.05$.

For the following situations the null hypothesis could not be rejected. The chi-square test of independence showed that there was a no significant association between gender and the path adjustment in a situation:

- without hurry with a single young pedestrian (JER), $\chi^2 (4, N = 439) = 6.57, p < 0.05$.
- without hurry with a single old pedestrian (OER), $\chi^2 (4, N = 463) = 6.46, p < 0.05$.
- with hurry with a single young pedestrian (JEH), $\chi^2 (4, N = 428) = 8.30, p < 0.05$.

Based on this we can now formulate the conclusion that the various described health threat scenarios do not cause a significant change in path adjustment for every situation. And the path adjustment is thus not dependent on this.

The above paragraph provides the substantiation of several statements that have now been made. To list these again:

A relationship has been found between whether people assess the situation based on a health risk or not and their path adjustment. However, it does not matter whether the respondent feels like this health risk affects himself or whether he sees himself as a potential threat to the other, or both options.

4.4 Analysis of the respondents characteristics that cause a path adjustment

In this sub section an analysis will be made based on personal characteristics. A link between these characteristics and the path adjustment will be searched. This will be the only link that is dived into, so no connection between personal characteristics and for example the sense of security is made in this thesis. When looking at the personal characteristics gained in the survey three main domestic categories were obtained. First, the age of the respondent, secondly the gender of the respondent and last of all whether the respondent is within one of the risk groups of the RIVM.

4.4.1 Age

In this section a comparison between the responses from respondents with different ages are made. Figure 4.4 has been made to find an answer to the question what personal characteristics cause a change of intended path. The two columns display the age categories as given in Figure 4.1. The different graphs display the ages of the respondent with on the x-axis the different scenarios. On the y-axis the answers to the question of their adjusted path alternative. The amount of filled in answers divided by the total amount of responses within each age category defines the colour of the square. Per column in each graph the darkest option was the one most chosen.

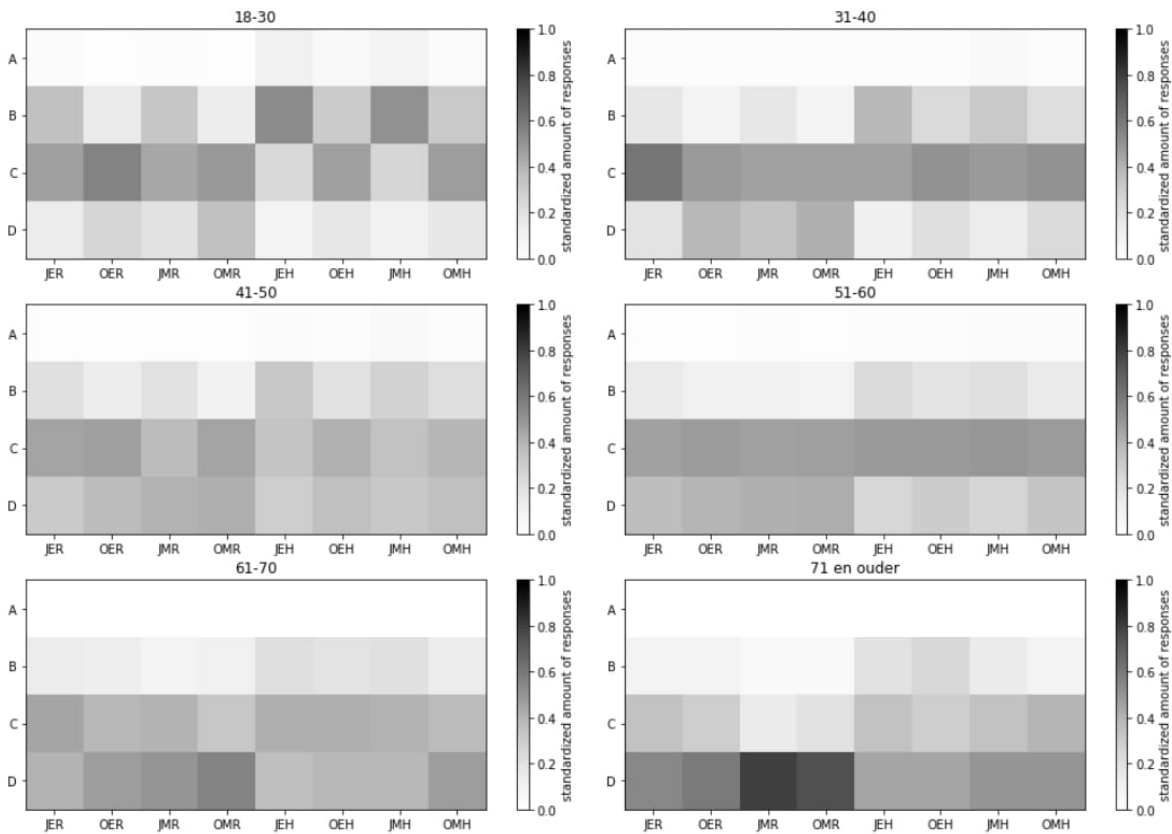


Figure 4.4: Normalized path adjustment distribution based on age

Based on the hypothesis it was expected that older persons adjust their intended path more than younger persons. This can be somewhat seen by the fact that with older age groups the amount of black spots moves to the bottom of the figure, and thus indicating that they do in fact take a bigger adjustment. Before these statements can be substantiated, the current age groups will be sized down to three groups. Early adulthood with the age span of 18-40, middle adulthood with the age span 40-60 years and late adulthood with the age of 60 and above (Erikson, 1997). To achieve this, each time two groups have been added together. Figure 4.5 shows these new groups. The reason for the fact that the colours are not a mean of the 2 columns of Figure 4.4 is that the age groups consist of a different amount of respondents and thus the influence of each age group may vary based on their size.

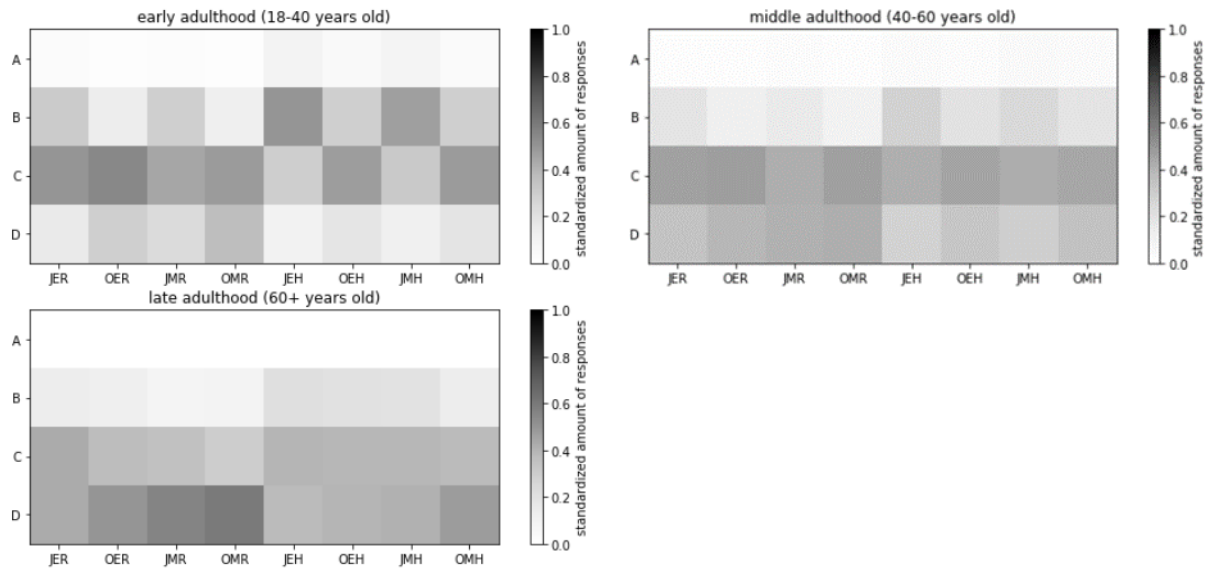


Figure 4.5: Normalised path adjustment distribution based on Erikson's age categories

The chi squared method is used to investigate whether the differences between the different age groups are statistically significant. The execution will be performed on four situations.

H_0 : There is no statistical difference in path adjustment between respondents in the three different age categories

H_1 : There is a statistical difference in path adjustment between respondents in the three different age categories

$\alpha = 0.05$, degrees of freedom = $(3-1) * (3-1) = 4$, so that H_0 gets rejected when $\chi^2 > 9.488$

For the following situations the null hypothesis was rejected. The chi-square test of independence showed that there was a significant association between age and the path adjustment in a situation:

- without hurry with a single young pedestrian (JER), $\chi^2 (4, N = 505) = 30.86, p < 0.05$.
- without hurry with a single old pedestrian (OER), $\chi^2 (4, N = 500) = 17.76, p < 0.05$.
- without hurry with multiple young pedestrians (JMR), $\chi^2 (4, N = 508) = 36.08, p < 0.05$.
- with hurry with a single young pedestrian (JEH), $\chi^2 (4, N = 491) = 47.02, p < 0.05$.

The tables in Table 4.3 provide additional information on the relation between the different age categories and the path adjustment. The hypothesis was that the older the respondent gets the more likely he or she is to take a bigger path adjustment.

For the lower path adjustment option, option B, the younger age group has a statistical higher residual value for three out of the four situations. For the higher path adjustment option, option D, the older age group has a statistical higher residual value for three out of four cases and the younger age group has a statistical lower residual value, for four out of four cases. Based on these values we can state that there is indeed a trend that proves our hypothesis. The older the respondent is the more likely he or she is to take a bigger path adjustment. Table 4.3 shows these residuals.

Table 4.3: Chi squared residuals for each age group for four situations

JER		Age Category		
		Early adulthood	Middle adulthood	Late adulthood
Path adjustment				
B	Residual	2.78	-1.15	-1.78
C	Residual	0.74	-0.20	-0.64
D	Residual	-3.29	1.22	2.31

OER		Age Category		
		Early adulthood	Middle adulthood	Late adulthood
Path adjustment				
B	Residual	1.90	-1.17	-0.63
C	Residual	0.75	0.04	-1.01
D	Residual	-2.60	0.95	1.77

JMR		Age Category		
		Early adulthood	Middle adulthood	Late adulthood
Path adjustment				
B	Residual	3.18	-1.07	-2.41
C	Residual	0.73	0.09	-1.06
D	Residual	-3.00	0.67	2.81

JEH		Age Category		
		Early adulthood	Middle adulthood	Late adulthood
Path adjustment				
B	Residual	4.12	-1.78	-2.35
C	Residual	-1.23	0.90	0.14
D	Residual	-3.35	0.99	2.61

4.4.2 Gender

The same test with the same 4 situations were applied to determine a statistically significant difference between genders. The responses of males and females are compared in this section. In the sample group we had 148 male respondents and 367 female respondents. One respondent did not say his or her gender and is thus left out of this analysis. The sample group may vary due to the different amount of responses to answer option A.

H_0 : There is no statistical difference between the path adjustment of respondents with different genders

H_1 : There is a statistical difference between the path adjustment of respondents with different genders

$\alpha = 0.05$, degrees of freedom = 2, so that H_0 gets rejected when $\chi^2 > 5.991$

For the following situations the null hypothesis was rejected. The chi-square test of independence showed that there was a significant association between gender and the path adjustment in a situation:

- without hurry with a single young pedestrian (JER), $\chi^2 (2, N = 493) = 24.79$, $p < 0.05$.
- without hurry with a single old pedestrian (OER), $\chi^2 (2, N = 509) = 19.34$, $p < 0.05$.
- without hurry with multiple young pedestrians (JMR), $\chi^2 (2, N = 507) = 38.79$, $p < 0.05$.
- with hurry with a single young pedestrian (JEH), $\chi^2 (2, N = 493) = 24.79$, $p < 0.05$.

The claim can be made that there is a relation between the gender of the respondent and the chosen path adjustment. When looking at the residuals for each question we can give more information about the claims made above. Based on Table 4.4, the statement can be made that males are significantly more likely to respond path adjustment option B. And for option D, males are significantly less likely to respond.

Table 4.4: Residuals of the path adjustment for genders compared in multiple situations

JER		Gender	
		Male	Female
Path adjustment			
B	residual	3.07	-1.87
C	residual	-0.60	0.36
D	residual	-2.88	1.75

OER		Gender	
		Male	Female
Path adjustment			
B	residual	2.23	-1.42
C	residual	1.24	-0.79
D	residual	-2.70	1.71

JMR		Gender	
		Male	Female
Path adjustment			
B	residual	4.00	-2.53
C	residual	0.58	-0.36
D	residual	-3.38	2.14

JMR		Gender	
		Male	Female
Path adjustment			
B	residual	3.07	-1.87
C	residual	-0.60	0.36
D	residual	-2.88	1.75

4.4.3 Risk groups

The last personal characteristic of the respondent that will be looked into is whether the respondent belongs to the risk groups as described by the RIVM. The comparison is made between respondents in a risk group as described by the RIVM and the respondents who are not. The same test with the same 4 situations were applied to determine a statistically significant difference between persons who do belong to this group (n=109) and those who do not (n=403). In this case each answer option could be considered in the calculation.

H_0 : There is no statistical difference between people from risk groups and the rest

H_1 : There is a statistical difference between people from risk groups and the rest

$\alpha = 0.05$, degrees of freedom = 2, so that H_0 gets rejected when $\chi^2 > 7.815$

For the following situations the null hypothesis was rejected. The chi-square test of independence showed that there was a significant association in path adjustment between people from within a RIVM risk group and people who are not in a situation:

- without hurry with a single young pedestrian (JER), $\chi^2 (2, N = 503) = 26.48$, $p < 0.05$.
- without hurry with an old single pedestrians (OER), $\chi^2 (2, N = 505) = 17.26$, $p < 0.05$.
- without hurry with multiple young pedestrians (JMR), $\chi^2 (2, N = 503) = 34.18$, $p < 0.05$.
- with hurry with a single young pedestrian (JEH), $\chi^2 (2, N = 489) = 34.08$, $p < 0.05$.

The claim can be made that there is a relation between the fact whether a respondent is in the risk groups and the chosen path adjustment. When looking at the residuals for each question we can give more information about this statement. For the risk group an additional statement could be made. The respondents that were within one of the RIVM groups are significantly more likely to choose the biggest path adjustment and significantly less likely to choose the smallest path adjustment, four out of four situations and three out of four situations respectively (see Table 4.5).

Table 4.5: Residuals of the path adjustment for risk groups compared in multiple situations

JER		Risk group	
		Risk group	Rest
Path adjustment			
B	residual	-2.22	1.17
C	residual	-1.47	0.77
D	residual	3.69	-1.94

OER		Risk group	
		Risk group	Rest
Path adjustment			
B	residual	-0.91	0.48
C	residual	-2.11	1.11
D	residual	2.87	-1.51

JMR		Risk group	
		Risk group	Rest
Path adjustment			
B	residual	-2.08	1.09
C	residual	-2.50	1.31
D	residual	4.03	-2.12

JMR		Risk group	
		Risk group	Rest
Path adjustment			
B	residual	-2.78	1.48
C	residual	-0.80	0.42
D	residual	4.26	-2.27

4.5 Analysis of the context in which pedestrians adjust their intended path

The last item to be tested is perhaps the most characteristic one of this research and concerns the influential factors in the route choice of the respondent. This analysis will consist of three parts in which each part will deal with a separate influential factor. It is examined whether there is a significant difference between two situations, the only difference being a change in the associated influential factor. This is done using the Wilcoxon signed-rank test. Given that the two data in this case are dependent since the same respondent assessed both situations.

4.5.1 Young to old approaching pedestrian(s)

The primary hypothesis is that people take a bigger path adjustment when the approaching pedestrian is older. The used steps will be demonstrated once for the comparison between a single young pedestrian in a situation without hurry (JER) to a single old pedestrian in a situation without hurry (OER). In each calculation the answer option ABCD have been reduced to BCD as done in previous calculations. The options BCD have been transformed to the numbers 1,2,3 for comparison. For each respondent the two chosen options have been compared. An increase in path adjustment from scenario 1 to scenario 2 is given a positive value, a decrease has been given a negative value. If no change has been made between the two scenarios than the respondent has been left out of the calculation. The value of the number depends on the step size that has been made. The following hypotheses are used:

H_0 : The change of image from a single young to a single old approaching pedestrian does not lead to a statistical difference in path adjustment

H_1 : The change of image from a single young to a single old approaching pedestrian does lead to a statistical difference in path adjustment

The level of significance $\alpha = .05$, with a confidence level of 95% so that H_0 gets rejected when

$$z_{critical} = 1.96 < |z|$$

- For the positive differences the ranks are summed up to get $T+ = 4329$
- For the negative differences the ranks are summed up to get $T- = 279$

For the statistical test the smallest of the T values is used, in this case that is T-. The sample size is reduced to 96 since the respondents who did not adjust their path between the two situations are left out. The mean and standard error can be calculated and finally the z-score.

$$\begin{aligned} \text{mean} &= \bar{T} = \frac{n(n+1)}{4} = \frac{96(96+1)}{4} = 2328 \\ \text{standard error} &= SE_{\bar{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24} - C_{ties}} = \sqrt{\frac{96(96+1)(2*96+1)}{24} - 3463} \\ &= 267.24 \\ z &= \frac{T - \bar{T}}{SE_{\bar{T}}} = \frac{279 - 2328}{273} = -7.67 \\ z_{critical} &= 1.96 < |-7.48| \end{aligned}$$

The H_0 , null hypothesis, was rejected. The Wilcoxon signed-rank test showed that there was a significant difference in path adjustment between the situations JER and OER. See appendix E for a visualisation of the path adjustment between the 2 scenarios. This calculation has also been done for the following differences with their given z-values:

Table 4.6: Z-score for the situations from a young to an old approaching pedestrian(s)

First scenario	Second scenario	z-score	H_0 gets rejected
JMR	OMR	-5.47	Yes
JEH	OEH	-7.68	Yes
JMH	OMH	-7.18	Yes

The hypothesis that there is a statistical difference is thus true for every situation. Respondents do take a bigger path adjustment when the approaching pedestrian is older.

4.5.2 Single to multiple approaching pedestrians

The comparison of responses between a situation with a single approaching pedestrian and multiple approaching pedestrians are made in this section. The primary hypothesis is that people take a bigger path adjustment when the approaching pedestrian is in a group. The Wilcoxon signed-ranked test is again used in which we find a statistical difference if $z_{critical} = 1.96 < |z|$.

H_0 : The change of image from a single to multiple approaching pedestrians does not lead to a statistical difference in path adjustment

H_1 : The change of image from a single to multiple approaching pedestrians does lead to a statistical difference in path adjustment

Table 4.7: Z-score for the situations from a single to multiple approaching pedestrians

First scenario	Second scenario	z-score	H_0 gets rejected
JER	JMR	-5.73	Yes
OER	OMR	-4.65	Yes
JEH	JMH	-3.06	Yes
OEH	OMH	-2.90	Yes

The H_0 , null hypothesis, was rejected for every situation. The Wilcoxon signed-rank test showed that there was a significant difference in path adjustment between the situations from a single to multiple

approaching pedestrians. See appendix F for a visualisation of the path adjustment between the 2 scenarios. The hypothesis that there is a statistical difference is thus true for every situation. Respondents do take a bigger path adjustment when the approaching pedestrian is in a group.

4.5.3 Without hurry to a situation in which the respondent is in a hurry

The comparison of responses between a situation in which the respondent is in a hurry and in which he is not is made in this section. The primary hypothesis is that people take a smaller path adjustment when they are in a hurry. The Wilcoxon signed-ranked test is again used in which we find a statistical difference if $z_{critical} = 1.96 < |z|$. Table 4.8 gives the z-score for each combination.

H_0 : *The change of the situations without hurry to a situation in which the respondent is in a hurry does not lead to a statistical difference in path adjustment*

H_1 : *The change of the situations without hurry to a situation in which the respondent is in a hurry does lead to a statistical difference in path adjustment*

Table 4.8: Z-score for the situations without hurry to a situation in which the respondent is in a hurry

First scenario	Second scenario	z-score	H_0 gets rejected
JER	JEH	-7.87	Yes
OER	OEH	-7.56	Yes
JMR	JMH	-9.77	Yes
OMR	OMH	-8.73	Yes

The H_0 , null hypothesis, was rejected for every situation. The Wilcoxon signed-rank test showed that there was a significant difference in path adjustment between the situations without hurry to a situation in which the respondent is in a hurry. See appendix G for a visualisation of the path adjustment between the 2 scenarios. The hypothesis that there is a statistical difference is thus true for every situation. Respondents do take a smaller path adjustment when they are in a hurry.

4.6 Analysis of the feedback

The survey left room for the respondent's own interpretation. This will briefly be discussed in this chapter. In the current setup of the research, certain choices have been made regarding the chosen influential factors. However, this choice is often based on hypotheses, literature research and certain criteria. The respondent was therefore asked whether he could have any additions to these influential factors that influence his or her route choice. These factors are not considered in this study but can serve as a basis for further research. This list of factors has been compiled from more than 500 responses. We have tried as much as possible to group the factors of the same nature together for a better overview. This considers the fact that the true nature of the respondent's train of thought has not been affected. Certain feedback was therefore disregarded because it either could not be grouped or first had to be adjusted in such a way as to belong to a group where the possible core of the respondent was lost. The feedback that could be grouped without too many adjustments is shown below. They are given in the order from most respondents to least. Only groups with more than 10 mentions have been added.

- The amount of space at the collision, this includes possible obstacles, roads, etc.
- The behaviour of the other pedestrian, some respondents stated that they will take a bigger path adjustment if the approaching pedestrian does not react, while others say they are less likely to adjust their path if this situation.
- The crowds at the close-by collision

- Whether the approaching pedestrian shows signs of an infection (coughing and sneezing)
- Whether the approaching pedestrian is wearing a mouth mask
- The appearance of the approaching pedestrian
- The weather at that time of the day

A final remark will be made based on the feedback of around 40 people they stated that the influential factors as described in this research shouldn't influence the behaviour and path adjustment at all. We should at all-times be aware of the possible health risks related with the COVID-19 virus. As most of them stated, freely translated, we should always have respect for others and just follow the given measurements by the government and thus stick to the 1.5 meter.

5. Discussion

The goal of this chapter is to discuss the used methodology and look critically at the choices that have been made before any conclusions will be made. It is in the interest of the research that the chosen method is first discussed in order to identify possible errors or deviations. So that conclusions are not drawn prematurely. Section 5.1 acknowledges the limitations of the survey, section 5.2 shows the correct interpretation of the results based on this. Section 5.3 shortly continues on the limitation of the influential factors.

5.1 Survey limitations

This research aimed to find out more about the behaviour of pedestrians in public spaces by looking at their path adjustment in multiple given scenario's. Since it is not possible to go around and make everyone fill in the survey, there will always be some deviation and the results will never be fully reliable. In this thesis we aimed towards a confidence level in our analysis of 95%. In stated preference surveys some biases will be included in the product. Obtaining reliable information is difficult since the questions are based on a hypothetical situation. A few sources of biases are further elaborated in the groups: measurement bias and representation bias (Lindhjem & Navrud, 2011).

Measurement:

The first bias comes from the *validity* of the answer. The question describes a theoretical situation in which the respondent is asked for his or her answer. The question, however, is to what extent this represents a correct reflection of reality. Can we say that this response is the same as what the respondent will actually do? In our case this is especially true since it is difficult to transfer the scenery correctly into an image. Factor as for example environmental sounds, eye contact, the speed, the path adjustment and the body language of the approaching pedestrian are lacking in an image. Without these factors the given image is a simplification of reality. But this simplification is used as a tool to focus the attention on the influential factors that we wanted to research. An additional point to notice, it has been decided to depict age factors, both young and old, with the help of a male person. Women may be able to choose an oversized deviation purely for the mere fact that it is a male person. This cannot be proved considering that the situation sketches were not made with both male and female pedestrians. This will be considered in the final conclusion.

The second measurement bias is a *measurement error*. Since some of the questions might not have been clearly distinctive enough, the respondent might answer them all in a same manner without paying attention to the altering factors. An attempt has been made to reduce this by using "clearly" different images. By always putting the different scenarios on a new sheet, an attempt was made to avoid an effect in which the respondent classifies the answers in a certain way based on a chosen order of the various influential factors. In addition to that there was a contextual description to provide extra information if needed.

Representation:

The first error is the *coverage error*. It comes from the fact that only a limited number of respondents were obtained from a larger population. With a survey covering every citizen of the Netherlands you will never be able to get each person to answer to the survey. All possible options were used to reach as many people as possible.

The second one is the *sampling error*. Since the survey is spread out within my own network a certain bias is added. People from outside my network have a smaller chance to be included into the sample group. When looking back at Figure 4.1 we see that there is a major difference in the amount of responses from men and women. For women we have 369 responses and 154 for men. About half of the male respondents are under the age of 30. Related statements therefore give a distorted picture when we talk about men as one group. The choice is then to formulate these statements for men under the age of 30 and for men above. However, we then ran into the problem that for the female age group a solid statement can be made about each category. This was not considered in the creation of the statements regarding the gender differences however it will be considered in the final conclusion. An important additional fact of the distribution of the survey within my own network is that the respondents are often highly educated. The education level of the respondent can possibly influence the route choice. In this way, the research group is not a correct reflection of society. To smooth this out as much as possible, I also asked my parents and environment to spread this research as much as possible in order to reach new people in this way for possibly more diversity. There has also been an attempt by means of posting it in over 4 forums and 15 Facebook groups to reach diverse underrepresented groups within society. For example, people from outside the Randstad, unemployed people or the elderly. However, this also gives a certain bias because these people have something in common and thus does not fully solve the problem.

The last form of error is the *nonresponse error*. This error is related to the fact that people with an interest in the survey topic are more like to fill in the survey (for example the Facebook group for hiking enthusiasts or that of dog owners since they come out more often). These people might respond differently compared with people who have no interest in the survey. No statements can be made about this since the information is lacking.

5.2 Interpretation of the result

Now that we have information about all possible deviations within our research results, it is time to look at the meaning of our results. Different conclusions emerge from the three different analyses. When we delve deeper into these analyses, we see that some of these conclusions may be related. We will also look at whether these conclusions are in line with previous research. The conclusions from the analyses are summed up.

1. There is a relation in path adjustment between people who assess the situation based on a health risk and respondents who do not.
2. The exact reason why people associate the situation with a health risk has no influence on the path adjustment. There is no relation between the path adjustment and these groups.
3. There is a significance difference in path adjustment between the early adulthood age 18-40, middle adulthood with the age span 40-60 years and late adulthood with the age of 60 and above.
 - a. Respondents in the early adulthood are more likely to choose the smaller path adjustment and less likely to choose to the bigger path adjustment.
 - b. Respondents in the late adulthood are more likely to choose to the bigger path adjustment
4. There is a relation in path adjustment and the gender.
 - a. Males are more likely to choose a smaller path adjustment and less likely to choose the bigger path adjustment.

5. There is a relation between whether the respondent is in one of the RIVM risk groups and the chosen path adjustment.
 - a. The respondents that were within one of the RIVM groups are significantly more likely to choose the biggest path adjustment and significantly less likely to choose the smallest path adjustment.
6. There is a relation in path adjustment and the age of the approaching pedestrian.
 - a. Respondents will take a bigger path adjustment if the approaching pedestrian is older.
7. There is a relation in path adjustment and the group size of the approaching pedestrian.
 - a. Respondents will take a bigger path adjustment if the approaching pedestrian is in a group.
8. There is a relation in path adjustment and the fact whether the respondent is in a hurry.
 - a. Respondents will take a smaller path adjustment if they are in a hurry.

Footnotes:

There can possibly be a relation between statement 1 and statement 5a. People who are within one of the risk groups are possibly more concerned of the health threat related to the close-by interaction. Because of this they probably take a bigger path adjustment. This relation however cannot be substantiated with any evidence.

Because about half of the male respondents are under the age of 30. We have reason to believe that analysis 3a and 4a are related. A footnote should be placed for these statements that they might be a generalisation. A type I error could occur in which we conclude something that does not exist in reality. Our conclusion for males and the conclusion about young adults might in fact be a conclusion about young male adults. Future research is needed to prove or disprove this conclusion.

Analysis 6 is in line with research done by Quentin Dumont-Freixo in which it is stated that the age plays an important role in determining the position. Although both researches look at the positioning in a different way they might still be related.

Analysis 7 is in contradiction with previous research done by Quentin Dumont-Freixo. He stated that group size was an attribute that was not observed in an effective way in an image. In our research it did show up. The reasoning behind this difference cannot be stated with the current knowledge.

5.3 Limitations of the chosen influential factors

Perhaps an important influential factor, apart from the ones described in section 4.6, that has not yet been discussed is the timestamp of the study. This survey may differ from week to week. It is of course a very topical subject and every week we are addressed by the Prime Minister again with possible new measures, this statement is made on 18-10-2020. For example, it may influence whether the respondent completed the survey just after such a speech or well afterwards. This can be related to the sense of health risk. If this speech is positive, that is, a relaxation of the measures, it may be the case, for example, that we notice that people are laxer with the rules and therefore keep less distance. On the other hand, if the prime minister addresses us with a stern hand, we can possibly see that people are paying more attention to what they do. Strictly taken, given that our data is collected over a period of 2 weeks, we can remove the possible influence of such a speech. However, adding a timestamp to these conclusions is important to place them in the correct framework.

6. Conclusion

This chapter aims to form a general conclusion based on the analysis and the discussion given in chapter 4 and 5. With the final goal to find an answer to the main research question “ *What is the response of pedestrians during a close-by interaction with another pedestrian in public areas as part of their behaviour in times of the COVID-19 virus outbreak?*”

The objective of this thesis was to determine whether pedestrians respond to approaching pedestrians, determine influencing factors for this and determine whether the feeling of safety was related to this. It was found that there is a difference in path adjustment of respondents. Multiple influential factors have been found for this.

First, the personal characteristics that were related to certain path adjustments. It was found that respondents in the early adulthood take a smaller path adjustment than respondents in the late adulthood. Due to the distribution of the responses possible closely related to this statement is the fact that we saw that the gender influences the path adjustment. Further research is needed to prove or disprove this so no premature claims are made. In general males took smaller path adjustments. It was also seen that the respondents from within one of the RIVM risk groups took bigger path adjustments.

Secondly the situation related influential factors. Both the age and the group size will cause a difference in path adjustment. An older approaching pedestrian or a group instead of a single pedestrian will both lead to a bigger path adjustment. However, if the respondent is in a hurry, he will take a smaller path adjustment.

The relation between the path adjustment and the sense of a possible health threat is made. In this it was found that the respondent will take a bigger path adjustment if he assesses the situation based on a health risk. The thinking behind this health risk has no further influence.

Finally, can be concluded that the main reason for respondents to go out and walk in public areas was for grocery shopping, 81.6% of the respondents chose this as an option. Second and third place were taken by exercise (which includes walking, jogging, walking the dog, etc) with 70.2% and work with 39%. Followed by recreation (cinema, cafes, visiting friends, etc) with 32.8%. If we want to decrease the amount of movements from people in public areas these are the points we should aim at.

All these claims were based on responses gained in the time frame 21 September 2020 to 04 October 2020.

7. Recommendation

With the knowledge gained from this research, there is enough room for further research. On its own, this research may mean little for real improvements in public space in order to prevent the spread of the corona virus. That is precisely why it is important that this research serves as a starting shot for further research to gain insight in order to act adequately in the short term, but also to be able to draw comparisons in the long term. For example, the results can be used for targeted research into specific situations and scenarios.

The relationship of route choice with the aspect of haste can be further investigated for situations on and around public transport. This study has shown that there is a relationship between these two factors, path adjustment and hurry, it may now be possible to look at which suitable measures will minimize this effect in order to guarantee the 1.5 meters.

The fact that the sense of health risk influenced the path adjustment can possibly be used in targeted measures to repeatedly make people aware of the fact that a close-by interaction can cause a health threat.

Likewise, the factors: amount of space at the collision, the behaviour of the other pedestrian, the crowds at the close-by collision, signs of infection, wearing a mouth mask and the weather of the day, obtained from the feedback of the respondents can be further investigated. It is then suggested to look at, for example, the effect of space and the possible behaviour of the other pedestrian using short videos. What is currently, 18-10-2020, also very topical and an interesting issue, is the wearing of masks and the effect of this on the route choice. In addition to that the same survey could be spread out again at a different time, in order to compare the results.

Each research should pay close attention to the timeframe in which the survey is being held. The responses might be different each time, even with the exact same sample group. In bigger follow-up studies this effect can be dived into by comparing the results from respondents in different parts of the week by making a distinction between responses gained right after a press conference and the one gained with some time passed. The nature of the press conference should be taken into account since this might influence the outcome.

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Appendices

A. | Final survey

TU Delft

Onderzoek route keuze van voetgangers in openbare ruimte.

Voor mijn bachelors eindverslag voor de studie civiele techniek aan de TU Delft doe ik onderzoek naar het gedrag van voetgangers in de openbare ruimte in tijden van Corona. Het gaat dan bijvoorbeeld om plekken als op de stoep, in het park of op pleinen. Door middel van een aantal persoonlijke vragen en 8 situatie gerelateerde vragen probeer ik erachter te komen wat het gedrag van voetgangers is. De enquête neemt ongeveer 5 minuten in beslag.

Voor vragen of opmerkingen rondom het onderzoek kunt u contact op nemen via: v.j.vanelk@student.tudelft.nl

Er worden geen namen, telefoonnummers, e-mailadressen en thuis- / werkadressen verzameld, zodat de respondenten niet gevolgd kunnen worden. Daarom wordt de enquête als volledig anoniem beschouwd. De optie "zeg ik liever niet" is bij persoonlijke vragen toegevoegd om u de mogelijkheid te geven deze vraag niet te beantwoorden.

Pagina 1 van 7

Volgende

Verzend nooit wachtwoorden via Google Formulieren.

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TU Delft

Onderzoek route keuze van voetgangers in openbare ruimte.

***Vereist**

Algemene informatie

Leeftijd? *

18-30

31-40

41-50

51-60

61-70

71 en ouder

Zeg ik liever niet

Biologische geslacht? *

Man

Vrouw

Anders

Zeg ik liever niet

Pagina 5 van 7

Volgende

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Valt u binnen een van de risicogroepen van het RIVM? *

<https://www.rivm.nl/coronavirus-covid-19/risicogroepen>

Ja

Nee

Zeg ik liever niet

Wat is/zijn de voornaamste reden(en) dat u zich lopend in de openbare ruimte begeeft? *

Werk

School/Studie

Boodschappen

Recreatie (bioscoop, terras, naar vrienden toegaan, etc.)

Sport & beweging (hardlopen, wandelen, de hond uitlaten, etc.)

Ik ga niet naar buiten

Zeg ik liever niet

Anders: _____

Probeert u sinds corona drukke plekken te vermijden? *

Nee

Ja, door op andere tijdstippen buiten te komen

Ja, door andere routes te kiezen

Ja, door zowel een andere route te kiezen als op een ander tijdstip buiten te komen

Pagina 5 van 7

Volgende

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Probeert u sinds corona drukke plekken te vermijden? *

Nee

Ja, door op andere tijdstippen buiten te komen

Ja, door andere routes te kiezen

Ja, door zowel een andere route te kiezen als op een ander tijdstip buiten te komen

Pagina 5 van 7

Volgende

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Onderzoek route keuze van voetgangers in openbare ruimte.

*Vereist

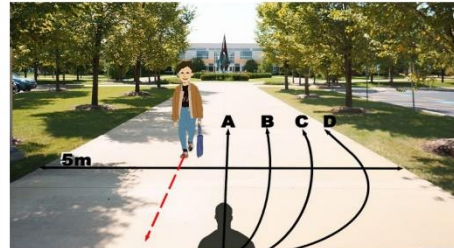
Onderzoeksvragen

In de volgende situaties wordt van u gevraagd op welke manier u reageert op de voetganger(s) die uw kant op komen. De eerste vraag gaat over uw route keuze de tweede vraag gaat steeds over een mogelijke redenatie achter uw keuze.

Situatie (zonder haast)

Uw reactie wordt gevraagd in een situatie waarin u geen haast heeft.

Welke looproute kiest u als u alle tijd heeft en deze jonge man op u af komt lopen? *

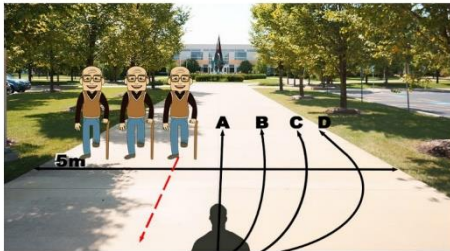


- A
- B
- C
- D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

- Ik vorm een mogelijke gezondheidsbedreiging voor de ander
- De ander vormt een mogelijke gezondheidsbedreiging voor mij
- Beide opties
- Geen van bovenstaande

Welke looproute kiest u als u alle tijd heeft en deze oude mannen op u af komen lopen? *



- A
- B
- C
- D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

- Ik vorm een mogelijke gezondheidsbedreiging voor de ander
- De ander vormt een mogelijke gezondheidsbedreiging voor mij
- Beide opties
- Geen van bovenstaande

Pagina 3 van 7

Vorige

Volgende

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Onderzoek route keuze van voetgangers in openbare ruimte.

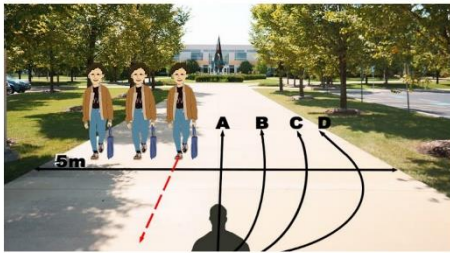
*Vereist

Vervolg vragen

Situatie (zonder haast)

Uw reactie wordt gevraagd in een situatie waarin u geen haast heeft.

Welke looproute kiest u als u alle tijd heeft en deze jonge mannen op u af komen lopen? *



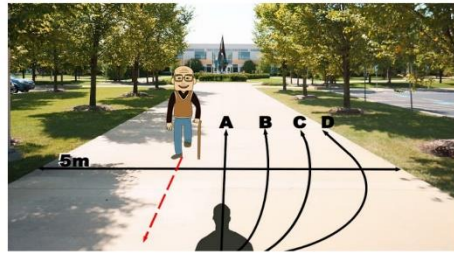
- A
 B
 C

- D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

- Ik vorm een mogelijke gezondheidsbedreiging voor de ander
 De ander vormt een mogelijke gezondheidsbedreiging voor mij
 Beide opties
 Geen van bovenstaande

Welke looproute kiest u als u alle tijd heeft en deze oude man op u af komt lopen? *



- A
 B
 C
 D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

- Ik vorm een mogelijke gezondheidsbedreiging voor de ander
 De ander vormt een mogelijke gezondheidsbedreiging voor mij
 Beide opties
 Geen van bovenstaande

Pagina 4 van 7

[Vorige](#) [Volgende](#)

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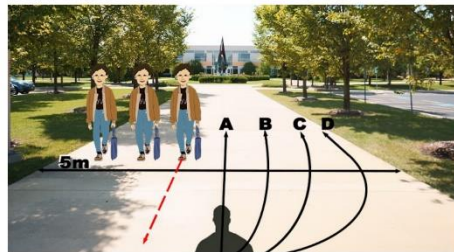
Onderzoek route keuze van voetgangers in openbare ruimte.

*Vereist

Onderzoeksvragen

De situatie waarin volgende vragen beantwoord moeten worden is nu veranderd. Nu wordt uw reactie gevraagd in een situatie waarin u haast heeft. Dit kan zijn voor een meeting, werk of het op tijd moeten zijn voor de trein/bus/tram.

Welke looproute kiest u als u haast heeft en deze jonge mannen op u af komen lopen? *



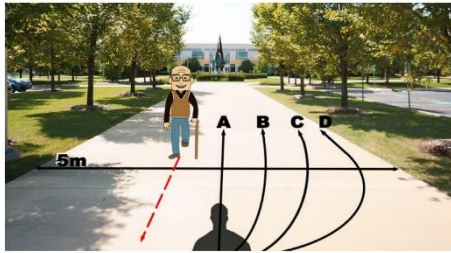
- A
 B
 C

- C
- D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

- Ik vorm een mogelijke gezondheidsbedreiging voor de ander
- De ander vormt een mogelijke gezondheidsbedreiging voor mij
- Beide opties
- Geen van bovenstaande

Welke looproute kiest u als u haast heeft en deze oude man op u af komt lopen? *



- A
- B
- C
- D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

- Ik vorm een mogelijke gezondheidsbedreiging voor de ander
- De ander vormt een mogelijke gezondheidsbedreiging voor mij
- Beide opties
- Geen van bovenstaande

Pagina 5 van 7

Vorige Volgende

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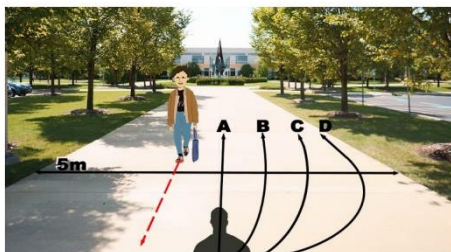


Onderzoek route keuze van voetgangers in openbare ruimte.

*Vereist

Vervolg vragen

Welke looproute kiest u als u haast heeft en deze jonge man op u af komt lopen? *

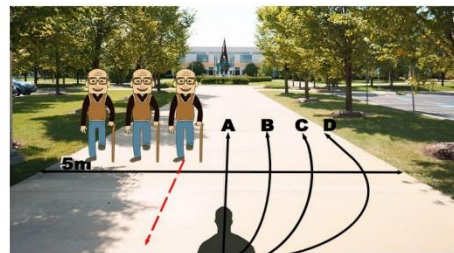


- A
- B
- C
- D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

- Ik vorm een mogelijke gezondheidsbedreiging voor de ander
- De ander vormt een mogelijke gezondheidsbedreiging voor mij
- Beide opties
- Geen van bovenstaande

Welke looproute kiest u als u haast heeft en deze oude mannen op u af komen lopen? *



- A
- B
- C
- D

Heeft u uw keuze gebaseerd op een van onderstaande principes? *

Ik vorm een mogelijke gezondheidsbedreiging voor de ander
 De ander vormt een mogelijke gezondheidsbedreiging voor mij
 Beide opties
 Geen van bovenstaande


Pagina 6 van 7

Vorige Volgende

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Onderzoek route keuze van voetgangers in openbare ruimte.

Afronding

Welke factoren zijn buiten die in het onderzoek zijn behandeld (de grootte van de groep, leeftijd en haast) nog meer van invloed op uw route keuze?

Jouw antwoord

Heeft u nog algemene feedback of opmerkingen over het onderzoek?

Jouw antwoord

Pagina 7 van 7

Vorige Verzenden

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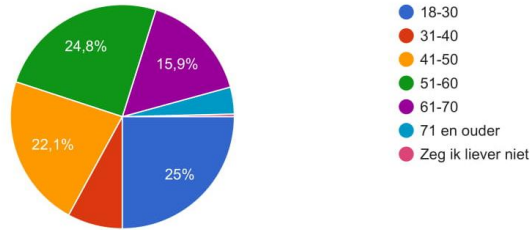
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B. | Survey results: respondents' portrait

Algemene informatie

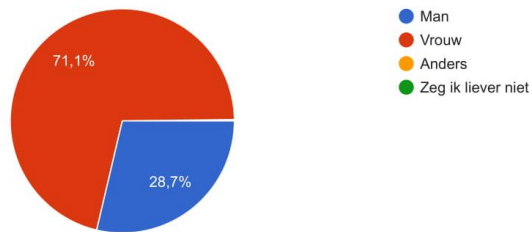
Leeftijd?

516 antwoorden



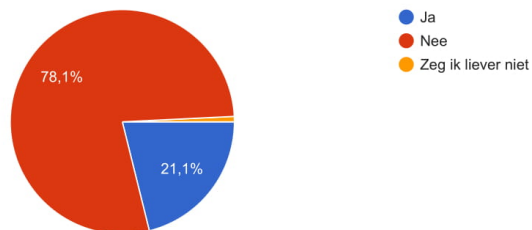
Biologische geslacht?

516 antwoorden



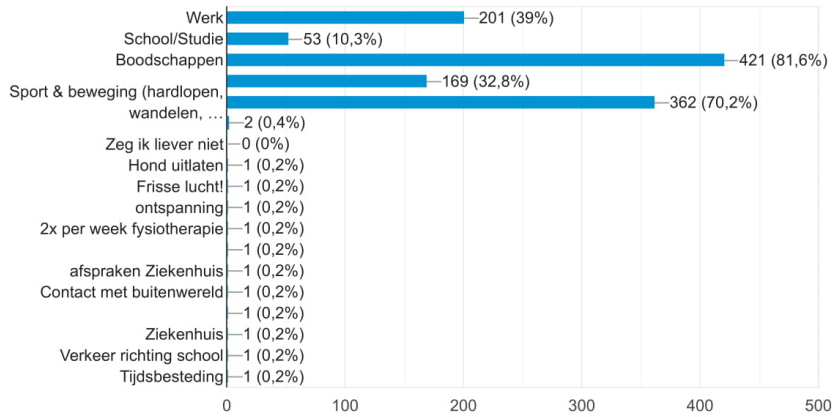
Valt u binnen een van de risicogroepen van het RIVM?

516 antwoorden



Wat is/zijn de voornaamste reden(en) dat u zich lopend in de openbare ruimte begeeft?

516 antwoorden



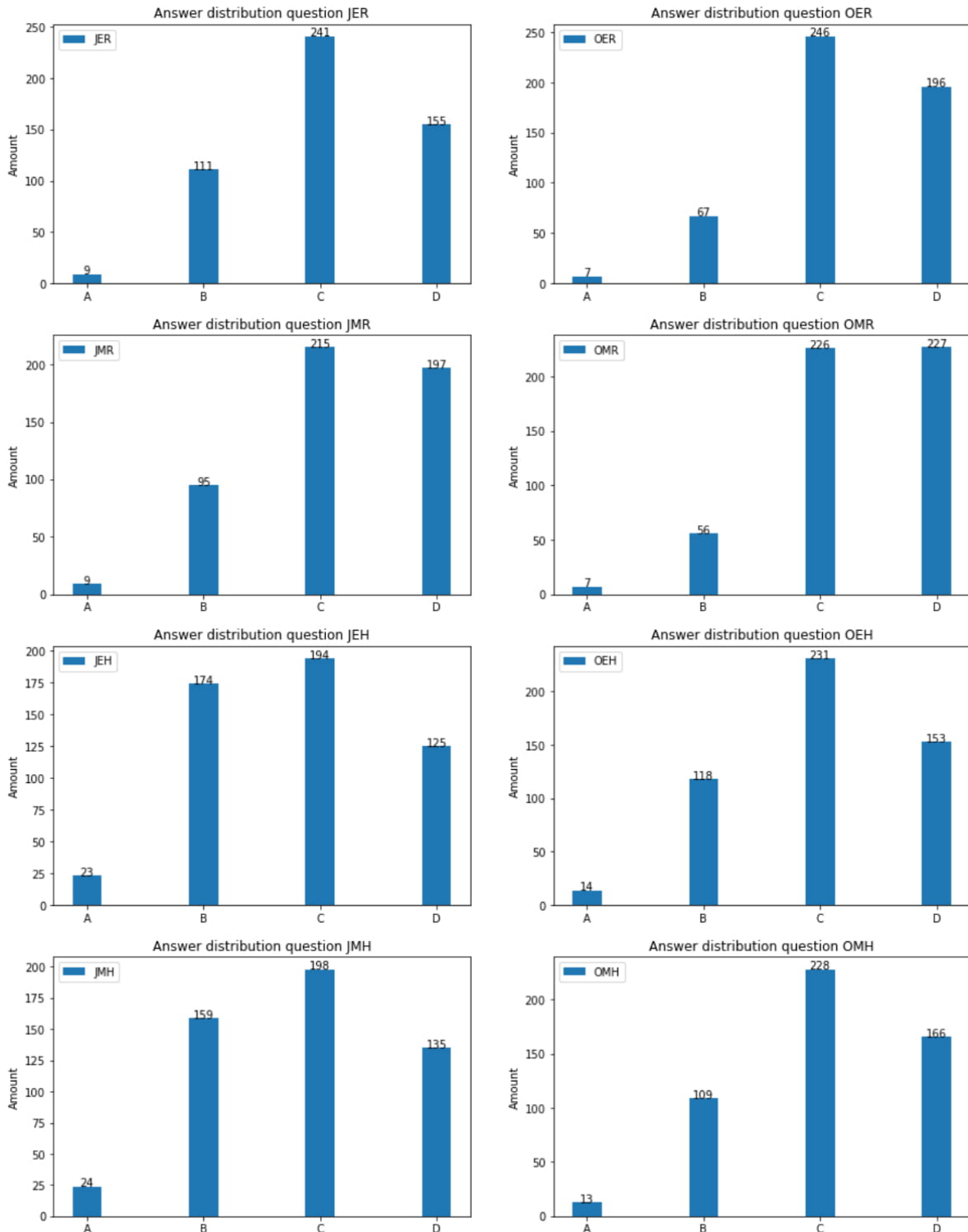
Probeert u sinds corona drukke plekken te vermijden?

516 antwoorden



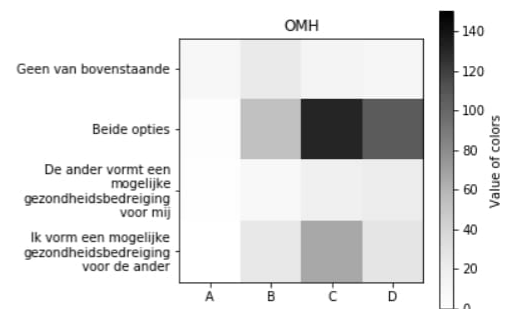
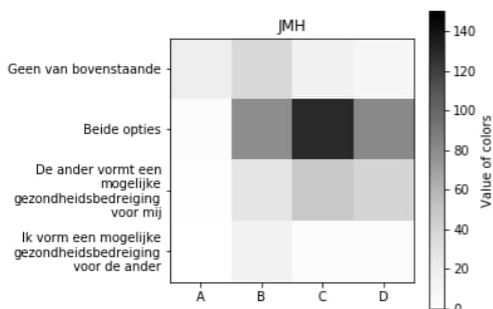
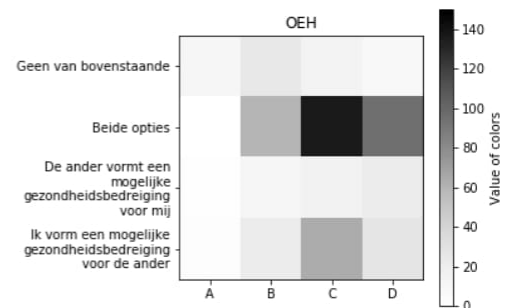
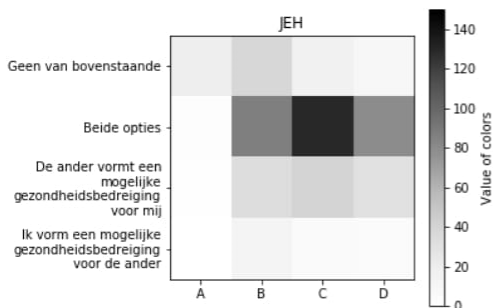
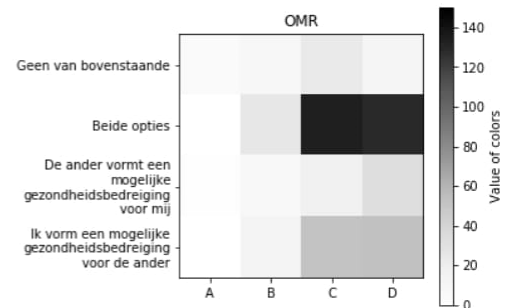
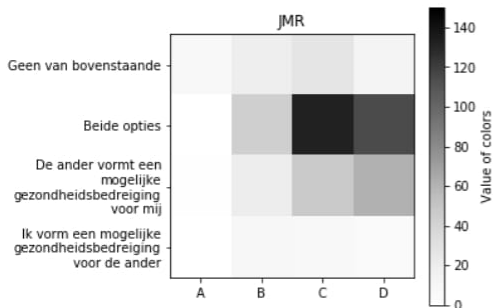
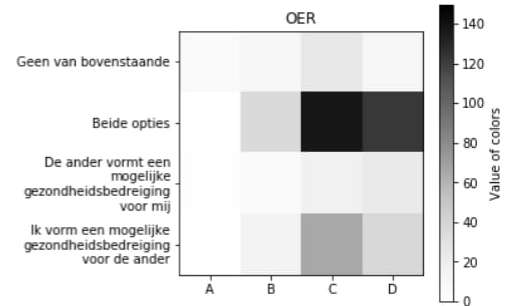
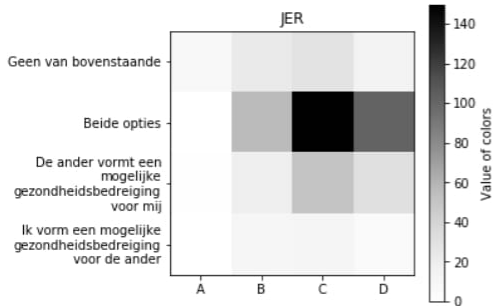
C. | Survey results: Chosen path alternatives

The relation between the chosen path adjustment options on the x-axis and the amount of responses that have chosen this on the y-axis. It should be considered that the y-scale is not the same in each image.



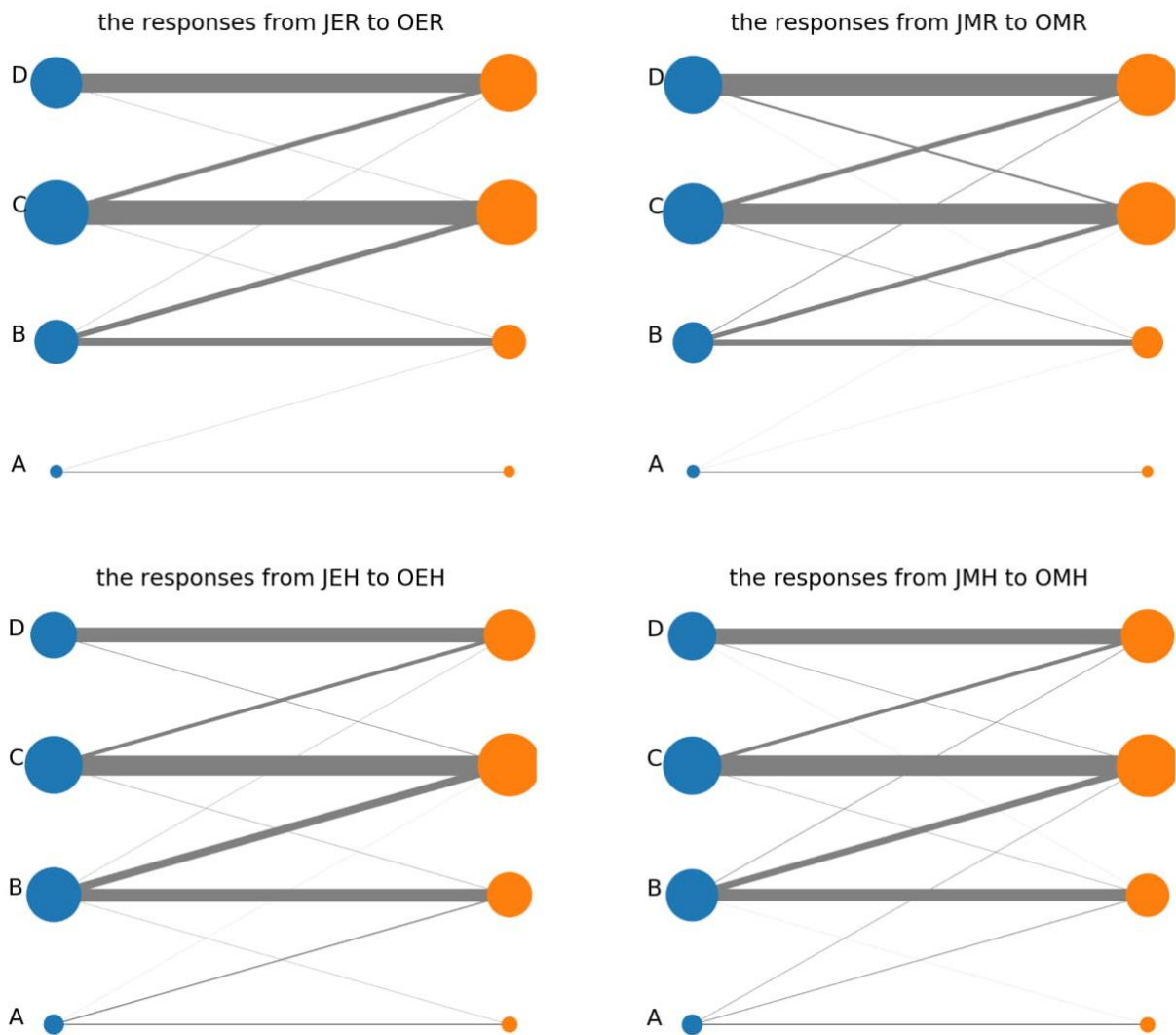
D. | Survey results: path adjustment linked with sense of security

The relation between the chosen path adjustment options on the x-axis versus the possible reasoning behind their chosen path adjustment on the y-axis. The colour of the square indicated the amount of responses that have chosen this specific combination. The colour scale is the same in each graph for easy comparison.



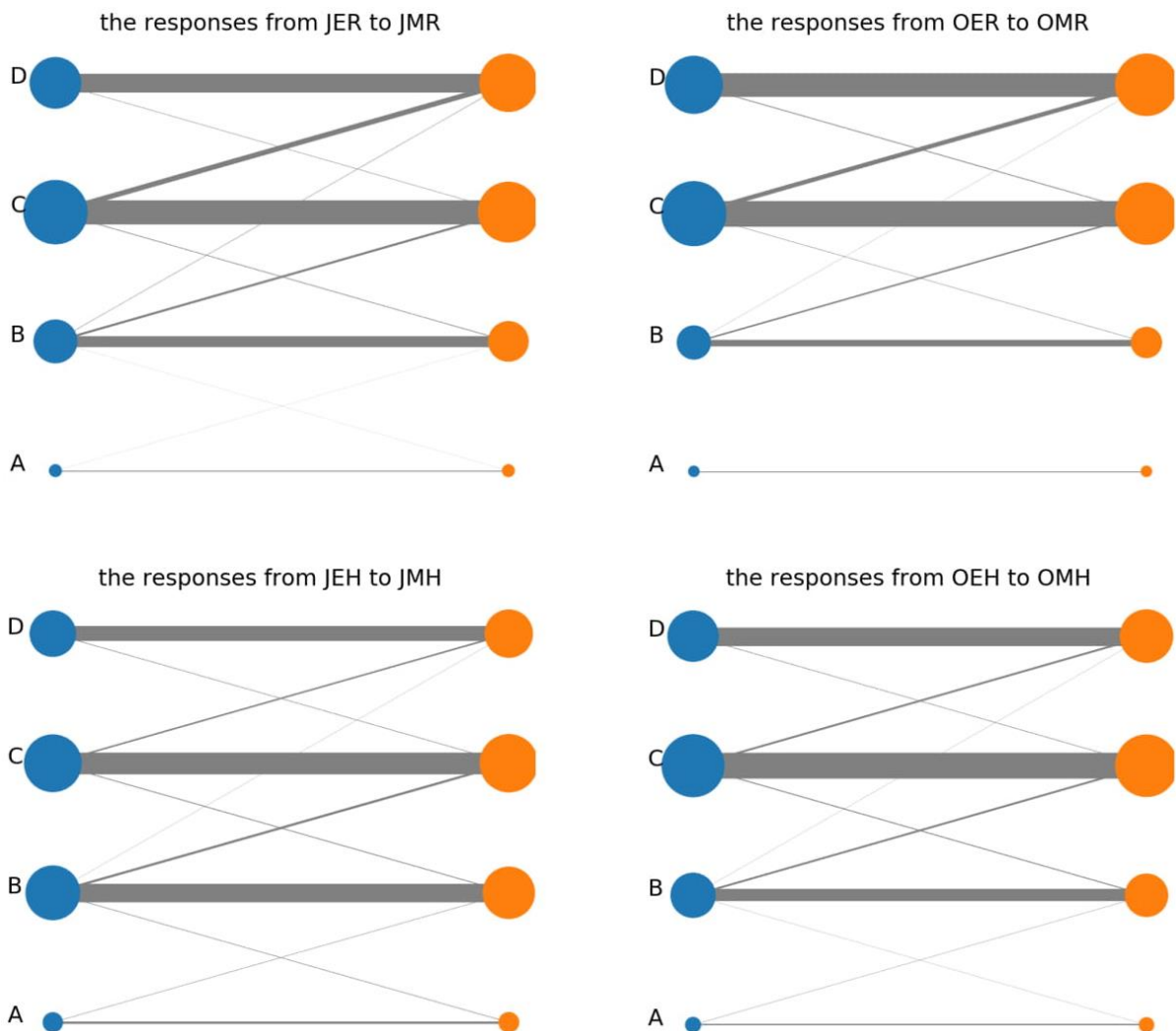
E. | Survey results: Relation of path adjustment young to old approaching pedestrians

On the left-hand side of each figure the amount of responses to the first question is given. The size of each dot indicates the number of respondents that filled in this particular answer option. The line between the two rows with dots indicate where the respondent, based on his original answer, answered the next question. In this case, it is therefore from a situation with a young incoming pedestrian to a situation with older incoming pedestrians. The thickness of the line indicates the number of respondents that took this specific path, the thicker the line the more respondent who choose this path.



F. | Survey results: Relation of path adjustment from single to multiple approaching pedestrians

On the left-hand side of each figure the amount of responses to the first question is given. The size of each dot indicates the number of respondents that filled in this particular answer option. The line between the two rows with dots indicate where the respondent, based on his original answer, answered the next question. In this case, it is therefore from a situation with a single incoming pedestrian to a situation with several incoming pedestrians. The thickness of the line indicates the number of respondents that took this specific path, the thicker the line the more respondent who choose this path.



G. | Survey results: Relation of path adjustment between a situation without hurry to a situation in which the respondent is in a hurry

On the left-hand side of each figure the amount of responses to the first question is given. The size of each dot indicates the number of respondents that filled in this particular answer option. The line between the two rows with dots indicate where the respondent, based on his original answer, answered the next question. In this case, it is therefore from a situation in without hurry to a situation in which the respondent is in a hurry. The thickness of the line indicates the number of respondents that took this specific path, the thicker the line the more respondent who choose this path.

