

(Gilman, 2020)

Behaviour in supermarkets during the corona crisis

A study focussing on behaviour; route adjustments, influence of measures, number of visits, patience, annoyance, and feeling of safety.

Bachelor Thesis Civil Engineering

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Published on:	15 June 2020	
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Preface

This thesis is part of the completion of the bachelor Civil Engineering at TU Delft. The research was done at the department of Transport and Planning. I have been researching and writing the thesis from April to June 2020.

The idea for the subject raised by the outbreak of the corona virus in the Netherlands. After consulting my supervisors, this became the final topic. Because I could not ask people in real-life to participate, I had to wait and see if I could find enough participants, but fortunately this worked out. During my research, my supervisors Rolf Koster and Yufei Yuan were always willing to help me. Jaap Vleugel also always attended the meetings and gave useful feedback. Winnie Daamen has given a lot of good advice for the research, especially for the setup and the mathematical analysis.

I would like to thank these people for their guidance and support during this thesis. I would also like to thank all participants in the survey for their contribution to my research.

Enjoy your reading.

B. den Hollander Delft, June 2020

Summary

After corona broke out, the government started to impose measures. These measures are particularly important for places where many people come together, such as supermarkets. These measures influence the behaviour of the visitors. In order to keep visitors healthy, it is important to know more about this behaviour.

This thesis is about the behaviour and experiences of people visiting the supermarket during the corona crisis. Behaviour includes various things, such as route adjustments, influence of measurers, number of visits, and patience. With experience is meant: annoyances and feeling of safety. Six subquestions were used for this research. These questions were about the normal situation, supermarket measures, behaviour adjustments, influence of measures, who made which adjustment, and feeling of safety.

To answer the research question, literature was used, and a survey was distributed. The survey is about people who visit the supermarket. During the analysis, a distinction was made in gender, age, and health. The results showed that the corona outbreak has resulted in quite a big change in behaviour and experience for everyone. Other visitors have a lot of influence on the behaviour and experience of people visiting the supermarket. Several measures ensure an adjustment of behaviour and a feeling of safety. Cleaning of shopping trolleys provides the safest feeling for all categories. There are also measures that people perceive as not useful and there are measures that do not achieve the desired goal. Supermarkets try people to keep their distance by implementing on-way paths, but because not everyone adheres to this, people regularly walk within 1.5 meters of each other. The risk group and the elderly are not much more careful than people outside these groups. So, the behaviour and experience of people visiting the supermarket during the corona crisis has changed considerably in several aspects.

For a follow-up research it might be interesting to redistribute the survey now (June 2020) to investigate changes in behaviour. The results of the survey are expected to be different when the survey is distributed again, because the government is easing more and more measures. Furthermore, it might be interesting to visit different neighbourhoods to investigate whether there are behaviour differences between people with different backgrounds. For this research this was not possible because of health risks.

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1. Introduction

This thesis is about the behaviour and experience of people in supermarkets during the corona crisis. The corona pandemic (SARS-CoV-2) started as 'just another virus in China caused by low hygiene standards'. Two different forms of the SARS virus occurred in history. In 2003 the virus disappeared after a peak. (Roossinck, 2020) With SARS-CoV-2 the same course as the SARS virus was expected. The virus has also become a major health hazard, also in the Netherlands. Up till now, more than 6000 Dutch people died of corona. (RIVM, 2020) The government knows that measures must be taken to limit the spread. Everyone is requested to avoid crowded places and keep 1.5 meters apart. Because supermarkets are essential for the food supply, many people still come together in these places. Supermarkets take various measures to prevent the virus from spreading. It is important to learn more about the behaviour of people in supermarkets to ensure that people are not exposed to health risks.

In this thesis the behaviour and experiences of people visiting the supermarket during the corona crisis are researched. The measures taken by the supermarkets play an important role in this. Therefore, the main question is: *How do people behave in supermarkets and how do they experience their visit during the corona crisis?* Behaviour includes various things, such as route adjustments, influence of measurers, number of visits, patience. With experience is meant: annoyances and feeling of safety. This question is answered using literature and a survey.

This research can be important for both supermarket employees and visitors. Everyone needs to move through the supermarket as safely as possible. That is why supermarkets might be interested in the results and the results of follow-up studies. The government can use the information to formulate their measures.

Chapter 2 further explains how the main question is answered. The used methods and analysis are explained. In chapter 3 the 'normal situation' is discussed. Subsequently, the supermarket measures are examined to see how the measures can adjust the 'normal situation'. The experiences of visitors are mentioned in chapter 4. The results of the survey are used here. The results are then discussed in chapter 5, followed by the conclusion in chapter 6.

2. Research Methods

This chapter focusses on the research goals. The used method is discussed. The main question is divided into several sub-questions. For each sub-question it is made clear why the question helps answer the main question and why a specific method is useful. This also clarifies the relationship between the sub-questions.

2.1 Sub questions

As mentioned before the main question is:

How do people behave in supermarkets and how do they experience their visit during the corona crisis?

To answer this main question, the following sub questions must be answered:

- 1) What is meant by the 'normal situation'?
- 2) Which measures are taken by the supermarkets?
- 3) What are reasons for people to adjust their behaviour?
- 4) How do the supermarket measures contribute to people adjusting their behaviour?
- 5) Who (which gender, age group or health group) made which adjustments to their supermarket visit?
- 6) Which measures contribute the most to a safe feeling for visitors?

These sub-questions are based on the mind-map below. All aspects that came to my mind thinking of a supermarket visit during the corona crisis can be seen here. The bigger topics are divided into smaller topics to indicate the meaning.



FIGURE 1 MIND-MAP SUPERMARKET VISIT DURING THE CORONA CRISIS

2.2 Methodology

Different methods are used to answer all sub-questions. Literature research is important to find background information. This provides a clear basis for explaining behaviour and experience. The results can be explained or substantiated with literature. The survey checked whether people have made adjustments to their visit. The influence of measures on the feeling of safety was also examined. More information about the survey can be found in Chapter 4.1.

Below you can see which method is used for each sub-question. The literature study and survey are discussed further below.

TABLE 1 METHOD USED PER SUB-QUESTION

	Literature	Survey
1) 'Normal situation'	Х	
2) Measures	Х	Х
3) Adjustments		Х
4) Measure influence		Х
5) who made which adjustment		Х
6) Safe feeling		X

2.2.1 Literature

To answer the following sub-questions, literature study is used. For each sub-question it is made clear why the question helps answer the main question and why literature is useful.

1) What is meant by the 'normal situation'?

To make a clear report, it is important to define the 'normal situation', the situation before the outbreak. Supermarkets use different strategies to get visitors to buy more. When more is known about the normal situation, you can look at what needs to be changed in the current situation to ensure safety. This information can be found in literature.

2) Which measures are taken by the supermarkets?

The government has devised several measures for supermarkets. In addition, the supermarkets themselves have come up with some measures. Centraal Bureau Levensmiddelenhandel (CBL) plays an important role in setting the measures. CBL represents the interests of the supermarket industry and food service companies in the Netherlands. (ter Maat, 2020) As a result, similar actions are taken in different supermarkets. The measures taken by the supermarkets contribute to change in behaviour, so it is important to know more about these measures. A lot is written about measures online, so more information can be found there.

2.2.2 Survey

In the following sub-questions, the survey is used to (partly) find an answer. For each sub-question it is made clear why the question helps answer the main question and why the survey is useful.

2) Which measures are taken by the supermarkets?

As mentioned before, the measures taken contribute to the change in behaviour. Much information on this topic is available online. However, there are also supermarkets that take other measures in addition to the known measures. The survey is used to find out more about these measures.

3) What are reasons for people to adjust their behaviour?

To find out to what extent people change their behaviour, it is important to know in which situation their behaviour changes. When it is known what the triggers are, it can be examined whether measures can have an effect. By asking in which situation visitors change their route, this question can be answered.

4) How do the supermarket measures contribute to people adjusting their behaviour?

When people try to keep distance from each other, they adjust their behaviour. By asking when visitors change their route, it becomes clear whether measurements contribute to these adjustments. Furthermore, it can be examined which measures focus more on keeping distance and which measures on other aspects.

5) Who (which gender, age group or health group) made which adjustments to their supermarket visit?

Not everyone adjusts their behaviour equally. To find out more about these differences, questions about gender, age, and health are included in the survey. While analysing, differences within these groups are investigated.

6) Which measures contribute the most to a safe feeling for visitors?

Visitors probably adjust their behaviour less if they feel safe. One measure makes people feel more secure than the other. This can differ per person, because it is not always clear to what extent measures counteract the spread. Because of that, the sense of safety plays an important role in the degree in which people adapt their behaviour.

This research concerns all residents of the Netherlands, about 17 million people. To determine how many responses are required for an investigation, the margin of error and the confidence level are considered. The margin of error is the degree of uncertainty in the results of a sample. The confidence level is the percentage of certainty with which can be indicated that a certain outcome is correct. With a margin of error of 5% and a confidence level of 95%, this means that a minimum of 385 responses is required. (Checkmarket, 2020)

To get many responses, the survey is kept short. For each sub-question, it is necessary to consider which survey questions are needed to find the answer. In addition, the survey is distributed in both Dutch and English. I used my own online network for distribution using Facebook and WhatsApp. I also asked people to share the questionnaire with their network. In this way I want to reach the groups which are less well represented in my network. This is important to be able to analyse a representative group.

2.2.3 Analysis

As mentioned before, distinction is made in gender, age group, and health group. Elderly and sick people may make different choices than healthy young people. (RIVM, 2020) It is important to divide the responses based on certain answers to discover patterns. Both differences and similarities are looked at. This is done using Google Forms and Excel. Connections can be found by drawing up graphs of different groups. Specific answers can also be looked at, such as the biggest annoyance for people who visit the supermarket more than four times a week. The results of the analysis are discussed in chapter 4.2.

In this research the following open-questions and hypotheses are tested. These are based on the sub-questions 3, 4, 5, and 6. The open-questions and hypotheses help answer the sub-questions. The relationship between the open-questions, hypotheses and sub-questions can be found in Figure 1. The open-questions and hypotheses can be found under the related sub-question.

3. What are reasons for people to adjust their walking behaviour?

- What is the most important reason for people to adjust their route?

- What is the biggest annoyance for people in the supermarket during the corona crisis?

4. How do the supermarket measures contribute to people adjusting their behaviour?

- Do people adjust their route when there are one-direction signs?
- Do people adjust their route when other people do not follow to one-way paths?

- Are the measures that ensure an adjustment of behaviour also the measures that contribute to a safe feeling for visitors?

5. Who (which gender, age group or health group) made which adjustments to their supermarket visit?

- People visit the supermarket less often than before the corona outbreak.

- a. This is especially true for the risk group.
- b. This is especially true for the elderly, but less so for the people under the age of 25.
- c. There is no difference between men and woman.
- People go to the supermarket with more patience.
 - a. This is especially true for the risk group.
 - b. This is especially true for the elderly, but less so for the people under the age of 25.
 - c. There is no difference between men and woman.

6. Which measures contribute the most to a safe feeling for visitors?

- What influence do measures have on the feeling of safety for visitors?

- a. What is the difference between the risk group and total group?
- b. How does age affect the feeling of safety?
- c. Is there a difference between men and women?

3. Behaviour adjustments

This chapter further discusses the adaptation of behaviour. The 'normal situation' is discussed. Literature was used for this. Supermarket measures play an important role in the adaption of behaviour. Therefore, these are also discussed in this chapter. Literature and the survey were used for this. Sub-questions 1 and 2 are addressed, about the 'normal situation' and supermarket measures.

3.1 'Normal situation'

When there is a lot of knowledge about the 'normal situation', differences become more noticeable during the analysis. The 'normal situation' refers to the situation before the outbreak. In this situation, people did not keep 1,5-meter distance from each other. Furthermore, people were less anxious, and supermarkets took no measures. It probably takes a while before we can speak of a normal situation again.

The ultimate goal of supermarkets is to make a profit. In the current situation, this is done in a different way than before. Supermarkets usually benefit greatly from impulse buying behaviour. By placing certain products in specific places, they try to seduce you. As a result, visitors stay in the store longer, which increases the chance that they buy more.

"The results obtained from statistical analysis highlights the pivotal role of in-store browsing as a strongest influential predictor of impulse buying behavior." (Cho, Ching, & Luong, 2014) A positive mood seems to be another important aspect. Therefore, supermarkets try to influence your mood, so that you walk around more through the supermarket. When you feel comfortable and amused you spend more time browsing. Influencing moods can for instance be done by keeping the store clean, playing pleasant music, creating shortcuts and sale promotions. Impulse purchases can also be stimulated by putting related products together. "Complementary products can be placed adjacent to others or even be bundled into specific solutions that address specific needs of consumers. That sort of product presentation undoubtingly triggers the cues for buying more things, from which one single product might promote for others in the neighboring." (Cho, Ching, & Luong, 2014)

So, normally, store owners try to keep you in the store for as long as possible and entice you with offers.

3.2 Supermarket measurements

Research has shown that people adjust their behaviour when there is an infectious disease. This can turn out both positive and negative. It can make people more aware of other people around them who are sick. The opposite can also happen. 'Patterns of an endemic disease could be due to changes in behaviour of the population.' (A. d'Onofrio, 2020) Good measures are needed to prevent this further spread.

The supermarkets have taken various measures since the corona outbreak. Not every supermarket has taken the same measures, but there are several general ones that have been introduced at every supermarket.

- 1. Maximum of one customer per 10 square meters.
- 2. Everyone is asked to come to the supermarket alone.
- 3. The use of a shopping cart is mandatory. If this is not possible in a store, a shopping basket is mandatory.

- 4. All shopping trolleys are cleaned by employees or visitors.
- 5. Keep 1.5 meters away from other people, including employees.
- 6. Stickers on the floor at the cash registers indicating the distance must be kept.
- 7. Preferably pay by card, not cash.
- 8. The request not to store more groceries than necessary.
- 9. Plexiglass shielding for cashiers.
- 10. Safety vests for shelf stockers.

There are also measures that not all supermarkets use. Measure 16 till 20 are found in the survey.

- 11. One-way indication in paths.
- 12. Recommended use of self-scanners.
- 13. Elderly hour or priority for the elderly.
- 14. Available hand gel.
- 15. Screens between the rows of the checkouts.
- 16. Employees who declare shopping trolleys.
- 17. Stickers on the floor near the shelves with fresh products such as cheese / meat products.
- 18. Mandatory gloves for grabbing fruit.
- 19. It is not allowed to walk away from your shopping cart.
- 20. Limited number of self-scanners available.

(Supermarkt.nl, 2020) ; (CBL, 2020) ; (Lidl, sd)

At the beginning of the outbreak, people started hoarding. Total expenditure declined, but this did not apply to food expenditure. Measure 8 arose from this. Research has shown that hoarding has had the biggest peak and that everyone is a bit calmer now. (Scott R. Baker, 2020)

Survey results supermarket measures

The survey showed that not every supermarket implements all measures or that visitors are not aware of them. Almost everyone indicates that measures 2, 3, 4, 5, 6 and, 9 can be found in the supermarket they visit.

- 68% indicate that there is a maximum number of visitors (measure 1), while this should be the case with every supermarket. It is possible that not all visitors experience this or that supermarkets do not indicate this but do perform it. This can also be the case with measures 7 and 8.
- 78% indicate that there are safety vests for shelf stockers (measure 10), a measure that should be taken by every supermarket.
- The most striking percentage is that only 17% indicate that one-way indication in paths (measure 11) are used. This measure is not possible in every supermarket, because there is not always enough space. However, this percentage is remarkably low.
- 33% indicate that their supermarket recommended the use of self-scanners (measure 12).
- 53% indicate that there is a shopping hour for the elderly (measure 13). It is possible that this percentage is higher, but that this is not known to everyone.
- 59% indicate that there is hand gel available (measure 14).
- 46% of the supermarkets have placed screens between the rows of the checkouts (measure 15). However, many supermarkets initially try to use checkouts where there are no rows next to each other.

Measures 16 to 20 were only mentioned by a few people in the survey, in the box other measures.

4. Visitors experience

In this chapter the design and results of the survey are discussed. The chapter is about the subquestions about adjustments, measure influence, who made which adjustment, and safe feeling (3, 4, 5, and 6). These sub-questions are the headings of chapter 4.2. The open-questions and hypotheses about route adjustments, annoyance, number of visits, patience, and feeling of safety from chapter 2.2.3 are used to find the answers to the sub-questions.

4.1 Survey design

As mentioned before, distinction is made in gender, age, and health group, because these aspects are expected to cause the biggest differences in the study. (RIVM, 2020) The first three questions were about these aspects. First, people had to enter their gender. Secondly, people had to enter their age, so specific age groups could also be investigated while analysing. Furthermore, people had to determine whether they belong to a risk group (e.g. lung problems, elderly). This was because there is no access to medical data of the participants. These distinctions are used while analysing the survey. All other questions are based on the sub-questions and therefore help answer the main questions. For sub-question three about adjustments, the questions 'When do you adjust your route? (multiple answers possible)' and 'What is your biggest annoyance in the supermarket? (top 3)', are added to the survey. In this way, the answers are researched in a direct and indirect way. For sub-question four about measure influence, the questions 'When do you adjust your route? (multiple answers possible)' and 'Which measure gives you the most secure feeling? (top 5)', are added to the survey. In this way, it is examined whether people mention measures as a reason to change their route and which measures have the biggest influence on their feeling of safety. For sub-question five about who made which adjustment, the questions 'How many times a week do you visit the supermarket before and during corona?' and 'What is the biggest change in your visit compared to before corona? (top 3)', are added to the survey. With these questions, it is possible to take a good look at the differences between people.

For sub-question five about feeling of safety, the questions 'Which measure gives you the most secure feeling? (top 5)', is added to the survey. In this way, the effects of the measures can be examined.

After the survey was designed, it was tested by a few people to ensure all questions are clear. The survey questions can be found in the Appendix.

During the analysis, both differences and similarities within the categories (gender, age, and health) are examined. In the next chapter the hypotheses are mentioned again when looking at the results.

4.2 Research results

The results of the survey are discussed in this chapter. After two weeks, 412 useful responses to the survey were received. This is more than 385, so as mentioned in 2.2.2, this means a confidence level of 95%. The group of people consists of 67% women and 33% men. 10% of the participants consider themselves to belong to the risk group. The figure below shows the age variety of the participants. Each bar indicates an age group of 5 years. As can be seen in the graph below, relatively many students have responded. This is because my own network mainly consists of people in this age group.



FIGURE 2 AGE DISTRIBUTION OF THE SURVEY PARTICIPANTS

When asked 'Is there an additional measure you would like the supermarkets to take?', A striking number of people mentioned that they would like to see the measures being enforced better. Many people also indicate that employees should keep to the distances better.

4.2.1 What are reasons for people to adjust their walking behaviour?

What is the most important reason for people to adjust their route?

The graph below shows in which situation people adjust their route. The results are percentages of the total number of responses. People were able to give multiple answers to this question, so the total percentage is above 100%. The graph shows that 93% of the people change their route if there are too many people where they need to be. This percentage is the highest of all and therefore the most important reason for people to adjust their route. More than 50% of the people also report changing their route when there are one direction signs and when there is a shelf stocker in the place they need to go. Not many visitors adjust their route if they cannot reach it without a shopping cart.



FIGURE 3 REASONS FOR PEOPLE TO ADJUST THEIR BEHAVIOUR, PERCENTAGE OF TOTAL NUMBER OF REACTIONS

What is the biggest annoyance for people in the supermarket during the corona crisis?

The graph below shows the top 3 biggest annoyances. The results are percentages of the total number of responses. There is one annoyance that clearly affects most people. This is when other people do not keep their distance from them. Furthermore, it is noticeable that after this, empty compartments are most often in first place. This is not necessarily different during corona, so this is also a major annoyance for people in a normal situation. People who shop in groups annoys a lot of people, because there are unnecessarily too many people. People who do not follow the one-way routing in paths also cause a lot of irritation in people. This is most often ranked at number two.



FIGURE 4 BIGGEST ANNOYANCE FOR PEOPLE VISITING THE SUPERMARKET, TOP 3

4.2.2 How do the supermarket measures contribute to people adjusting their behaviour?

Do people adjust their route when there are one-direction signs?

Figure 3 shows that 63% of the participants changes their route when there is one-way routing in paths. Therefore, more than 50% of the people try to adhere to this measure. If not, everyone adheres to this measure, the measure is not very effective. People still pass each other in a radius of less than 1.5 meters.

Do people adjust their route when other people do not follow to one-way paths?

Figure 3 shows that 32% of the participants changes their route when other people do not follow one-way paths. This is not very much. This indicates that people prefer to stick to the measures. When people do not change their route themselves when they meet other people, it means that they regularly come within 1.5 meters of each other.

Are the measures that ensure an adjustment of behaviour also the measures that contribute to a safe feeling for visitors?

Figure 5 shows which components provide a safe feeling for the visitors. For each measure, it is indicated how often people entered it in their top 5 and where in the top 5. From this list, supermarkets try to adjust visitor behaviour with the measures mandatory shopping trolleys, floor tape at checkouts, one-way routing in paths, mandatory self-scans, and safety vests for shelf stockers.

The components that score best are cleaning shopping trolleys and a maximum number of visitors. Both components do not contribute to an adjustment of behaviour. Of the measures with which supermarkets try to adjust the behaviour of their visitors, mandatory shopping trolleys has the highest score.



FIGURE 5 SAFE FEELING IN THE SUPERMARKET DURING THE CORONA CRISIS (TOP 5)

4.2.3 Who (which gender, age group or health group) made which adjustments to their supermarket visit?

People visit the supermarket less often than before the corona outbreak.

Figure 6 shows how often people visit the supermarket before and during the corona outbreak. You can clearly see that the number of visits decreased. If people go to the supermarket less often, people will probably stay in the supermarket longer to be able to do all the shopping. In this case, the exposure per visit is longer.



FIGURE 6 NUMBER OF SUPERMARKET VISITS BEFORE AND DURING CORONA, ALL PARTICIPANTS

The question is whether this difference between the number of visits and the time of visit before and during corona is statistically significant. The Wilcoxon signed-rank method is used to investigate this. The following hypotheses are used for this.

H₀: There is no statistical difference between the number of visits during both periods.

H₁: There is a statistical difference between the number of visits during both periods.

The level of significant is $\alpha = 0.05$, since there is a confidence level of 95%. With this value of α , H₀ gets rejected if $z_{critical} < |z|$. For this level of significant $z_{critical} = 1.96$.

The first step is to calculate the absolute differences between both situations. The differences are ranked from low to high.

The ranks that came from a positive difference are summed up to get $T_{+} = 2697.50$. The ranks that came from a negative difference are summed up to get $T_{-} = 27437.50$.

For the test statistic, T, the smallest value is used, so T = 2697.50.

The sample size *n* is 245, since there were 245 people who filled in two difference numbers before and during corona (when the difference is 0, the answer does not count).

Hereafter the mean (\overline{T}) and standard error ($SE_{\overline{T}}$) are calculated with the following formulas. The z-score is then determined to see how far the results deviate from the mean.

$$\overline{T} = \frac{n(n+1)}{4} = \frac{245(245+1)}{4} = 15067.50$$
$$SE_{\overline{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24}} = \sqrt{\frac{245(245+1)(2*245+1)}{24}} = 1110.41$$
$$z = \frac{T - \overline{T}}{SE_{\overline{T}}} = -11.14$$

Entered in the formula this gives $z_{critical} < |z| \rightarrow 1.96 < 11.14$. Therefore, H₀ gets rejected. There is a statistical difference between the number of visits during both periods.

a. This is especially true for the risk group.

Figure 7 shows how often people from the risk group visit the supermarket before and during the corona outbreak. Here it is also visible that the number of visits has decreased. If Figure 7 is compared with Figure 6, it becomes clear that people from the risk group went to the supermarket less often anyway.





The Wilcoxon signed-rank method is used to investigate whether the difference between the number of visits for the risk group is statistically significant.

H₀: There is no statistical difference between the number of visits for the risk group.

H₁: There is a statistical difference between the number of visits for the risk group.

 α = 0.05, so H₀ gets rejected if $z_{critical} < |z|$. For this level of significant $z_{critical} = 1.96$.

The ranks that came from a positive difference are summed up to get $T_+ = 0$. The ranks that came from a negative difference are summed up to get $T_- = 351.00$.

For the test statistic, T, the smallest value is used, so T = 0.

The sample size *n* is 26, since there were 26 people of the risk group who filled in two difference numbers before and during corona (when the difference is 0, the answer does not count).

Hereafter the mean (\overline{T}) and standard error ($SE_{\overline{T}}$) are calculated with the following formulas. The z-score is then determined to see how far the results deviate from the mean.

$$\overline{T} = \frac{n(n+1)}{4} = \frac{26(26+1)}{4} = 175.5$$
$$SE_{\overline{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24}} = \sqrt{\frac{26(26+1)(2*26+1)}{24}} = 39.37$$
$$z = \frac{T-\overline{T}}{SE_{\overline{T}}} = -4.46$$

Entered in the formula this gives $z_{critical} < |z| \rightarrow 1.96 < 4.46$. Therefore, H₀ gets rejected. There is a statistical difference between the number of visits during both periods for the risk group. This difference is bigger for the total group.

b. This is especially true for the elderly, but less so for the people under the age of 25.

When Figure 8 is compared with Figure 9, it can be seen that older people go to the supermarket less often than young people. It is striking that the elderly only slightly reduced their number of supermarket visits when corona broke out. This group has least changed their number of visits compared to other groups.

Comparing Figure 6 with Figure 9, it becomes clear that young people go to the supermarket more often both before and during the corona outbreak. It also shows that young people have reduced their number of visits more than the total group. Among young people, the percentage of people who visited the supermarket 5 or more times a week decreased from 29% to 7%. For the total group, this percentage decreased from 22% to 6%.



FIGURE 8 NUMBER OF SUPERMARKET VISITS BEFORE AND DURING CORONA, ELDERLY (50+)



FIGURE 9 NUMBER OF SUPERMARKET VISITS BEFORE AND DURING CORONA, YOUNGSTERS (UNDER 25)

The Wilcoxon signed-rank method is used to investigate whether the differences between the number of visits for both age groups are statistically significant.

H₀: There is no statistical difference between the number of visits during both periods.

H₁: There is a statistical difference between the number of visits during both periods.

 α = 0.05, so H₀ gets rejected if $z_{critical} < |z|$. For this level of significant $z_{critical} = 1.96$.

The ranks that came from a positive difference are summed up to get $T_{+, elderly} = 137.5$; $T_{+, youngsters} = 513$.

The ranks that came from a negative difference are summed up to get $T_{-, elderly} = 1147.5$; $T_{-, youngsters} = 6627$.

For the test statistic, T, the smallest value is used, so T_{elderly} = 137.5; T_{youngsters} = 513.

The sample size $n_{elderly}$ = 54 and $n_{youngsters}$ is 119, since this is the number of people who filled in two difference numbers before and during corona (when the difference is 0, the answer does not count).

Hereafter the mean (\overline{T}) and standard error ($SE_{\overline{T}}$) are calculated with the following formulas. The z-score is then determined to see how far the results deviate from the mean.

Elderly:

$$\overline{T} = \frac{n(n+1)}{4} = \frac{54(54+1)}{4} = 742.5$$
$$SE_{\overline{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24}} = \sqrt{\frac{54(54+1)(2*54+1)}{24}} = 116.14$$
$$z = \frac{T-\overline{T}}{SE_{\overline{T}}} = -5.21$$

Youngsters:

$$\overline{T} = \frac{n(n+1)}{4} = \frac{119(119+1)}{4} = 3570$$
$$SE_{\overline{T}} = \sqrt{\frac{n(n+1)(2n+1)}{24}} = \sqrt{\frac{119(119+1)(2*119+1)}{24}} = 377.10$$
$$z = \frac{T-\overline{T}}{SE_{\overline{T}}} = -8.11$$

Entered in the formula this gives $z_{critical} < |z| \rightarrow 1.96 < 5.21$ and 1.96 < 8.11. Therefore, H₀ gets rejected. There is a statistical difference between the number of visits during both periods for the risk group. This difference is bigger for the youngsters.

c. There is no difference between men and woman.

Figure 10 shows the number of supermarket visits by men and women before and during the corona outbreak. The number of responses from men and women are not equal. To make a good comparison, the numbers of reactions have been converted into percentages. Both before and during the outbreak women visited the supermarket more often than men. It can also be seen that both groups limit their number of visits during the outbreak. Women go to the supermarket a little more often, but that was also the case before the outbreak.



FIGURE 10 NUMBER OF SUPERMARKET VISITS BEFORE AND DURING CORONA, MEN AND WOMEN

The chi-square method is used to investigate whether this difference between men and women is statistically significant. The difference between the number of visits will be examined. The following hypotheses will be used for this.

 $H_0:$ There is no statistical difference between men and women.

H₁: There is a statistical difference between men and women.

The level of significant is $\alpha = 0.05$, since there is a confidence level of 95%. The number of degree of freedoms is v = (c - 1)(r - 1) = (9 - 1)(2 - 1) = 8. The critical value is therefore $X^2_{0.05,8} = 15.507$

$$\chi^2 = \sum_{i=1}^{6} \sum_{j=1}^{2} \frac{(O_{ij} - E_{ij})^2}{E_{ij}}$$

This formula gives $X^2 = 12.97$

 $X^2 > X^2_{0.05,8}$, 12.97 < 15.507 Therefore, H₀ gets not rejected at the confidence level of 95%. There is no statistical difference between men and women.

People go to the supermarket with more patience.

77% of participants indicate that 'more patience' is in the top 3 biggest changes of their visit. This percentage is remarkably high. When people have more patience, people are more likely to implement the measures better and keep their distance from each other. In this question from the survey, people were asked to indicate their top 3 biggest changes to their visit. The other options were buying more, better thought trough, making lists, and time of visit.

a. This is especially true for the risk group.

The graph below shows the distinction between the risk group and the non-risk group.

To be able to compare the results properly, the number of responses has been converted into percentages. It is striking to see that the risk group less often has patience than the non-risk group, while the measures are more important for them.



FIGURE 11 PERCENTAGE OF PEOPLE WHO SAY THEY HAVE MORE PATIENCE, RISK GROUP VERSUS NON-RISK GROUP

b. This is especially true for the elderly, but less so for the people under the age of 25.

Figure 12 shows the percentage of people who say they have more patience divided into age groups. The results have been converted into percentages to make differences visible. Here you can see that the elderly score higher than average and the younger people lower. The middle group scores about average.



FIGURE 12 PERCENTAGE OF PEOPLE WHO SAY THEY HAVE MORE PATIENCE IN THE SUPERMARKET, AGE GROUPS

c. There is no difference between men and woman.

Figure 13 shows that there is a 12% difference between the number of men and the number of women who have entered patience as number 1 answer. Women have more often put their answer in their top 2 and 3. 78% of the male respondents put the answer in their top 3, compared to 75% of the women. These values are close together.





4.2.4 Which measures contribute the most to a safe feeling for visitors?

What influence do measures have on the feeling of safety for visitors?

The graph below shows the top 5 measures which causes a feeling of safety. The results are percentages of the total number of responses. This way you can compare well with other graphs.

The cleaning of shopping trolleys provides a safe feeling for many people. The maximum number of visitors and mandatory shopping trolleys also score high.

Safety vests for shelf stockers score lowest. This probably has to do with the fact that this measure ensures safety for the shelf stockers and not for themselves. It is also noticeable that one-way routing in paths does not score high, while 4.2.2 showed that 63% of the participants still adhere to this.



FIGURE 14 SAFEST FEELING FOR VISITORS (TOP 5)

a. What is the difference between the risk group and the total group?

If you compare Figure 14 and Figure 15, you can see that the compulsory shopping trolleys and plexiglass in front of the cashier provide a safer feeling for the risk group. Cleaning shopping trolleys and a maximum number of visitors still score high. Measures that have less to do with distance, such as use of self-scan recommended, shopping-hour for the elderly and safety vests for shelf stockers, are less important to people in the risk group.



FIGURE 15 SAFEST FEELING FOR RISK GROUP VISITORS (TOP 5)

b. How does age affect the feeling of safety?

If you compare Figure 16 and Figure 17, you can see that mandatory shopping trolleys provide a safe feeling, especially for the elderly. Young people attach less value to this. Young people attach much more value to the maximum number of visitors. The cleaning of shopping trolleys provides a safe feeling for both groups.

What is striking is that the feeling of safety of young people increases when there is a shopping-hour for the elderly, while it is intended for the elderly.



FIGURE 16 SAFEST FEELING FOR YOUNG VISITORS (TILL 25) (TOP 5)



FIGURE 17 SAFEST FEELING FOR OLDER VISITORS (50+) (TOP 5)

c. Is there a difference between men and women?

If you compare Figure 18 and Figure 19, there are no major differences to be found. Women score a little higher on several distance-related measures, such as mandatory shopping trolleys and one-way routing in paths. Men focus more on cleaning. They think clean shopping trolleys and available hand gel are more important. The results do not show a big difference between men and women.



FIGURE 18 SAFEST FEELING FOR MEN (TOP 5)



FIGURE 19 SAFEST FEELING FOR WOMEN (TOP 5)

4.3 Conclusion

There are several reasons for people to adjust their behaviour. The most important reason for people to adjust their route is: If there are too many people where I need to be. Two other important reasons are when there are one direction signs and when there is a shelf stocker in the place they need to go.

The biggest annoyance for visitors is: When other people do not keep their distance from them. Empty compartments also annoy a lot of people. People shopping in groups and people who do not follow the one-way routing in paths also cause a lot of irritation.

With some measures supermarkets try to influence the behaviour of visitors. One-way routing in paths ensures an adjustment of behaviour for 63% of participants. 32% of participants changes their route when other people do not follow one-way paths.

Not every measure ensures a safe feeling for visitors. Of the measures with which supermarkets try to adjust the behaviour of their visitors, mandatory shopping trolleys has the highest safety score. The components that score best are cleaning shopping trolleys and a maximum number of visitors. However, these measures do not change behaviour.

The number of supermarket visits before and during the corona outbreak decreased. The Wilcoxon signed-rank method showed that there is a statistical difference between the number of visits during both periods for the total group, risk group, elderly and youngsters. The chi-square method showed that there is no statistical difference between men and women.

77% of participants indicate that 'more patience' is in the top 3 biggest changes of their visit. It is striking to see that the risk group less often has patience than the non-risk group, while the measures are more important for them. Elderly score higher than average and the younger people lower. The middle group scores about average. 78% of the male respondents have the answer in their top 3, compared to 75% of the women.

The cleaning of shopping trolleys provides a safe feeling for many people. The maximum number of visitors and mandatory shopping trolleys also score high. Safety vests for shelf stockers score lowest. The same top 2 answers apply to the risk group. It is also noticeable that one-way routing in paths does not score high, while 63% of the participants still adhere to this.

Mandatory shopping trolleys provide a safe feeling, especially for the elderly. Young people value the maximum number of visitors much more. The cleaning of shopping trolleys provides a safe feeling for both groups. Only the feeling of safety of young people increases when there is a shopping-hour for the elderly, while this is intended for the elderly.

5. Discussion

The aim of this research was to find out more about the behaviour of people in the supermarket and the way they experience their visit. Literature and a survey were used. It is not possible to interview every supermarket visitor. This ensures that the results are not 100% reliable. The results were analysed for 95% confidence. For striking results, it may therefore be good to conduct further research, with a more specific focus on that question. One of the most remarkable results is that young people get a bigger sense of safety from the elderly hour than the elderly themselves, while this is intended for the elderly. Another striking result is that the elderly only slightly reduced their number of supermarket visits when corona broke out. This group has least changed their number of visits compared to other groups. Furthermore, it is striking to see that the risk group has patience less often than the non-risk group, while the measures are more important for them. It is interesting to further investigate these unexpected results.

Furthermore, it also matters which people respond to the survey. It remains a random sample. More women than men completed the survey and the results are therefore more reliable for women. In addition, the percentage of results of young people is higher than that of the elderly, which means that the results are more reliable for young people. With my own network I mainly reach university-educated students. To get more representative responses I also used the network of my family and friends. Even then there still will be groups of people that I do not reach, but the reach will be bigger. Normally I would also go to supermarkets to ask people questions on the spot. In order not to endanger my own health, I did not do this. This could have created a more diverse group by visiting in specific neighbourhoods.

Meanwhile (June 2020), the government is easing more and more measures. Also, not all people follow the existing measures as well as before. That is why I expect different results when the survey is distributed again. It might be interesting to redistribute the survey now to investigate changes in behaviour.

With this research I want to make a first step to optimize the flow in supermarkets. This can be investigated in a follow-up study. So people can move through the supermarket as safely as possible. This research can be important for both supermarket employees and visitors. Everyone needs to move through the supermarket as safely as possible. The government can use the information to formulate their measures. Not every measure achieves its intended purpose.

6. Conclusion

The purpose of this thesis was to find out more about the behaviour and experience of people visiting the supermarket during the corona crisis. Six sub-questions were used for this, which were answered by means of literature and a survey.

The results of the first sub-question about the normal situation have shown that supermarkets usually benefit greatly from impulse buying behaviour. Normally, store owners try to keep you in the store for as long as possible and entice you with offers. This is very contradictory to current government recommendations, avoiding busy locations.

The results of the second sub-question about supermarket measures have shown several measures can be found in almost every supermarket. Some of the measures are mandatory for every supermarket, but not all participants indicate that these measures can be found in the supermarket they visit. In addition, there are supermarkets that have taken additional measures.

The results of the third sub-question about adjustments have shown that important reasons for people to adjust their route, and their biggest annoyances relate to other people. Therefore, other visitors have a lot of influence on the adaption of the behaviour of visitors.

The results of the fourth sub-question about measure influence have shown that the measures with which supermarkets try to adjust the behaviour of their visitors, mandatory shopping trolleys has the highest safety score. This measure was not the measure that scored best in the question about feeling safe. One-way routing in paths ensures an adjustment of behaviour for 63% of the participants. 32% of the participants changes their route when other people do not follow one-way paths. So, a lot of people try to stick to this measure, but not everyone. This means that they regularly come within 1.5 meters of each other.

The results of the fifth sub-question about who made which adjustment, have shown that there is a statistical difference between the number of visits during both periods for the total group, risk group, elderly and youngsters. The difference is the biggest among young people. Elderly least changed their number of visits compared to other groups.

The risk group has patience less often than the non-risk group, while the measures are more important for them. Elderly score higher than average and the younger people lower.

The results of the sixth sub-question about safe feeling have shown that the cleaning of shopping trolleys provides a safe feeling for many people. Young people attach much more value to the maximum number of visitors. Mandatory shopping trolleys provide a safe feeling, especially for the elderly. Measures that have less to do with distance came out to be less important to people in the risk group.

Finally, it can be concluded that the corona outbreak has resulted in quite a big change in behaviour and experience for everyone. Other visitors have a lot of influence on the behaviour and experience of people visiting the supermarket. Several measures ensure an adjustment of behaviour and a feeling of safety. Cleaning of shopping trolleys provides the safest feeling for all categories. There are also measures that people perceive as not useful and there are measures that do not achieve the desired goal. Supermarkets try to let people keep their distance by implementing on-way paths, but because not everyone adheres to this, people regularly walk within 1.5 meters of each other. The risk group and the elderly do not act significantly more careful than people outside of these groups. So, the behaviour and experience of people visiting the supermarket during the corona crisis has changed considerably in several aspects.

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Appendix – survey questions

- 1. What is your gender?
- Male
- Female
- Other, ...
- 2. What is your age?

Open question

- 3. Do you think you are in the corona risk group? (e.g. lung problems, elderly)
- Yes
- No

4. For each statement, enter whether you agree or disagree.

- I usually visit a different supermarket now than before the outbreak
- I go to less different supermarkets when I go shopping
- I order groceries more often now
- Other people get (almost all) groceries for me
 - Agree
 - Disagree
 - n/a
 - 5. Which supermarket do you usually visit? (chain + location, e.g. Jumbo Bastiaansplein Delft) Open question

6. How many times a week do you visit the supermarket?

- Before corona
- During corona
 - 0 times
 - 1 time
 - 2 times
 - 3 times
 - 4 times
 - 5 times
 - 6 times
 - 7 times
 - More

7. When do you usually visit the supermarket?

- During the elderly hour
- In the morning
- During lunch
- In the afternoon
- Just before dinner
- In the evening

8. I think better about my route through the supermarket than before the corona outbreak. (Think of making lists, devising a route, etc.) Fully disagree ... fully agree (ranking 1 - 5)

- 9. When do you adjust your route? (multiple answers possible)
- If there are one direction signs
- If other people do not stick to one-way paths
- If there are too many people where I need to be
- If there is a shelf stocker
- If I have to walk through a checkout line otherwise
- When other people are too slow
- If I have to walk on without a cart
- Other, ...

10. What is the biggest change in your visit compared to before corona? (Make a top 3)

- More patience
- Buy more (stocking up or through fewer visits)
- Better thought trough (route, groceries, etc.)
- Making lists
- Time of visit

11. What is your biggest annoyance in the supermarket? (Make a top 3)

- Empty compartments
- That my visit takes longer than before
- Shelf stockers who are filling where I need to be
- Other people who do not keep their distance from me
- People who do not follow the one-way routing in paths
- People who do not visit the supermarket alone
- Mandatory shopping cart
- One-way routing in paths

12. Is there anything else that annoys you in or near the supermarket? *Open question*

13. Which measures are taken in your supermarket? (multiple answers possible)

- Mandatory shopping trolleys
- Cleaning of shopping trolleys
- Tape to the floor at the checkouts
- Plexiglass in front of the cashier
- Screens between the rows of the checkouts
- One-way routing in paths
- Use of self-scan recommended
- Available hand gel
- Shopping hour for the elderly
- Maximum number of visitors
- Safety vests for shelf stockers
- Other, ...

14. Which measure gives you the most secure feeling? (Make a top 3)

- Mandatory shopping trolleys
- Cleaning of shopping trolleys
- Tape to the floor at the checkouts
- Plexiglass in front of the cashier
- Screens between the rows of the checkouts
- One-way routing in paths
- Use of self-scan recommended
- Available hand gel
- Shopping hour for the elderly
- Maximum number of visitors
- Safety vests for shelf stockers
- **15.** Is there an additional measure you would like the supermarkets to take? *Open question*
- **16. What did you think of this survey?** *Open question*