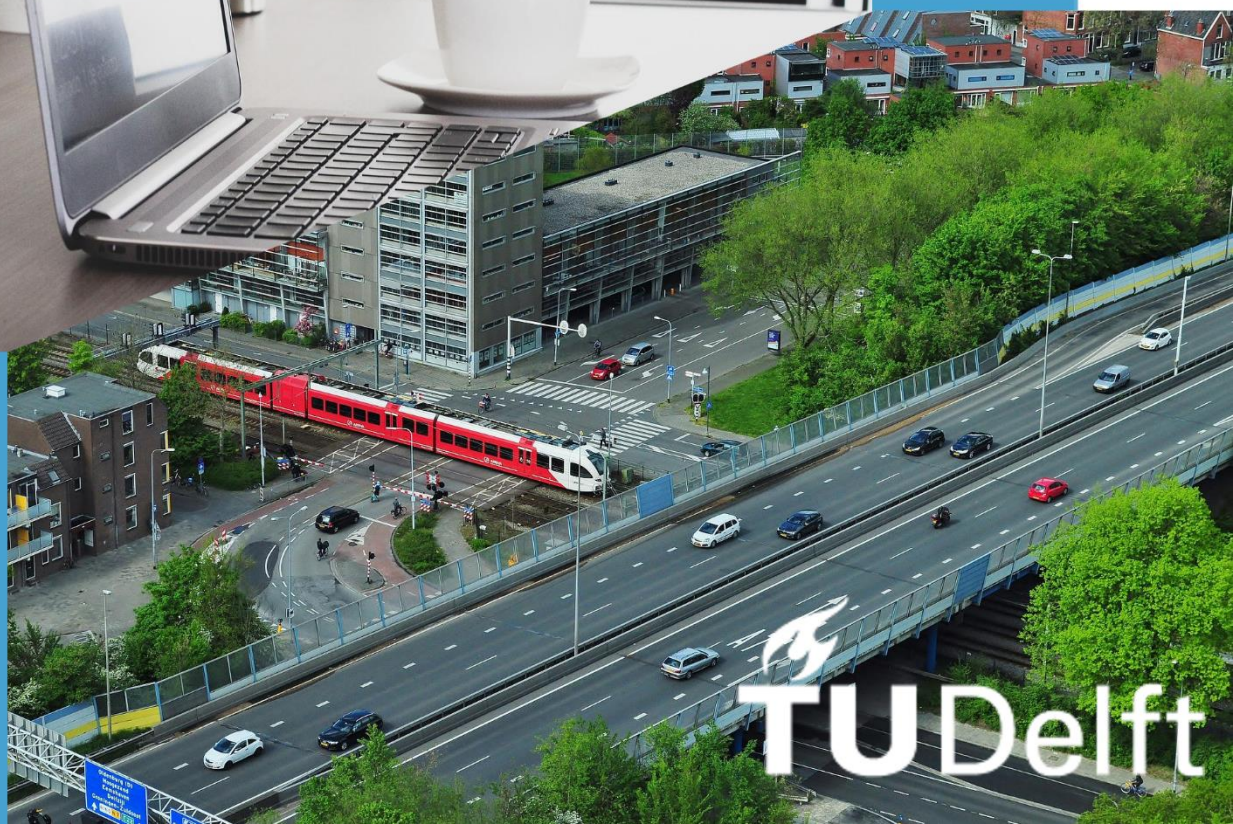
Changing attitudes to daily commute due to the pandemic

Working from home, Public transport, Cycling, Car use and ownership. Changing attitudes towards travelling and the environment: a dynamic Q-methodology approach

Jeffrey Huisman
MSc Complex Systems Engineering
and Management



TU Delft

Changing attitudes to daily commute due to the pandemic

Working from home, Public transport, Cycling, Car use and ownership. Changing attitudes towards travelling and the environment: a dynamic Q-methodology approach

Master thesis submitted to Delft University of Technology
in partial fulfilment of the requirements for the degree of
MASTER OF SCIENCE

in Complex Systems Engineering & Management
Faculty of Technology, Policy and Management

by

Jeffrey Huisman

Student number: 4575709

To be defended publicly on Thursday June 23, 2022 at 10:15

Graduation committee

Chairperson	: Prof.dr. G.P. B. van Wee, Transport and Logistics
First Supervisor	: Dr.ir, M. Kroesen, Transport and Logistics
Second Supervisor	: Dr.ir. C.E. van Daalen, Policy Analysis

Foreword

This master thesis report was written over the period of late-2021 to mid-2022, spanning the last 2021 winter lockdown into summer. At times the writing of this report was demanding, however in the end it has produced a satisfactory result.

I'd like to thank my first research supervisor Dr.ir. Maarten Kroesen, as well as my secondary supervisor Dr.ir. Els van Daalen and the research subject chairperson Prof.dr. Bert van Wee, for their support while conducting this master's thesis. Their input was invaluable in writing this report.

Furthermore, I'd like to thank my parents for their continued support during my academic career, as well as everyone that assisted me in research through participating in the developed online survey or through spreading it to others in their professional circle. Your participation was greatly appreciated.

I hope you enjoy reading this report.

Thesis summary

Large changes to Dutch travel behaviour occurred due to the pandemic and government policy surrounding it. Within this report, particularly abrupt and structural changes to commute take importance, as the pandemic and the widespread adoption of working from home (WFH) (CBS, 2021a) resulted in a temporary decrease in car use and congestion during rush-hour (Bremmer, 2020). Post-pandemic however, there still appears to be a structural effect on commute behaviour, as car usage and particularly public transport (PT) usage appears structurally lower and WFH adoption remains partially in place. This shift is likely due to circumstances of the pandemic and government COVID policy causing a change in commuter outlook on their commute behaviours.

Public discourse on the subject saw changes and attitudes among Dutch commuters have and will continue to impact their travel behaviours (van Wee, et al., 2019). Widely held attitude changes will indirectly influence behaviour trends and resulting government and employer policy. This mix of public involvement, the technical transport system and related policy advise, make research into pandemic effects on travel behaviour a prime topic for discussion within a CoSEM master thesis. It's results offer societal relevance, as new insights allow for advice on sustainable commute policy. Central to this thesis lie changes in attitude towards the car, the longstanding former main method of commute, and WFH, the newly surging practice that partially supplants commute trips. Car use saw a change as the pandemic popularized the purchase of second hand cars (Jansen, 2021) and PT users seem to have structurally traded PT for the car due to the pandemic (CBS, 2021d, Hamersma et al., 2021) which goes against years of policy promoting PT as an alternative to car usage. WFH on the other hand became the mode that gained structural popularity and growth among car users, PT users and cyclo-pedestrians alike (Hamersma et al., 2021), but the slow return from WFH post-pandemic moves largely through the car, where much of the commute sticks around not returning to PT.

This master thesis was written to answer the following main research question;
What different societal perspectives on changes in attitude towards private car usage, working from home and overall commute travel behaviour can be identified as a result of the COVID-19 pandemic?

This presents 3 knowledge gaps, offering different scientific contributions. **Firstly**, a main empirical contribution, granting direct quantitative insight into the statistically distinct attitudes among different Dutch societal groups about commute behaviour, such as changes in perspective on WFH, cycling, car and PT use, following the pandemic. **Secondly**, a theoretical contribution determining how usable newly developed theories and conceptual models on attitude change are in application to a real case. In this case, the change of attitude triggered by changes to travel behaviour due to the COVID pandemic. **Thirdly**, a methodological contribution determining how suitable the use of Q-methodology is for measuring dynamism in societal attitude and in turn the effects of attitude on the behaviour of individuals. Q-methodology traditionally measures an attitude-snapshot of the current respondents' attitude towards a certain subject, allowing them to be clustered into groups (Watts & Stenner, 2005). A different way of questioning about change of perspective on travel, seeks to explore methodological efficacy of adjusting Q-methodology use to include dynamism in perspective.

The main research question is answered through 6 sub-research questions. The report features a singular methodology section, but when summarizing the research that was undertaken, it will describe the different steps of Q-methodology as it was incorporated through research questions.

The summary will follow the following research flow; First gather information regarding commute behaviour, attitude and policy. Secondly, identify and adapt methods to measure attitude change. Thirdly, execute data gathering on commuter attitude and behaviour. Fourthly, examine said gathered data on commute behaviour and characterise results. Fifthly, evaluate empirical, theoretical and methodological results. Lastly, draw conclusions, offer policy recommendations and evaluate research in general.

Firstly, there's a need to gain understanding of the overall trends in Dutch car usage and commute behaviour, to determine yet unexplored longer term effects of the pandemic (Van Wee & Witlox, 2021 ; Thomas et al., 2021) on changes in these trends and travel habits. This will aid in better evaluating recent changes in commute and policy, through answering research **sub-question 1;**

***1:** What historic and societal developments and trends surrounding car ownership, car usage and government daily (commute) transport policy can be identified, including their influence on travel behaviour change?*

This sub-question was answered through conducting a limited historic literature review over a period of 35 years of government reports regarding commute, offering insight into historic behaviour changes, policy changes and overview variable changes. On the topic of behaviour change there's been the identification of slowly lessening individual mobility, in the sense that the number of daily trips slowly keeps decreasing while congestion and time loss increases (MuConsult, 1998; G.J.A. AI, 2006; KiM, 2019; F.M. Roschar, 1997). However there's also increase in mobility as total travel distance continues to grow, if not more slowly. Congestion, particularly during evening rush (G.J.A. AI, 2006), is caused in part by commuters. This was further emphasized during the pandemic where congestion dropped by over half. Influence of the car is confirmed through direct and structural shift of commute travel towards WFH during both lockdown periods. Structural car decrease in the past often grew back fast (KiM, 2021), the current decrease will likely also only be temporary.

In a policy sense, reports don't mention WFH or teleworking much (KiM, 2019; KiM, 2015), as it appears to not have been a serious part of policy. Meanwhile, most policy that was aimed at congestion reduction includes infra expansion, a method that was repeatedly identified as reaching its limit (F.M. Roschar, 1997), although government does keep engaging in the practice (KiM, 2019). Similarly, old expectations of the car going out of style fall flat, as the car remains ever popular among commuters (KiM, 2021). Holding on to old habits is also seen in how reports measure mobility, largely sticking to the same more economically measurable variables that were already used in the 90's (MuConsult, 1998; G.J.A. AI, 2006; KiM, 2019). Attitude is often identified as important, but quickly disappears from reports. As attitude plays an important part in influencing behaviour (van Wee, et al., 2019), proper identification is thus necessary for successful policymaking. Identified policy trends and variables are taken forwards to SQ 2, 5 and survey development.

Having thus identified attitude variables regarding commute through this historic review and other additional desk study on knowledge gaps, the need to better implement these variables within data and policy evaluation becomes clear. Thus it's necessary to conceptualise a framework on how these variables and their effects are categorised, through answering research **sub-question 2;**

***2:** What theory on travel behaviour, regarding the influence of attitude and habit, can be applied to identify the variables in attitude changes towards travel impacted by the pandemic?*

A qualitative desk study largely adapts the framework by van Wee, et al. (2019), to explicitly explore and propose improvements to the viability of the framework. Frameworks on the built environment and its relation to attitude and behaviour, are useful for classifying the different factors influencing travel behaviour, but limited in framework depth. The model for attitude change by van Wee et al. (2019) goes more in depth, but similarly feels a little broad in how it defines environmental triggers, outside variables influencing attitude change. The model solely investigates attitude change and does this well. However, criticism of the model also considers that analysis of change is somewhat difficult without taking baseline attitude before change into account. This thesis sees investigating attitude change itself as a goal of its own, as it would determine whether the more traditional, less labour and time intensive simple method of Q-methodology is able to properly catch dynamism. Rather than unnecessarily widely and impractically expanding the model and in turn the Q-set and survey. The conceptual model proves useful as a tool for explorative analysis, but is limited in its connection to the creation of a Q-set, indicating the need for changes to methodology in future research to assure

a better connection. The model identifies different triggers influencing attitude change, many of the triggers mention the importance of relation to colleagues employer, which is a variable that wasn't considered much before. Similarly, while variables such as the effect of WFH on attitude towards other commute modalities were implicitly mentioned in the policy literature, the social effects of WFH or the effects of WFH on the attitude towards itself are newer.

Having done preliminary literature research leads to exploring Q-methodology, the construction of online survey and the further statistical evaluation of survey results, to answer the following research questions. The online survey makes use of Q-methodology to measure respondent attitude on a selection of statements, the Q-set, and through the statistical method of principal component analysis cluster groups of respondents, the P-set, together in groupings of commuters with similar changed attitudes on commute as a result of the pandemic. These groups are called factors and, evaluated through factor analysis, they represent significantly held perspectives within society. In this case perspective on changed attitude towards commute. This thesis is special, as normally in Q-methodology respondents are asked to rank statements on their static opinion to measure their attitude towards certain subjects, this is the Q-sort. In this study, statements within the Q-set feature questions regarding change in opinions, investigating dynamism in opinion among respondents and evaluating whether it's possible to properly measure change in opinion within this method.

Thus, when constructing this Q-set a selection of statements are chosen from a concourse, a broad collection of gathered statements from public discourse on commute and the pandemic. Based on findings within desk studies a concourse of around 200-250 statements was developed surrounding the topic of commute and the pandemic. A selection of 50 statements was made for the Q-set. The subjects of this Q-set are spread halfway between the subject of WFH and of commute modalities, like PT, cyclo-pedestrianism and car usage and ownership which takes emphasis. Due to a lack of recent statements on these latter subjects in regards to the pandemic, an open survey among was carried out to widen the concourse. Both the additional survey, as well as the final Q-method related survey was spread online to respondents within the researchers professional circle. Respondents are Dutch nationals above the legal driving age with the ability for respondents to (partially) work from home or to have (partially) worked from home during the pandemic. Accompanying this survey is an extra multiple choice survey that measures respondent characteristics relevant to commute, their pre- and post-pandemic commute behaviour and questions on the evaluation of the survey itself.

These additional questions help evaluate variables that weren't captured within Q-sort regarding commuter characteristics. Results regarding commute behaviour from the post Q-sort questionnaire, for the entire P-set, primarily show the shift in mode use from before to after the pandemic. Car use decreased on average by 22%, distribution of the number of workdays per week skewing from around 4 to around 2 among actual users. PT use decreased by half, resulting in hardly 0.38 days in use on average. Cyclo-pedestrianism decreased only slightly by 19%, the skew of actual use among multi-modal commuters moving from 3-4 to 2. Full-time cyclists continue their use the same amount. Lastly, WFH saw an enormous increase of 154% to 2.56 days on average. As respondents are already able to work from home as a requirement to participate, they're likely more positive and engaged in WFH use than the average Dutch population. This relates to results showing a higher representation of office jobs and only 25% of respondents planning full return to old commute behaviour. Keeping these results in mind, through Q-method preparation, research **sub-question 3** can be answered**;**

***3:** What different perspective clusters on changing attitude towards car ownership, usage and travel behaviour can be found within Dutch society, in regards to pandemic impact?*

It answers this sub-question through using factor analysis, as described in the methodology section. This factor analysis resulted in the identification of 8 different statistically significant factors; societal perspective groups concerning Dutch commuters changed attitude towards commute. The number of factors was rather high, but necessary for statistical reasons. This was likely due to the fact that the subject of this thesis is broad with a large Q-set featuring many different subjects. Different

modality users years' of experience through commute behaviour informed their attitudes differently. Their attitude would thus change differently when exposed to triggers of circumstances surrounding the pandemic. Table S.1 shows identified factors, i.e societal perspectives.

Factor titles	Primary (former) commute based on attitude	Status of attitude towards WFH
1; Car commuters that strongly shifted to structurally working from home	**Primarily car users**	**Have embraced WFH**
2; Car commuters looking to return to pre-pandemic commute behaviour	**Primarily car users**	**Have denied WFH**
3; Multimodal opposers of working from home themselves	**Primarily multimodal cyclo-pedestrians**	**Have denied WFH (due to their work circumstances)**
4; Multimodal PT commuters shifting to WFH, remaining steadfast car owners	**Primarily multimodal PT-car users**	**Have embraced WFH**
5; Part-time cyclo-pedestrians, unchanged in their behaviour	**Primarily multimodal cyclo-pedestrians**	**Have denied WFH (due to their enjoyment of commute)**
6; Car use opposers, strengthened in THEIR own personal car use	**Primarily car users**	**Have become ambivalent to WFH**
7; Full time cyclo-pedestrians that have shifted to working from home	**Primarily multimodal cyclo-pedestrians**	**Have embraced WFH**
8; Commuters generally opposed to government & policy	**Primarily car users**	**Have embraced WFH, despite opposing (pandemic) government policy**

Table S.1 Factor summary

Those whose attitudes indicate being formerly or still engaged in multimodal (cyclo-pedestrian), have often been more critical on WFH. The respondents that make up factor 2 and 5 interestingly also remain attitudinally more attached to the car than many of those whose attitudes indicate that they used to or still actually do primarily commute by car. This is likely due to multimodal travellers having the belief that the car is always necessary as back-up to other modalities. Another observation is that ideological attitudes, not investigated within this thesis, also impact attitude towards commute, in factor 6 and 8. On the other hand however, attitude affected by such presumed political attitudes then did not always completely match with other attitudes or actual behaviour indications. This possible discrepancy is further evaluated through **sub-question 4;**

***4;** What are the possible behavioural effects on commute behaviour, of the identified changes in attitudes towards commute within perspective clusters?*

To examine the effects of attitude on behaviour, responses regarding commute behaviour are examined for respondents within formerly identified societal perspective clusters within SQ 3. The limited amount of responses was able to give an initial indication on whether expectations on behaviour are correct based on identified attitudes, interestingly it was also able to see when behaviour deviated from expectations based on identified attitude. The size of the factors is too small to draw quantitatively significant conclusions, generalizing them to the Dutch populace of commuters, however, knowing detailed Q-sorts of these respondents, it was possible to measure whether statements made on attitude match the actual behaviour of those respondents.

The indications of respondent commute behaviour change seem to generally conform with expectations based on respondent attitude within the identified factors. Groups that have come to strongly appreciate WFH, such as factors 1, 4, 7 and 8, generally seem to engage far more in WFH after then pandemic than before. This is a trend that is seen among most factors, where even ambivalence towards WFH seems to have resulted in a structural modal shift towards WFH. The exceptions to this shift are the car commuters within factor 2 that are explicitly opposed towards WFH, where car use remains the same, and multi-modal cyclo-pedestrians in factor 5 where bike and PT use remained roughly the same after the pandemic in comparison to before, WFH did not increase. This latter group is opposed to WFH through enjoying the commute itself, their professed eagerness to return to their old commute habits apparent within their behaviour. What must be mentioned however, is that factor 3, cyclo-pedestrians that have come to dislike WFH itself, and factor 6, car use opposers that were strengthened in THEIR own personal car use, have grown to

(partially) dislike WFH, yet further engaged in the practice as a result of the pandemic. Another interesting observation is that those generally opposed to government commute and pandemic policy, now structurally WFH far more, but still use the car at the same level as pre-pandemic. Knowledge from SQ 3 and 4 on commute attitude and behaviour, as well as information on policy gathered through SQ1, 2 can be applied to answer research **sub-question 5;**

***5:** What are the implications of the findings for government and possible impact on prevailing government policy?*

What identified societal perspectives and change in attitude mean for current prevailing government policy regarding commute are evaluated through trends identified. This is a qualitative interpretation of quantitative findings, identifying most important implications for policy. **The first** general policy implication, is that WFH policy support or WFH appreciation aspects are widespread among most perspectives. Even government policy opposers like the practice of WFH on its own. Partial (non-full-time) WFH is supported by all perspectives. This might be a successful popular base for policy to limit commute trips in the future if government might wish to choose so. **The second** implication is that curbs on car use and policy, such as road pricing (rekeningrijden) or the further establishment of car use alternatives, remains unpopular among most perspectives. Even among road pricing supporters and those that tentatively seem to agree that the private car should no longer be as acceptable as it once used to be, there has been an increase in the sense that private car ownership (for themselves at least) and the freedom of private ownership has gained new appreciation. They are strengthened in their personal car ownership and they do not see this changing in the future. However, a sizeable amount of car users shifting away to WFH have grown far less negative of such policy than they likely were. **The third** implication is that simply because commuters often cycle to work, doesn't mean they want car use or ownership limited, seeing it as back-up for multi-modal commute or important for other travel. One could limit car use within commute to limit congestion, but find popular resistance, even among non-car commuters. **The fourth** implication is existence of (political) ideology affecting attitude among some factors, making interpretation of attitudes and effects on behaviour difficult. View of policymakers on actual attitude change could be positive however, as the group opposed to car use curb and COVID policy has come to enjoy WFH. While groups traditionally positive on government policy have become strengthened in their personal car ownership, yet indications of their actual behaviour still shows car use decrease in favour of WFH. Some groups' political sentiment does or doesn't triumph over personal commute experience based attitude. Having identified changes in attitude on commute through factorisation, having checked the effects of attitude on behaviour and policy trends , the need to evaluate the used method of 'dynamic' Q-methodology becomes apparent. This is done through answering research **sub-question 6**;

***6:** What facets of Q-methodology have shown the need to be adjusted to account for dynamism and change within perspective?*

This SQ is answered through literature research and respondent consultation on Q-methodology. Exploratory research through SQ 3 and 4 aided in identifying the efficacy of the future use of the dynamic Q-methodology. The majority of respondents are generally ready for dynamic Q questioning. They profess to be perfectly able to answer questions or rank statements based on their changed opinions. The quality of results is thus ensured. Respondents are more ambivalent on Q-methodology itself, although in-depth response mostly shows that this is due to the required time investment, issues with layout when taking the survey digitally through phone and having to abide by Q-method forced distribution. These issues offer an insight into aspects that would make data gathering more structured in the future to increase research success. Issues with the introduction of dynamism into the Q-set were identified, as it risks adding 'double' statements in the Q-set that cause issues during result interpretation. Different interpretation or missing context regarding factor analysis results due to differently phrased or structured statements, makes later analysis and interpretation of perspectives more difficult. The implementation of dynamism into Q methodology

within this study, a method that focuses solely on change in attitude itself, containing questions primarily centred around change in opinion, was largely successful. It was able to identify a number of significant changed attitude clusters that were insightful in the investigation of behaviour changes and their relation to policy. It also helped to pinpoint issues with the employed method of dynamic Q, allowing for more structured and possibly higher quality research in the future.

A more involved method of Q-methodology was drafted, based on experience gained in this study. This set-up could investigate starting points (formerly held attitude), triggers for attitude change and change itself. This new method addresses methodological complications in the employed method, but is also flawed in comparison to the current method. It focuses on a different set-up of Q-set construction through a more researcher involved method of interviewing to develop concourse. This method can likely avoid unclarity in statement presentation and analysis, through better following the model by van Wee, et al. (2019). However, this method requires more researcher guided interview which might lead to researchers seeking specific answers and not gathering information from wider societal concourse, but pre-determining interview findings. This risks researcher bias in interview construction, creating wanted P-set rather than basing it on 'natural' discourse.

Conclusion, Policy recommendation and Evaluation

In conclusion, results of research identifies the existence of 8 different societal perspectives on changes in attitude towards commute as a result of the pandemic. Change in attitude among Dutch commuters able to work from home was confirmed, as well as resulting commute behaviour. As was shown by SQ3, societal perspectives were largely identified for what are likely car users and multi-modal commuters, primarily cyclo-pedestrians. Attitudes are roughly divided into those who've fully embraced WFH, those who've come to deny WFH due to work circumstances and attachment to their old commute (primarily full-time car users and cyclists), and lastly those more ambivalent towards WFH often citing attitude towards communication with colleagues having grown negative. Behaviour generally conforms with attitude change in case of apparent single mode commuters, but starts to differ among multi-modal commuters where, regardless of negative attitude, WFH appears to have grown. The exception to these groups are (car) commuters whose behaviour appears affected by identified unmeasured ideological motivation affecting attitude, which appears counter to effects of professed attitude on behaviour, which requires further study.

Recommendations on policy are given for each of the 8 identified factors. Where general promotion of continued WFH encouragement is recommended to curb congestion. Similarly, it was identified that policy that seeks to directly curb car usage, such as road pricing, remains observed negatively in most perspectives. However, with former full-time car users becoming less negative on this policy and multi-modal commuters more negative, policy makers would do well to conduct further research on the quantitative sizes of these groups, as the apparent large size of more positive former car users and more negative cyclists might require a fundamentally different view of the subject.

To shortly evaluate different aspects of the thesis; Literature review was seen as successful, offering all necessary information but selection was often somewhat small due to the large amount of separate review required through the broad subject. The application of the conceptual framework could have been more direct. Currently, the framework van Wee, et al. (2019) was mostly used to explicate the nature of attitude change categorize its effects on commute behaviour. However, direct application of the framework was somewhat lost within questionnaire construction, as Q-method requires statement gathering that doesn't conform to this structure. Future research could mend this gap through application of the newly proposed method within SQ 6. The execution of online survey did well, surpassing the aim of 50 respondents. Distribution of the survey was met with technical issues during the first weekend of distribution, which required technical fixes that highlighted the need to prepare back-up methods of distribution for future online survey. This underscores some downsides to an otherwise successful method of necessarily online respondent survey.

Contents

Chapter 1. Problem Introduction

During the height of the pandemic and shift to working from home in November 2020, Dutch newspaper Parool (Bremmer, 2020) proclaimed that the definitive answer to traffic jams had been found. Reallocating car travel to flexible different time slots and the shift to working from home decreased congestion by 93% compared to 2019. In the summer of 2021, reopening started and experts expected the effects of working from home to partially remain. Commuters likely wouldn't return to rush-hour en-masse, preferring flexible work hours (Kooten & Bolink, 2021). At the time of writing, the winter of 2021, even when total traffic hasn't returned to pre-pandemic levels, traffic jams have returned in full force (van der Wurf, 2021).

The COVID-19 pandemic had a strong impact on travel behaviour. During 2020 and early 2021, airplane and train passengers massively decreased (CBS, 2021c). The car, while affected early pandemic, saw less of a drop and car traffic has almost returned to pre-pandemic levels (CBS, 2021c). This, despite the rise in working from home during the pandemic (CBS, 2021a). Perhaps this can be explained by the resurgence of homegrown tourism within the Netherlands during the end of 2020 and the beginning of 2021 (CBS, 2020; CBS, 2021b) repopularising the car as a method of tourism? More likely however, an increase in car use, during specifically rush hour and commute, did occur in spite of the growth in working from home and its structural growth of popularity. Car ownership was affected by the pandemic. Sales of second-hand cars grew a lot in 2021 (Jansen, 2021). Dealerships are en-route to deliver a record number of 1,3 million occasions this year and public perception of the car as the most important mode of transport has grown from 69% to 80% during the pandemic (van Putten, 2021). Data from the BOVAG, RAI Association and RDC (2021a; 2021b) does however show that the sale of new cars in 2021 has decreased by 7% in comparison to 2020, spiking at a 17% decrease in august. While the report blames supply chain issues, 2020 was also a worse year for car sales than the preceding 2019 (RDC, 2020). One can wonder whether an uncertain societal attitude towards travel and the pandemic influences the popularisation of the second hand car.

Attitude change influences behaviour (van Wee, et al., 2019) , thus widely held societal attitude change indirectly influences behaviour trends and resulting policy. The pandemic led to discourse on changing the transport status-quo, leading to criticism of mass tourism and aviation (Bijlo, 2020; Becken, et al., 2020) intensifying within the public arena. Resurgence of the car appears to counter longstanding trends of shifting travel away from private car use, to public transport and other alternatives, sure to spark public debate (Kolarova, et al., 2021; Thombre & Agarwal, 2021). On the other hand, the sudden structural shift to partial and full time working from home and changes in opinion on such teleworking has also upset this balance in a, from the point of view from government policy, more positive way, lessening car use. The presents the main gap that is to be explored, how can the desirable trend be stimulated and the undesirable trend be disincentivised, to attain a sustainable transport system. It's become necessary to not only investigate travel behaviour itself, but also identify what parts of society saw changes in perspective.

The pandemic changed Dutch car usage and, more importantly, views on the daily commute as a whole, featuring a large impact on working from home, train use and cyclo-pedestrian travel. It's unclear however to what extent these changes apply to what parts of Dutch society. The longer term effects of change in personal attitude towards car usage among different groups in society, are unknown. This graduation thesis, centring around the interaction between daily car usage and working from home, runs parallel with other MSC graduation projects at the TU-Delft that seek to identify societal perspectives and their effects on travel behaviour after the pandemic. This study on car travel and daily commute accompanies research into air travel that was proposed by Professors at the TPM faculty.

As will be explored further in the preliminary literature review, changes have occurred to the use of and perspectives on travel modalities. For this study four main travel modalities were considered; Of the traditional transport modalities there are Public transport (PT), cycling and pedestrianism, and, the traditionally most used modality, car usage. There is also the 'new-comer' in working from home (WFH), which saw a structural surge during the pandemic, particularly in full-time WFH (Hamersma, de Haas & Faber, 2020). Their interchangeability is portrayed in figure 1.1. How these modalities seem to have been affected during the pandemic is portrayed in figure 1.2, where PT declined in favour of the other three modalities, mostly the car, and the car itself saw users leave to cycling and working from home, the latter which increased due to a travel influx from all modalities (Kantar, 2021; Kolarova, et al., 2021).

This shift is the reason for displaying the car in the middle of the figure, as this commute modality that's traditionally the largest, came to hold a new 'funnel'-like position during the pandemic. During the pandemic, commute use essentially trickled downward through the figure, towards the bottom and the fast growing method of WFH in the bottom right of the figure. The pandemic and the following popularisation of this 'newcomer' modality has abruptly upset the historically slowly developed status-quo of mode division. After the pandemic, commute will likely move back upwards through the figure, returning to former commute patterns. This more halting return, that will be described more later, halts far more around the car funnel than the trickle down, resulting in earlier returning traffic jams during rush hour. This undoes the congestion lessening effects of PT that were slowly built up through years of promotion and policy.

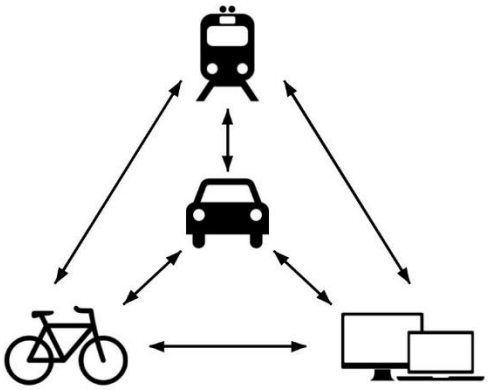


Figure 1.1. Interchange between modalities for commute

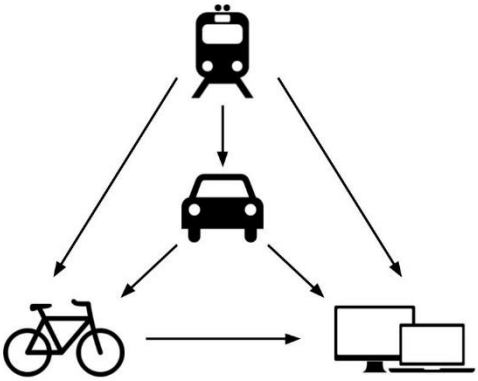


Figure 1.2. Shift in modality during pandemic

These changes might have a lasting impact on modal breakdown for the foreseeable future. A balanced discussion around car travel in the public arena or as part of governmental deliberation on policy, requires an objective view of what attitudes exist towards car usage and their effect on travel behaviour among significant groups in the population. This knowledge will positively impact the value of public discussion and the possible success of private and public policy. The ministry of Infrastructure and Water management would like to maintain the shift to working from home to avoid car usage moving outside of its current capacity, inducing congestion. It has limited resources however and knowledge on constraints and factors influencing the inability to hold this structural mode change is necessary. When policymakers are aware of why certain groups move to working from home, away from car use, and particularly why they would choose to structurally work from home, it can more effectively adjust its policy decisions with this information in mind. This will stimulate the further development of a sustainable transport system.

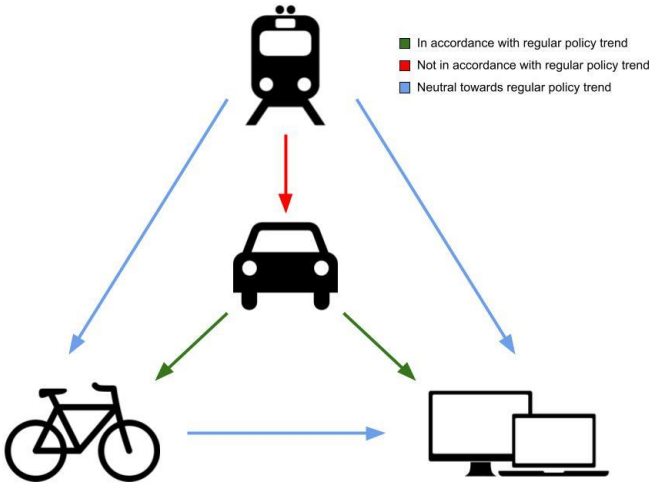


Figure 1.3. Modal shift during pandemic, related to policy trend

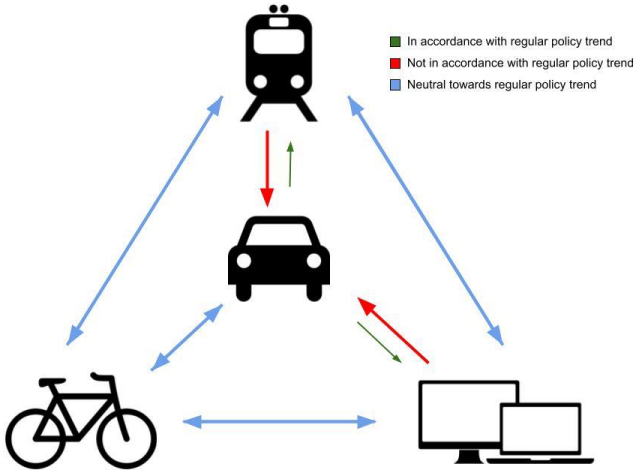


Figure 1.4. Modal shift post pandemic, related to policy trend

As it stands, the shift away from the car during stages of the partial lockdown decreased congestion significantly, even when PT users adopted the car. The shift away from the car positively coincided with longstanding government policy of disincentivising or spreading car usage to limit congestion, as portrayed in figure 1.3. After lockdown however, as portrayed in figure 1.4, working from home decreases and commuters switch back to the car (Jongen, et al., 2021), whereas PT remains negatively impacted (CBS, 2021d; Verkeerskunde, 2021), worsening congestion. It could thus be useful to, for example, identify the factors that impact the positive perception on working from home among those that have continued to avoid the car. This would allow for more efficient public policy in avoiding congestion. These factors could be directly related to societal attitude changes towards commute travel. However, commuter characteristics such as the characteristics of their job sector or the specifics of their employment might also impact the ability to work from home or reason for choosing the car, identifying categories of commuters that might be affected differently by policy. As such, to attain a clear focused insight into these changes to commute and attitude, it's become necessary to establish a basic standardized framework for studying the disruptive influence of the pandemic on changes in societal attitudes towards travel behaviour. Behaviour change must be analysed, putting emphasis on changes in car use evaluating the rise of the most used commute method, to now becoming a 'funnel' mode of transport between the 3 other major modalities, as well as the unknowns around the newcomer modality in WFH and other factors influencing behaviour besides the pandemic. To analyse these attitudes towards travel behaviour, a methodology of measuring attitudes, particularly changes in attitude, should be employed or developed. This is done to answer the main research questions that structures research.

Research question

This chapter presents the main research question and present a preliminary approach on how to answer this research question, aiding the conducted research in exploring and filling identified knowledge gaps. The research question is as follows:

What different societal perspectives on changes in attitude towards private car usage, working from home and overall commute travel behaviour can be identified as a result of the COVID-19 pandemic?

This research question has sought to incorporate a threefold of knowledge gaps identified during literature review to evaluate changes in people's outlook on their travel patterns as a result of the COVID-19 pandemic and related policy. It seeks to primarily fill an empirical knowledge gap, with the theoretical and methodological contributions it seeks to offer being an academic bycatch.

1.1 Knowledge gaps

The knowledge gaps investigated within this study correspond to the three parts of the literature review, that can be found within the methodology, offering different scientific contributions:

Firstly, the main empirical contribution, grants direct quantitative insight into the statistically distinct attitudes among different Dutch societal groups about car ownership, usage and other daily travel behaviour, such as changes in perspective on working from home, cycling and public transport use, following the pandemic.

Secondly, a theoretical contribution determining how usable newly developed theories and conceptual models on attitude change are in application to a real case. In this case, the change of attitude triggered by changes to travel behaviour due to the COVID pandemic.

Thirdly, a methodological contribution determining how suitable the use of Q-methodology is for measuring change in societal attitude and in turn the effects of attitude on the behaviour of individuals. Q-methodology traditionally measures an attitude-snapshot of the current respondents' attitude towards a certain subject, allowing them to be clustered into groups (Watts & Stenner, 2005). Using a different way of questioning about their change of perspective on travel, analysis of results seeks to explore the methodological efficacy of adjusting current Q-methodology use to include change in perspective.

1.2 Research approach

Research into these knowledge gaps takes a mixed exploratory and descriptive research approach. It evaluates existing theories on habitual travel behaviour (*descriptive research*), as well as explores both the changing societal perspectives on travel behaviour and the use of Q-methodology for evaluating dynamism in perspective (*exploratory research*). The research approach is based on Q-methodology studies of the past, such as the paper by Kroesen (2013). The prime research methodology of Q-methodology, a mixed quantitative approach, is used in combination with more qualitative methods like literature review and interview to answer the sub-research questions drafted in the following chapter. Sub-questions structure research workflow, aid in answering the main research question and aid in exploring and filling identified knowledge gaps. The nature and use of the chosen research methods will be summarised along with their accompanying sub-question.

A combination of public involvement, the technical transport system and private as well as public policy advice, make research into pandemic effects on travel behaviour a relevant topic for discussion within a Complex Systems Engineering and Management (CoSEM) master thesis. The topics of transport policy, statistics and data analysis will be discussed. Mixed-quantitative research will be conducted among Dutch citizens, with the goal of identifying the different societal perspectives on changes to the daily commute and car use. To properly attain this insight, a theoretical framework to structure this data must be developed. A proper methodological method must be developed to measure the complicated factors of societal attitude. To attain this data on societal groupings Q-methodology is used. Q-methodology clusters people in categories based on their opinions on a specific topic. This method has been used successfully in grouping people’s opinions on travel and environmental policy (Brůhová, et al., 2020) (Stevenson, 2015), but has been unexplored in this specific topic of exploring changing opinions in regards to post and peri-pandemic travel behaviour. Research will make empirical contributions to understanding societal opinion change. Methodologically, it evaluates how suitable Q-methodology is in segmenting people with respect to changing attitudes regarding pandemic related travel behaviour. This new 'dynamic' Q-

methodology, doesn't necessarily differ as much from the traditional method in methodology, but more in how it poses questions towards respondents regarding perceived changes in their opinions.

The following section of the introduction includes research question development and research approach development. Lastly, a Research Flow diagram that describes the flow of the overall thesis will be presented.

1.3 Subquestions; Selecting research methods and tools

This sub-section presents the sub-questions related to the main research question, including a limited-depth exposition of the methods, tools and requirements on how to answer the sub-questions. The approach of iteratively answering sub-questions is used to conduct research.

The research approach is split for all sub-question into 5 categories. In this chapter a very limited insight is given into these steps, which will be expanded upon in the method section using these steps along with knowledge gap exploration.

1. Short summary of question and method. Seeking to summarise the reasoning behind the sub-question and research method and outline the expected data result.
2. Research method. Indicating relevancy over other methods, including mention of flaws.
3. Tools. Which identifies tools that are appropriate for the chosen research method.
4. Data requirements. Which will identify what input and output data is required to answer the sub-question.
5. Design Flow. Short indication on how this sub-question relates to subsequent sub-questions.

Sub-question 1; *What historic and societal developments and trends surrounding car ownership, car usage and government daily (commute) transport policy can be identified, including their influence on travel behaviour change?*

1. Summary; It's necessary to gain an understanding of the overall trends in Dutch car usage and commute behaviour, to determine yet unexplored longer term effects of the pandemic (Van Wee & Witlox, 2021 ; Thomas et al., 2021) on changes in these trends and travel habits. The car is the funnel node within pandemic modality shift, seemingly serving as a fallback option for other modalities, whereas government policy is usually to shift away from the car. WFH seems to have become more prevalent, partially supplanting these travel modes, as home-office becomes a serious contender as a replacement of the formerly popular travel modalities, seeing a significant growth in both part-time and particularly full time teleworking.
2. Research method; A limited desk study is be performed, mimicking a historic literature review.
3. Tools; SCOPUS and Google Scholar use will gather grey government and academic literature.
4. Data requirements; A selection of 5 – 10 government reports containing historic mobility review, as well as additional academic literature sources covering development in Dutch commute over the last 30 years.
5. Design flow; Identified policy/mobility data trends and variables will be used in SQ 3, 4 and 5.

Sub-question 2; *What theory on travel behaviour, regarding the influence of attitude and habit, can be applied to identify the variables in attitude changes towards travel impacted by the pandemic?*

1. Summary; To investigate changes in travel behaviour, as a result of attitude change, it's necessary to identify the different variables that influence (habitual) travel behaviour through conceptualising a framework on how these variables are categorised and affect attitude.
2. Research method; A qualitative desk study largely adapts the framework by van Wee, et al. (2019). As the paper seeks to explicitly explore and improve the viability of a single framework.
3. Tools; SCOPUS and Google Scholar use will gather academic literature.
4. Data requirements; A set of recommended and gathered authoritative academic papers.
5. Design flow; The framework is necessary for categorising variables affecting car usage and commute behaviour change in SQ 1, to analyse survey results in SQ 3. Results will evaluate its descriptive use in SQ 6.

Sub-question 3; *What different perspective clusters on changing attitude towards car ownership, usage and travel behaviour can be found within Dutch society, in regards to pandemic impact?*

1. Summary; Preceding data gathering has delivered large amounts of data on Dutch respondent attitudes towards commute (see method section for in-depth description of data gathering and cleaning). These findings on attitude are be bundled to identify significant societal perspective.
2. Research method; Survey results are used to measure research participant opinions. Quantitative Q-methodology analysis is used to identify attitude clusters groups that represent significant societal opinions.
3. Tools; For data analysis and cleaning, data analysis programmes (such as SPSS) are used, whereas the established conceptual framework and expert input is used for factor (or rather societal perspective group) identification.
4. Data requirements; Based on other similar studies (featuring Q-methodology), between 50-100 filled out responses were required (Kroesen, 2013). Respondents are Dutch nationals above the legal driving age with the ability for respondents to (partially) work from home or have (partially) worked from home during the pandemic. 51 participants were examined.
5. Design flow; This sub-question follows SQ 2 and the online survey described in the method chapter. Of its results different aspects are evaluated in SQ 4, 5 and 6 afterwards, through different methods.

Sub-question 4; *What are the possible behavioural effects on commute behaviour, of the identified changes in attitudes towards commute within perspective clusters?*

1. Summary; To examine the effects of attitude on behaviour, the responses regarding commute behaviour are examined for the respondents within identified societal perspective clusters. The limited amount of responses should be able to give an initial indication on whether expectations on behaviour are correct based on identified attitudes.
2. Research method; Outside of attitude related questions examined in SQ 3, a query based on respondent characteristics such as age, education, employment sector and characteristics or experience with working from home or car use was spread. Data analysis of the results to this question was done for every identified perspective in SQ 3.
3. Tools; For data analysis and cleaning, data analysis programmes (such as SPSS) are used.
4. Data requirements; The filled out responses of 51 respondents are considered.
5. Design flow; This sub-question follows SQ 3 using its results in tandem with other results gained from survey.

Sub-question 5; *What are the implications of the findings for government and possible impact on prevailing government policy?*

1. Summary; What identified societal perspectives and their changes in attitude might mean for current prevailing government policy regarding commute are analysed through the evaluation of the trends identified.
2. Research method; Qualitative interpretation of earlier quantitative findings.
3. Tools; The conceptual framework is used to further interpret results.
4. Data requirements; Conceptual framework on travel behaviour, data set and analysis of development of commute over the last few years and results of SQ 3 and 4.
5. Design flow; The general trends in public policy and societal attitude towards the car and daily travel, identified in SQ 2, will be compared with the results of SQ 3 and 4.

Sub-question 6; *What facets of Q-methodology have shown the need to be adjusted to account for dynamism and change within perspective?*

1. Summary; The Q-methodology clusters people in categories based on their opinions on a specific topic (Watts & Stenner, 2005), giving a fixed snapshot (Kroesen, 2013). To investigate whether dynamism can be implemented within Q-methodology, mixed method research is applied.
2. Research method; The main goal of this question, is the evaluation of Q-method application within this case. Literature research and respondent consultation on Q-methodology will assist in success identification. Exploratory research on both the quantitative and qualitative results of the former two sub-questions aid in identifying the efficacy of the future use of the dynamic Q-methodology.
3. Tools; Data analysis programmes such SPSS are used. As well as literature and expert input.
4. Data requirements; Literature on Q-methodology, questionnaires adjusted for dynamism, results from survey on car usage and the pandemic as well as a survey on whether accounting for dynamism was doable for respondents.
5. Design flow; Literature on Q-methodology was gathered within the method section. Answering the SQ is done through evaluating the results of SQ 3.

1.4 Research flow diagram

The Research Flow diagram displays connection between the sub-questions within the MSC Thesis.

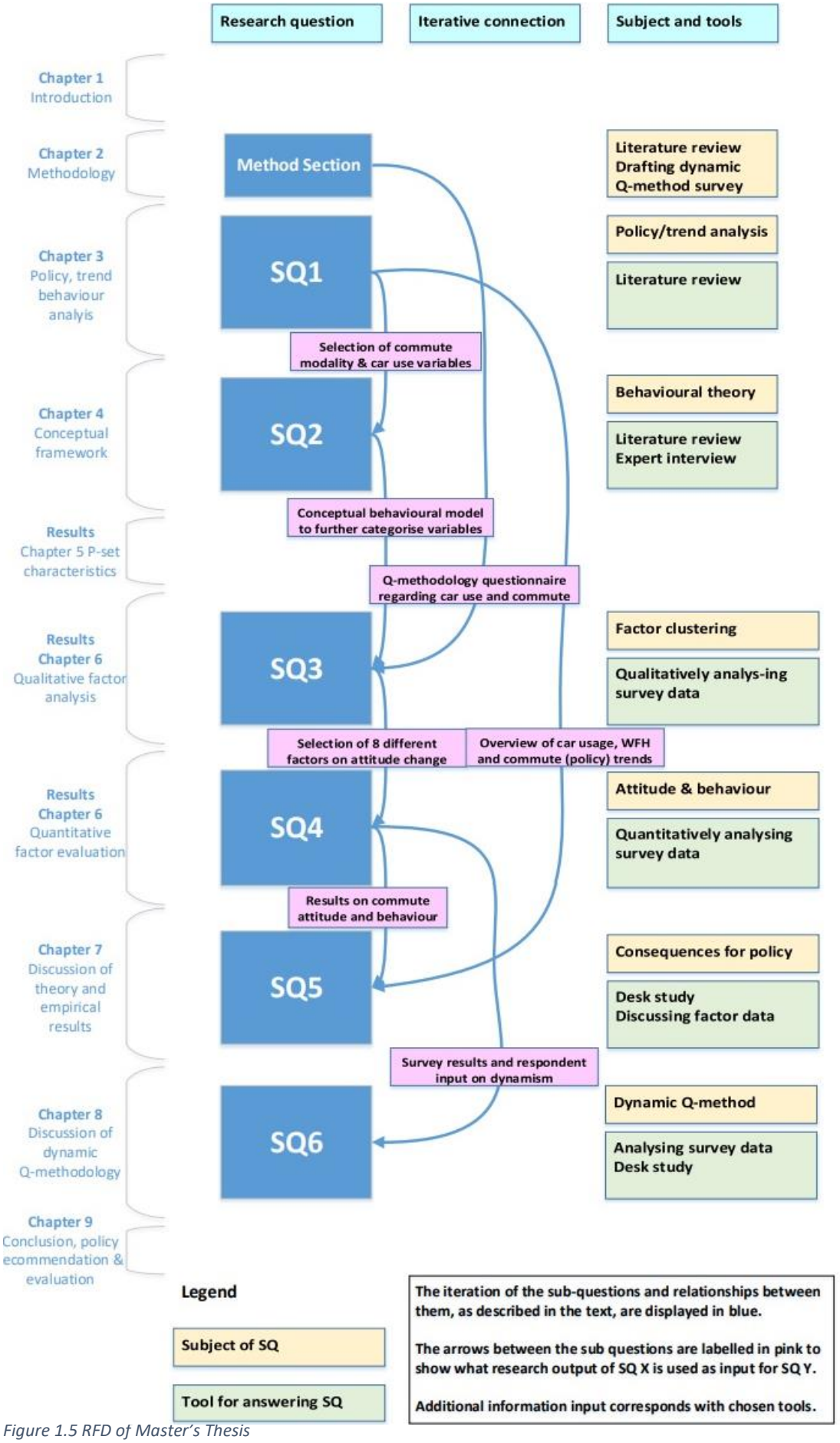


Figure 1.5 RFD of Master´s Thesis

Chapter 2. Methodology

This chapter features a complete and comprehensive methodology section for this master's thesis. It includes a general methodology section explaining both the methodology regarding literature review and the steps of Q-methodology in order. The chapter also features knowledge gap exploration, the explicated links between sub-questions and the methods to answer said sub-questions. As it offers a methodology for all sub-questions, certain parts of the methodology uses results and frameworks reported and evaluated at later parts in the report. It must thus be noted that parts of this method Section will point forwards to results or literature review in other parts of the main report, as well as the appendix, if necessary. Sub-questions are further explained through a more involved analysis following the same set-up as in section 1.3 of the introduction. This section is structured as follows;

1. Exploration of the empirical and theoretical knowledge gap, including a methodology section on the different applications of literature review throughout different sections of the report. Primarily, this section shows how SQ 1 & 2 are answered. To explore the knowledge gaps it firstly further analyses the empirical gap regarding travel behaviour change, emphasising the change of the car as former primary used commute method, to now becoming a 'funnel' mode of transport between 3 other major modalities, as well as other factors influencing behaviour besides the pandemic. Secondly, it synthesizes literature to establish a basic framework for analysing the disruptive influence of the pandemic on changes in societal attitudes towards commute to explore the theoretical knowledge gap.
2. Exploration of the methodological knowledge gap, through describing the steps in Q-methodology. This section shows how SQ 3 & 4 are answered. To explore the knowledge gap, use of q-methodology to analyse attitudes towards travel behaviour is investigated on whether it's plausible to use this methodology for determining attitude change.
3. Short exploration of methods to evaluate results, showing how SQ 5 & 6 are answered.

2.1 Literature review - SQ 1 and 2

Within this thesis limited literature reviews are performed, as papers and scientific databases on travel behaviour and the pandemic are recent and numerous, but scattered. Developed conceptual frameworks on travel behaviour disruptions within literature often haven't been validated analysing real cases. Bundling insights from new quantitative databases and validating developed frameworks is paramount for analysing changes brought on by the pandemic. Chapters 3, 4 and the methodology section regarding Q-methodology require additional literature review, due to the wide selection of subjects within this thesis requiring additional information. The setup of this section is as follows;

1. The description and execution of the desk study on empirical knowledge gap exploration.
2. The description of literature review for chapter 3, SQ 1.
3. The description of the desk study for chapter 4, SQ 2 and the theoretical knowledge gap.

1. Desk study empirical knowledge gap exploration

9 academic papers on three different facets of the empirical knowledge gap are used to explicate core concepts, to make sure sources have a significant level of scientific authoritativeness ensuring quality. Studying changing travel behaviour due to pandemic impact is a newly popular, but also scattered, subject in scientific literature. Scientific case studies and literature reviews are synthesized to structure this. Contemporary literature is preferred, but papers published pre-pandemic weren't excluded to allow for enough literature to properly identify knowledge gaps. Literature is gathered primarily through Scopus to ensure high grade peer reviewed scientific articles. Google Scholar is used when search through Scopus led to scarce results. Lastly, through Google search sources are gathered on relevant government reports. Each section of the review features a short introduction to literature gathering and a short summary of literary findings. Literature on the different facets was sought using different search queries. Literature on car use change after the pandemic, was scarce, but useful. Literature on general travel behaviour factors is abundant, removing the need for snowballing. Selection, shown in table 2.1, is based on relation to the pandemic.

Papers, with exception of Kantar research report, were found using Scopus under the search query; TITLE-ABS-KEY **("car use" + "pandemic" + "after")**	This query offered **6** results, **5** of which were deemed useful for inclusion in the review.	
Title	**Author**	**Year**
Acceptability of sustainable mobility policies under a post-COVID-19 scenario. Evidence from Spain **(Scopus search)**	Awad-Núnez, et al.	2021
Shifting streets COVID-19 mobility data: Findings from a global dataset and a research agenda for transport planning and policy (**Scopus search)**	Combs & Pardo	2021
The impact of COVID-19 on cost outlays for car and public transport commuting - The case of the Greater Sydney Metropolitan Area after three months of restrictions **(Scopus search)**	Hensher, et al.	2021
Analysing the impact of the COVID-19 outbreak on everyday travel behaviour in Germany and potential implications for future travel patterns **(Scopus search)**	Kolarova, et al.	2021
A paradigm shift in urban mobility: Policy insights from travel before and after COVID-19 to seize the opportunity **(Scopus search)**	Thombre, & Agarwal	2021
Werken op afstand blijft ook na de coronacrisis populair en transformeert de wereld van de forenzen **(Google scholar)**	Kantar (Organisation)	2021, May 5th
Papers were found using Scopus under the search query in shifting combination; **"travel", "environment", "attitude", "tourism" AND "pandemic"**	This query at the time resulted in results fluctuating around 80. Small selection of literature was selected based on recency and connection to flightshame	
Title	**Author**	**Year**
Climate crisis and flying: social media analysis traces the rise of "flightshame" **(Scopus search)**	Becken, et al.	2020
When and why do people experience flight shame? Annals of Tourism Research. **(Scopus search)**	Doran, et al.	2021
A STUDY ON CHANGES IN TOURIST BEHAVIOUR DURING PANDEMIC **(Scopus search)**	Augustine & Balachandran	2021
Lastly, specified data and government documents and research into changes due to the pandemic were searched based on insights gained from the former two categories using more general google search. No specific search queries were applied, moreso use was made of exploratory snowballing.	The size of the search result and the specifics of the query aren't of high importance in this highly exploratory part of the literature review	
Title	**Author**	**Year**
Mobiliteit in coronatijd **(Google search, website)**	CBS	2021, December 2
Mobiliteitsbeeld 2021: geen goed jaar voor ov en luchtvaart. **(Google search, website)**	Verkeerskunde	2021, November 18
THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT, Op zoek naar trends, trendbreuken en kansen als gevolg van corona. **(Google search, government report)**	Plan Bureau voor de Leefomgeving	2021
Thuiswerken vóór, tijdens en ná de coronacrisis, CPB Achtergronddocument. **(Google search, government report)**	Jongen, et al. (PBL)	2021
Gaat het reizen voor werk en studie door COVID structureel veranderen? Verwachte veranderingen in thuiswerken, televergaderen en thuisonderwijs na COVID en de effecten op mobiliteit. **(Google search, government report)**	Hamersma, et al. (KiM)	2021

Table 2.1 – Literature on factors influencing behaviour

Studies on pandemic impact on car use shows similar trends in travel behaviour. Kolarova, et al. (2021) found that the pandemic has led to an increase in car use and decrease in train use. Their survey specifies that perception of PT has become less and car more favourable, further encouraging regulators to implement measures improving favourability towards PT. Thombre & Agarwal (2021) echo this sentiment, remarking that investment in public and cyclo-pedestrian transport is necessary to counter the shift in favourability towards private car usage. Walking and cycling saw an increase in importance during the pandemic (Kolarova, et al., 2021; Thombre & Agarwal, 2021), increasing academic calls for policy stimulating cycling and pedestrianism (Combs & Fardo, 2021), also aiming to disincentivise car use through limiting car access in the city. A Spanish survey (Awad-Núñez, et al., 2021) during the pandemic, purports that 75% of respondents would accept restrictions on car use post-pandemic. This contradicts the global shift towards car use, yet there are examples of voluntary, limits on car travel. WFH increased during the pandemic, changing travel patterns and attitudes towards commute differently based on factors such as age, income and the nature and distance of trips (Kolarova, et al., 2021; Thombre & Agarwal, 2021). Surveys by Kantar (2021) show attitude towards WFH remaining popular post-pandemic. Academics and policymakers see opportunities to decrease congestion, through using flexible work arrangements (Hensher, et al., 2021).

Other triggers influence attitude besides the pandemic. For example, factors influencing attitude towards car use also influence air travel. Dislike of flying is related to a person's belief in proposed climate change impact (Doran, et al., 2019). Social norms and group interaction have a strong capability for predicting opinions on the curbing of flight activity (Doran, et al., 2019). Online such interaction happens in homogenous social circles (Becken, et al., 2020). Augustine & Balachandran (2021) indicate that an impactful social factor influencing tourism during the pandemic is perceived virus risk. Will such a factor, unlike influence of perceptions on environmental impacts, remain influential towards the end of the pandemic? Attention must be kept on other outside factors socially influencing attitudes towards car use. Being familiar with this notion of uncertainty surrounding pandemic and non-pandemic related variables influencing perspective on travel behaviour, government research into changes to commute behaviour were briefly evaluated. Updates on the state of Dutch travel in December 2021 show that PT use is higher than back in 2020, but still only half of 2019. Car usage averages in intensity at around 80 percent of 2019 at the start of 2021, but will likely reach 100 percent or more in the later parts of 2021 (CBS, 2021d). Expectations by KiM are that changes to the travel patterns will have long term effects on future travel, as total car travel will likely be back at the level of 2019 in 2022, whereas public transport usage possibly won't return to these 2019 levels until 2023 or even 2025 (Verkeerskunde, 2021). Government institutions have conducted broad research into the underlying reasons for these shifts. PBL (2021) and other organisations, have conducted studies including focus group insights and statements, to explore perspective on travel behaviour changes, particularly on the effects of and on WFH. PBL study states that changes to WFH will likely stay, but this differs significantly per sector (Jongen, et al., 2021). Furthermore, research by KiM points out that the position one takes within organisations also impacts the perspective on whether changes to commute, particularly WFH will stay (Hamersma, 2021). The view that's gained through focus group meetings and qualitative analysis does seem to be that for significant groups the positive change in attitude towards the necessity of WFH lessens when not mandatory or enforced.

The exploration of this knowledge gap within this desk study shows that recent changes in the Dutch commuters view of commute have occurred as a result of the pandemic. This opens up two main further points of investigation. The first point is the need for historical context to recent changes in commute behaviour and attitude towards that behaviour, which will be explored within the limited literature review on historic changes in commute behaviour and the view on these changes in government reports. It's important to understand this to study implications of attitude on future policy. The second point is the need for the better categorisation of identified behavioural and attitude changes, to better understand these changes and their possible effects.

2. Literature review - SQ 1

Chapter 3 seeks to conduct a literature review to identify historical trends in Dutch mobility and mobility related policy. It seeks to answer the following sub-question;

Sub-question 1; *What historic and societal developments and trends surrounding car ownership, car usage and government daily (commute) transport policy can be identified, including their influence on travel behaviour change?*

A desk study, mimicking a limited historic literature review, is performed. This review will examine government documents on most important developments in Dutch mobility. Particular focus will be given to changes within personal travel, specifically commute. The review synthesizes government reports written over a period of roughly 35 years, from 1985 to 2021. The longer time period of examination is chosen to give a proper overview of the long term development of mobility metrics, the development and coming into prominence of these metrics within government policy itself, and lastly the interpretation of these evolving metrics and how they impact policy. Overview reports were found through in online archives of the Ministry of Infrastructure and Water management.

Review doesn't exactly focus on the changing of Dutch mobility, but also what variables government services consider to be significantly influential or important within the development of mobility or policy surrounding mobility. The review entails the periods of 1985 to 1995, 1995 to 2005, 2005 to 2015, 2015-2019 and the pandemic period of 2020 to 2021. This last period is examined in more depth as it features the biggest short term changes in mobility, as well as the biggest change in government view on commute policy. Lastly, the sub-question is answered by identifying and summarizing the most important changes identified in the review. Identified variables are expanded and recategorized in SQ 2, which features a more in depth look at pandemic related variables that impact attitude towards the pandemic. The chosen reports are displayed below in table 2.2.

Historical review period	Report title	Author and date
1985-1995	*Trends in het woon-werk verkeer* **(Extensive review state of Dutch transport)**	**(MuConsult, 1998)** *Ministerie van Verkeer en Waterstaat*
	De toekomst van het verkeer in Nederland – de tien belangrijkste trends in het personenvervoer in Nederland **(Future of transport and policy predictions)**	**(Raadgevend Bureau F.M. Roschar, 1997)** *Ministerie van Verkeer en Waterstaat*
1995-2005	*Trends in mobiliteit 2005* **(Extensive review state of Dutch transport)**	**(G.J.A. AI, 2006)** *Ministerie van Verkeer en Waterstaat*
2005-2015	*Mobiliteitsbeeld 2015* **(Extensive review state of Dutch transport)**	**(Kennisinstituut voor Mobiliteitsbeleid (KiM), 2015)** *Ministerie van Infrastructuur en Milieu*
2015-2019	Mobiliteitsbeeld 2019 **(Extensive review state of Dutch transport)**	**(Kennisinstituut voor Mobiliteitsbeleid (KiM), 2019)** *Ministerie van Infrastructuur en Waterstaat*
2019-2021	Mobiliteitsbeeld 2021 **(Extensive review state of Dutch transport)**	**(Kennisinstituut voor Mobiliteitsbeleid (KiM), 2021)** *Ministerie van Infrastructuur en Waterstaat*

Table 2.2 Government reports

This selection is somewhat limited, which could risk arbitrariness in selection or the incorrect assumption of societal consensus towards commute based on examined reports. The chosen overview reports are expansive and in-depth however, featuring plenty of overlap in findings to correct issues in former reports or allow for discussion of findings. Combined with the fact that these are reports (commissioned directly) by the Ministry of Infrastructure and Water management, the quality of reporting is considered to be high enough to avoid mentioned issues with methodology.

3. Desk study - SQ 2

Literature on the identification of frameworks on travel behaviour change, was included through expert recommendation based on their relation to the case at hand. These papers were used to explore the theoretical research gap and answer the following sub-question;

Sub-question 2; *What theory on travel behaviour, regarding the influence of attitude and habit, can be applied to identify the variables in attitude changes towards travel impacted by the pandemic?*

Papers discuss travel behaviour from the perspective of outside and personal factors influencing habitual behaviour. The paper by Van Wee & Witlox (2021) combines different existing theories, applying them to the pandemic using existing socio-economic data to explain changes in travel behaviour, predicting future travel habits. The paper by Thomas et al. (2021) investigates new quantitative data about travel behaviour, during different stages of the pandemic. While theoretically and statistically impressive, both papers mention difficulty determining whether changes to travel habits will persist. The papers investigate mostly external environmental influences and personal socio-economic indicators, negating another indicator of behaviour, namely attitude, discussed in depth in the paper by van Wee, et al. (2019). This model for analysing attitude is further explained within the conceptual model, to summarize; personal attitude can influence an individual's behaviour. Attitudes towards certain subjects themselves can be influenced by 'triggers'. One such trigger for attitude change studied here is the pandemic, among other social and personal triggers.

Further investigation using this model can identify how attitude changes over the long term. This makes identifying this and other models through literature review important, as it will structure variables impacting attitude found in other sections of the report. To apply this framework, a mix of academic papers and grey government reports is gathered through SCOPUS and Google scholar. The primary goal of the desks study is to ensure that there is an overview of the relation between the theory and conceptual model around attitude, as proposed by van Wee, et al. (2019), and the chosen main categories that will structure questions and statements within the Q-methodology questionnaire. Additional literature is identified through limited desk-study, both literature that might offer a different perspective on attitude than van Wee, et al. (2019), or papers that necessarily expand the literature review to more expansively identify the variables influencing attitude, specifically in regards to the pandemic. Those additional papers are displayed below within table 2.3.

Title *(Additional literature used within analysis)*	Author	Year
1. Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren? **(expansion on literature review)**	Rubin et al.	2020
2. User acceptance of electric car-sharing services: The case of the Netherlands **(expansion on literature review) & (expansion of framework)**	Curtale et al.	2021
3. Assessing the impacts of social norms on low-carbon mobility options **(expansion on literature review)**	Mundaca et al	2022
4. Why do you care what other people think? A qualitative investigation of social influence and telecommuting **(expansion on literature review)**	Wilton et al.	2011
5. THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT *(Gov. Report)* **(expansion on literature review)**	PBL	2021
6. Thuis of terug naar kantoor Plus- en minpunten van thuiswerken voor het welbevinden van werknemers *(Gov. Report)* **(expansion on literature review)**	Josten & Merens	July, 2021
7. Onderzoek onder Nederlandse werkgevers (100+ medewerkers): inzicht in maatregelen omtrent duurzaam reisgedrag **(expansion on literature review)** *(Gov. Report)*	Immerzeel, & Mazajchik	Juli, 2020
8. Thuiswerken vóór, tijdens en ná de coronacrisis *(Gov. Report)* **(expansion on literature review)**	Jongen et al.	Januari, 2021
9. Gaat het reizen voor werk en studie door COVID structureel veranderen? *(Gov. Report)* **(expansion on literature review)**	Hamersma et al.	Oktober, 2021
10. Thuiswerken en de coronacrisis -- Een overzicht van studies naar de omvang, beleving en toekomstverwachting van thuiswerken in coronatijd *(Gov. Report)* **(expansion on literature review)**	Hamersma et al.	September, 2020

Table 2.3 Additional literature conceptual framework

Literature identified through desk study is used for application of the conceptual framework.

2.2 Q-methodology - SQ 3 and 4

This section describes the different steps of respondent data gathering and analysis through Q-methodology. It uses data and results attained in chapter 3 & 4. It's divided into 5 different sections;'

1. The description and execution of the desk study on theoretical knowledge gap exploration.
2. The description of the different steps of Q-methodology Q-sort survey set-up.
3. The description of the introduction of dynamism to Q-methodology and survey development.
4. The description of the different steps regarding Q-methodology and survey results relevant for SQ 3, in regards to principal component analysis.
5. The description of the different steps regarding Q-methodology and survey results relevant for SQ 3, in regards to factor characteristics exploration.

1. Desk study theoretical knowledge gap exploration

The current 'state of the art' involving Q-methodology is explored in a limited desk study review to investigate whether there appears to be a need for dynamism in the methodology and to determine how well Q-methodology might fit to the subject of travel behaviour. When searching through SCOPUS, a shifting search query of; **"travel", "behaviour", "attitude", "tourism", "pandemic" AND**

"Q-method" OR "Q-methodology" generated results ending in the low 100, 4 papers were chosen. Additional literature was involved mostly through supervisor recommendation. Q-methodology is a specific method of study, additional search terms remain broad to avoid the pool of results becoming too small. Selection of papers is based on recency, authoritativeness and relevancy to the topic.

Introduction to Q-methodology

Q-methodology is a statistical research method that clusters people in categories based on their opinions on a specific topic (Watts & Stenner, 2005). It measures societal attitudes towards certain topics and has been successful in grouping people's opinions on travel and environmental policy with nuance (Brůhová, et al., 2020; Stevenson, 2015), although those studies only test expert opinion. Q-studies directly related to the topic of travel behaviour are the studies by Williamson (2021) and Lee, et al. (2021), evaluating the experiences of travelers affected by the pandemic. In Lee, et al. (2021) respondents were clustered in groups worried about health, problems during travel, tourism itself and issues within the home area. Research by Kroesen (2013) clustered airpassengers in regards to their opinions on climate change. Studies only indicate an opinion at the moment and the reasons for having it, not how or whether these attitudes had recently developed, underscoring that changing opinions regarding travel behaviour and the pandemic haven't been explored with Q-methodology.

2. Method section – Q-methodology

This section features the executed methodology to attain results analysed within chapter 6 and 8. An introduction and method section description of the first half of Q-methodology is given, explaining the specifics of the method as well as the introduction of dynamism to Q-methodology, outlining the steps starting from the development of concourse, to selection of statements and questions within a survey. The literature review's lower amount of search results on Q and travel behaviour might seem to indicate a weak basis for application of Q-methodology to the subject of travel behaviour. However, as identified in chapter 4 and the theoretical framework, commuter attitude, impacted by outside triggers, can impact travel behaviour. As such, the investigation of attitude towards certain subjects like commute behaviour, is a relevant avenue of study through the use of Q-methodology. Similarly, implementation of dynamism ought be further explored. Chapter 4 further emphasizes change and development of new attitudes due to pandemic related triggers. Reinforcing the need to test whether measuring for dynamism in opinion could be possible within Q-methodology.
Before spreading a survey, Q-methodology goes through several steps within survey creation.

Defining concourse

In Q, the first step is to define the concourse, "*the collection of all the possible statements the respondents can make about the subject at hand. The concourse is thus supposed to contain all the relevant aspects of all the discourses. (…) The concourse may consist of self-referent statements (i.e., opinions, not facts), objects, pictures" (van Exel & de Graaf, 2005, p.4).* This concourse is gathered through various means of data gathering. In this study desk study and survey are used. It seeks to represent existing opinions of the research subject, in this case the opinions of Dutch commuters.

Development of Q-set

Based on the concourse, a Q-set is developed. The Q-set is a collection of " 'heterogeneous items' which the participants will sort. There are many possibilities in this context (…) It is more usual, however, in a qualitative and psychological context, for a Q set to be constituted of statements, each making a different (but nonetheless recognizable) assertion about the appropriate subject matter." (Watts & Stenner, 2005, p.74); The Q-set consists of statements that the researcher has deemed relevant enough to add to the limited group of statement that respondents are required to rank.
A Q-set is structured based on what the researcher considers a representative limited collection of the most relevant parts of the concourse. The structure may arise from examining a large collection of statements, or through more directly imposing it through theory (van Exel & de Graaf, 2005). In this study Q-set structure is based on both methods, seeking middle ground between categorisation of variables identified through literature review and a theoretical framework, and through examining

the concourse that was considered in academic and government focus group and opinion poll reports. Regardless of chosen structure, it's respondents that conclusively give actual meaning to the provided Q-set through their own subjectively based sorting of the statements (van Exel & de Graaf, 2005). Statements within the Q-set are subject to editing where necessary, before they are granted a number and added to the list, to ensure clarity and brevity to benefit the respondent experience.

Selection of P-set

Q-methodological research requires a limited number of respondents. The P-set, the selection of respondents to a Q-method survey, are necessary in numbers enough to establish the existence of a factor for the purpose of comparing factors to other factors (van Exel & de Graaf, 2005). The aim is to have a group of around 5 respondents being representative of a certain factor. In Q-methodology factors represent a significant societal perspective. Respondents aren't chosen based on quantity, but because they're theoretically relevant to the case in consideration. The number of respondents associated with certain opinion clusters is of less importance than the qualitative observation of who that group represents (van Exel & de Graaf, 2005).

Q-sorting

Once respondents are selected, they're asked to rank the statements within the Q-set. This ranking procedure is called Q sorting; "*the technical means whereby data are obtained for factoring (..) is a convenient means of facilitating the (evaluations and) rankings of the participants.*" (Watts & Stenner, p. 77). To aid the orderly inter ranking of the Q-set statements, respondents are asked to assign statements to rankings within a fixed quasi-normal distribution. This Q-sort framework ranges in variables, from most agree to most disagree. Different statements are ranked along this horizontal range based on respondent evaluation, the fixed distribution forcing respondents to deliberate their choice. An example of q-sort distribution (Watts & Stenner,2005, p. 77) is displayed in figure 2.1.

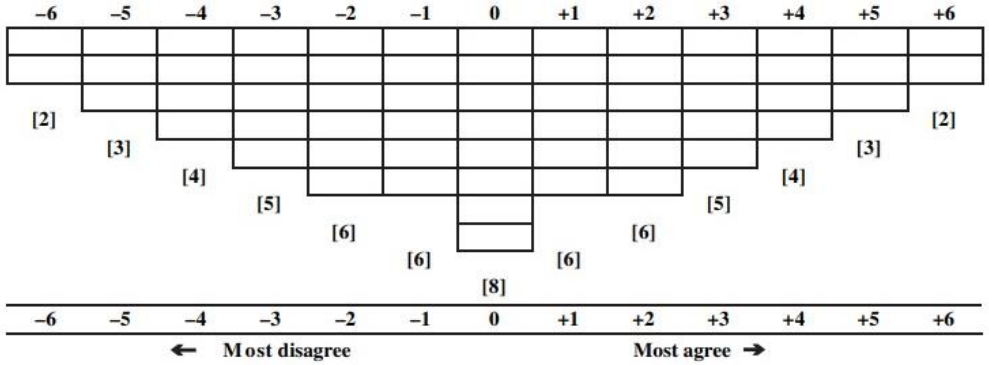


Figure 2.1 Quasi normal distribution

The forced bell-shaped distribution that balances the number of statements on either side of the Q-sort isn't always required for conducting research, but offers a distinct statistical benefit for interpretation. In the case of this project, the Q-sorting will occur online. As Q-sorting is often experienced as complex by respondents new to the methodology, proper explanation of Q-sorting should be added before starting the Q-sorting within the survey (van Exel & de Graaf, 2005).

3. Q-methodology, dynamism and survey development

Watt and Stenner (2005) give a comprehensive overview of the historical development of Q-methodology. Historically, Q-methodology was introduced as an adaptation to an already existing quantitative technique in factor analysis. Stephenson developed this method as an inversion of the conventional factor analysis procedure. Where factor analysis is concerned with a selection of N individuals measured in M variable tests, where identifying intercorrelation between these M variables is the main goal, Q methodology inverts this. Q starts with a population of N tests, often statements, which is then scaled by M individuals, after which the researcher is able to do the conventional factorisation of the intercorrelations between the individuals. This inversion initiated a significant department from the then existent psychological tradition (Watt and Stenner, 2005).

Now within Q, it's N different tests or measurable materials, in this case the statements within Q, not the respondent group that features as the main study sample. Watts and Stenner (2005, p,72) state the following; "*the 'variables' are no longer tests or hypothesized traits, but the various persons who take part in the study (..) persons become the variables of interest in an inverted (or 'Q') study. Such studies actively explore 'correlations between persons or whole aspects of persons' (..). As a consequence of these changes, it is also persons (not tests, traits or other types of variables) that load onto the emergent factors of an inverted factor analytic study.*". It allows creating respondent guided opinion clusters through this factorisation. Factors represent significant respondent societal opinion attitude groups. Following this historical trend of methodological innovation, this study implements a new methodological change. It investigates whether it's useful to make changes to the N variable tests through the introduction of dynamism, measuring change in opinions, to the statements and questions that are posed to the M respondents. As such it will through Q's inverse factorisation, seek to create attitude clusters based on the change in attitude of the respondents, rather than the at that moment stagnant opinion of the respondent group. This difference is displayed in figure 2.2.

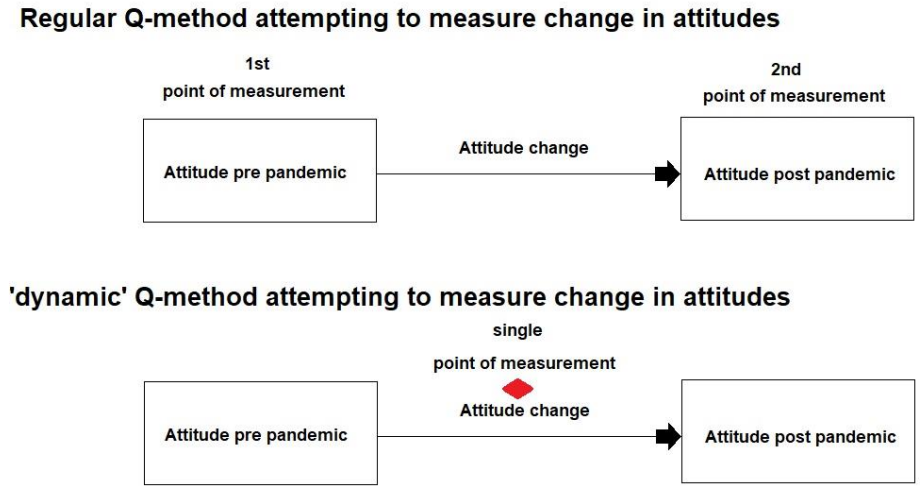


Figure 2.2 Dynamic Q-methodology

A change to dynamism might allow for Q-methodology to forego needing multiple consecutive Q-studies to identify a change in attitude. The old method is flawed, as Q identifies a diverse set of significant attitude clusters, but isn't meant to quantitatively measure the size of factors, making it impossible to identify a change of respondents between attitude clusters, unless other types of quantitative statistical research based on the identified factors is carried out. On the other hand, dynamism invites further complexity in survey of respondents unsure on how to rank statements based on change in their opinion, rather than based on their current opinions. Furthermore, a cluster based on change in attitude might give the wrong impression of attitudes held in society; A positive shift in attitude on car use doesn't necessarily indicate car use is being held more favourably than other travel modalities, as it could also represent that attitudes of fervent car users were reinforced. Researcher interpretation of factors remains important in Q-methodology and evaluation of the new method results will thus also rely on the researcher and the feedback respondents provide.

Steps of Q-methodology - Subject categorisation and Q-set development

This section recategorizes findings of chapter 3 and uses them to develop a Q-method questionnaire through building a concourse that's structured by these recategorized findings. This is done in several steps. Firstly, after identifying the most important influencing factors on attitude towards travel behaviour through desk research in the last chapter, these triggers and other variables are grouped and recategorized on a subject basis. Afterwards, a concourse is developed by conducting several respondent surveys, as well as doing surveying research literature published by CPB and other public government institutions into views on travel behaviour using focus groups, to create a list of claims and statements about the daily commute and perspectives on the 4 specific modalities. Conclusively, this list is cut down to a useable sourced selection within development of a Q-set for later

development of an online questionnaire. A suitable Q-sort distribution framework and the set-up of the online survey, including post Q-sort questions to define the P-set, supplements this list to gather information on influence of personal characteristics and variables and allow respondents to evaluate the questionnaire they filled out. This section functions as partial execution of the first half of the method section due to method execution being linked to the nature of the subject discussed.

Categorisation of variables

Insights from chapter 3 through use of the conceptual framework are converted to subject categories more easily useable for Q-set development. The most important triggers and factors influencing commute related attitude change were gathered and explicated using the theoretical framework. Making an additional distinction between pandemic related variables and other significant influencing variables, for example economic variables or environmental variables, is necessary as this study seeks to primarily focus on pandemic related impact on attitude towards commute.

When starting to make these categorical distinctions, the dually divided empirical knowledge gap introduced within chapter 1 is the main divider between the categorical trigger clusters that causes this subject category spread. On the one hand emphasis is put on the impact of the pandemic on the attitude towards the use of the three main 'classic' travel modalities, with emphasis on car use, and on the other hand extra focus will be given to the newcomer 'modality' in working from home (WFH) and how it impacts the attitudes towards commute behaviour.

Table 2.5 displays the categorisation of triggers into subject categories and motivation for inclusion of categories into the further study. These categories were deduced based on the triggers gathered through the conceptual framework and other aspects identified through desk study, such as the selection of the 4 main commute modalities and aspects of these modalities as identified through interview and government reports. Trigger numbers correspond with their number in table 4.1.

Subject related categorisation	Triggers/variables within category	Relevant to pandemic case
Environmental	1,2	No, this subject is quite far removed from the (post)-pandemic case.
Societal safety	13	No. While social safety related variables might have become more influential on behaviour during the pandemic, as concepts such as hygiene and virus risk might have overtaken older concepts such as car crash related injury, the hypothesized expectation is that most of these worries will disappear with the pandemic. PT use change also largely implicitly includes the effects of social safety, making it redundant.
Car Use	5, 14	Yes, as primary method of commute transport and in effect significant driving contributor to the congestion crisis, investigation into attitude around car use is a must. Further investigation is required.
Car Ownership	14	Yes. This concept is separated from car use, as phenomena like change in car sales, mentioned within chapter 1, can perhaps be spurred on by other societal changes that impact ownership differently than usage.
Bicycle use and walking	5,15	Yes, as one of the main three commute modalities this category requires inclusion.
Public Transport use	6,16	Yes, as one of the main three commute modalities this category requires inclusion.
Employer cooperation related variables	9	Yes, (social) interaction between employer and employee seems to impact attitude towards WFJ thus impacting commute behaviour.
Employee cooperation related variables	8	Yes, (social) interaction between employees seems to impact attitude towards WFH and thus impacts commute behaviour.
Impression on WFH (as a modality replacement)	3,4,12	Yes, working from home was often introduced as a (forced) replacement for commute, which has impacted attitude towards past and current commute habits.
General impact of WFH on travel behaviour	5,6,7	Yes. The effects of WFH impacts travel behaviour through the necessitated change in commute behaviour, impacting attitude.

Table 2.5 Trigger-subject categorisation

These chosen categories and their interconnection are displayed in figure 2.3. The categories are largely spread between, on the one side attitude change towards the 'classic' commute modalities of the car, PT and cyclo-pedestrianism, and on the other side categories related to widespread introduction of WFH and the structural changes to commute behaviour it has spurred on.

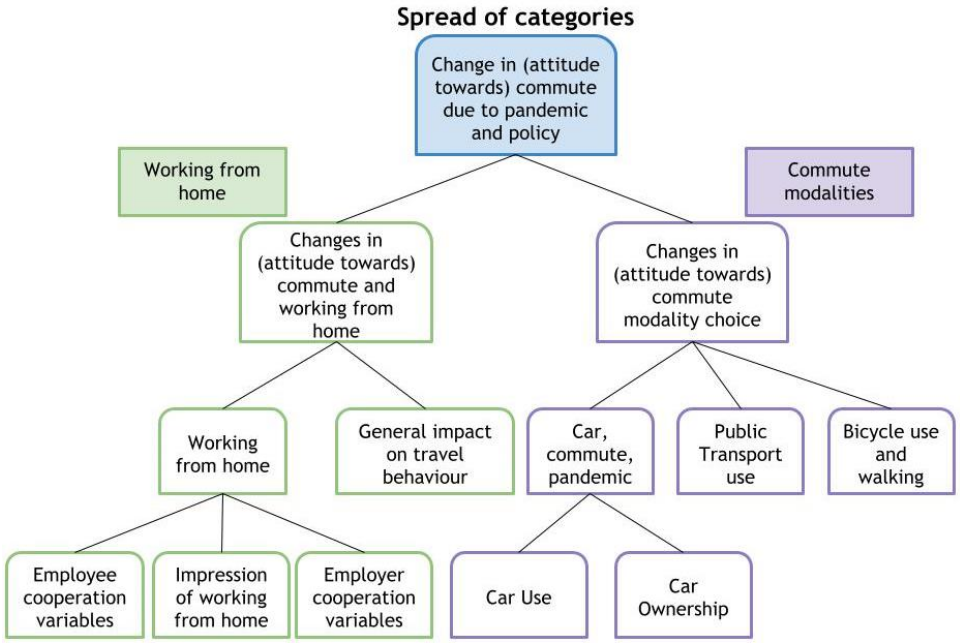


Figure 2.3 Subject category spread

Concourse development

Within Q, the concourse is used to develop a set of statements within the questionnaire. To create this concourse, data is gathered through multiple avenues. One of the main goals within concourse development is ensuring a wide spread of statements is gathered. The trigger inspired categorisation of subjects helps concourse construction. Statements were gathered through 2 different methods.

Firstly, a desk study was conducted on both academic and grey government reports in search of opinions and statements on pandemic induced changes to travel behaviour. One of the prerequisites for finding statements is that they not only relate closely to the pandemic, but also include a sense of dynamism within the statement. As such, the statement would need to feature opinion change, or data gained from opinion polls would need to feature such a type of opinion change. Because of this, especially government reports featuring focus groups and academic literature featuring opinion polls were used. This brought forth the issue that recent publishing of opinion polling and focus groups, particularly within government reports, focuses near entirely on the new subject of WFH. While this created a wide spread on this subject and the left half figure 2.3, this left the right half lacking. Especially when making a selection of useable statements for the concourse, the right side on transport modalities was left rather barren. This desk study gathered around 200 statements.

As such, secondly, a limited informal survey was conducted to gather more statements on the change in attitude towards travel modalities. The desk study primarily identified statements on WFH, this limited survey helped fill in blanks within the other half of the diagram. The survey featured 8 main questions corresponding with the subject categories within the diagram. The survey allowed for open responses and was spread among varied Dutch adult respondents within the researchers' personal network. The goal was a participation of around 10 respondents to allow for a general overview of held opinions within Dutch society, deeming this number to be somewhat representable for a limited selection of largely subjective statements. The survey questions can be found in appendix A. Besides instructions, the survey had several requirements for participating. The most important of these requirements were as follows, as respondents were only allowed to participate if;

- It's possible for the participant to (partially) work/study from home, or they have worked/studied (mandatory or not) from home, for example as a result of the pandemic.
- The respondent was over the age of 18 years old.
- The respondent was currently working and/or studying, or had worked and/or studied in the past 2 years during the pandemic.

11 respondents gave their input and this resulted in a total of 88 statements. The responses offered a wide spread of opinions on attitude and behaviour change as a result of the pandemic. During the gathering of responses no personal data was gathered and the respondents remain entirely anonymous. In total between both methods, a concourse of around 250 statements was gathered.

Once a broad concourse of statements is gathered, a selection of these statements included within the Q-set. The researcher needs to ensure that the Q-set contains a broad representative sample of the concourse (van Exel & de Graaf, 2005). These statements will have to be categorized under the different subject categories. This results in a limited selection of around 50 statements as displayed in the figure 2.4. The aim is to allot around half the Q-set to both categories. Car use takes focus over the other two main modalities, due to its outsized influence within this study and broader subject due to the duality of use and ownership. The category based on WFH also involve statements that might not be directly related to attitude in regards to commute. This might seem unwanted, however the experience with WFH as a whole, will influence its viability as a replacement of commute towards on-site business. Thus it will be included. The Q-set is roughly structured as displayed in figure 2.4.

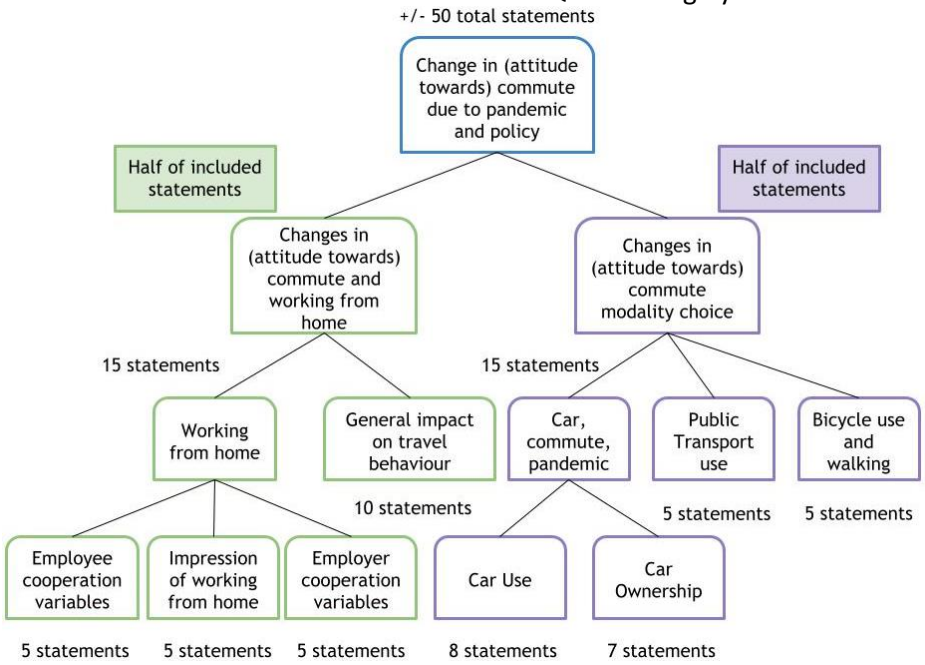


Figure 2.4 Projected statement distribution Q-set

Q-set development

In the last step of Q-study development, a process of slimming down and categorising the gathered concourse is performed to establish a limited Q-set. This Q-set of statements is a representation of the spread of opinions and statements surrounding the different categories that were established and largely follows the proposed categorical set-up established earlier in this method section. A selection of statements included in the Q-set is made between all statements in the concourse. They're selected based on their connection to the subject in discussion and variety in contents. The finalized Q-set includes a total number of 50 statements, mostly conforming to planned category sizes to ensure proper representative spread of statements within a category. The final spread is displayed in figure 2.5. It features the additional category of characteristics regarding commute itself, which does not conform to the two categories, but influences commute behaviour.

To summarize Q-set creation, the chosen statements were primarily gathered through survey use, as statements regarding in particular specific modality choice, were rather scarce in the examined literature and thus hard to come by when investigating changes in attitude due to the pandemic specifically. Statements were often partially rewritten to be shorter or more clear to respondents. This was done to allow for more time efficient ranking of the statements by respondents as the Q-set of 50 statements is rather large. It was also simply a necessity on the logistical side of creating the Q-

study survey, as program limitations required shorter statements to be input. Within shortening or clearing up statements, care was taken to not lose the intent or meaning of the original gathered statements. The full selection of statements comprising the Q-set can be found in appendix G.

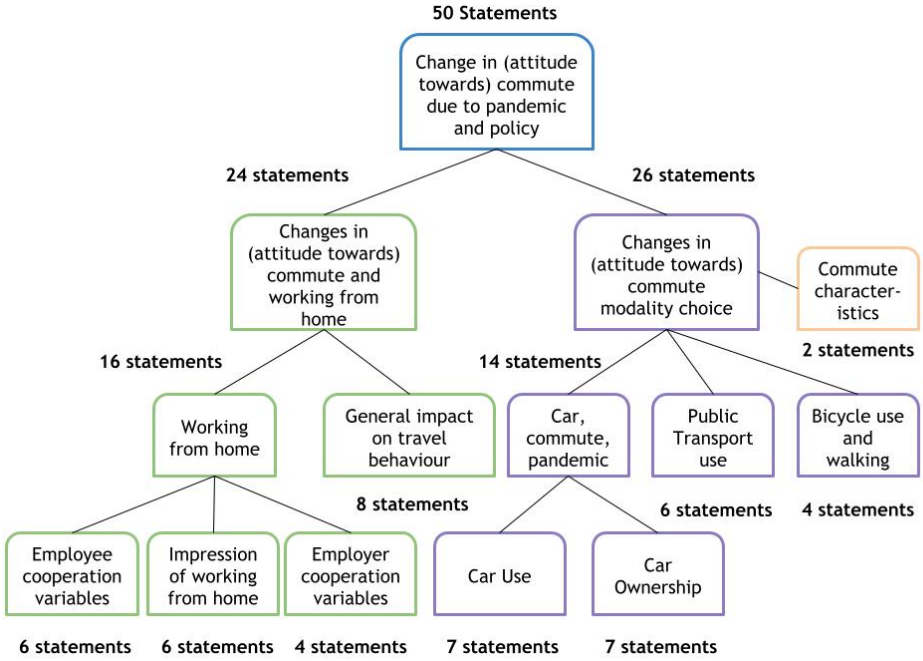


Figure 2.5 Final statement spread for Q-sort

Final forced Q-sort template

This results in a Q-sort template that hold the following form and distribution;

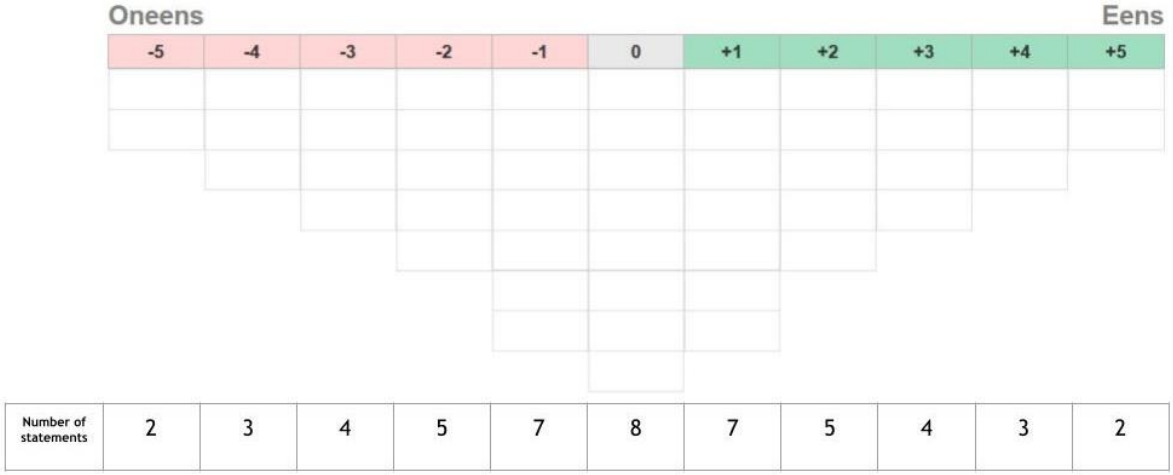


Figure 2.6 Q-sort template

The template features a bell shaped distribution that is a relatively weighted towards the middle, around the neutral stance towards the statements within the Q-set. This is done for several reasons; Firstly, when testing Q-sort out among 'laymen' participants, during the initial statement distribution an equal distribution of statements was generally present, with a significant amount of statements being regarded as neutral. Thus more space for more neutral opinions is reserved. This also forces respondents to more deeply consider what statements they feel more strongly about in the Q-sort.

Secondly, theoretically one could expect respondents not to feel strongly about their change in attitude towards commute modalities they haven't been using or aren't using now. A car user could be rather indifferent towards changes in attitude regarding public transport or cycling and walking to work. As such, a good portion of the Q-set, particularly the right side within the categorical diagram, is bound to be regarded as neutral regardless of other changes in attitude due to the pandemic.

Spreading survey

Lastly, the developed survey is spread among respondents that fit the requirements for being part of the desired P-set. To reach respondents, letters of invitation were sent out through various social media channels towards respondents within the researcher's professional circle. A more in-depth version of the methodological breakdown of spreading the survey can be found in appendix D.

4. Factor analysis clustering – SQ 3

Within this section an insight is given in the most important steps during factor analysis done on the data gathered through the online Q-sort survey. It uses the ranked Q-sort results of a 50 statement Q-set for a total of 51 respondents within the P-set that is explored in chapter 6. Data was cleaned when necessary, afterwards factor analysis was applied until a satisfactory result was achieved. These results are used to answer the following sub-question;

Sub-question 3; *What different perspective clusters on changing attitude towards car ownership, usage and travel behaviour can be found within Dutch society, in regards to pandemic impact?*

Data cleaning and reorganisation

Firstly, data files generated from the online survey are gathered. Raw results are delivered in .JSON formatting, requiring conversion to .CSV or .XLSX formatting to be useable within most data analysis programmes. Use was made of the data analysis program SPSS for most raw data analysis. Other software, like KADE v.1.2.1. which was made available alongside Easy HTML-Q the program used to set-up the online survey, was used for doing calculations specifically on Q-sort results and factoring.

Data received from respondents largely required no cleaning. Due to research set-up, all questions were answered within required boundaries (no non-allowed answers within the Q-sort and post Q-sort questionnaire). The sole exceptions were several unexpected results regarding the age variable within the post Q-sort questionnaire. However, those problems did not negatively impact other data or results, particularly the results of the filled out respondent Q-sorts. As was required for handing in responses within the online survey, all respondents have complied with forced Q-sort distribution and fully filled out the premade mould. As such, the only required changes to responses within the final datafile was change in respondent ID for easier legibility and the transposition of respondent Q-sorts from the original datafile as to allow for respondents to function as variables within SPSS.

Calculating correlations, factorisation and factor rotation

Once data was made suitable for analysis, correlations were calculated between all respondents. As respondents are now 'coded as variables', it's possible to calculate correlations between all 51 respondents. These correlations serve for the development of factors through principal component analysis. A cursory glance over all intercorrelations between respondents shows a majority in positive correlation, with even mild neutral correlation values approaching 0, compared to the scarce amount of negative correlation. This could indicate a shared view in perspective among many respondents and the existence of perspectives that assign different value to variables, but aren't fully opposed to the views of other respondents. On the other hand, there is only a small group of respondents generally diametrically opposed to the 'consensus' held among most respondents. This likely spells that most identified perspectives will largely agree on many subjects, whereas the amount of identified perspectives diametrically opposed to these other perspectives will be limited as well.

Based on these results, a principal component analysis was carried out. This resulted in a wide array of different factor loadings for different respondents on a selection of initially 15 factors. A factor loading represents how strongly a respondent 'fits' into an identified factor. 15 factors was rather high, but this was intentional as a method of working down to a suitable amount of factors. To more easily approach simple structure, especially on the large amount of 51 respondents, the choice was made to employ Varimax rotation to make analysis more accessible for the researcher. When doing this, the factor loadings for the different factors are calculate differently, oftentimes become more specifically loaded upon a specific factor, increasing the ease of interpretation for the researcher.

Preferably, when identifying the necessary amount of factors, the number of factors should be limited to allow for easier analysis and to ensure sense of distinguishable identity and significance to factors that are able to incorporate a decent amount of respondents into the societal perspective they are supposed to represent. The 'optimal' amount of factors is preferably a lower number, however more factors might be necessitated based on statistical results indicating a far wider spread of significant attitude clusters (societal perspectives). When identifying the necessary amount of factors based on factor loadings, the baseline for stopping the decrease of investigated factors is when a minimum number of 3 respondents load the highest at a value of 0,5 or higher on every factor. The principal component analysis and varimax rotation started at 15 factors, iteratively decreasing to 8 variables at which the prerequisites for an optimal solution was reached.

Number of factors	Eigenvalues	% Explained Variance	Cumulative % Explained variance
Factor 1	13.06	26%	26%
Factor 2	4.83	9%	35%
Factor 3	3.22	6%	41%
Factor 4	2.52	5%	46%
Factor 5	2.09	4%	50%
Factor 6	2.02	4%	54%
Factor 7	1.81	4%	58%
Factor 8	1.75	3%	61%

Table 2.5 Difference in explained variance for different numbers of variables

Table 2.5 and the scree plot in figure 2.7 show the general declining gain in attained explained variance per generation of additional variable. In that sense, this shows more reasons to cut the generation of factors of at 8 factors, the gains simply being too low to continue factor generation. It must be noted however, that a cumulative explained variance of 61% at 8 factors seems rather low. This is likely due to the fact that the large amount of respondents as well as the large size of the Q-set simply, combined with the broad range of topics discussed within the Q-set, make it impossible to explain more than just over half of the variance within a limited selection of 8 factors. Responses are simply too diverse. A total explained variance of 61% is satisfactorily high for this broad subject.

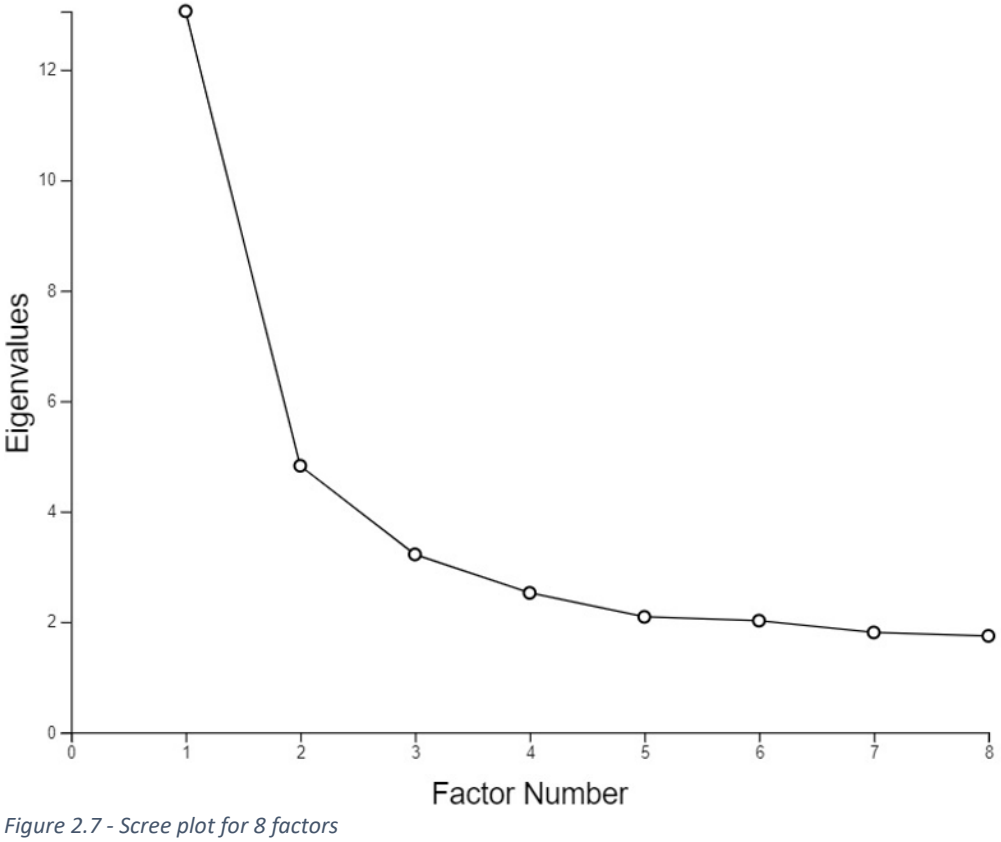


Figure 2.7 - Scree plot for 8 factors

Once these 8 factors had been generated, additional analysis ensured that among these factors 3 or more respondents, or respondents in general, load on a factor at a factor loading value of 0,5 or higher. Not that they load at a large negative value of less than -0,5. Respondents with these high negative factor loadings might have been wrongly assigned due to issues within rotation, looking for the largest value, not the most positive one. Some respondents were wrongly assigned to factors and had to be reassigned. Within table 2.6 the respondents that were initially wrongfully assigned are displayed, including their initial varimax and varimax rotated factor loadings. When respondents were wrongfully assigned due to a large negative value being bigger than the largest positive value, they were reassigned to the factor with the largest positive factor loading within the varimax rotated matrix. This was the case for 3 respondents and didn't change the total number of factors as these respondents weren't part of factors that would decrease to less than 3 respondents after relocation.

Initially assigned factor	Factor Loading (Varimax rotated)	Factor Loading (Regular Varimax)	Newly assigned factor	Factor Loading (Varimax rotated)
1	Respondent 19 = -0.7799	Respondent 19 = -0.5547	3	0.226 *(Very weak, but highest value)*
7	Respondent 20 = -0.4673	Respondent 20 = 0.2095	3	0.3947
5	Respondent 9 = -0.4951	Respondent 9 = 0.3171	1	0.4724

Table 2.6 - Factorswap of respondents

Respondents 20 and 9 were easily reassigned to new factors, whereas 19 loaded badly on most factors, being reassigned to factor 3 with a rather low factor loading value. Based on the assignment of these respondents, factors characteristics are calculated, including the Z-scores, a mathematical score showing the level of respondent (dis)agreement with statements within a factor.

5. Questionnaires post-Q sort – SQ 4

To examine the effects of attitude on behaviour, the responses regarding commute behaviour should be examined for the respondents within identified societal perspective clusters. The limited amount of responses should be able to give an initial indication on whether expectations on behaviour are correct based on identified attitudes. This is done to answer the following sub-question.

Sub-question 4; *What are the possible behavioural effects on commute behaviour, of the identified changes in attitudes towards commute within perspective clusters?*

After filling out the Q-sort, respondents are asked to define themselves to more properly in order to;

1. Define the P-set's commute related personal characteristics and gain an overview and understanding of who the respondents are that participated within the survey.
2. Investigate whether the commuter characteristics that were surveyed feature any clear interaction with certain statements or even factor profiles within the Q-sort.

The variables that are requested within this section of the survey are based on variables that were also investigated within other studies on travel behaviour change related to the pandemic that proved to either be significant within those studies, or that are of significance as a result of the former literature reviews and the subject of this study. This post Q-sort questionnaire can be found within the second half of appendix G (table G.2) and is divided into two halves;

The first half of the questionnaire inventorises respondent characteristics that might be of effect on attitude towards commute and thus relevant for this thesis, such as age or education (Rubin, et al, 2021). This includes questions #1 through #6. Cited sources refer to government or academic reports stating that these variables have some influence on commute behaviour regarding the pandemic. Particular interest is given to questions regarding respondents' work situations it's expected that this will have an impact on the attitudes that were developed by a respondent, particularly towards WFH. Trigger inventorisation through the conceptual model showed that circumstances at work seem to play a strong role within the engagement in WFH, also mentioned by Hamersma, et al. (2021).

The second half of the questionnaire, questions #7 through #10, look directly into actual commute behaviour change that occurred over the pandemic. Results of these questions can be used to gain a clear sense of commute change across the entire P-set. To a lesser extent these empirical results on actual behaviour can be used to gain some form of indication whether attitudes identified within a certain factor actually influence behaviour they were expected to, by comparing these results with their corresponding respondent's factor attitudes, particularly z-scores gained through factorisation.

6. Summary conclusion

The aim of this chapter was to identify different subjects and statements that needed to be included within the Q-sort survey. This was done through recategorizing the pandemic related triggers, towards subjects more aimed at the contents of the triggers, rather than their categorisation within the conceptual framework. This resulted in 8 subject categories, namely Car use, Car ownership, Public transport use, Bicycle use and walking, General impact on travel behaviour by working from home and COVID policy, General impressions on working from home itself, Employee cooperation related variables, Employer cooperation related variables. One category, Commute characteristics, was added into this selection later based on literature that explicated commute on its own as subject that required input from respondents. Among these statements care was taken that policy relevant statements were included. Furthermore, additional questions regarding respondent commute behaviour, commuter characteristics and workplace characteristics were drafted, to aid in the interpretation of the Q-sort results. This survey is spread as described in Appendix D.

2.3 Evaluation of results - SQ 5 and 6

Lastly, in this section a short insight will be given into the methodology behind evaluation of results regarding both methodological as well as empirical findings within this master's thesis.

1. Evaluation regarding empirical results and policy – SQ 5

Identified societal perspectives and what these changes in attitude might mean for current prevailing government policy regarding are analysed through desk study. The risks of the approach to the sub-question are a result of issues in former chapters. If survey results are unusable, this SQ must be analysed through additional literature. The sub-question is as follows;

Sub-question 5; *What are the implications of the findings for government and possible impact on prevailing government policy?*

Answering this sub-question is rather straightforward, as statements regarding policy or statements on attitude change strongly related to policy or long term behaviour change evaluated for the different identified factors. This is done through more specifically analysing the Z-scores different factors have for policy related statements, indicating a communally held opinion among the respondents within said factor. In a larger sense, policy trends identified in the historic literature review desk study of chapter 3, as well as more recent policy proposals identified in concourse development, will be compared to the identified societal perspectives.

1. Evaluation response regarding Q-methodology – SQ 6;

Lastly, respondents that are part of the P-set are asked to evaluate their experience with the survey, particularly with ranking statements within the Q-sorts. This will firstly include an evaluation of how respondents experienced ranking choices within the Q-sorts. Secondly, questions are asked regarding the request for respondents to account for dynamism in their attitudes during the ranking within the Q-sort, to measure their experience with accounting for change in their attitude, important parts of the questionnaire are displayed in table 2.8 to answer the following sub-question;

Sub-question 6; *What facets of Q-methodology have shown the need to be adjusted to account for dynamism and change within perspective?*

		Choice options
#1	**Were you able to easily rank statements based on your opinion?**	**Multiple choice:** Yes, I found this easy.; No, I experienced difficulties with this.; Neutral/No opinion.;
#3	***This study specifically looks at dynamism in attitude, i.e. statements that usually feature a change in your opinion as a result of the pandemic, instead of a current static opinion.*** **Were you able to easily rank statements based on change in your opinion?**	**Multiple choice:** Yes, I found this easy.; No, I experienced difficulties with this.; Neutral/No opinion.;

Table 2.8 Q-method survey evaluation (full questionnaire can be found in appendix G, table G.3)

Expectations on the results to these questions are split. Q-methodology can be experienced as complicated by respondents. The respondent experience with dynamism is perhaps more important within this study, however there is no clear prognosis on how respondents will respond. There is also the expectation that the open questions will be used for all different manner of responses regarding the survey. The sheer possible variety of responses and particularly the ability of the respondent to give more in-depth insight into their experience with the survey, will likely make these responses to open questions the most valuable for evaluation of Q-methodology and the survey as a whole.

This ends the methodology section. The report from here on forward executes said methodology and most important results are reported within this main report, or referenced within the appendices.

Chapter 3. Historical trends in mobility and policy

This chapter seeks to identify recent historical trends in Dutch mobility and related policy. These historical trends in mobility on how commute and policy are viewed saw significant shake-up due to the pandemic and pandemic related policy. It's necessary to gain an understanding of overall trends in private car usage and other travel modes, to determine yet unexplored longer term effects of the pandemic (Van Wee & Witlox, 2021 ; Thomas et al., 2021) on changes in these trends. In short, there's a need to investigate the history of change in commute behaviour and attitude towards that behaviour. Analysing past change will better put into context recent and current change, as well as it's possible lasting effects. The car has within the last few decades become the most widely used commute modality among the main 3 modalities of car, PT and cyclo-pedestrianism, seemingly serving as a structural fallback option for other modalities, whereas government policy is usually to shift away from the car. This relationship between travel modalities is further complicated by the emergence of a serious fourth 'modality' in the form of working or studying from home.

This review investigates the history of behaviour change and to what extent the attitude commuters have towards commute has been taken into account within overview reports. This in turn gives an indication into different policy trends and what variables are generally measured and considered within commute policy. Conclusively, this chapter answers the following research sub-question;

Sub-question 1; *What historic and societal developments and trends surrounding car ownership, car usage and government daily (commute) transport policy can be identified, including their influence on travel behaviour change?*

To answer this question a limited historic literature review is performed. Methodology can be found in chapter 2.1. The review synthesizes government reports written over a period of roughly 35 years, from 1985 to 2021. The longer time period of examination is chosen to give a proper overview of the long term development of mobility metrics, the development and coming into prominence of these metrics within government policy itself, and lastly the interpretation of these evolving metrics and how they impact policy. The review won't fully focus on changes in Dutch mobility, but also what variables government considers to be influential or important within development of mobility or surrounding policy. Identified variables are expanded and recategorized in chapter 4 through a more

in depth look at pandemic related variables impacting attitude towards the pandemic. The review is fully featured in appendix F, this chapter gives a summarizes parts of importance.

3.1 Structure of the reports

These different reviews generally follow the same structure, as they've continued to primarily survey the same variables and subjects concerning Dutch transport since the 1998 report by MuConsult. What's interesting, is that these large overviews focus less on commute behaviour as time goes on, opting for a broader overview of all relevant travel behaviour. Commute and work circumstances become aspects or footnotes. This is interesting, as 2021 reports see a serious change in this trend of review, as commute behaviour change regains prominence in the review as a result of the pandemic.

The initial report on development around commute travel in the period 1985 to 1995 serves as a baseline for a framework on synthesising the most important variables influencing commute travel. Review is structured along the four main categories that it identifies as the most important variables influencing mobility and particularly commute travel;

1. A basic overview of the most important changes to travel behaviour within and metrics measuring the developments in commute travel.
2. The characteristics of the nature and size of employment, as these factors, in combination with spatial spread of living and working influences commute travel.
3. The characteristics of the different transportsystems utilized as travel modalities for commute and the developments within these systems.
4. The transport policy of employers in influencing employee travel behaviour.

Future reports, while structured differently, continue to roughly make use of these more concretely measurable 'econometric' variables for further analysis of Dutch mobility. Focus on the influence of specifically commute and variables related to commute tends to slowly disappear from reports. Seldom new variables are added as similar values are measured throughout most reviews. Before moving forward to other reports, the future prospects at the time for Dutch commute and general traffic developments are evaluated using the report by Raadgevend Bureau F.M. Roschar (1997). Written at the end of the first decade reviewed in this study, the then current and projected future state of Dutch traffic issues is evaluated based on the input of a wide range of government specialists within the field. Advice is given for future policy.

Even at this time, the report identifies that the most pressing traffic challenge appears to be congestion, costs of said congestion and that issues due to that congestion aren't easily solved. The Dutch citizen is committed to the car, as it offers freedom, privacy and comfort, as well as serving as a status symbol. While PT is referred to as a possible solution to congestion, it's also identified as too slow, infrequent or unreliable to be a real alternative to the car. Limitless road construction is seen as impossible and costly, leaving only options for policy that limits car use itself. Propositions of road pricing are already mentioned, but seen as unsupported. Outside of the competition between car and PT, other modalities aren't really mentioned. Based on these challenges, predictions are given for future traffic and policy developments until 2030, a date that we're slowly approaching a good 25 years later. The most important parts of the predictions were summarized;

As transport becomes faster and people will live further apart, car use will explode, exacerbating congestion issues. The car will make itself impossible as mobility growth will decrease and mostly come through PT. Congestion causes car travel to continue to cost more time, lowering its reliability. Societal change will see the car becoming less of a status symbol. Parked cars clog the street, making travel more difficult, as recreational activities close to home will impossible as parks and nature are sacrificed for car parks. In need of alternatives to car ownership, politicians are encouraged by their constituents to tackle the car and its issues with policy. The writers expect a significant growth of resentments towards the car, envisioning a situation where owning and operating an automobile becomes so expensive that people will only own a car out of necessity. Bikes become an alternative

in the city, car-on-demand services replace ownership and the number of company lease cars decreases. One can wonder whether this prediction of anti-car sentiment was reasonable, or wistful thinking on the part of those opposed, rightfully or not, to further expansion of car use.

Car use and travel is predicted to increase in price, more closely matching its 'real' cost; Travel will become far more expensive. Unprofitable trainlines will be scrapped whereas new PT-chipcards (OV-chipkaart) and flexible pricing will inadvertently eventually increase cost. Technological advancement will improve the comfort of PT through expanded telecommunication facilities and the ability to plan travel post train-trip. As PT gains a stronger position within the Randstad, through the introduction of new (unmanned) transport systems like people movers, the car is pushed out of the city, reigning in rural areas of the country. New types of car will be developed. Small plastic 'urban' hybrid cars, using gas on highways and electricity within the city, will become the dominant car, eventually becoming self-driving to facilitate comfort and the ability to work during commute. Interestingly, while electric and hybrid cars have become more popular in the modern day and self-driving concepts are being tested, those cars have certainly not decreased in size the way its predicted here. 'Call-a-car' concepts are predicted to overtake car ownership. Self-driving car concepts, coordinated by government infrastructure, will decrease the freedom of the traveller in a similar to PT. Interestingly, video-conferences are mentioned here for the first time in the review, serving as a replacement for a car ride when a MAAS-type service is unable to offer a car, not a modality of alternative of its own.

As the car made spread living and working increasingly accessible, this leads to spatial planning to create urban cores that mix living, working and recreation to limit long distance movement and avoid congestion. It's questionable to what extent this fixed problems around environment and congestion, while it's become clear that spatial planning will hardly fix future issues. Government making laws from a higher position of power is predicted to fade, as hierarchical policy implementation makes way for necessitated cooperation between companies, citizens and government. Transport policy becomes a joint venture. Whether predictions made in the late 90's appear to ring true in later decades can be considered through different reports of the ministry of infrastructure and water management. Reports focusing specifically on (daily) commute related travel also become scarce, as the topic becomes integrated into broader mobility and travel review. From 2015 onwards these "Mobiliteitsbeeld" mobility reviews of historic government reports start reaching a mostly standardized state. Where it's noticeable that reports Mobiliteitsbeeld 2019 and 2021 respectively, offering a pre and post pandemic view on the published general government overview on Dutch mobility, once again give a more in-depth indication of the effects of the workplace on commute.

Summary conclusion per research question

This subchapter was written with the goal of answering the SQ 1. This question can be shortly answered in 3 different categories, regarding behaviour, policy and the identification of attitude. In depth explanation can be found in appendix F, where sections 1 through 4 give a full explanation.

3.2 Summary conclusion on the historic changes within mobility;

There's been declining growth in individual mobility, as average daily trips per person decrease from around 3.3 to 2.8 over a 30 year time period, even before the pandemic (MuConsult, 1998; G.J.A. AI, 2006; KiM, 2019), likely as result of increased distance travelled due to more spread living-activities (F.M. Roschar, 1997). However there has been an overall growth in mobility in the sense that travel distance continuously more slowly increases. Simultaneously, congestion continuous grew over the years, particularly during the evening rush which is related strongly to commute traffic. However, most commute related congestion during morning rush is caused by an increase in task combiners (G.J.A. AI, 2006). Were it not for the 2008 recession or the 2020-2021 pandemic lockdowns, mobility growth would have pushed congestion to be far higher. This can be observed within figure 3.1 based on data from KiM (2021), further emphasizing the impact of the pandemic. What must be noted however, is that this structural decrease caused by infra expansion and the recession was recovered in a 5 year period.

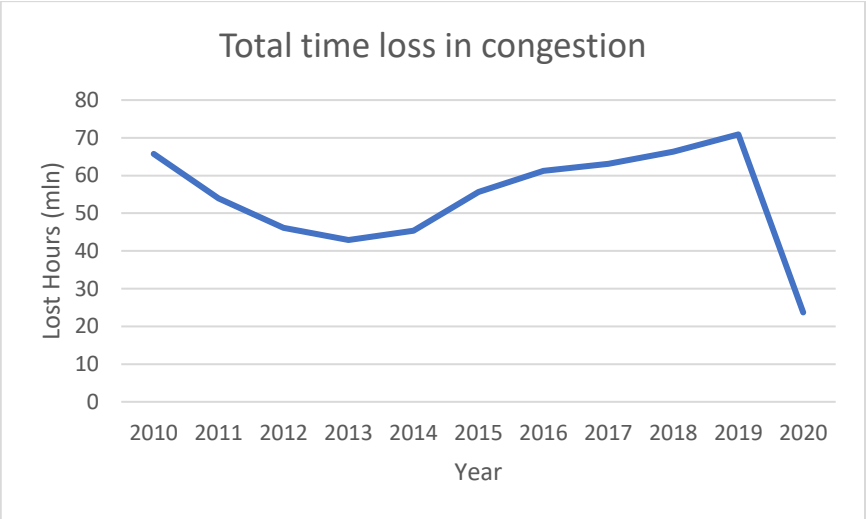


Figure 3.1 Total time loss in congestion

The share of car use decreases slightly moving from around 80% to 70% (G.J.A. AI, 2006; KiM, 2015). This is pushed by the modality of car operator, relative to other modalities and in particular at the expense of car passengers, growing most over the entire examined period. This is pushed by growth in task-combiners, part-timers and carpooling seemingly going out of style. Changes occur in PT use as train use seemingly mostly grows at the expense of bus use, increasing distance by a lot, but being limited in trip growth, emphasising importance on increasingly longer distance commute (MuConsult, 1998; G.J.A. AI, 2006). During the pandemic travel mode usage decreased, more during the first than the second lockdown, causing a structural decrease in use of travel modalities post pandemic. This is likely due to differences in policy (KiM, 2021), portrayed in table 3.1, as well as difference in attitude.

Stages of lockdown policy	**Government policy**
Stage 1 – January to march 15	Pre-covid/lockdown period
Stage 2 – March 16 to May	Implementation of the intelligent lockdown that enforces the closure of non-essential business, prohibits gatherings, in-person education and non-essential PT-use.
Stage 3 – June to October 15	Iterative abolishment of most lockdown and pandemic related restrictions.
Stage 4 – October 15 to December 31 (and onwards into 2021)	Reintroduction of intelligent lockdown, where PT-use isn't curbed.

Table 3.1 stages of lockdown policy

This period saw a large structural shift towards working from home. Relatively however, car and bike use did not have a percentage shift as much as PT use did, which might indicate that encouraging working from home outside of the pandemic will see a lesser impact on the curbing of car use than PT. This might limit the impact of working from home as policy on congestion, even though WFH will likely structurally remain a large new player. These structural shifts are portrayed in table 3.2.

Change in distance travelled by modality	**Car**	**PT (Train)**	**PT (Bus, Tram, Subway)**	**Bike**	**Walking**
Effect of working from home	**-2.35%**	**-6.35%**	**-5.85%**	**-0.60%**	**2.30%**
Shift from PT (train, bus, tram, subway)	**+0.54%**	**-3%**	**-3%**	**+0.54%**	**0.35%**
Total structural effect	**-1.81%**	**-9.16%**	**-8.67%**	**-0.06%**	**2.60%**

Table 3.2 Total structural effect on travelled distance due to modality shift (Hamersma et al., 2021)

3.3 Summary conclusion on the historic changes within policy

Within the late 90's, it was determined that congestion would continue to grow worse. At the time the assumption was that road expansion would become less possible, making changes in parts of the car transport system necessary, like introduction of a new compact on demand car (F.M. Roschar, 1997, MuConsult, 1998). Predictions also put forward the certainty of general growing unpopularity of the car in the future. This appears partially untrue, as road expansion did take place within the early 2010's due to lane expansion, being instrumental in congestion reduction (KiM, 2019), but has hit a predicted wall. The expectation was that new methods for public transport, like people movers,

would be encouraged, but realistically PT saw no large expansions outside of doubling train tracks (G.J.A. AI, 2006). Another expectation was that government would step back from its hierarchical position in favour of private-public cooperation with employers, this hasn't changed much until the pandemic where government encouraged employer travel policy more (KiM, 2021).

While predictions put forward in the 1996 report appear to partially ring true, most changes to the transport system still seem to have been made to infrastructure. Recently, car sharing and shared mobility concepts have been gaining steam, but early 90's carpooling policy seems to have largely disappeared from policy goals and also appears to have lost popularity in general. The use of car has, currently pushing towards the 2030s, not become wildly unpopular (KiM, 2021), while policy aims of ensuring curbs on congestion haven't yet seriously occurred. However, while employer-public cooperation has been put forth since the 90's, employer transport management or effects of 'Het Nieuwe Werken', a program of telecommuting and WFH, don't seem to take priority in government policy (KiM, 2019; KiM, 2015). Working from home is a fringe topic within mobility reports and even after the pandemic, where it became far more relevant, government plans to maintain a structural shift towards working from home to curb congestion appear lacking. Furthermore, PT policy seems to mostly replace other PT use. E-biking is new but it's hard to determine whether it strongly impacts commute. Due to the pandemic, it's of prime importance to understand that the trend of mode shift to PT has been broken and that there is a new player in WFH (KiM, 2021), something that was never a truly prioritized government policy. All in all, perhaps the most important observation is how separate review in the relation between mobility the workplace has become in more recent reviews.

3.4 Summary conclusion on attitude in commute policy and overview reports;

Methods and variables used to describe mobility in the review reports that were examined tend to remain based around the basic 4 categories introduced in the 1985-1995 report by MuConsult. Over the years, it becomes apparent that work-travel and related factors become less important in larger scale mobility reports, disappearing from them. Expansion of variables examining mobility occurs, but they often don't stick around. The 2005 report by G.J.A. AI puts more interest on travel experience and other partially attitudinal traveller inherent variables, in their influence of mode choice. Reports start putting more focus on (social) safety, livability and most importantly commuter attitude towards certain aspects of travel. There also an even more clear introduction of attitude, as respondent were asked to grade modalities on their own perception on comfortability, annoyance, ease of use, tranquillity, traffic delays, cost, punctuality, solitude/privacy, speed, enjoyability, safety, independence and flexibility. This is a far more in depth view of commuter subjective opinion, which is more in line with important variables identified in late 90's predictions (F.M. Roschar, 1997). Yet, despite constant identification within government reports, these metrics seem to not stick around. Perhaps this is partially due to the fact that the format of mobility reviews continues to shift, only settling down to the format of Mobiliteitsbeeld in 2014 (KiM, 2015). Where societal cost of mobility, through measuring social safety and environmental factor among others, becomes most important.

These and other variables that were identified within this chapter will be further integrated into the framework by van Wee et al. (2019) and used to structure the q-method questionnaire. But perhaps most importantly, it must be noted that within 30 years of policy report, a standardized method of measuring attitude and its effects on commute behaviour has not been introduced or upheld. This further emphasises the need to develop a method for measuring an analysing these attitudinal variables to better evaluate policy, attitude was and has remained under investigated.

Chapter 4. Conceptual framework

4.1 Introduction

This chapter identifies and investigates changes in travel behaviour as a result of attitude change. As explicated within the historical literature review of the government reports in chapter 2, there is a distinct lack in evaluating the effects of commuter attitude and attitude related variables in relation

to policy, as attitude is of importance when evaluating policy as it structures commuter behaviour. As such, it's necessary to identify the different attitude related variables that influence (habitual) travel behaviour, in particular commute behaviour in relation to the pandemic. To do this a conceptual framework on how these variables are categorised and structurally affect attitude needs to be adopted and tested. To do this sub-question 2 will need to be answered, which is as follows;

Sub-question 2; *What theory on travel behaviour, regarding the influence of attitude and habit, can be applied to identify the variables in attitude changes towards travel impacted by the pandemic?*

To answer this question, a limited qualitative literature desk study is conducted that investigates the framework created by van Wee, et al. (2019), while also seeking additional literature that can be used to adapt and test said framework. This desk study is further described in the methodology of this report. The framework is necessary for categorising variables affecting car usage, WFH and other commute behaviour change in chapter 3, to better understand these variables effecting perspective change. This data is further categorized in the first half of chapter 6. The framework is also used to support analysis of the survey results in chapter 8. Results of the Q-methodology survey will evaluate the descriptive use of the framework.

4.2 Introduction to framework van Wee, et al.

The conceptual framework by van Wee, et al. (2019) is evaluated in two steps, much like introduction of the conceptual framework as is present in the paper from which the framework stems. This means that firstly, the main assumptions on the relation between attitude, the built environment and travel behaviour are examined to determine model usefulness on a macro level, focusing on observations on travel behaviour trends and trends in effect that the built environment has on travel behaviour. The evaluation of this conceptual model mostly involves the rearrangement of variables identified within chapter 3, whereas the second model that deals with attitude in depth, will evaluate variables found within the new literature introduced in this chapter through the additional literature review.

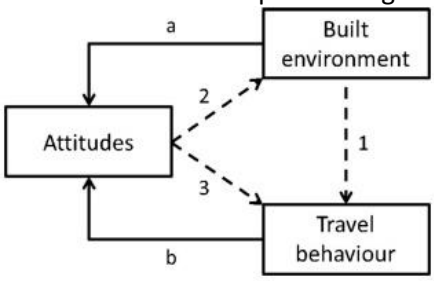


Figure 4.1 – Relationship between attitudes, environment and travel behaviour by Van de Coevering et al. (2016), figure taken from van Wee, et al. (2019, p. 3).

The paper by van Wee, et al. (2019 describes that, for decades, researchers have been primarily studying the influence of the Built Environment and Travel Behaviour, noting association between travellers residential location, destination and their travel mode choice. Low urban density areas see far more car trips than denser inner-city mixed urban neighbourhoods where cycling, walking and PT accounts for most trips. In that sense, differences in mobility patterns are explained by differences in travel distance and the prevalence of travel modality services within both areas, underpinning the effect of spatial concepts on travel. A direct connection between the built environment and travel behaviour (van Wee, et al., 2019). While putting more emphasis on trave modalities themselves within reports, the government overview reports largely report along these more macro level lines.

But, outside of this relation there's a third, perhaps more influential, conceptualised variable within this system. Namely the variable of attitude, defined as "*the degree to which the evaluation of a certain object, person or behaviour is favourable or unfavourable*" (van Wee, et al., 2019, p.1). Figure 4.1 portrays personal attitude and the built environment influencing travel behaviour. When specifying attitude in the case of travel behaviour, travel related attitudes are often specified as travel mode specific attitudes, like preference for car use, or the attitude towards travel as a whole, like a person's value of time when travelling or their dislike for time spent in congestion specifically. Attitude, much like built environment, effects travel behaviour. Mode specific attitudes influence the

choice for that mode, much like distance between destinations resulting from the built environment. This model and the model that will be described later on in this chapter consider the process that influences long term behavioural habit and attitude forming, particularly the tightly interconnected 'looped' influence these three variables have on one another, referring to it as reverse causality.

"In this study we refer to the effects of TB on attitudes, or the BE on attitudes as 'reverse causality' (RC). This study focuses on the direct and indirect impact of the BE as well as on direct attitude changes resulting from TB."(van Wee, et al., 2019, p.2)

As the loop of effects from changes in any of the variables is technically infinite, model application, and particularly of the model that conceptualising attitude change later this chapter, will be limited to a single 'path' of influence from infinite loops. To return to applying this basic framework to the variables identified in the former chapter; The connection between travel behaviour and the built environment, further being indirectly inter-affected by attitude, is a concept that appears to be implicitly mentioned within the mobility reports that were discussed within the literature review.

The reports describe a longstanding trend of increased travel distance due to larger distance between working and living areas. This trend of the wide urban environment spatial spread seems to continue and result in consistent travel behaviour trends that seem to encourage the increase of individual car use and long distance trips. There appears to be an implicit effect of travel on attitude towards travel and in return the effects of attitude on travel. This is never explicitly investigated. Variables on societal and environmental cost of mobility are measured. Travel time loss in congestion gains attention, but more often than not there is no follow up investigation of how this changes the outlook on travel as a whole and how that influences individual choices made in travel behaviour.

There are some explicit mentions of attitude related variables influencing travel behaviour from time to time; earlier reports make note of the "freedom" of the car, whereas G.J.A. AI (2006) makes mention of travellers ranking travel modalities by variables such as Comfortability, Annoyance, Ease of use, Tranquillity, etc. However, these types of measurements don't stick around and the ranking of modalities based on such categories alone doesn't give a particular deep dive on attitudes that are reflected in the respondents own behaviour themselves.

This leads to the main caveat to this initial framework. It gives a wide description of the built environment as an external constant, but seems to dismiss the characteristics of travel modes themselves as entirely subjective and not clearly defined within the model, not explicitly present in the model like the BE. Existence of these variables is purely implicit and present only in evaluation of attitude. Buildings and places are concrete and the spatial spread of activities due to the BE causes generation of movement in between, structuring travel behaviour. However, it's not like the characteristics of travel modalities, like for example the size of a car or the speed at which it moves, or even factors like the employment statuses of travellers aren't as concretely definable as variables in the proposed system. Attitude shows how much we value these characteristics of different commute modalities over each other, which in turn influences choice and commute behaviour. Abstraction is the goal of frameworks, but all these different variables are put under the same subjective umbrella. Such a high level observation of what structures travel behaviour appears to be lacking for now, as such more concrete variables influencing commute ought be more explicitly present and categorised in the model, similarly to BE.

4.3 Conceptual framework on attitude

Perhaps a more direct look at the triggers and factors behind attitude change will aid in the description of the effect of transport variables and characteristics on attitude. This can be done with the consecutively developed conceptual model for attitude changes by van Wee et al. (2019). Figure 4.2 portrays how attitudes towards subjects are influenced. This study evaluates impact of the pandemic on attitude and consecutively travel behaviour. It follows this framework from left to right.

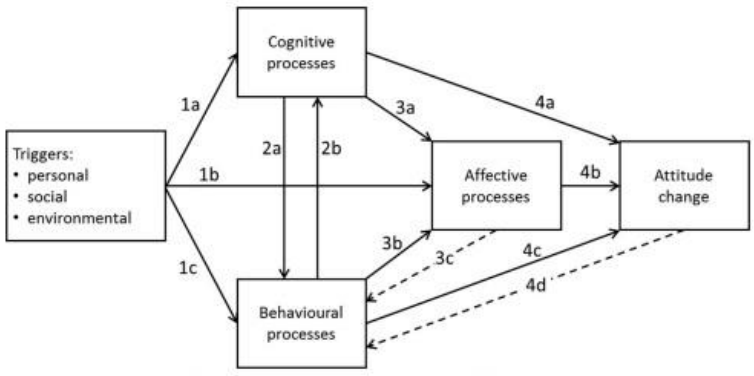


Figure 4.2 – A conceptual model for attitude changes (van Wee, et al., 2019, p. 4).

As stated before, the assumption is made in the paper by van Wee (2019) that reverse causality is a plausible hypothesis for how attitude is structured. In the paper, the question of how the process of attitude change develops while affected by reverse causality is explained through linking:

1. *Triggers' that influence those processes;*
2-3. *Three process clusters leading to attitude change; cognitive, behavioural and affective;*
4. *Attitude changes;*

This study follows this process from left to right, focusing mostly on the triggers demarcated as (1).

Triggers

Different facets of the pandemic, government policy and business policy can be seen as the main 'triggers' examined by using the framework. Triggers are described as the main variables and events driving the processes of attitude change. They are the prime reason why people change what they do, as they are "*the external initiators of the internal processes*" ((Van wee, et al. 2019, p.4) that lead to attitude change. Triggers are clustered into three categories (Van wee, et al. 2019, p.4);

1. The personal level *"refers to the actors own information and experiences"*
2. The social level *"refers to the influences from the actor's network, such as family, friends or colleagues"*
3. The environmental context, *"refers to all the other triggers, dominant subcategories being changes in the Built Environment, and in the transport system (for example: changes in transport services, traffic congestion, traffic safety), and other societal changes (such as societal changes in norms and values, an economic recession, or levels of immigration)"*

The conceptual model was primarily developed to explain why the built environment leads to attitude change, through travel behaviour or directly. "*We developed our conceptual model primarily to explain why the BE can lead to attitude changes (directly or via TB). Related triggers can be placed in the category 'environmental'. A biographical key event like a change in job or residential location, can expose people to another type of residential or work area (..) the BE surroundings of a person can change, for instance when a new light rail station or shopping centre opens. However, our conceptual model is more general since it also contains non-BE related triggers"* (Van wee, et al., 2019, p.4).

Attitude clusters

Triggers for attitude change in the pandemic case are primarily environmental triggers on the left of the conceptual model, among social and personal triggers. This model aids in understanding how attitude changes in the long term, through identifying effects of triggers on three different clusters of attitude. The three main clusters are; *"the cognitive cluster refers to people knowing something they did not know before, and consequently changing their attitudes. The behavioural cluster refers to people doing something. The affective cluster makes people feel something which leads to attitude changes.*" (Van Wee, et al, 2019, p.2). The clusters of processes are potentially interrelated. The three processes can strengthen each other's effects, or conflict with one another, lessening their impact on attitude change and thus behaviour change. The clusters can also be influenced by the

same triggers. For example, a new type of electric car charger could serve as an environmental/social trigger, as new faster chargers start appearing in the area and you, and your neighbours start making more use of electric cars. This might affect your attitude through the behavioural cluster, as faster charging can cause you to use the car more often, reinforcing car use behaviour. But this might also be true for you neighbours. As such the affective cluster isn't only impacted by you feeling better about car use as it's more free and comfortable, but it's also influenced by a type of social 'pressure' from you social circle to normalize more electric car use as you're affected by their use and attitude.

Attitude

Lastly, these attitude clusters impact general attitude and thus travel behaviour through impactful triggers causing a reaction throughout the attitude clusters and eventually effecting attitude and thus behaviour. The three clusters affect attitude differently;

1. The cognitive process cluster causes attitude change through new information gained about a certain object, behaviour or person. The cognitive information gathering happens directly through direct experience and requiring knowledge, but also through performing an activity. It can happen indirectly through reading articles or conversing with others. In that sense, this cognitive process seems to overlap with the following two clusters, with emphasis on first time experience being the factor that makes this cluster distinct from the others.
2. The impact of the behavioural process cluster is related to 'doing', as experience is required. People align their attitudes with their behaviour, thus they change their attitude when their behaviour is (forcibly) changed. When behaviour and attitude don't align, people tend to adjust attitude to ensure correspondence with prior behaviour. People might also change behaviours as a result of behavioural experience outside of the motive to reduce dissonance.
3. The affective processes cluster, often referred to as emotional processes. Changes attitude due to 'feeling': people change their attitudes based on negative or positive emotions towards a certain object or activity (van Wee, et al., 2019, p.5.)

4.3 Application of conceptual framework

van Wee, et al.(2019) is applied on literature to identify triggers and test the framework. It shows a trigger and describes how this trigger impacts attitude and thus behaviour. A broader look at attitude change is given than solely looking at the pandemic 'trigger'. This main pandemic 'trigger' is deemed as too broad to serve as a single trigger, a such more specific variables influencing commuters are investigated. The pandemic is seen as the trigger that spurs on triggers related to employer implementation of working from home policies or commuters' own impulses to reconsider their own travel patterns. Application of the framework is displayed in table 4.1, where different triggers are categorised based on their contents. The numbers displayed within the trigger categorisation serve as a reference towards the literary sources that were used to gather these triggers as to allow for better legibility and refer back to additional literature listed in this report's methodology section.

	Trigger	Trigger categorisation	Attitude clustering and attitude impact
Non pandemic related triggers impacting attitude change			
1	Environmental concerns and the drive for travel modality replacement	Social (2)(3)	Research into the effects of attitude in choosing for more, what are considered, 'sustainable' commute alternatives is mostly driven by cognitive processes dispelling or enforcing preconceptions of specific modalities such as electric cars or other low carbon options. On the other hand, a strong psychological social influence, moving through the affective cluster, also influences a shift in attitude towards modality choice.
2	Pre-pandemic employer efforts to improve sustainable commute	Environmental (7)	Pre-pandemic efforts to disincentivise unnecessary commute were under way within a large amount of companies in 2019, before the pandemic. As 70% of companies participating in government research mentioned aiming to stimulate less travel within that year. However, actual policy regarding such aims is often not implemented yet. As such attitude change among employees through cognitive and behavioural clusters is limited. It will be interesting to see how enforces WFH from the pandemic might share similarities to these policy goals and see whether it's structurally effective.

Primarily pandemic related triggers impacting attitude change			
3	**The activity of working from home itself** spurs on more full-time working from home	Personal (5)	As those that already (partially) worked from home were forced to work more hours from home during the pandemic, their attitude towards full-time or expanded WFH was strengthened through the behavioural process of doing.
4	**The activity of WFH itself** spurs on a small increase in causing those new to working from home to adopt the practice	Environmental, personal (5)	Those that did not work from home before the pandemic, were introduced to the practice through cognitive processes induced by the trigger of 'forced working from home'. Effects on attitude from this new experience seems to be limited however as the behaviour change doesn't stick for these newcomers.
5	**The activity of WFH itself** influences former commuters to make more different trips	Personal (5)	The loss of mobility during commute is replaced with (recreational) shorter distance trips in the local area. Behavioural processes then slowly seem to change attitude in favour of more general bike use or car use for such regular short trips.
6	**Changed commute behaviour encourages other general changes in modality use**	Personal (5)	As short distance, non-work related trips become more common, this phenomenon functions as a trigger that can change the attitude norms on travel modality choice through repetitive behavioural and affective processes. For short distance trips, Pt use become less favourable, falling structurally out of favour.
7	**The structural adoption of WFH itself** historically seems to encourage changes in living or working locations and increase in commute distance	Personal (5)	Through cognitive and affective processes attitude towards working from home slowly changes and, for some commuters, eventually becomes a motivator to change jobs or move if more enticing options are given. This usually also improves attitude towards long distance commute more positively.
8	**Changed social pressure between employees** as a result of the pandemic influence commute behaviour	Social, environmental (5)	During the pandemic, the historic social pressure that existed between employees on when and how to work lessened due to working from home. This allowed, through behavioural and affective processes, for changes in employee attitudes on commute.
9	**Changed social pressure by employer** as a result of the pandemic influences commute behaviour	Social, environmental (5)	Similarly, the social interaction between employer and employee has changed the historic social pressure on when and how to work lessened due to working from home. This allowed, through behavioural and affective processes, for changes in employee attitudes on commute.
10	**Changed employer policy regarding WFH**	Environmental (5)	Direct policy changes by the employer are the most impactful trigger towards attitude change.
11	**WFH impacting employee personal life**	Social, environmental (6)	Working from home impacts an employee's social life, as it significantly restructures their day and social life. In that sense, through cognitive processes employee attitude towards working from home is either changed positively allowing for more perceived flexibility in structuring their own free time, or it's been started to be regarded as a factor putting significant strain on personal relationships at home or working relationships with colleagues. This impacts the general attitude towards working from home in regards to the favourability of other travel modalities.
12	**Virus risks impacting social and business related travel**	Environmental, personal, social (6) (5)	Perceived virus risks by commuters or, for example, business clients and colleagues has changed attitude towards in person meetings and business. Through cognitive processes it disincentivised the feeling to meet in person for work related activities. In some cases this has caused a positive shift in attitude towards working from home as working has reportedly been more productive. On the other hand, mention is often made of direct social interaction between employees or with clients being missed as a result of working from home, indicating a negative shift in attitude over the longer term.
Working from home and the pandemic as catalyst for reconsidering past travel modality use in general			
13	**Working from home and the pandemic as catalyst for reconsidering past car use**	Environmental, personal (1)	Interestingly, some research suggests that car use for commute is missed least of all different modalities. In that sense the trigger of enforced working from home significantly impacted attitude towards car use, only half of commuters missing their commute. Attitude has changed through cognitive and behavioural experience with temporary loss of habitual car use. Factors of car use that are primarily most missed are the ability to listen to music during the trip and a feeling of temporary solitude, not even necessarily a feeling of loss of independence. It's interesting then, that despite such a significant negative shift in attitude towards the car, car use still bounced back in behaviour much more prominently than public transport use which is missed more.
14	**WFH and the pandemic as catalyst for reconsidering past Bike use**	Environmental, personal (1)	Bike use for commute appears to be missed most of all travel modalities. Attitude changed through cognitive and behavioural experience with temporary loss of habitual bike use for commute appear to be extremely limited, as factors such as the activity and ability to experience the environment during the commute trip are missed. In that sense,

			the pandemic does not seem to have caused particularly strong attitude change towards bike use, only reinforcing the positive opinion that bike users already had.
15	WFH and the pandemic as catalyst for reconsidering past PT use	Environmental, personal level (1)	Changes in attitude towards Public Transport as a commute modality appear to be somewhere between the changes in attitude related to car and bike use. Attitude changed through cognitive and behavioural experience with temporary loss of habitual PT use for commute appears to mostly
16	Past habitual patterns re-emerging post-pandemic	Personal level (1)	More than half of the respondents in some research aims to completely return to their old commute habit after the pandemic. Whereas only 40% seeks to further engage in working from home. This indicates that habitual attitudes and the preceding factors creating this habitual behaviour are likely stronger and more long lasting than the impacts of newer outside triggers on attitude.

Table 4.1 Conceptual framework application

The table shows a limited selection of 16 different evaluated triggers, primarily focused around commute changes due to the pandemic and WFH policy. Many of the triggers examined mention the importance of relation to colleagues and the employer, which is a variable that wasn't dealt with before in other parts of the literature review. While variables such as the effect of WFH on attitude towards other commute modalities were implicitly mentioned in the government reports, the social effects of WFH or the effects of WFH on the attitude towards itself are newer. Thus the expectation moving forward is that within the drafting of statements for Q-methodology, social aspects around WFH will play a far larger role in commuter perspectives, than might have seemed before analysis. Beforehand, connections examined were the effects of the introduction of WFH on the use of other modalities. However, there is a far wider spread of triggers related to commute and the pandemic.

4.4. Criticism on conceptual model

The model by van Wee, et al. (2019) has proven useful in identifying triggers and allowing for a more structured analysis of changes in attitude for Dutch commuters. However, there pre-emptively exist some concerns regarding further implementation of the model. Other models that deal with attitude and behaviour change in regards to travel behaviour, such as the behavioural intention model developed by (Curtale, et al, 2021), feature more concrete transport-related characteristics within the model. It does this through including socio demographic characteristics as well as adding transport related characteristics as constants within the model. These different pre-set factors and the attitude towards them, influence behaviour. Another model on attitude change is the model by Coevering et al. (2021) which examines strength of effects of attitude on behaviour or other attitude. The model sees attitude at a certain moment as a 'constant' variable that affects other variables.

The conceptual model for attitude change isn't developed solely for travel behaviour and specialised like the model by Curtale (2021) is for the purchase of electric vehicles including variables that are important for that practice, but not commute behaviour. It makes sense that those variables aren't explicitly included within the conceptual model, but it lacks such constants entirely. The model for attitude change doesn't require a baseline to start from in its change in attitude, this is useful in this thesis for this exact reason. This baseline attitude has to be the result from another comparable Q-method study, necessitating more than one study, which is something that is explicitly aimed to be avoided by implementing dynamism into Q-methodology. However, a starting attitude does help in identifying the context to attitude change, specifying whether a person is strengthened or weakened in an already held attitude, or whether attitude change might have caused a switch in attitude.

This model lacks a starting point attitude and a point to arrive to after change. In the model, attitude change is the final box to the right, whereas In a different study this should perhaps feature the post-change attitude. More importantly, the original attitude should perhaps have been situated at the left of the model, a starting point when regarding the model left to right. A slight attitude change doesn't necessarily constitute enough change to change behaviour. On the other hand the triggers are implicitly changes to a status quo as well. In that case too, the status quo constant before change appears missing from the model.

The biggest issue that this model does help avoid, is the fact triggers or other phenomena aren't investigated properly. Black boxes between triggers and behaviour are avoided. It also helps to see the different processes a trigger can start within attitude change, as they might differ per different person, their attitude impacted differently as their baseline habits and attitude are react differently to triggers. The reason as to why these baselines aren't included within this study's conceptual model; Including baseline statements is theoretically useful for analysis, but impractical in practice. It would require asking respondents about specific attitudes they used to have, additional statements as a baseline would be requested separately for every response. This could result in a bloated survey, with too many required statements. This is impossible within this study, as Q-methodology is only able to account for a limited number of statements within the Q-set. This number is necessary to properly explore the different aspects of the wide research subject of commute change across 4 modalities. As such, the choice is made to base further research within this study on the investigation of attitude change itself as regarded in the developed framework by van Wee et al. (2019) focusing most entirely on change in attitude. Per subject slight adjustment to ensure correct interpretation of change is made, requesting commuters to answer whether their attitude changed at all. This rules out misinterpretation on if a formerly held attitude simply stays in place, or if it's subject to change.

4.5 Summary conclusion

This chapter features an introduction to the theoretical background of attitude and the conceptual model. The 2016 framework on the built environment and its relation to attitude and behaviour, is useful for classifying and usefully structuring the different factors influencing travel behaviour. It is however limited in framework depth , while the model for attitude change by van Wee et al. (2019) goes quite in depth, but similarly feels a little broad in how it defines environmental triggers as any trigger coming from outside of the person themselves. Criticism of the model regards the analysis of change, which can be difficult without considering a baseline attitude before change. However, this study sees investigating attitude change itself as a goal of its own, as it would determine whether this more traditional, less labour and time intensive method of Q-methodology can properly account for dynamism. Rather than widely and impractically expanding the model and in turn Q-set and survey. Practically, the conceptual model proves useful as a tool for explorative analysis, but limited in direct connection to the creation of a Q-set. Through identification of the triggers, corresponding categorisation was possible. This allows for categorisation of subjects for Q-set creation, which happens more on a content subject basis, rather than categorisation based on the type of the trigger.

Chapter 5. Results and P-set characterisation

This chapter features an overview of P-set characteristics, based on data attained in the post Q-sort questionnaire of the survey. It serves as an addendum to factor analysis. A summary of is given of P-set characteristics, followed by a description of results regarding change to commute behaviour.

5.1 Summary of P-set characteristics

Data regarding the characteristics of the P-set can be found within appendix B. This section serves as a summary of the most important aspects of the first half of the post Q-sort questionnaire. When conducting the online Q-method survey, the goal was to attain the responses of 50-100 respondents. It was reached with 51 respondents within the P-set. The age of respondents is evenly spread, with slight skew towards 45-55 year olds. Sex of respondents is spread 1 to 3 in favour of men. While men on average work longer workweeks than women, this doesn't mean that women are employed far less, thus the spread isn't skewed to unevenly towards men. Education wise, respondents are slightly skewed towards higher education, with a heavy weight towards HBO level of education. As the P-set is skewed to somewhat older, higher educated respondents, income might be somewhat higher encouraging car ownership and use. This might give of an impression that car usage is more prevalent or more supported than it actually is, which might play a role in the interpretation of commute behaviour, giving a slanted view of reality, but it won't negatively influence the execution of Q-methodology as the spread of factors is varied enough to ensure most perspectives are heard.

Respondents operate in a wide range of job sectors. Based on this fact, many different perspectives will likely be present within Q-sort results. There's a heavy skew to more "office-bound" job sectors, the largest sectors present are finance or business consultancy. The number of respondents working in production type jobs is low. While this might indicate a loss in perspectives, it's sadly also a result of the research set-up, as respondents that didn't or weren't able to work from home were asked not to participate. By design, research was done into the structural impact of the pandemic and WFH on commute attitudes and behaviour, this requires a base amount of WFH to have taken place. It's interesting that the majority of respondents, around two-thirds of the P-set, works either an office or management function. The vast majority of respondents are employees. A decent selection are employers and entrepreneurs, but only 4 in the entire Q-set are fulltime students.

The spread of respondents is varied enough that these respondents are sufficient for identification of significant factors in Q-methodology. For evaluation of other empirical data, it must be kept in mind that there is a particularly significant group among respondents that seems generally well able to work from home. As such, this 'commute' method is likely more popular than it would normally be, even among those that are per definition able to WFH.

5.2 Commute behaviour change

One of the most interesting facets of this study is the fact that change in commute is investigated, both in attitude and in actual behaviour. Within the analysis of changes this will allow for checking whether attitude changes are even roughly similar to actual changes in the behaviour of respondents. It must of course be noted that, while useful for analysis of the P-set, actually generalizing these results to the general Dutch populace will be difficult for two reasons;

1. Respondents do not necessarily represent an accurate reflection of the overall Dutch working populace. A respondent P-set size of 51 is ample to conduct a successful Q-sort, especially with how wide the range of respondent characteristics appears, based on exploration of the P-set through the post Q-sort questionnaire, but this size is relatively small for quantitative research. Certain categories within the past questions, such as job characteristics for example, are simply too small to offer a fully significant insight into the general populace.
2. Respondents participating within this study needed to have worked from home during the pandemic or have the possibility to work from home. Job sector representation, like the production sector, is likely limited. It must thus be noted that data only holds for those that can possibly work from home in the first place. This means that the shift to WFH and likely the shift away from car usage, is likely significantly smaller in the general Dutch populace.

These two points don't necessarily invalidate the value of this data, as it's able to give a valuable indication into characteristics and behaviours of the Dutch population, under certain conditions. This is true as gathered data on commute change pre and post-pandemic, shows interesting trends.

Car commute behaviour change pre-pandemic and post-pandemic – form 7 & 11

The change in car usage and commute behaviour between before and after the pandemic appears significant. The decrease in usage is rather large, but limited in the sense that the number of car commuters themselves has not declined. As shown in figure 5.1, the amount of respondents that do not use the car for commute at all remains at 18 respondents. This might indicate that the amount of car users has not decreased, however the purported change among car commuters is significant.

Before the pandemic, car usage showed a skewed normal distribution towards 4 days usage per week, reaching an average of 3.3 workdays per week among actual car users. Averaged among all users this was around 2 workdays. After the pandemic this skew was shifted towards 2 days of car commute per week, reaching an average of 2,5 among actual car users. Primarily among heavy car users there appears to have decrease of 1-2 workdays of use. On average, the number of workdays commuted by car was 1.6, a 44% decline in workdays.

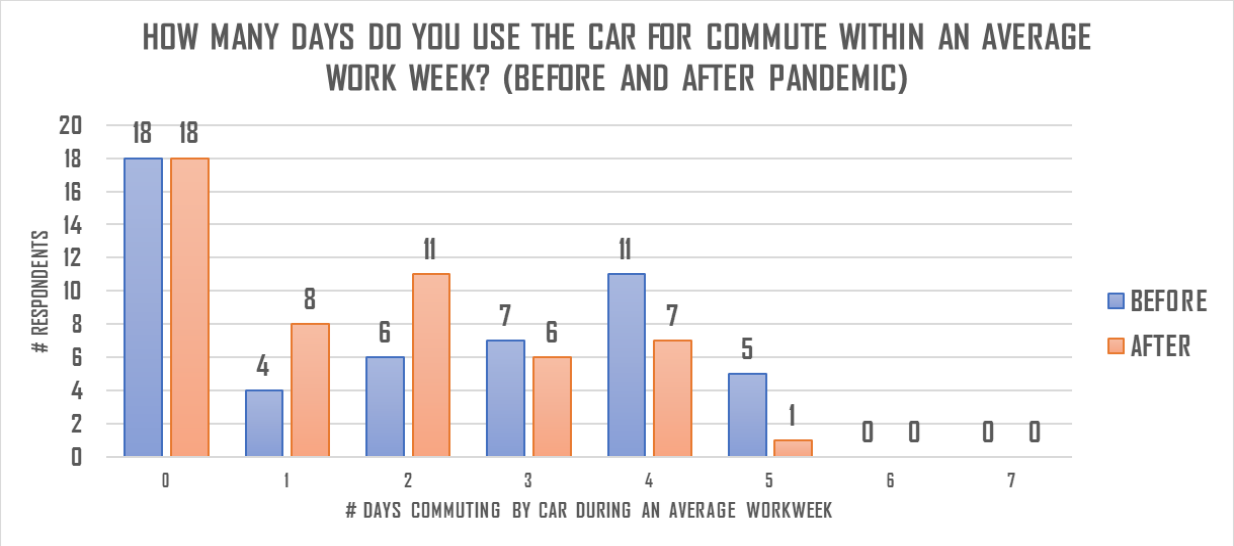


Figure 5.1 Car usage change

PT commute behaviour change pre-pandemic and post-pandemic – form 8 & 12

The change in PT usage and commute behaviour between before and after the pandemic echoes sentiments raised within the thesis introduction and literature review. Namely that public transport saw a very steep structural decline in usage. This is reflected in figure 5.2, where an overall decline in every category of days-travelled can be observed. The number of pre-pandemic PT users within the P-set isn't particularly high, but with 16 still considerable as part of the entire P-set. The more important part of the story portrayed by the data, is that the number of total non-users grew significantly as a result of the pandemic. Furthermore, where PT use was generally evenly spread among those that did utilise the modality, after the pandemic most remaining users only utilise PT at most 1 to 2 days per week, likely when necessitated for their jobs. More frequent users are outliers after the pandemic. When observing the pure averages, respondents used PT on average for 0.94 workdays pre-pandemic, which dropped to 0.38 afterwards. This was a significant 56% drop.

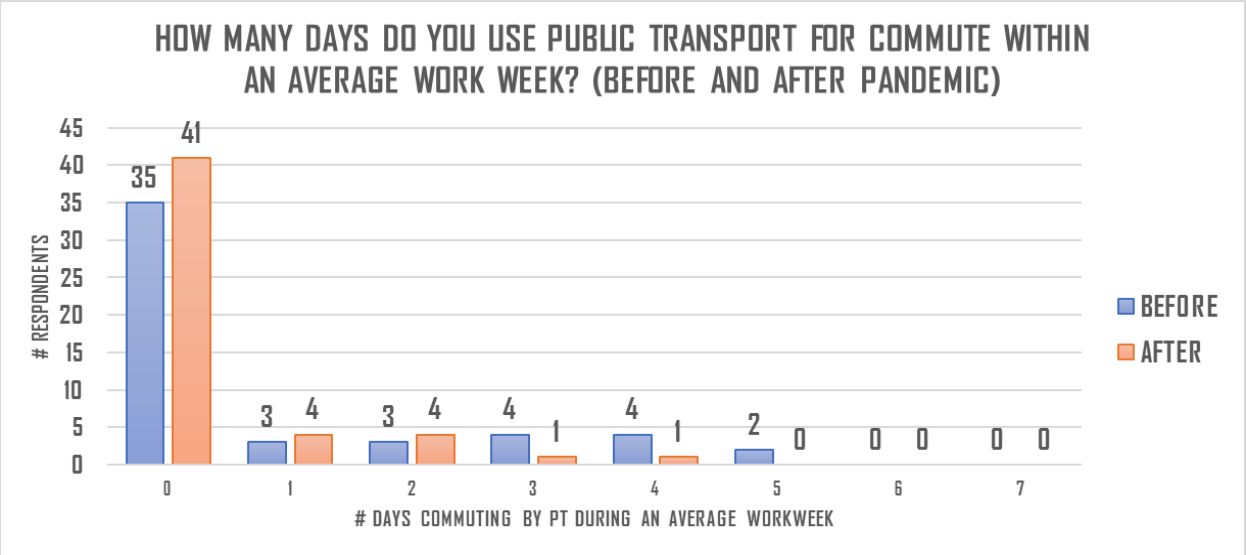


Figure 5.2 PT usage change

Cyclo-pedestrian commute behaviour change pre-pandemic & post-pandemic – form 9 & 13

Of all modalities, cycling and walking were prone to least change. There is a general decrease of average days travelled from 1,8 to 1,4 days per week, or from 3,3 to 2,5 days among those that already walked or cycled to work. The general spread of use among the different respondent isn't impacted that harshly. The amount of non-users only increases slightly due to the pandemic and the respondents that commute to work 5 or mor times per week generally continue to do this. The biggest shift is among those that travel to work by bike often, i.e. 3-4 days per week, to a lesser amount of times like 2 days per week. In short, the hardcore cyclo-pedestrians remain unimpacted. "Non-committed" frequent users decreased their days travelled.

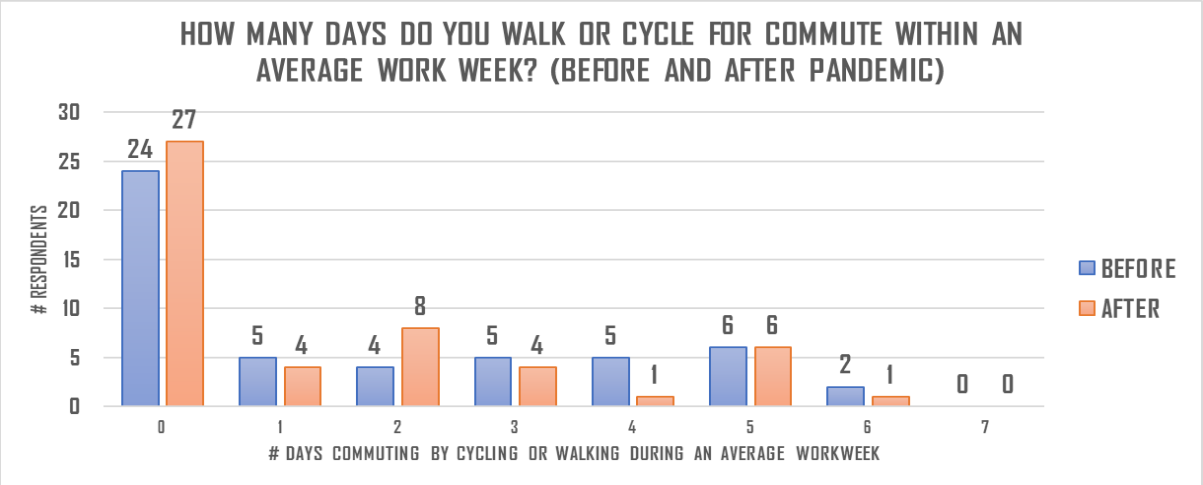


Figure 5.3 Cyclo-pedestrianism change

Behaviour change in WFH pre-pandemic and post-pandemic – form 10 & 14

WFH was affected most as a result of the pandemic. Data suggests that post-pandemic only 7 of 51 respondents do not work at home at all, the vast minority. Before the pandemic only 22 respondents didn't work from home, meaning that the majority of respondents already had some experience with WFH even before the pandemic. Overall, the average number of days that respondents work from home increased by 154%, more than doubling the average amount of days, from 1 day on average before, to 2,6 days on average after the pandemic. This shift to WFH after the pandemic is skewed to 3-4 days for those that chose WFH, a shift away from the pre-pandemic more prevalent 0-1 days per week. WFH became widespread among those likely already somewhat open to the idea. There is a peculiarity however, as the amount of respondents working from home for more than 5 days per week remains insignificantly small. This might be due to the fact that WFH requires some in person labour at location, or that these 'full-time' jobs WFH generally don't offer full workweeks.

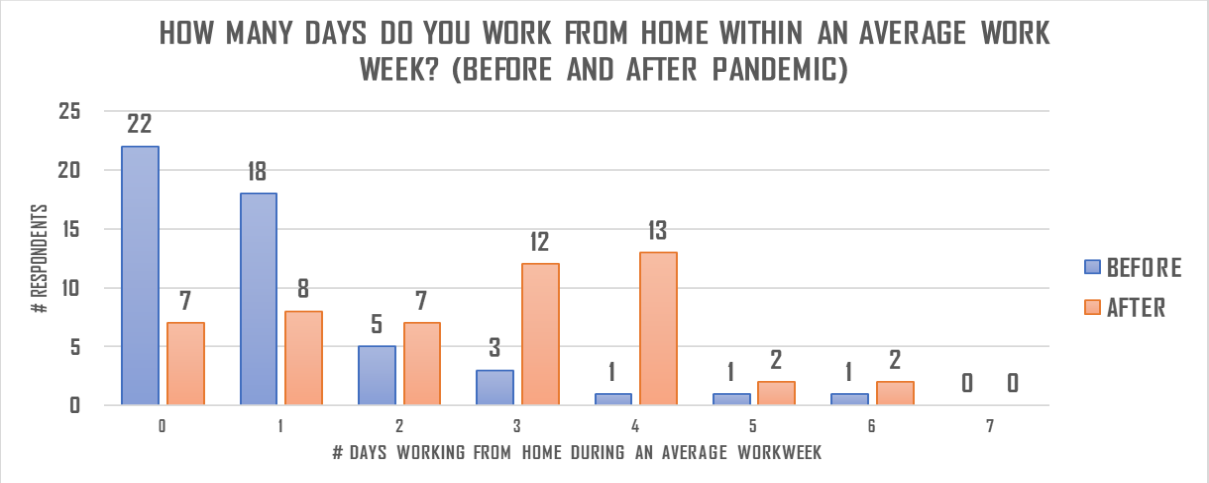


Figure 5.4 WFH change

5.3 General change in commute behaviour due to the pandemic

Based on data from the post Q-sort questionnaire the average number of weekly modality uses for commute are calculated for the entire P-set, this is shown in table 7.1. Both pre and post-pandemic the average number stops just short of 6 different transport uses per week. The number of modality uses for commute lies higher than the average full-time workweek of 5 days. Considering that some commuters work part-time, i.e. not every day of the week, the average amount of workdays per week will likely lie lower than 5. This means that there are respondents that work multiple (part-time) jobs, meaning that they use different commute modalities for different trips, and/or that there are commuters that make use of multimodal commute methods for their home-work trips. In either case, this means that on average commuters make use of more than 1 modality per work day.

The number of work day 'commutes' stays roughly the same, indicating that respondents were able to correctly estimate their change in commute usage, when assuming that the average number of workdays did not significantly increase or decrease from before to after the pandemic. This number includes WFH during a day as a commute modality use for that day. The amount of average commute uses within an average workweek, excluding WFH are shown in table 5.1. This number perhaps most clearly shows the structural commute use decrease per week, saving a full work trip per week.

	Including WFH	Excluding WFH
Average number of modality uses in average workweek pre-pandemic	**5.76**	**4.74**
Average number of modality uses in average workweek post-pandemic	**5.96**	**3.4**

Table 5.1 Weekdays breakdown modality

How this has impacted the breakdown of commute is shown in figure 5.5, as the balance between the major modalities **Car use** and **Cyclo-pedestrianism** from before the pandemic has given up equal ground to **Working from home** as the new majority 'modality' after the pandemic. It must be noted that this is among those that are able to work from home in the first place, with a decent 'base' use of around 18% already in place before the pandemic. Regardless, this does reinforce that modality use has structurally changed significantly, likely decreasing commute trip rate. This will likely impact the amount of traffic during rush hour, lessening congestion. However, this change doesn't indicate that car usage overall has necessarily decreased. This study did not investigate decrease in non-commute related trips and it's likely that non-work related trips weren't impacted by the increased popularity of WFH due to the pandemic. To further put this into perspective, most adoption of WFH doesn't occur to a level of a full-time workweek. It appears to be more like a replacement of full-time workweek commute by car or bike, by half a workweek of the old commute modality and half a week of WFH, as most modalities have given way in their full-time workweek use.

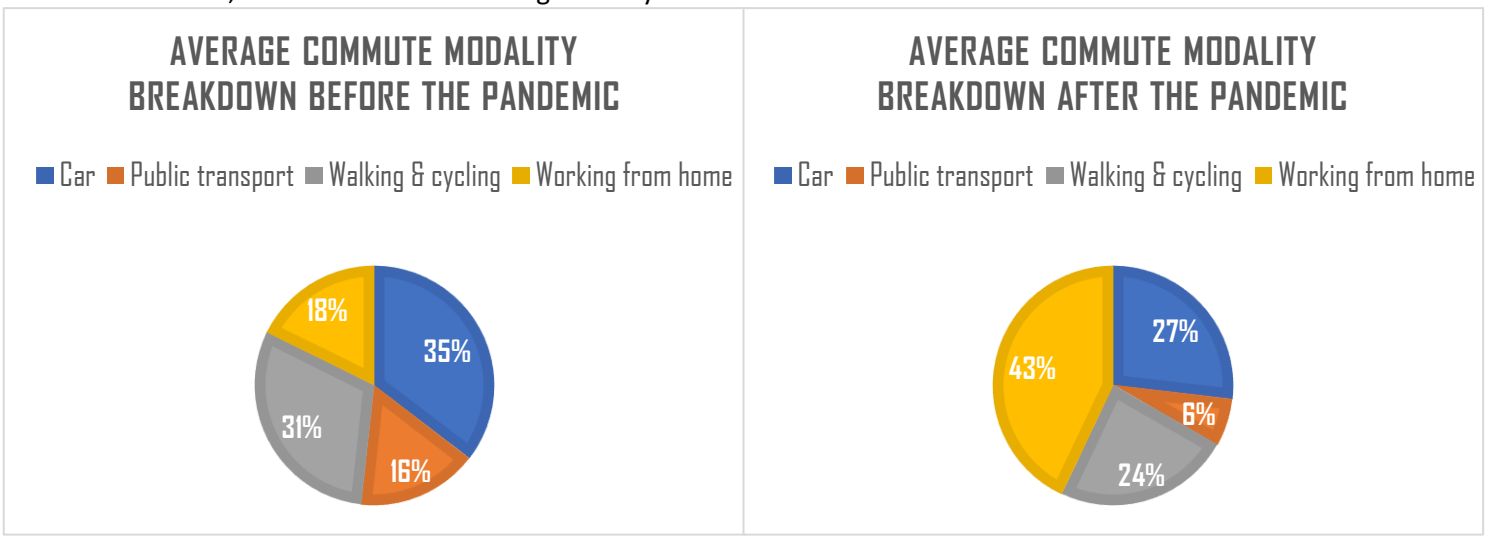


Figure 5.5 Modality spread breakdown before and after pandemic

While percentage wise not seeing the largest decrease, car usage saw the largest decrease in commute use in an absolute sense, with the largest summed decrease in days commuted using this modality. While largely following the overall trends in commute behaviour that were identified in literature research, with PT taking a larger structural hit in usage than the car for example, the decrease in modality use appears structurally far greater than generally mentioned in government reports. This could be due to the P-set, that contains a significant portion of respondents working office jobs in job sectors that appear more suitable for home working, such as finance. For them, the switch to WFH structurally was perhaps far more easily made. This is thus not necessarily the case for the general Dutch populace. Furthermore, the data indicates that this change is reportedly made in commute trips, not other travel motives. Work related travel only makes up a limited portion of all

travel, even during rush hour. This decrease might not influence the overall flow of car Traffic. Besides this, a 44% decrease in daily trips for commute, doesn't necessarily mean a 44% decrease in usage for commute, as perhaps shorter trips are replaced by WFH or vice versa.

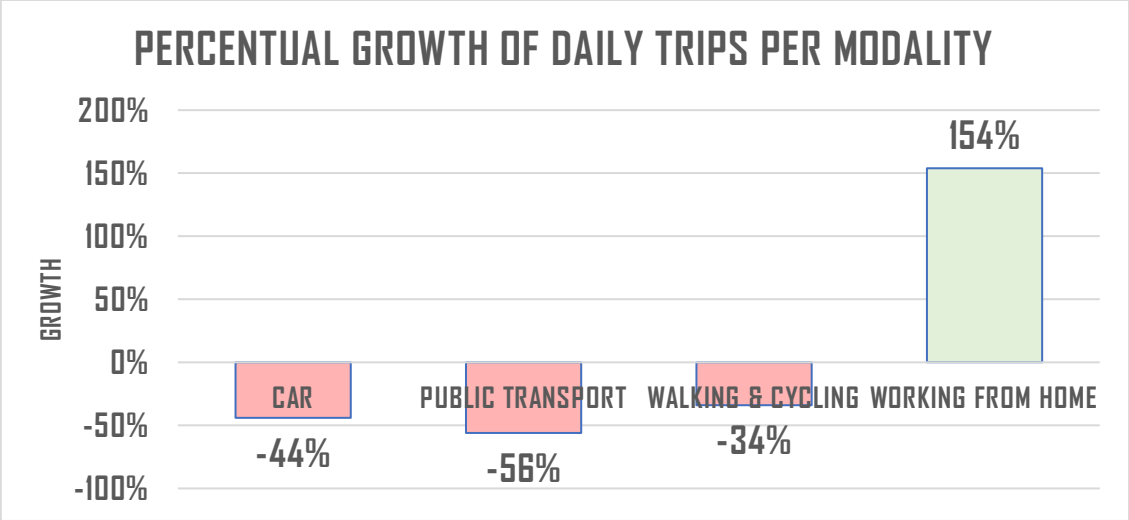


Figure 5.6 percentage growth of commute

This data can be further put into context by this last question posed in the post Q-sort questionnaire. One that requests respondents to answer whether they plan to return to their old habits, as such questioning how structural the changes identified within their commute behaviour really are. As shown in figure 5.7, most respondents do not seek to return to pre-pandemic commute habits. This means that around 75% of respondents have been structurally affected in their commute behaviour by the pandemic. The largest group of respondents mention seeking to partially return to old habits, perhaps indicating that the structural shift might still be proven to be rather fickle given time.

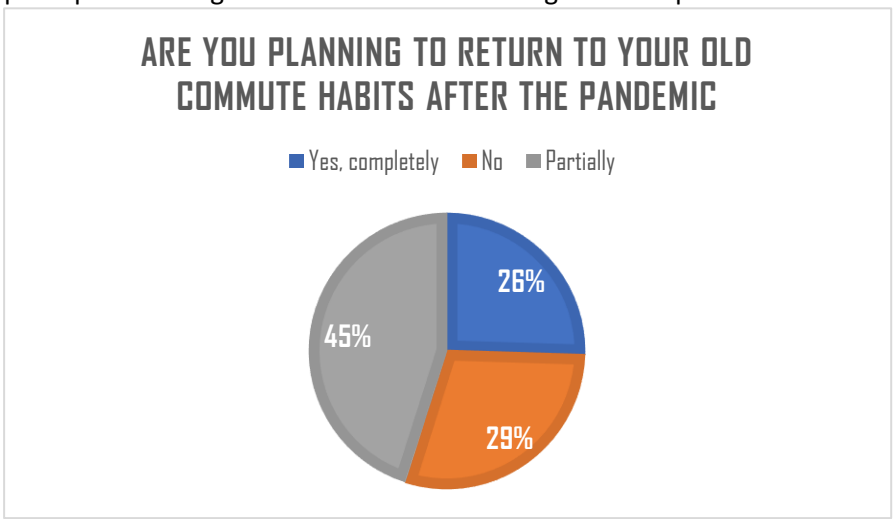


Figure 5.7 Breakdown on return to old habits

Chapter 6. Factor analysis and Perspective interpretation

In this chapter, survey results are used to quantitatively measure participant attitudes and opinions and statistically cluster them into significant groups that represent a societal perspective. Quantitative Q-methodology analysis, literature review and researcher opinion will be used to identify significant societal opinion groups. Outside of these Q-method related questions, a query based on respondent characteristics such as age, education, employment sector and characteristics or experience with working from home or car use was spread, results of which will be used to contextualize findings from the factoring. The aim is to answer the following research sub-question;

Sub-question 3; *What different perspective clusters on changing attitude towards car ownership, usage and travel behaviour can be found within Dutch society, in regards to pandemic impact?*

This is done in three main steps. Firstly, the most important steps of the mathematical factor clustering within SPSS, that have been discussed in the methodology section. Secondly, the quantitative results of the factor clustering, such as the z-scores belonging to each factor and respective statement, will be discussed in depth, further exploring them using additional results from the post Q-sort questionnaire. Lastly, correlations between the different factors will be qualitatively examined to determine the overlap between the different factors and to identify why some similar perspectives might agree or disagree on certain aspects. This will force a deeper look into the identity of the developed factors and offer an insight in how these perspective 'alliances' might agree or disagree on certain commute policy or other commute related statements.

6.1 Factor description and analysis

Within this section, a basic synopsis for different identified factors is developed. These perspectives are further analysed using data gathered in the post Q-sort questionnaire, that might be specifically useful for further contextualising a factor or identifying the triggers for and effects of attitude change not explicitly present within the Q-sort itself.

Within table 6.2, the most significant finds from analysing the z-score results are summarized to give a general overview of the attitudes held within this factor. Emphasis is put on the more extreme positions with a Z-score of more than 1,5 or less than -1,5. But due to the large amount of different subjects that also require some form of attention, an overall interpretation of Z-scores is added. If a factor is indifferent towards a statement, with a x-score value of roughly between -0,5 and +0,5, the attitude towards this statement isn't mentioned. Statements that generate higher or lower Z-scores are discussed as relevant and emphasis is given to how high the Z-score is to put emphasis on the strength of conviction of a factor attitude towards the statement. In cases where response is generally neutral, or where indifference is special, evaluation of smaller Z-scores is also given, as this (small) change from the norm might indicate a difference in opinion from the average perspective. Normally this attention to the more neutral scores would not be given, but as this study is largely skewed towards more neutral responses, the amount of statements with far higher Z-scores in comparison to the overall amount of statements would be too low to give a correct identification of factors. The full Z-score results for every factor can be found in table E.1 in appendix E, neatly colour-coded to assist in legibility.

The number of respondents and the ID of these respondents within the data file and factor scores provided within the appendix, are shown in table 6.1. As statistically required, each factor features 3 or more respondents whose perspective aligns with the developed factor. The size of the factors range from a sizeable 12 to a small 4, generally containing around 5 to 6 respondents.

Factor	**Total # of respondents**	**Respondents**
1; Car commuters that strongly shifted to structurally working from home	12	1, 2, 4, 9, 18, 23, 24, 26, 34, 35, 41, 51
2; Car commuters looking to return to pre-pandemic commute behaviour	8	7, 8, 12, 27, 29, 30, 44, 49
3; Multimodal opposers of working from home themselves	6	15, 19, 20, 22, 31, 33
4; Multimodal PT commuters shifting to WFH, remaining steadfast car owners	5	10, 13, 17, 40, 46
5; Part-time cyclo-pedestrians, unchanged in their behaviour	5	14, 16, 28, 38, 45
6; Car use opposers, strengthened in THEIR own personal car use	5	6, 21, 36, 37, 43
7; Full time cyclo-pedestrians that have shifted to working from home	6	3, 5, 25, 32, 47, 48
8; Commuters generally opposed to government & policy	4	11, 39, 42, 50
Total number of respondents	51	

Table 6.1 Division of respondents per factor

Statement Category	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Car Use	**(Small - No change)** **Remains;** Neutral/Negative on car use curb policy. **Has become;** Positive on effects of lessened car use due to working from home.	**(No change)** **Remains;** Very negative on car use curb policy. Steadfast in positivity on car use. **Has become;** Positive towards WFH lessening car necessity.	**(No change)** **Remains;** Very negative on car use curb policy. **Has become;** Even more positive on comforts car use. Positive towards WFH lessening car necessity.	**(Small change)** **Remains;** Very negative on car use curb policy. **Has become;** Neutral/Negative on continued car use. Positive on effects of lessened car use due to working from home.	**(Large change)** **Remains;** Very negative on car use curb policy. **Has become;** Very positive towards car alternatives and WFH lessening car necessity. Neutral on car use and lessening effects.	**(Very large change)** **Remains;** **Has become;** Positive on car use curb policy. Very positive towards car alternatives and WFH lessening car necessity. Neutral on car use and lessening effects.	**(No change)** **Remains;** Positive on car use curb policy. Didn't miss or grow fonder of car use. **Has become;** Did not see improvements within city due to car lessening.	**(Small change)** **Remains;** Very negative on car use curb policy and car alternatives. **Has become;** Positive towards WFH lessening car necessity. Negative towards lessening effects.
Car Ownership	**(Small – No change)** A steadfast car owner that does not see an alternative to car ownership in PT.	**(Absolutely no change)** A steadfast car owner that's strengthened in their belief in car freedom. They do not see PT as a possible replacement. However, believes car reliance could slightly lessen in future decades.	**(No change)** Steadfast supporter continued freedom of car ownership, but not necessarily a car owner themselves. Does not see PT as a serious alternative to car use and was strengthened in belief in the freedom of the car.	**(Small change)** A steadfast car owner. They do not see PT as a possible full replacement and do not believe car reliance will lessen in future decades. A more steadfast car owner than factor 1.	**(Small - No change)** A steadfast car owner that's strengthened in their belief in car freedom. They do not see PT as a possible replacement and do not believe car reliance will lessen in future decades	**(Large change)** While positive on policy to curb car use, they seem (to have become) ironically very adamant on freedom of the car, their personal ownership and do not see PT as a serious alternative. However, believes car reliance could lessen in future decades.	**(No change)** While not agreeing that PT could serve as an alternative to the car, they were not swayed to the freedom of the car. Tentatively disavow-ing widespread car ownership. Believes car reliance could lessen in future decades. Likely not a car owner/user, as shown by preference to biking and walking.	**(Large change)** Perhaps the strongest steadfast believer of car ownership, having gained an even greater appreciation for the freedom of car ownership. Does not agree that PT could serve as an alternative to car usage. Even still believes coming decades might lessen car necessity.
Public Transport Use	Did not start to miss PT and is slightly annoyed with rule-breakers on PT. Likely not steady PT users.	Did not start to miss PT. Didn't gain worse view of PT due to hygiene. Believes face masking in PT to have become bothersome and PT uncertainty to have made it less attractive.	Did not start to miss PT. Likely had a negative view of PT. Pandemic hygiene and rule breaking slightly decreased the view of PT. Decrease of PT crowding didn't make PT more attractive at all.	Did slightly miss PT use. Believes face masking in PT to have become bothersome. No other strong opinions and likely a steady PT user.	Did not experience issues with hygiene on PT, nor with passengers breaking rule or face masking. Finds less crowded PT more attractive, but likely not a steady PT user.	Did not start to miss PT. Doesn't believe face masking in PT to have become bothersome and experienced increased issues with hygiene in PT.	Did not start to miss PT. Did not experience issues with hygiene on PT, nor with face masking. Wasn't more attracted to PT due to less crowding. Likely not a steady PT user.	Did not start to miss PT. Didn't have issues with hygiene or rule breaking. Face masking became bothersome and uncertainty made PT less attractive. Likely not a steady PT user, that also opposes Covid measures.

Bicycle use and walking * (Opinion change was small, thus some change is highlighted)	**(Small change)** Did not miss biking or walking to work. **Hasn't become;** Less appreciative of biking and walking as an alternative to the car.	**(Small change)*larger** Strongly did not miss biking or walking to work. **Has become;** Biking likely wasn't an alternative.	**(Small change)*larger** Strongly missed biking or walking to work. **Has become;** Likely disagrees on commute distance being too long and misses the activity.	**(Small change)** **Hasn't become;** Less appreciative of biking and walking as an alternative to the car.	**(Small - No change)** **Hasn't become;** Less appreciative of biking and walking as an alternative to the car and laments the loss of the activity.	**(Small change)** **Has become;** Less appreciative about bike use as alternation for car use. No change on bike use and walking.	**(Small - No change)** Strongly missed biking or walking to work. **Hasn't become;** Less appreciative of biking and walking as an alternative to the car and laments the loss of the activity.	**(Small change)** Did not miss biking or walking to work. **Has become;** Likely did not see biking or walking as a car alternative and did not partake in biking.
General impact on travel behaviour by working from home and COVID policy	Has become very positive on WFH and does not intend to return to pre pandemic travel habits. WFH does not have a particular impact within their job sector and does not disturb personal life. Better travel predictability is lightly appreciated.	While not necessarily feeling that their personal privacy or personal life was negatively impacted by WFH, there is a strong urge to return to old travel habits post pandemic. This is likely due to their work sector being heavily impacted by WFH, as WFH did not gain appreciation.	Did not experience WFH and its time loss and energy savings as particularly pleasant. This is likely due to the fact that WFH that has a large negative impact within their personal life and job sector. As such they seek return to old travel habits post-pandemic.	Has become very positive on WFH and does not intend to return to pre pandemic travel habits. WFH does not have any impact within their job sector and does not disturb personal life at all. Respondents put great emphasis on this latter attitude.	Largely has no strong opinions on WFH affecting travel habits, but appreciates time saving. Doesn't feel personal life is disturbed by the employer due to WFH and feels that less road crowding has made commute more predictable.	There is no strong opinion on the time loss savings of WFH, and less energy loss isn't appreciated. While better travel time predictability is appreciated and WFH is realistic in their job sector as it doesn't impact their job or personal life as much, there is a relatively strong urge to return to pre-pandemic commute habits.	Has become positive on WFH and does not intend to return to pre pandemic travel habits. WFH does not have any impact within their job sector and does not disturb personal life at all. Better travel predictability isn't lightly experienced. Working from home was likely very much possible within their line of work.	WFH has gained strong appreciation and there is no aim to return to old travel habits. Time and energy savings due to WFH are appreciated, much like increased on road travel time predictability. While generally gov policy on pandemic and commute is opposed, WFH is not seen as negatively impacting personal life.
General impressions on working from home itself	Has a decent WFH office and strongly believes partial WFH to be ideal. Does absolutely not believe WFH has become an intrusion on privacy and finds it generally ideal as it saves time. Does absolutely not believe enforced WHF will lead to productivity loss due to employee abuse.	Has a good WFH office and strongly believes partial WFH to be ideal. Does not believe WFH has become an intrusion on privacy. Does believe enforced WFH will lead to productivity loss due to employee abuse.	Has a decent WFH office. However, they did not get used working from home and did not find it ideal.	Has a good WFH office and strongly believes partial WFH to be ideal, as it also save a lot of time. Strongly had to get used to WFH. Does not believe WFH has become an intrusion on privacy.	Has a good WFH office and strongly believes partial WFH to be ideal. However, they did not necess-arily get used to WFH and do not value the time savings. Believes WFH has become an intrusion on privacy. Does not believe enforced WHF will lead to productivity loss due to employee abuse.	Has a decent WFH office and strongly believes partial WFH to be ideal. Does absolutely not believe WFH has become an intrusion on privacy and does absolutely not believe enforced WHF will lead to productivity loss due to employee abuse.	Has a good WFH office and strongly believes partial WFH to be ideal. Had to get and got used to WFH and slightly appreciates time savings. Does not believe enforced WHF will lead to productivity loss due to employee abuse.	Strongly believes partial WFH to be ideal, in part due to time savings. However, does believe WFH has become an intrusion on privacy. Does absolutely not believe enforced WHF will lead to productivity loss due to employee abuse.

Employee cooperation related variables	Has become very positive on WFH in a professional sense, believing in productivity benefits and disagreeing with statements posed on the ease of online communication. Does only tentatively disagree with issues surrounding more informal social activities.	Has become ambivalent to WFH. While non-committal on belief in benefits /negatives in productivity, they do mention issues with reaching colleagues and missing informal social contact. Isn't necessarily negative about online meetings when they happen.	Has become rather negative on WFH. Strongly misses both the informal an professional aspect of in person communication, being negative on WFH. They did not see any productivity increases due to WFH limiting colleague distractions.	Did not become more negative about WFH. While they might miss informal parts of in person communication and find reaching colleagues more difficult, they strongly disagree with issues during online meetings negatively affecting their view of WFH and do see some productivity benefits.	Hasn't become fully negative on WFH due to interaction with other employees. However, they're negative on most all aspects of both professional and informal interaction with other employees.	Has become more negative on both informal and professional WFH interaction. Also doesn't necessarily see productivity increases. Did not necessarily become more negative on professional communication during meetings, or WFH as a whole due communication issues.	Has remained neutral on WFH. Sees the productivity benefits and does not see issues during professional meetings. However, they did come to miss more informal social contact and found colleagues hard to reach.	Has become more negative on WFH in the sense that professional communication is generally worse. However, they do see productivity benefits and do not necessarily miss social interaction.
Employer cooperation related variables	Had a digitally facilitating employer. Believes employer has become more positive on WFH, its cost benefits and believes government should further encourage WFH.	Believes employer has become more positive on WFH and believes government should further encourage WFH. No change regarding cost benefits.	Had a digitally facilitating employer. Believes employer has become more positive on WFH, doesn't believe in cost benefits.	Had a digitally facilitating employer. Doesn't believe embraced WFH, but believes government should further encourage WFH.	Has slight belief in cost benefits of WFH for employer and government encouragement of WFH, but has no strong opinion on employer outlook change.	Had a digitally facilitating employer. Slightly believes employer has become more positive on WFH, its cost benefits and believes government should further encourage WFH.	Had a digitally facilitating employer. Has slight belief in cost benefits of WFH for employer and strong belief in government encouragement of WFH.	Believes that WFH has become more embraced by employers, but also strongly believes that government should not further involve themselves within WFH encouragement (for emission reduction purposes).
Commute characteristics	**/**	Did not start missing experience of the environment.	Did start missing music, solitude and the environment in commute.	Did start missing experience of the environment.	Did start missing music and solitude during commute	Did not start missing experience of the environment.	Did not start missing experience of the environment.	Didn't start missing music, solitude and the environment in commute.

Table 6.2 Description of factors for different subjects

The different factors will be further explored through researcher analysis of the results of the Q-sort, looking for connections between results. A short analysis of the Q-sort results will be done for all 8 factors to produce a summarized 'profile' overview of the respondents within those factors.

Factor 1; Car commuters that strongly shifted to structurally working from home

These respondents have become very positive towards WFH. They aim to retain a car for personal use and did not use to be PT or bike users. However, they'll likely not use the car for commuting anymore. Likely due to this fact, they're not or no longer strong opposition to car use curbs, such as road pricing (rekeningrijden), or the idea of travel/commute alternatives to the car taking precedent. Most aspects of WFH are appreciated, such as productivity increases, prevailing good communication with colleagues and a good WFH relationship with the employer. It could be due to the fact that all different aspects of the work situation, like a digitally facilitative employer or a good home office, are perceived as lending themselves well to WFH, thus the general attitude towards WFH has become positive. A well facilitated workplace might allow respondents to enjoy travel time savings or other benefits of forsaking car commute for WFH more, as commute and its required investments are no longer seen as a necessary sacrifice. However, most respondents mention having a decent home office or a supportive boss, while not having become as enamoured with WFH as these respondents.

It could also be perceived that these respondents have simply come to like the practice of WFH itself. Either their job or the priorities of these respondents lend themselves well to WFH, as this group of commuters is the only group to not come to experience issues in communication with colleagues, either formal or informal. This could be a sign that these respondents don't much value colleague interaction, citing their increased sense of productivity due to less distraction by fellow employees. However, outside of variables not discussed within this study, this preference could be born from a sense of practicality that has spurred these respondents, operating in a sector where WFH didn't come to have a negative impact on respondent perception of the ability to do their job, to start viewing the practice in more positively. While these respondents have become positive on policy further encouraging WFH, it likely won't impact their commute behaviour as much anymore. They have already been facilitated in the practice and most that are able to WFH, these respondents are, might not be able to change their behaviour more. It would be prudent to observe to what extent attitude change on WFH has caused a behaviour change from before to after the pandemic. Similarly, it will be interesting to gain some form of indication on how much work circumstances and their job sector have allowed for an attitude shift that led to this possible behaviour change.

Factor 2; Car commuters looking to return to pre-pandemic commute behaviour

These respondents represent commuters that weren't charmed by WFH. They did not come to like WFH, but likely never saw bike use or PT use as an alternative to car use, as they're negative on both travel modes and state that their opinion on the modes has hardly changed. They've not come to appreciate travel time savings of WFH and lament what they experienced as worsened (in)formal communication with colleagues. Is this latter issue a result of these respondents being personally attached to old in person interaction, or their job being dependent on communication that won't function well digitally? These respondents do feel that WFH has become more accepted in general and do not necessarily oppose further introduction of WFH for others, or partially for themselves if possible. In that sense, they can't be seen as opposition to the introduction to WFH in general.

Much like in the consensus in factor 1, the new WFH proponents, they have a good home office and while they don't cite their employer to be digitally facilitating, they also don't insist otherwise. Furthermore, they do mention that their employer themselves has become more positive on WFH. So what gives? The most important attitude change here, is that these respondents have come to strongly feel that WFH has a large negative impact on their work sector. As respondents do mention having come to enjoy partial WFH and having come to believe in further government encouragement of the practice, WFH likely greatly affects their specific job. Their position likely requires colleague interaction that hasn't been able to be offered through WFH. This is further enforced by the strong opposition that has formed against enforced WFH, believing that it will cause productivity loss. These observations are paralleled with the fact that respondents have not come to feel that WFH would necessarily impact their privacy or personal life. As such it can be concluded that they haven't come to dislike WFH itself, they're simply unable to engage in the practice for practical reasons.

No amount of employer support or government encouragement will lead these commuters to WFH, they simply don't see the ability to. It will be interesting to see if this group that has come to strongly wish for a return to old travel habits, shows no indication of having actually adjusted their commute patterns as their perspective suggests based on their Q-sort results, remaining car commuters. It could give an indication into what jobs technically allow for WFH, but aren't compatible in practice.

Factor 3; Multimodal opposers of working from home themselves

These respondents, likely due to their job position or their job sector, are very negative about WFH themselves as it's not a serious option for them. They strongly came to miss informal interaction with colleagues and weren't impressed by formal interaction with colleagues while working from home. They seek to return to old travel patterns, not further embracing WFH. These respondents aren't necessarily PT users or appreciators, if anything they were strengthened in their distaste for PT use, but they certainly aren't solely frequent car users either. They likely cycle to work often, but also strongly support car ownership for moments when cycling is impossible. This comes with opposition to government curbs on car usage and ownership. These respondents have strongly come to miss cycling to work. Coming to miss the activity on its own and disagreeing on travel distance being too long to walk or cycle. This indicates a general favourability towards bike commute, both for shorter trips and longer trips for 'workout' purposes. This latter half is reinforced by timesaving due to WFH not having come to be regarded highly in comparison to other factors that appreciate time savings.

Having come to miss cyclo-pedestrianism indicates likely deprivation during the pandemic, perhaps even structurally post-pandemic if they were forced to adopt WFH for a certain amount of days. One would expect this attitude to influence behaviour into returning to this habit, like respondents wish. It remains to be seen whether this is actually the case. Having continued to have a positive view of car use, it would also be interesting to see if a positive attitude towards multimodality, is structurally strong or more easily supplanted in actual behaviour by WFH. Or whether bike usage is more easily given up on in favour of car usage, as commuters embrace some form of WFH personally disliking it.

Does a positive view of multimodality, and consecutive engagement in multi-modal commute, make a commuter more open to behaviour change, even if unwanted? Or were both car usage and cyclo-pedestrianism similarly affected by the pandemic related WFH policy by government and employers? That could mean that bike commute appears to have become more expressly missed than car use if it was decreased. Or there is the more simple explanation that car usage did not decrease, whereas bike use was easily given up on. This might be the case, as respondents have remained staunchly in favour of the comforts of car usage and more appreciative of the individual freedom it offers. One point that does have to be raised here, is the possibility that not all of these respondents were car owners or frequent users before the pandemic. This could be a belief unrelated to pandemic triggers experienced during enforced WFH, but a variable like political ideological reasoning. Many likely still favour the car and have been using it on and off. If this were to be the case, one can wonder whether WFH, even when decreasing commute in general, will effectively decrease car usage in commute through further introduction. The ability, to decrease car usage appears limited if this is the case for more factors, as attitude might suggest that other modalities are given up more easily in practice.

Factor 4; Multimodal PT commuters shifting to WFH, remaining steadfast car owners

These respondents mention to be steadfast car owners, even if they don't necessarily plan to further use the car in commute themselves. While they oppose car use curb policy, they are positive on the effects of lessened use. This complements their overall positive change in attitude towards WFH, having developed a positive attitude towards not returning to pre pandemic commute behaviour. The benefits of WFH, such as productivity benefits, seem to outweigh some perceived negative effects on informal communication with colleagues. However they also mention that they had to strongly get used to WFH. This seems similar to factor 1, whose attitude changes indicate a shift from former majority car usage to WFH, but these respondents also mention having come to miss PT use, further mentioning a growing annoyance with mask mandates. These opinions indicate that these

are likely steady PT users. Respondents also mention not having become more negative on bike use. This appears to suggest a pattern of multimodal commute, that's been informed by their attitudes.

Much like factor 1, while these respondents have become positive on government policy further encouraging WFH, it likely won't impact their commute behaviour anymore. They have already been facilitated in the practice and most that are able to WFH might not be able to change behaviour more than it already has throughout the pandemic. They mention having a good home office. No large change can be made here as they mention not believing their employer hasn't fully embraced WFH.

Combined with issues in informal communication having grown to negatively impact respondents' otherwise positive attitudes towards WFH and having to get used to WFH, their job sectors, or more likely individual functions, were probably impacted harshly at the start of the pandemic. Serious changes to how the job was structured by introducing WFH might have been necessary. Respondents have come to feel that the employer has grown to be digitally facilitative, which might not have been the case earlier in the pandemic, having likely experienced WFH as a whole more positively. Issues in early digital workspace development also explain negative attitude towards informal communication with colleagues, as this more involved communication with colleagues within the job might have made implementing WFH more difficult, causing the aforementioned early WFH related problems.

Based on insight that full-time WFH initially wasn't facilitated well, but now is, based on increased commuter appreciation, change in attitude on commute modalities and resulting behaviour will likely be structurally stagnant from here on out. As these respondents have come to miss PT, mentioning a growing annoyance with mask mandates, one could expect a return to old commute patterns. However, as they have a strong attitude to not return to pre-pandemic commute habits, this likely won't happen. Commute car use has similarly grown less appealing, but attitude indicates steadfast support for car ownership and use outside of commute, far stronger than the car users in factor 1. This could mean that those already familiar with frequent use of other modalities can't be swayed from the car as much as those that primarily used the car, but were radically shifted away from it in attitude through introduction to WFH. This could be due to those familiar with multimodal travel having been or having become more protective of their car ownership. This could be due to frequent multimodal travel, using for example PT, granting them more experience with circumstances under which those other modalities aren't accessible, like during the pandemic or other circumstances in which PT use is more difficult, cementing the continued need for the car in their minds.

As for the commuters in factor 4, both their primary commute modalities from before the pandemic, are still somewhat appreciated. Interestingly, the multimodal commuter appears to have become or remained more positive on the car than former car commuters, again indicating that multimodal travel patterns are likely more easily given up on even when WFH isn't fully experienced as positive.

Factor 5; Part-time cyclo-pedestrians, unchanged in their behaviour

These respondents seem ambivalent towards WFH, being indifferent towards the activity, disliking some aspects, but preferring others. They prefer to part time WFH, but make it clear that they have some issues with WFH and how it impacts their commute patterns and experience. They have strong issues with how WFH negatively impacts both informal and formal interaction with colleagues and don't appreciate time saving due to WFH replacing commute. Furthermore, while they don't feel their personal life to be disturbed by WFH, they have come to lament the sense of privacy loss that came with working at the home office. However, they have come to appreciate time savings and don't necessarily oppose government policy encouraging WFH in general. Much like factor 4, there's indication of multimodal commute, with attitude changes suggesting a primary focus on bike usage.

To put emphasis on this possibility of bike usage, unlike those in factor 3, these respondents haven't come to miss bike usage. They've come to lament the loss of the activity (as a work-out), but haven't become less appreciative of cycling. This characterises attitude that has remained largely unchanged towards bike usage. Likely, the pandemic didn't structurally change cyclo-pedestrian behaviour, as

such respondents haven't come to miss the modality. This could indicate that they only shortly worked from home and returned to working at location quickly after. This might be due to their job situation, or simply because they like the commute itself and wish to continue the behaviour. The presumption of largely unchanged behaviours since before the pandemic, based on the identified attitudes, comes from the fact that these respondents also don't believe their car reliance will lessen in the future. These respondents haven't gotten used to WFH and are largely ambivalent towards it.

There's a good chance that WFH once in a while might have become preferable, but that commuting to work in person remains largely preferable, as these respondents are the only factor, except factor 4, that mention that they started missing solitude and listening to music while commuting to work. This indicates enjoyment from commute itself, further emphasised by time-saving through WFH not having come to be valued by these respondents. They might have come to enjoy the freedom to WFH when wanted and want employer to further encourage it, but rarely do this themselves.

Respondents that make up this factor are similar to the part-time cyclo-pedestrians within factor 3, in that they simply haven't embraced WFH. But, whereas the cyclo-pedestrians of factor 3 had their attitude influenced by the negative impact of WFH and the pandemic on their work sector, these respondents simply enjoy working at location and have become reinforced in their enjoyment of their commute, in part due to likely not fully engaging in WFH during the pandemic. As such, it's hard to determine what would change this attitude. WFH could serve as back-up for moments that cyclo-pedestrianism isn't possible due to outside variables such as weather, instead of the car. However, these respondents are part of one of the few factors that mention being unsure on whether they'll ever come to rely less on the car in the future. However, like factor 3 and unlike factor 4, the fact that these are likely commuters that prefer using the bike more than other respondents also means that statement 12 that this observation is based on, could be misinterpreted. The statement reads;

> *I've come to currently believe that car ownership remains necessary, however this could change in the coming decades.*

It could also mean that cyclo-pedestrian respondents of factor 3 and 5 disagree that a car is currently necessary, not that this will be different in the future. This misinterpretation of 'double statements' is evaluated in chapter 8. It would help to study respondent actual behavioural change to gain an indication to whether their attitude and change in that attitude truly led to such stagnant behaviour. However, this issue in interpretation isn't shared by the cyclo-pedestrians in factor 7, or the car supporters in factor 4. Nor would the interpretation that these cyclists simply remain attached to the car necessarily be incorrect, as these respondents have also become far more positive in attitude towards the freedom offered by the car. This indicates that these respondents truly do remain attached to the car even if they largely believe in the use of commute alternatives when possible.

Factor 6; Car use opposers, strengthened in THEIR own personal car use

This group is interesting, as they've come to strongly support curbs on car use through road pricing and tentatively agree that widespread car ownership has become a negative variable within cities. They've also come to support for government policy to further promote WFH and alternatives to car use for commute. Yet, when asked about the changes in attitude towards their own car use, they mention having become more confident in their own personal car ownership and having become strongly appreciative of the freedom that is offered by the car. Their attitude towards WFH can be described as 'lukewarm' with many aspects of WFH not being appreciated. Then what is going on here? This group sees problems with widespread car use and hasn't found PT or cyclo-pedestrianism to have become more attractive, yet also remains somewhat ambivalent towards WFH. If these are car users that did not like PT and cycling before the pandemic, then they've likely been strengthened in their appreciation of the freedom of the car due to issues surrounding these modalities during the pandemic, like public transport being limited or closed down for most commuters at the start of the pandemic. While this attitude change makes sense, it still does not answer the issues regarding WFH.

These respondents have come to strongly wish for return to pre-pandemic commute habits. As they haven't been impressed with the effects of WFH, having grown negative on communication with colleagues, with the exception of digital meetings, yet also not feeling more productive. Interestingly they do profess to have come to like partial WFH and had a good at home office as well as a digitally facilitating employer who has become more positive on WFH and its benefits. So what is the issue?

These respondents might not like the overall experience of WFH. While WFH is realistic within their job sectors and hasn't come to negatively impact their personal lives, there's a large urge to return to old commute habits. They simply haven't come to like WFH much. This discrepancy between the attitude towards personal car usage being rather positive and the attitude towards policy aimed at lessening car usage to be equally positive isn't explained. Evaluation of other statements might give an insight into this discrepancy, as it's perhaps caused by personal ideological beliefs, that aren't examined within this study, affecting their view on car use. Respondents are positive towards road pricing and believe WFH should be further encouraged for emission reduction reasons, even while not liking WFH much personally. Similarly, despite not using PT, these respondents have strongly reinforced their aversion of hygiene within PT due to the pandemic, while not having become bothered by mandatory face masking and moreso with fellow commuters not following rules.

This indicates attitude change possibly being motivated by ideological attitude positive on COVID restrictions and environmentalism. Whether these respondents actually have come to embrace WFH within their commute behaviour during the pandemic, or whether they remain using the car that they profess to have come to oppose for climate reasons, while having come to support it personally.

Factor 7; Full time cyclo-pedestrians that have shifted to working from home

(A part of the discussion regarding these respondents was done within factor 3 due to similarity regarding bike use.)

These respondents are full-time cyclo-pedestrians that were swayed to WFH. They aren't fond of PT and were likely never steadfast car owners or users for commute, neither seeing the benefits of car use decreases, nor becoming more appreciative of the car's comfort and freedom. They did strongly miss walking and cycling to work, indicating a former cycling and walking commute habit. They've become more positive on WFH, but have come to miss informal communication with colleagues, while having come to like more other aspects. WFH was likely well possible within their work sector and job function, also not negatively impacting personal life. However, it is necessary to mention that time loss savings are only lightly appreciated. This could be due to the fact that bike users do not particularly value travel time as highly as other commuters, finding some enjoyment in the activity.

This observation is reinforced as respondents have come to miss the activity itself. However, the increased positivity towards WFH has likely structurally affected commute trips, including bike usage, if attitudes are anything to go by. This view is based on a strongly developed positive attitude toward not returning to old commute habits post-pandemic. As such, while cyclo-pedestrianism is missed, WFH has likely become more positively regarded. This change could be due to the fact that a good home office was available, but this is the case for most every factor. It could also be due to the fact that WFH and the pandemic haven't come to have any particular impact within their job sectors, but this was also largely the case for cyclo-pedestrians in factor 3 who were opposed to WFH.

As such, the following attitude change might explain what makes factor 3 different from this factor. The cyclo-pedestrians that have come to be somewhat negative on WFH claim to have missed music, solitude and the environment in commute. Whereas these respondents, within factor 7, express not having come to miss the environment during commute, nor giving any definitive indication that they might have missed solitude during commute. As shown in the analysis of factor 3, this factor features commuters that use the bike far more than the average commuter within the P-set. It must thus be mentioned that this group seems to mostly not be opposed to curbs on car commute, as they're not avid car users themselves. Although there is of course the possibility that opposition to car usage and ownership informed the decision to commute through walking and cycling in the first place.

Factor 8; Commuters generally opposed to government & policy

These respondents are marked by their general opposition to introduction of government policy to the field of travel or any area of policy that would seem to impact their personal lives, primarily by limiting certain choice freedoms. In particular, they seem to strongly oppose curbs on car use, such as road pricing, or statements concerning the need to lessen car ownership. This is interesting, as these respondents aren't particularly opposed to WFH, they have come to support it. They believe it positively lessens the necessity of the car and see partial WFH as ideal, yet also mention that they will not part with their car, despite possibly seeing the car as no longer necessary in future decades.

It's likely that this critical position, much like the one portrayed in factor 6 towards car usage, isn't caused by commute behaviour and related attitudes or by factors related to the work situation, but by ideological beliefs that aren't examined within this study. This observation is further supported by the fact that these respondents having become heavily bothered by (at the time of survey) continued mask mandates within PT, despite likely not being frequent PT users. Another aspect that might hint at influence of ideological belief, is that these respondents have come to disagree with how much of an annoyance rulebreakers are in PT and that worries about hygiene related to the pandemic have not grown larger. This indicates, much like the stance against environmentalism that seeks to limit car usage, that there is a stance against COVID-policy and the political reasons for drafting this policy.

When considering that these respondents have a bias against aspects of commute that are influenced or spurred on by government involvement, some of the z-scores for statements start making more sense. Despite having grown positive about most aspects of WFH, only seeing some smaller issues in communication with colleagues and interestingly privacy at home, a statement that isn't supported by any factor with the exception of factor 5. They oppose the government further encouraging WFH, likely due to the statement mentioning the climate and pollution decrease as a reason for the encouragement. These respondents also do not seem to miss any aspect of commute, not even missing the experience of music, solitude or the environment during commute. They've generally come to support WFH and haven't come to miss the commute trips themselves. It's thus interesting to see whether a positive change in attitude towards WFH has caused behavioural changes that conform with this attitude, whereas they oppose the government encouraging it.

6.2 Exploration of factor respondent characteristics and behaviour

This section is an addendum to exploration and interpretation of attitude factors in the last sub-chapter. For each different variable, several variables from within the post Q-sort questionnaire are examined to give some indication of whether assumptions made about z-scores indicating attitude change were representative of actual commute behaviour. This is done to answer sub-question 4;

Sub-question 4; *What are the possible behavioural effects on commute behaviour, of the identified changes in attitudes towards commute within perspective clusters?*

The sizes of these groups are too small to draw quantitatively significant conclusion, generalizing them to the Dutch commuter populace, however, knowing the detailed Q-sorts of respondents, it could well be possible to at the very least measure whether statements made on attitude somewhat match actual behaviour of those respondents. This will help further characterising the different factors and give an indication on the behavioural effects of the measured attitude changes.

Factor 1; Car commuters that strongly shifted to structurally working from home

While Q is a qualitative method not meant for making quantitatively generalizable conclusions, this perspective interestingly contains far more respondents than the other perspectives. This could somewhat indicate that, while not necessarily being a perspective held by the majority of Dutch commuters, it's likely one of the more widely held societal perspectives among Dutch commuters.

Due to data gathered in the post Q-sort questionnaire, it's possible to examine whether the attitude change towards working from home, has also caused a change in these respondents commute patterns. Unsurprisingly, the amount of days that these respondent work from their homes have

grown. It's perhaps more interesting to see how this has impacted their car usage, to possibly link this behaviour to their attitude change on car use curb policy. With the increase of WFH, has come a significant decrease in car usage, approximately doubling the percentual decrease within the P-set and possibly the average population. The average number of workdays commuted by car pre-pandemic is 2.75 and decreases by -83% to 1.5 after the pandemic. This is shown in figure 6.1.

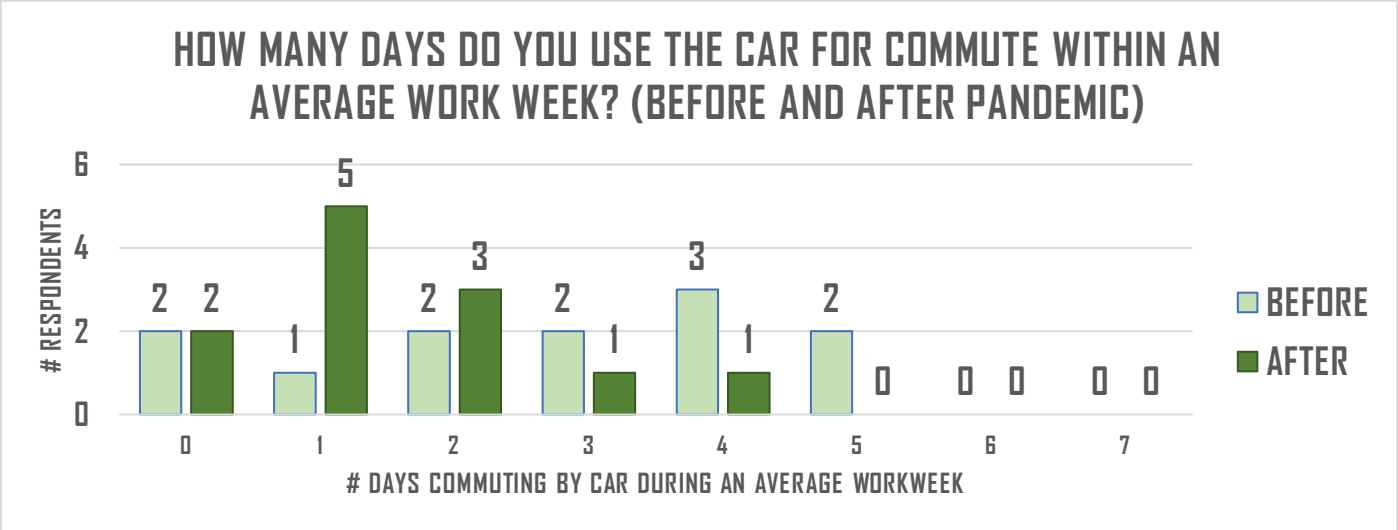


Figure 6.1 Factor 1 car usage change

Why do these respondents wish to continue WFH? Could this be linked to the type of job allowing for a shift away from in-person working, or is it the result of personal attitude being caused by other variables? Upon inspection, the division of jobs among job sectors and functions complies with what was expected based on factor synopsis. The largest numbers of jobs can be found within the sectors of finance and public administration, accounting for half of all respondents. The contents of these jobs could lend themselves to WFH. When observing of job functions, shown in figure 6.2, something interesting can be noticed. The amount of office jobs isn't that high compared to the amount of job functions that are identified by the respondents as management or even care functions. This shows that even among these type of functions, a large increase in WFH could be seen as possible.

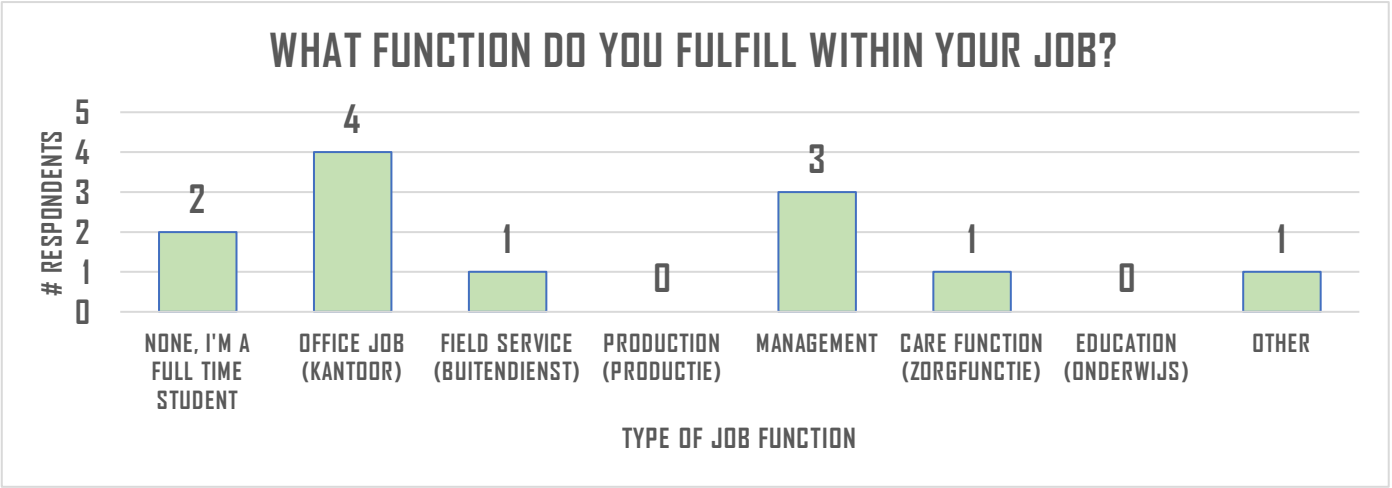


Figure 6.2 Factor 1 job function

Investigation of job positions doesn't show anything particularly interesting, having roughly the same distribution as the general population, which supports that this shift from the car to WFH is a general trend among Dutch commuters. The majority of respondents are employees, but even 1 employer, 1 student and 2 entrepreneurs are present, which indicates that function does not impact attitude for these respondents. The full distribution can be found in appendix I, figure I.1.

Factor 2; Car commuters looking to return to pre-pandemic commute behaviour

Assuming, based on attitude data attained in the Q-sort, that these respondents sought to return to working on location, data from the post Q-sort survey is analysed to somewhat see whether these conclusions are correct. The change in car commute before and after the pandemic is shown in figure 6.3. It shows, that whereas car use has generally decreased within the P-set, car use stayed level within this factor, as commuters have returned to old commute patterns. The average number of workdays commuted by car was 2.625 pre-pandemic, hardly growing by 9% to 2.875 post-pandemic.

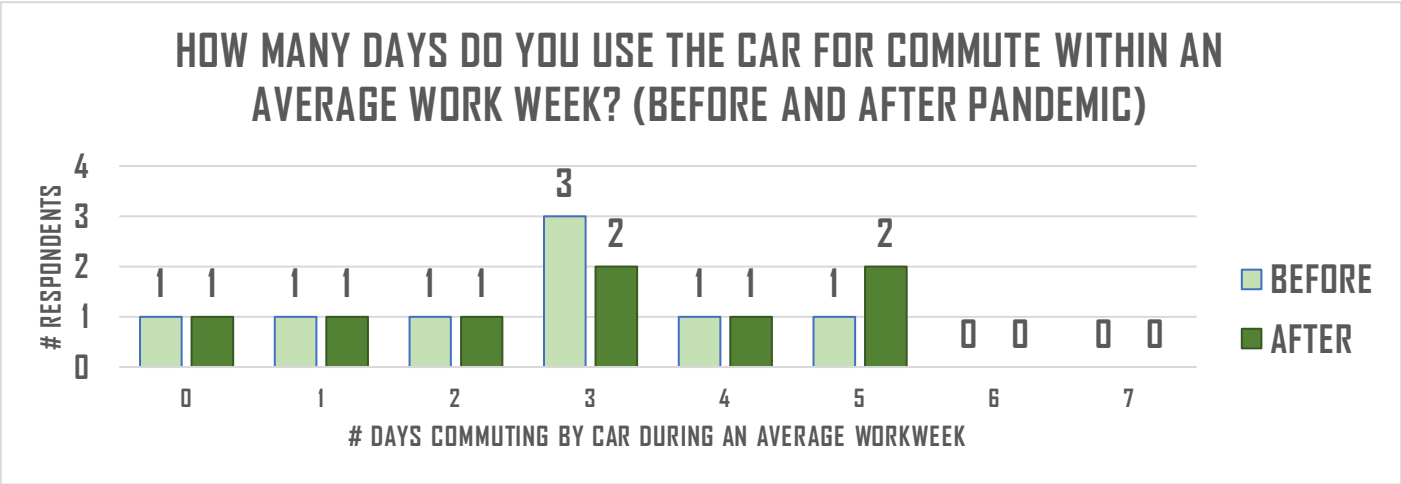


Figure 6.3 Factor 2 car use change

Further analysis shows that only 3 respondents make use of the bike at all, 1 making use 1 day per week and 2 doing this for 3 days. All in all, rather negligible in comparison to overall car usage. PT use is equally small. It's interesting that WFH generally saw no changes among the respondents within this factor, with only 1 respondent's WFH workdays ranging from 3 to 5. This hasn't changed much post-pandemic, a growth in WFH among respondents only being seen for 1 single day per week.

Why do respondents not wish to return to in person working? Could this be linked to the type of job requiring in-person working, or is it the result of personal attitude being caused by other variables? Upon inspection, the division of jobs among job sectors doesn't stand out as much as was expected from the factor synopsis. There are jobs in education and healthcare, for which it makes sense to wish to return to in person working. But there are also jobs in finance and business communication services. It's however likely that these specific jobs within these sectors require on location activity. As shown in figure 6.4, the different functions within their job sector are displayed. While there are a number of office jobs that could, at first glance, be assumed to suitable for WFH, there are also a fair number of jobs within management, education and production. These jobs naturally don't positively lend themselves to an attitude or behaviour shift towards WFH.

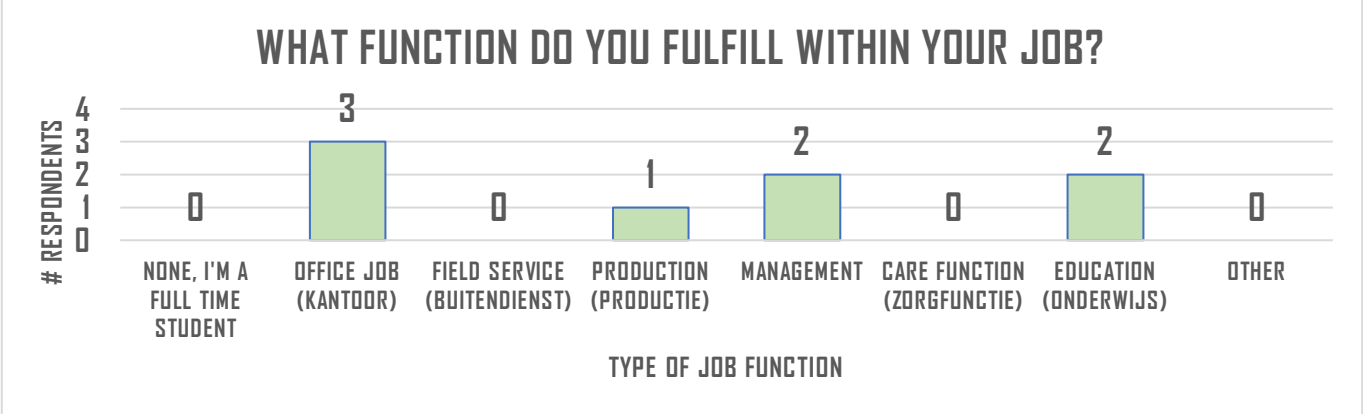


Figure 6.4 Factor 2 job functions

As shown in figure 6.5 , position within the company doesn't appear to be of importance for holding this perspective. The sample size is small, but largely seems to be distributed similarly to general distribution of job positions. One might have expected entrepreneurs and employers to be over-represented, generally preferring work on location to have employees near, but this isn't apparent.

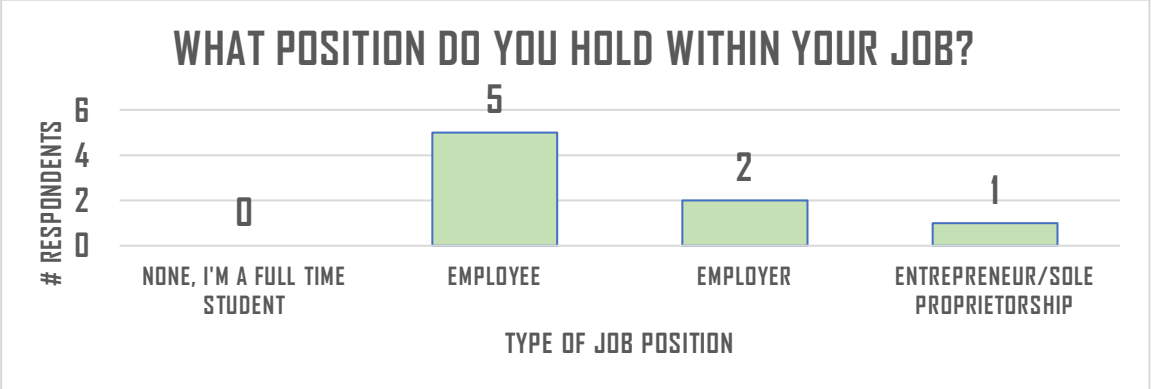


Figure 6.5 Factor 2 job position

Factor 3; Multimodal opposers of working from home themselves

Qualitative analysis shows that factor 3 has a relationship with 7 in the sense that these are the only factors that were strongly missing biking to work. These perspective clusters thus likely rely or relied more on bike use and walking during their commute, than others. Possibly with the exception of factor 5. This can be quantitatively explored in limited fashion through data collected in the post Q-sort questionnaire. Displayed below, is data on the combined respondent set of factor 3 and 7. It contains 12 respondents total. Car ownership and cyclo-pedestrian commute trips are discussed.

Car ownership	# 3 & 7	Factor 3	Factor 7
Yes	9	4	5
No	3	2	1
Not anymore	0	0	0

Table 6.3 Data on car ownership within factor 3 and 7

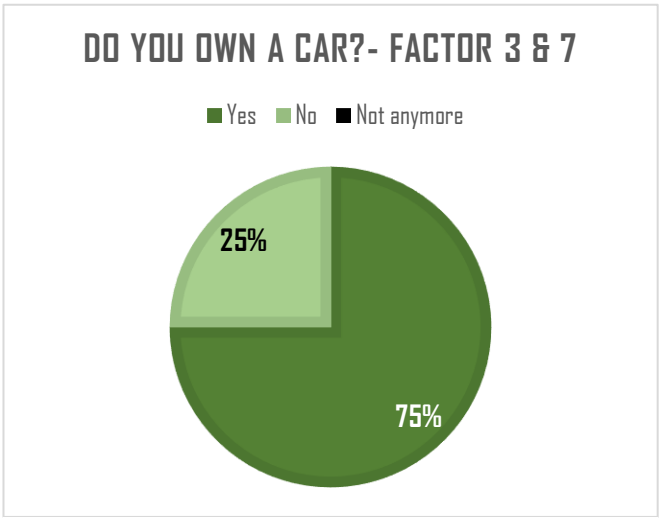


Figure 6.6 Factor 3 & 7 car ownership

Out of the entire population of 51 respondents there are only 5 non car owners. 3 of those total 5 non-car users fall within the cluster of factor 3 and 7, 2 in factor 3 and 1 in factor 7. As such, it's possible to say that the initial view established on factor 3 (and 7), that this group is the least likely to use a car in commute, relying on other methods such as the bike more than other groups was a correctly inferred from the data produced by the Q-sort analysis. However, it must be noted that even among these groups that either remain less positive on WFH and the use of the car for commute, in the case of factor 3, or that remain more negative on car use in general and replaced bike use with working from home, the majority still likely owns a car.

Having confirmed these perspective groups as bike users, it becomes useful to examine to what extent the pandemic might have impacted these groups. The average number of workdays during a week that respondents would commute to work, was 1,76 pre-pandemic for all respondents. So it's clearly noticeable that among the commuters in factor 3 and 7, the amount of bike use and walking is much higher at 2,67 days per week. Barely 24% of respondents is responsible for over a third of the bike trips pre-pandemic. Interestingly however, the overall drop-off of bike use within these perspective clusters, even among those in factor 3 that do not enjoy working from home, is far larger than in the overall respondents, dropping by 78% to the average level of all respondents of around 1,5 days per week. This shift is visualised in figure 6.7, it's data displayed in table 6.4 below.

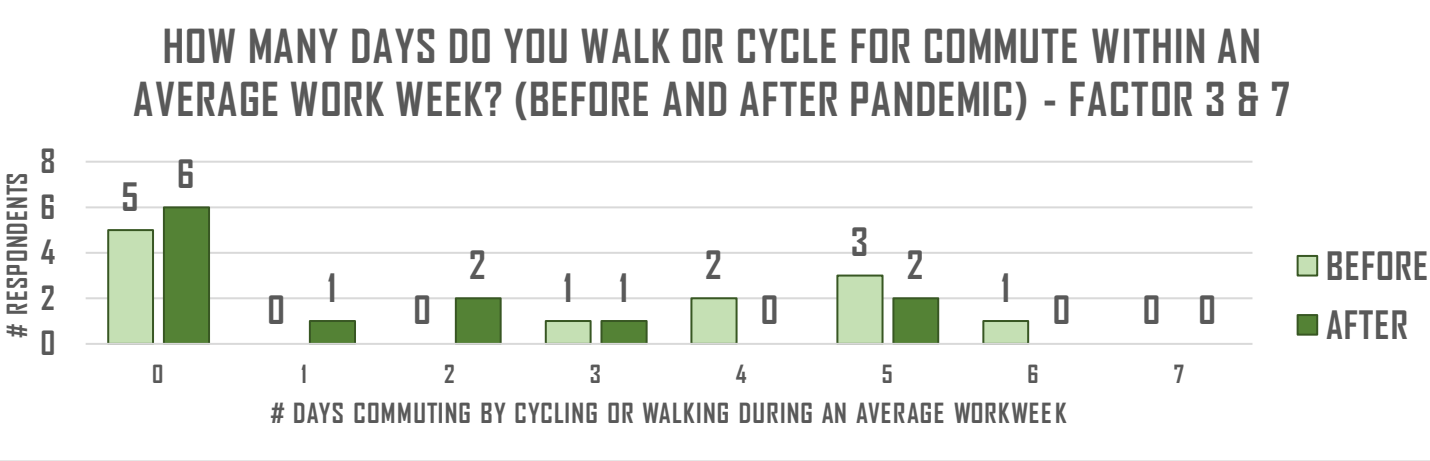


Figure 6.7 Factor 3 Cyclo-pedestrianism change

Days commute by walking and cycling	# Respondents pre-pandemic	# Respondents post-pandemic	
0	5	6	
1	0	1	
2	0	2	
3	1	1	
4	2	0	
5	3	2	
6	1	0	
7	0	0	Percentual decrease
Average number of workdays	**2.666667**	**1.5**	**-78%**

Table 6.4 Cyclo-pedestrianism change

Factor 4; Multimodal PT commuters shifting to WFH, remaining steadfast car owners

To further examine the attitudes of these respondents, car usage is examined using data from the post Q-sort questionnaire. This data shows a decrease in car usage for commute. However, it must be noted that the majority of respondents within this factor do not actually make use of the car for commute. Their bike use roughly stayed the same, whereas PT use declined a fair bit and WFH grew significantly, but never became the norm for more than 3 days per week. In that sense all commute modalities, with exception of the bike, gave up ground to WFH. This is interesting as attitude change shows that these respondents strongly believe in their continued car ownership and that this is one of the few factors that does not expect to change in opinion on this, even in the coming decades. Car usage halved, from a weekly 1.6 days on average pre-pandemic to 0.8 days on average afterwards.

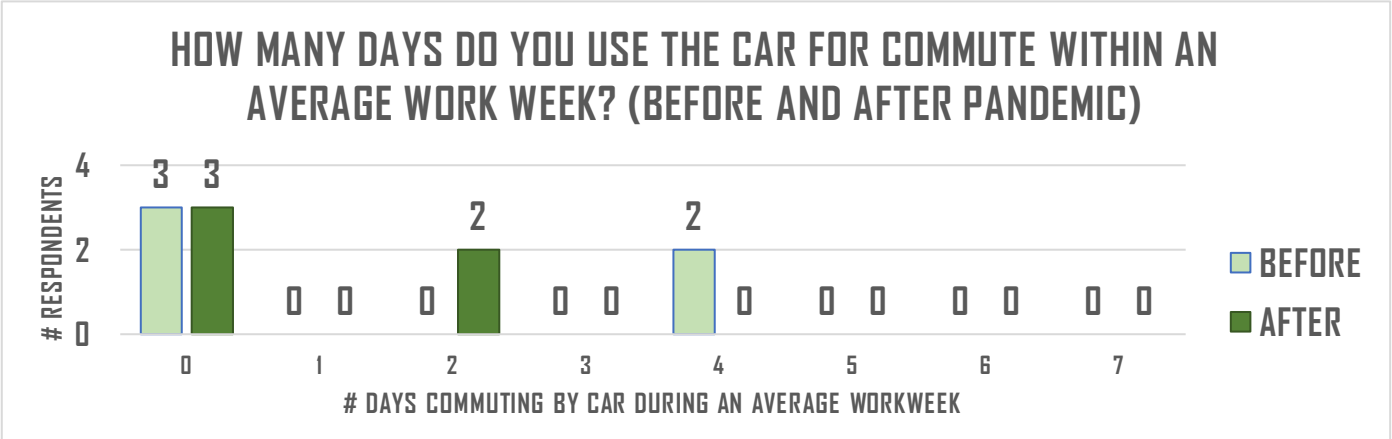


Figure 6.8 Factor 4 car use change

To thus refer back to the interpretation of the factor and attitudes that come with it, steadfastness in car use and ownership for these multi-modal commuters could possibly stem from variables outside of regular or pandemic related commute attitude and behaviour. For example a positive attitude towards the non-work related use of the car could inform this attitude. It would also explain why these respondents have not gained a more negative attitude toward non-car alternatives for commute, yet still remain so bound to the car.

Factor 5; Part-time cyclo-pedestrians, unchanged in their behaviour

To check whether the assumptions made about cyclo-pedestrianism as a primary modality for commute are correct, cycling and walking before and after the pandemic are measured. As shown in figure 6.9, bike use has remained largely the same before and after the pandemic. That number lies roughly a day above the average commuter's. This means that 2.6 workdays commuted by walking and cycling pre-pandemic dropped very slightly to 2.4 workdays after the pandemic. Further looks into car usage and WFH shows that those have respectively decreased and increased only marginally, such a change being largely insignificant. PT usage even lies and remains around the overall average.

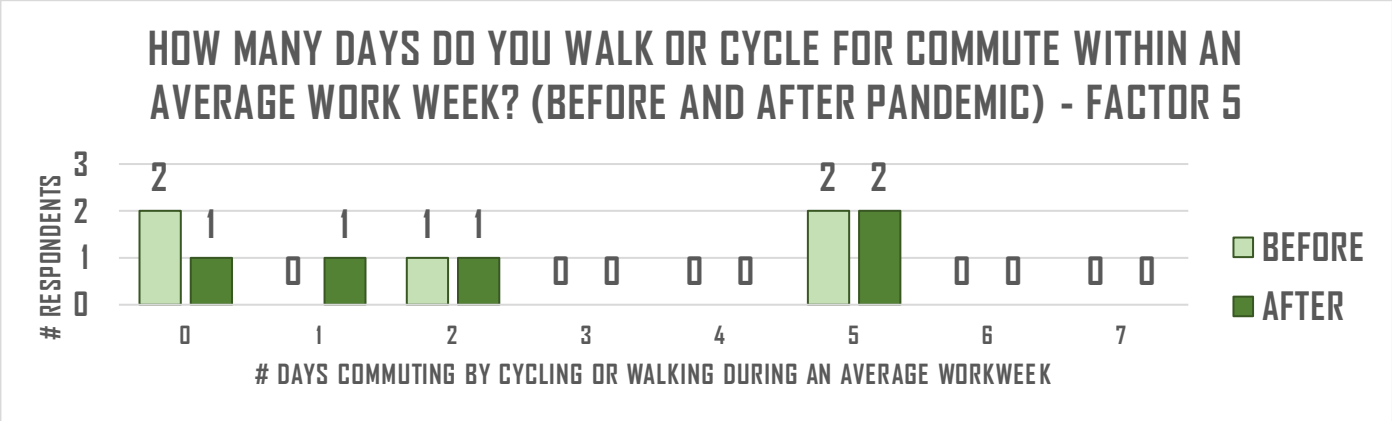


Figure 6.9 Factor 5 cyclo-pedestrianism change

Having confirmed that these are multimodal commuters, hardly changing attitude and behaviour due to the pandemic, it's interesting to see if they plan a return to old habits in figure 6.10. Like the factor synopsis, this shows an indication of the general ambivalence towards commute methods, the result being as spread as it is. This result can perhaps garner interest for research into why this group of primarily multimodal commuter seek to retain that behaviour and not be affected in their attitude.

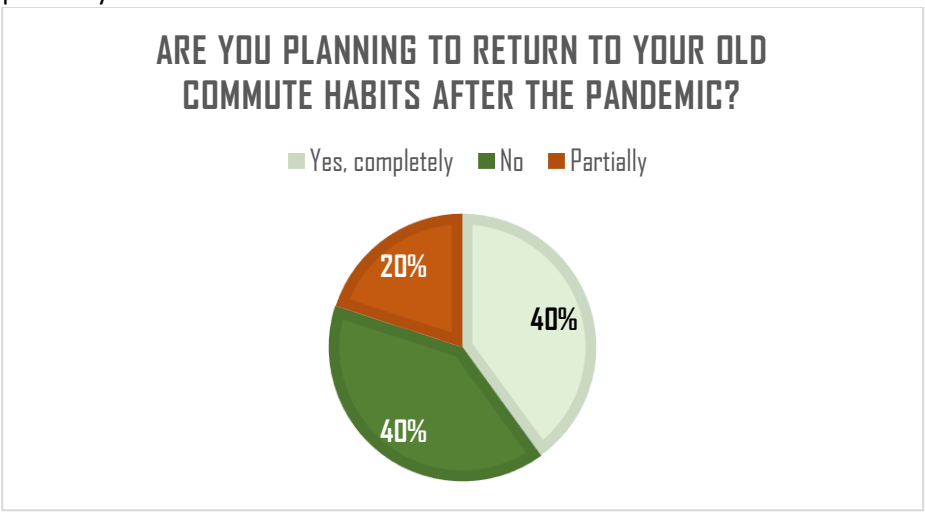


Figure 6.10 Factor 5 Aim to return to pre-pandemic commute habits

Factor 6; Car use opposers, strengthened in THEIR own personal car use

The respondents in factor 6 were identified through the analysis of attitude change z-score as opposed to general widespread car use, but strengthened positively in attitude on their own car use. They were also very ambivalent towards WFH. It's interesting to determine whether this group did change their own car usage due to the pandemic. As shown in figure 6.11, this is the case. Car usage for commute has dropped significantly, as the average number of workdays commute took place by car was 2.4 pre-pandemic, which dropped by 71% to 1.4 after the pandemic. But then if car usage decreased, did WFH actually increase? As shown in figure 6.12, despite the indifference towards WFH, it saw a large increase among the commuters within this group. The average number of workdays WFH took place was 1.4 pre-pandemic, which doubled to 2.8 after.

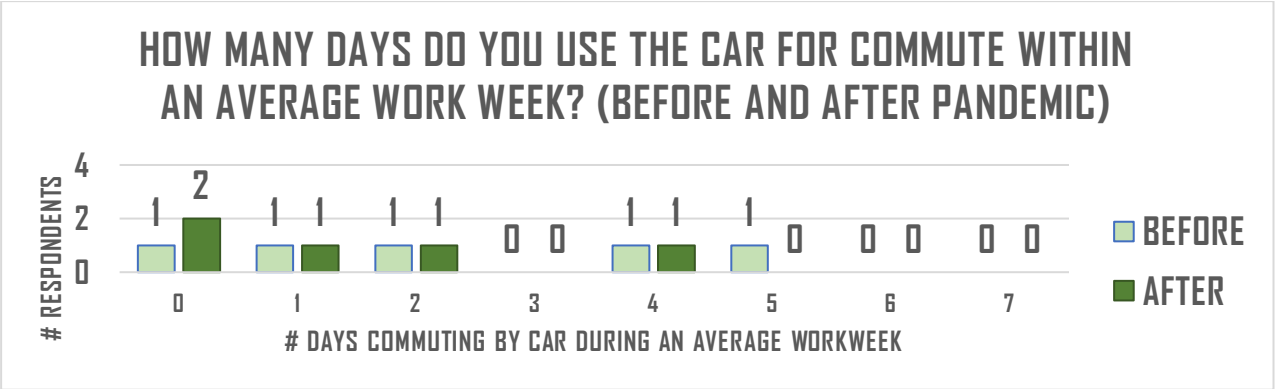


Figure 6.11 Factor 6 car use change

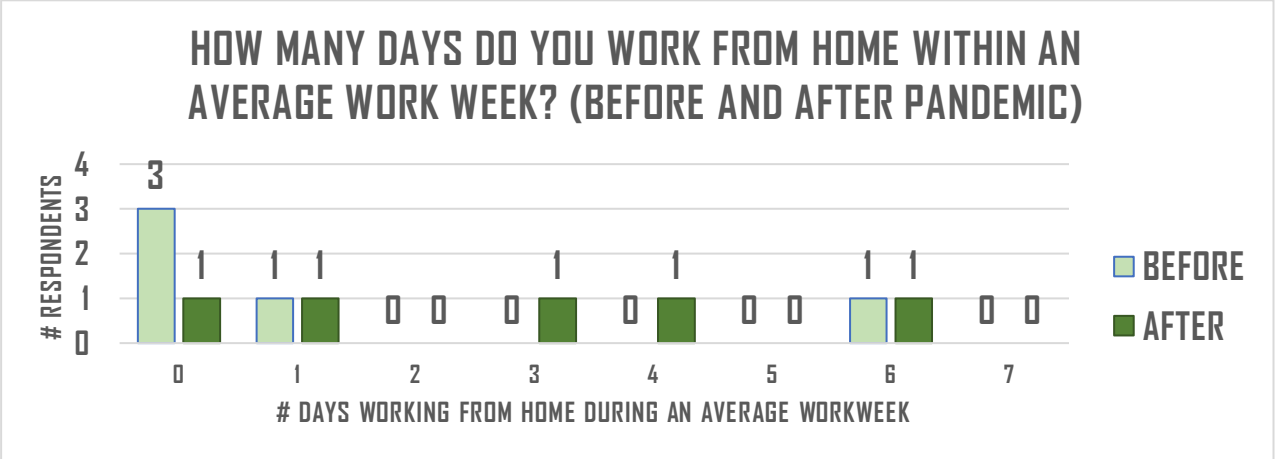


Figure 6.12 Factor 6 WFH change

It's interesting to see that even though this group seems strengthened in their car usage, not having become particularly charmed by WFH, car usage saw a decrease, whereas WFH increased. Outside of complete opposition to WFH, this can largely be seen across the board where non cyclo-pedestrian commuters indifferent to WFH have shown indications of continuing to work more from home than they used to, much like those that have become positive towards working from home. This might indicate a general 'culture-shift' in commute behaviour, structurally affecting most every employee.

Factor 7; Full time cyclo-pedestrians that have shifted to working from home

(A part of the discussion regarding these respondents was done within for factor 3 due to similarity regarding bike use.)

As shown in the analysis of factor 3, this factor features commuters that make more use of the bike than the average commuter within the P-set. This group seems to mostly not be opposed to curbs on car commute, as they're not avid car users themselves. Although there is of course the possibility that opposition to car usage and ownership informed the decision to commute through walking and cycling in the first place. WFH data is further examined to see if an indication can be given of the positive attitude towards WFH causing a shift towards this commute replacement option. WFH did indeed increase from an average of 1.2 to 3.2 days per week. Increasing by over 60%. 5 of the 6 respondents professed to only engage in WFH 1 day per week before the pandemic. Whereas there is a wide spread of days engaged in WFH after the pandemic, skewed towards 3 to 4 days per week.

Factor 8; Commuters generally opposed to government & policy

Two different aspects are examined. Firstly, reported PT use was examined, to determine that these users aren't actually PT users and their opinions on the subject are conjecture based on political opinion. Secondly, WFH related behaviour must be examined, to see whether the positive attitude change towards WFH has grown. Analysis of post Q-sort data shows that 3 of 4 respondents used PT 0 times per week before and after the pandemic. For 1 of the respondents the amount of days using

PT decreased from 2 to 1. While this is a limited quantitative amount of responses, there is an indication that PT use is indeed low among respondents within this factor. When examining car usage and WFH change, it must be noted that car usage did not change, the majority of respondents commuting by car 4 days per week before and after the pandemic, at an average of 2.3 days per week, which is slightly higher than average commuter before the pandemic. It's around a full day higher after the pandemic. On the other hand, WFH actually increased by a lot, most respondents working from home only at an average of 1.25 before the pandemic, increasing to an average of 3 days after the pandemic. Of these respondents 3 engage in WFH for an almost full-time workweek.

If this observation is right, this would be an interesting field of further study, as it poses the question whether expressly trying to convince opponents of government policy is always a useful method of achieving policy goals to limit congestion, and emissions. There will be those that oppose policy, whereas they would not necessarily oppose the goals of that policy, i.e. the increase of WFH, decrease of car commute and lessening congestion. As such, simply promoting WFH on its own might convince many within this more general opposition to policy.

6.3 Correlation and interrelation between different factors

After the principal component analysis, statistically identified factors were further qualitatively discussed based on researcher input. While such an analysis gives a far greater insight into these factors than a simple statistical overview might, there are further statistical values in relation to these factors that might warrant further analysis. Besides the PCA itself, creating the different factors, a further statistical analysis was done by comparing the correlations between the different factors. These correlations can be used to identify significant relations that might not have been apparent through qualitative analysis by the researcher. The correlations between the different factors are displayed in table 6.5. Finding the overlap between factors can prove useful for better interpretation of the variables on the one hand, as there are quite a few of them at 8 in total, but it could also aid in later policy analysis as larger clustered groups of multiple respondents might agree on certain topics, allowing for more insight that could prove useful within policy analysis, showing 'alliances' between factors on certain subjects.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
Factor 1	1	0.3857	0.0249	0.5563	0.3121	0.4748	0.5744	0.4192
Factor 2	0.3857	1	0.3726	0.4672	0.3892	0.2621	0.3547	0.3841
Factor 3	0.0249	0.3726	1	0.1449	0.208	0.1459	0.2512	0.2146
Factor 4	0.5563	0.4672	0.1449	1	0.409	0.4086	0.4559	0.4694
Factor 5	0.3121	0.3892	0.208	0.409	1	0.4359	0.4234	0.3238
Factor 6	0.4748	0.2621	0.1459	0,4086	0,4359	1	0,3643	0,3274
Factor 7	0,5744	0,3547	0,2512	0,4559	0,4234	0,3643	1	0,3006
Factor 8	0,4192	0,3841	0,2146	0,4694	0,3238	0,3274	0,3006	1

(LEFT) Table 6.5 Factor inter-correlations

Similarity ->	Correlation~/>0.5	Correlation < 0.3
Factor 1	4,6,7	3
Factor 2	4	6
Factor 3	/	1,4,5,6,7,8
Factor 4	1,2,7,8	3
Factor 5	/	1,3,8
Factor 6	1	3
Factor 7	1,4	3,8
Factor 8	4	3,7

(RIGHT) Table 6.6 Correlation clusters between factors

Based on these correlations, table 6.6 is created. Within this table correlations of factors with other factors are categorised based on the strength of their correlation. In the case that factors correlate at a value of above 0,5 (rounded up), they have been identified as similar and thus related with other factors on certain subjects. When correlation is 0,3 or lower, this means that these factors are largely dissimilar showing a perspective clash.

Based on these correlation thresholds, several clusters can be identified, whose statistically identified relations can be investigated. For the sake of further investigating the meaning of some factors, their interrelation with other factors is qualitatively examined, and categorized within the different clusters. This results in several combined clusters, displayed in table 6.7 below.

	Factors	Clashes	Cluster theme
Cluster 1	**1** **4** **7**	**3** **3** **3,8**	**Varied commuters, that have grown very positive towards WFH, shifting to this method of commute.** Respondents within these factors largely agree on subjects 4 and 5. They have the same perspectives on WFH itself. They are or have become more positive on WFH and don't seek return to old travel habits post-pandemic, as they believe WFH has made work more productive and saves them a lot of energy. As such, they relatively strongly support government policy to encourage WFH. This is interesting, as the 3 different factors show different opinions on controversial issues, such as the implementation of car use/ownership curbs, or policy surrounding public transport and COVID related commute measures, but WFH in general is seen in a similar light. Differences are likely due to their working circumstances or the difference in job-sector, as there are differences in attitude regarding employee and employer interaction.
Cluster 2	**1** **6**	**3** **3**	**Non-multimodal commuters, primarily car users, mostly growing more positive towards WFH** These two factors seem very different. Factor 1 features car and bike users that shifted very positively to WFH, whereas factor 6 features those already opposed to unlimited car use strengthened in their OWN car ownership, only mildly enthusiastic about WFH, aiming return to their old travel habits. Upon inspection, they almost entirely agree on their positive relation to the employer in regards to WFH as well as WFH in general, being negative about PT use and indifferent towards bike use. They also state that WFH was possible in their job sector and did not have a significant negative impact on their lives. However where there is no agreement, is on whether WFH as a work experience itself is necessarily more pleasant, factor 1 becoming big WFH supporters and factor 6 not being impressed. Furthermore, they seem to agree WFH in regards to travel and lessening congestion. Limiting personal commute time loss, doesn't appear to be a serious motivator for the switch for those in factor 6. This might show that WFH won't necessarily find a big growth in support, or many supporters at all, among those already critical of widespread car use, like in factor 6. If they are critical of widespread car use (and not fans of PT) and they didn't yet WFH, it either means that they will never make the switch for work or other reasons. This begs the question whether a group like factor 6, sees concepts such as road pricing as a method to limit congestion or whether it's simply an ideological goal for them. The latter could be linked to political or ideological reasoning in regards to for example the environment. Whereas congestion and other transport related externalities as a whole, are simply not on their radar of issues motivating attitude change. One of the largest supporting groups for methods to decrease congestion, such as road pricing, might not see one of the primary goals as important or even as realistic. One can wonder whether this will lessen the potential impact of such policy, or warrant caution for those implementing the policy as supporters might not be aware of its complete impact. However, this correlation also shows that the popularisation of WFH has caused former steadfast opposition to road pricing to become indifferent to such policy or the idea that there are alternatives to car use during commute.
Cluster 3	**2** **4**	**6** **3,5**	**Overlap between steadfast car commuters and the wavering multimodal WFH shifters** The relation between factor 2 and 4 shows that, even on the concept of WFH, there is still a relatively high amount of concurrence between the more steadfast car owners. Whereas respondents within factor 2 seek to return to work in person, those in factor 4 have tentatively embraced working from home. This however does show, that there is the possibility that many that have become more positive on WFH, could always fall back into old commute habits of frequent car usage, as both these groups are relatively steadfast in their car ownership. A further hint that factor 4 might be tempted to return to old commute habits, is that fact that this is perhaps the only respondent cluster that mentions missing PT commute. Factor 4 also ranks masking annoyance as a relatively prominent issue that negatively impacts their attitude toward PT commute. With such a mask mandate being lifted, in person working through PT commute is once again more attractive. One can wonder however, what the policy implications are for the effectiveness of PT as an alternative to car usage, as the PT users strongly support the car as a back-up for commute and might be tempted to give up on working from home under other possible circumstances.
Cluster 4	**4** **8**	**3** **5**	**Opposition to government COVID policy and policy to limit car-usage policy** Factor 4 exists of steadfast car owners that, while having gained a positive outlook on WFH and planning to continue WFH in the future, will strongly cling on to the car. They assume that this won't happen even in future decades. factor 4 is similar to factor 8; those that generally oppose government policy on commute behaviour. This is further emphasized by a growing annoyance with masking mandates in PT, however for factor 4 this appears to come from more serious experience within PT, rather than a general dislike of government policy as espoused by those in factor 8. The reality is that for many groups, increased positivity on WFH and even an actual move away from car usage to WFH, will not cause a positive attitude shift on policies aimed to limit congestion or emissions caused by commute traffic. Negativity towards car use curb policy remains and certain groups will likely continue to support car ownership and usage.

Table 6.7 Factor cluster themes

What must be noted is that correlations do not show everything. Factor 3 is (strongly) uncorrelated with factor 7. However, a review of the relation between both perspectives shows that there is overlap, as both are strongly related to bike use. Factor 3 and 5 are even more similar in attitude. These two factors feature multi-modal travellers that enjoy bike use and have come to dismiss WFH, albeit for different reasons. Correlation shows a picture of statements being ranked similarly. Generally, seeing as this involves a similarity in attitude towards certain statements, one can find clusters of the different factors, where they overlap in opinion. Realistically however, these could also simply be a number of random similarity within the statement rankings, with no clear or useable insight being derived from the examination the factors clustered based on a high correlation.

6.4 Short summary conclusion

This chapter explored the different societal perspectives held within Dutch society on the changes to commute behaviour due to the pandemic. This was done through principal component analysis on gathered data, to identify the number and identity of these factors. The number of these identified factors was rather high. Where a number of 4 factors is generally optimal, statistical reasons required 8 in this study. This was likely due to the subject of this thesis being relatively broad with a large Q-set featuring many different subjects. There were bound to be different perspectives for most of the different modality users, respondents' years of different structural commute behaviour informing their attitudes differently. Their attitude would thus also likely change differently as well when exposed to the attitude triggers created by the circumstance surrounding the pandemic. A very simple overview of these respondents is shown below in table 6.8, where their presumed primary (former) mode of commute is compared to their attitude towards working from home.

Factor titles	Primary (former) commute based on attitude	Status of attitude towards WFH
1; Car commuters that strongly shifted to structurally working from home	Primarily car users	Have embraced WFH
2; Car commuters looking to return to pre-pandemic commute behaviour	Primarily car users	Have denied WFH
3; Multimodal opposers of working from home themselves	Primarily multimodal cyclo-pedestrians	Have denied WFH (due to their work circumstances)
4; Multimodal PT commuters shifting to WFH, remaining steadfast car owners	Primarily multimodal PT-car users	Have embraced WFH
5; Part-time cyclo-pedestrians, unchanged in their behaviour	Primarily multimodal cyclo-pedestrians	Have denied WFH (due to their enjoyment of commute)
6; Car use opposers, strengthened in THEIR own personal car use	Primarily car users	Have become ambivalent to WFH
7; Full time cyclo-pedestrians that have shifted to working from home	Primarily multimodal cyclo-pedestrians	Have embraced WFH
8; Commuters generally opposed to government & policy	Primarily car users	Have embraced WFH, despite opposing (pandemic) government policy

Table 6.8 Factor summary

Those whose attitudes indicate being formerly or still engaged in multimodal cyclo-pedestrian travel that doesn't primarily use the car, have often been more critical on WFH. Respondents that make up factor 2 and 5 interestingly also remain attitudinally more attached to the car than many of those whose attitudes indicate that they used to or still actually do primarily commute by car. This is likely due to multimodal travellers having the experience with the belief that the car is always necessary as a back-up option to other modalities. Another interesting observation is that ideological attitudes, not investigated within this thesis, likely also impact attitude towards commute. This was the case for factor 6 and 8, where attitude is affected by opinions on environment or government. On the other hand however, attitude affected by such presumed political attitudes then did not always completely match with other attitudes or actual behaviour indications based on data from the post Q-sort questionnaire. Based on results of this chapter, such as the characteristics of different societal perspectives and their accompanying attitudes towards different statements, policy proposals and policy trend re-evaluation can be performed.

Chapter 7. Policy implications

Through qualitative and quantitative analysis within the last chapter, changes in attitude were identified within the P-set. These changes were translated towards profiles of larger changed societal perspectives within the Dutch populace. Within this section a limited analysis will be done on what these changes in attitude might mean for current prevailing government policy regarding commute. Results of the Q-sort and post Q-sort questionnaire, primarily presented in depth analysis in chapter 6, is analysed through comparing them to knowledge gained within literature reviews in the chapter 1, 2 and 3. This chapter serves an addendum to the factor analysis from chapter 5 giving a more focused policy related view on the results. It seeks to answer the following sub-question;

Sub-question 5; *What are the implications of the findings for government and possible impact on prevailing government policy?*

It does this through qualitative interpretation of earlier quantitative findings. Table 7.1 is presented first which shows the most directly policy related statements and the relevant factor scores associated with these statement from the different societal perspectives. The larger the value assigned to a factor score, the more intensely a perspective feels about a subject, whereas the higher of lower the score the more a perspective shows agreement or disagreement with the statement.

Statement 2; **Factors ->**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
The pandemic shows that car use could be curtailed as much as possible through, for example, road pricing.	**-0.34**	**-0.85**	**-1.1**	**-1.28**	**-1.7**	**0.84**	**0.64**	**-1.25**
Statement 1;								
The car should be used far less than before the pandemic, as there are suitable commute alternatives.	**-0.12**	**-0.74**	**-0.9**	**-1.03**	**1.41**	**1.32**	**0.37**	**-1.83**
Statement 9;								
I'm in the possession of a car and this will not change.	**1.36**	**1.48**	**0.06**	**1.78**	**0.39**	**1.39**	**-0.32**	**1.48**
Statement 12;								
I now believe that owning a personal car remains necessary, but this could change in the coming decades.	**0.3**	**0.52**	**-0.22**	**-0.17**	**-0.05**	**1.11**	**0.99**	**0.47**
Statement 48;								
Mass working from home due to COVID now shows that government could further encourage business to stimulate working from home, for the purpose of emissions reduction.	**1.63**	**1.5**	**-0.03**	**0.66**	**0.99**	**0.95**	**1.97**	**-1.16**
Statement 35;								
I find working from home pleasant to a certain level. Alternating between working from home and occasionally working on location is ideal in my eyes.	**1.95**	**1.17**	**0.12**	**2.13**	**1.34**	**0.99**	**1.5**	**1.31**

Table 7.1 Policy related factor scores

Based on results explored in chapter 6 and shown in table 7.1, distinction is made between changed attitudes that influence commute behaviour. There are two main commute policy implications that come forth from the analysis in chapter 6, namely the shift in views on WFH and car ownership. PT use and Cyclo-pedestrian related statements also show changes in attitude, but the results are generally rather subdued in comparison to the more controversial statements related to the car and WFH. This is likely due to the fact that multi-modal commuters, while being more flexible in their own commute behaviour, were generally less affected by the pandemic in their attitudes towards behaviour. They experience more different modalities and are affected more regularly by outside triggers that might cause them to change their commute patterns, having often made their attitude more resistant towards change induced by a trigger such as the pandemic and related policy.

The first policy implication, is that WFH policy supporters, or those that strongly appreciate aspects of WFH, are widespread among most perspectives. Even government environmental policy opposers, appreciate WFH on its own. Partial (non-full-time) WFH is supported by all perspectives. This might be a popular base for policy to limit commute trips if government might wish to do so in the future. Secondly, curbs on car use and policy such as road pricing (rekeningrijden) or the further establishment of commute alternatives to replace car use, remains unpopular among most factors. Even among strong road pricing supporters and those tentatively agreeing that widespread private car should no longer be as acceptable as it used to be, there's been an increase in the sense that private car ownership (for themselves at least) and freedom that comes with private ownership has gained new appreciation. While there are still those that support car use curbs, they themselves are newly strengthened in their personal car ownership and don't see this changing in the near future.

Limited commute policy literature review refresher

To put this second policy implication in perspective, an overview of commute policy history is given based on findings from literature review. It's split into 3 segments; Firstly, historic developments in commute and goals for commute, as well as ways to measure travel behaviour. Secondly, there is actual policy implemented over the years to achieve these goals. Lastly, there are commute patterns that were changed as a result of the pandemic, as well as policy goals;

Historically, as shown in exploration of 35 years of government overview reports regarding commute developments and policy, there's been the aim to increase Dutch mobility and limit time loss during

travel. In the case of car travel, the aim has been to limit congestion to enable faster travel. Needless to say, car congestion has not been eradicated since the nineties. Car use and time loss within car use continues to grow. Percentage car use growth has grown smaller over the years compared to growth in earlier years, whereas PT use has managed to keep up the same percentage growth as car use, but remains small. Bike usage and walking retain a significantly large share of commute modalities, even as individual car use among both men and women has grown to be more prevalent.

There have historically been consistent 'wishes' to limit car congestion, that would be fulfilled by new future commute alternatives. Back in the mid 90's Dutch government reports already spoke about forms of self-driving cars or MAAS concepts that would eliminate congestion within a few decades, reality has been somewhat different. Much of this policy, as far as overviews are concerned, seems to be measured and informed by the same primarily econometric variables for the most part, while specific emphasis on commute travel seemed to disappear in favour of general transport behaviour. Reports occasionally measure attitude related variables, but these variables never seem to become standardly measured or regarded within policy. Furthermore, most policy seems to be based on road expansion and rail expansion to limit congestion, both of which have slowed significantly as time went on. Other initiatives such as carpooling came and went. Policy largely abided by the status-quo. As a result of the pandemic there appears to have been a structural shift in popularity towards WFH, gained from decreased car an PT usage for commute. This change was in part due to government and business encouragement of WFH during the pandemic. Furthermore, based on insights gained in the pandemic future policy to limit congestion is being drafted. For example recently planned policy commitments to introduce road pricing in the future. The long-time policy emphasis of PT as a replacement for the car also seems to have been hampered by the pandemic.

7.1 Expanded exploration of policy related statements for different factors

There are other observations that might put those two important attitude developments for policy into more perspective and might serve as a counterpoint to the 2 points made earlier. To better come to these points and evaluate the impact of attitude change on commute in regards to policy, policy related statements will be regarded in order to describe factor attitudes in relation to policy. These 6 statements, as shown in table 7.1, will be explained in order of first generally unaccepted statements, towards statements towards which attitude has generally changed positively during the pandemic. The statement are translated to English as to allow for easier interpretation for readers.

Statement 2; The pandemic shows that car use can be reduced as much as possible through for example road pricing.

This statement has come to be or likely remained broadly unpopular among the identified societal perspectives. It finds support among factors 6 and 7, ideological supporters of environmentalist policy and bike users simply indifferent towards the car and car related policy respectively. What is interesting here, is that road pricing has likely remained negatively regarded, even among groups that have become more positive in attitude towards WFH and have started to structurally engage in it, lessening car necessity. Examples of this are factor 4 and 8. Opposition to this policy by the latter factor appears ideologically driven. More interesting are the multimodal bike users in factor 5 and 3 that weren't charmed by WFH, likely having come to appreciate the car as a back-up option. It most importantly shows that, among former steadfast car commuters, there is an opening to gain their support for this policy, in the case that government may want to implement it. Z-score for factor 1 shows a mildly negative attitude towards road pricing. Former sole car users were introduced to another method of commute in the pandemic, one that surprisingly resonated, likely because these respondents had never seriously engaged in other commute than the car.

Statement 1; The car should be used far less than before the pandemic, as there are good travel alternatives.

The notion that the pandemic proves that car use should be lessened, as good alternatives are available, is far less controversial than road pricing, even though the aim of road pricing is also to achieve less car usage. The formerly car using WFH-converts have become practically neutral in

attitude towards this statement. Factors 2 through 4 have grown almost equally as negative towards this statement as the one on road pricing. Factor 2, car users that didn't become positive on WFH, have become less negative towards these 2 statements than the bike users in factor 3, or steadfast car users now WFH in factor 4. This is likely due to these respondents simply being unable to WFH due to their work situation. The respondents in factor 3 and 4 have come to appreciate the car due to their own experiences with commute. This indicates that among many if not most perspectives of car users, the notion that car use needs to be lessened does hold somewhat true. Factor 2 might agree with this notion when disregarding work circumstances, focusing solely on commute.

The cyclists of factor 5 have come to strongly support this notion, which is likely due to them taking great enjoyment in the cyclo-pedestrian commute itself, unlike factor 3 that sees commute as a necessity and want the car as clear back-up. Factor 7 is lightly positive towards this statement for similar reasons that they were likely positive towards road-pricing. They're indifferent to issues surrounding the car as they've come to prefer other commute methods. Among those in factor 8 that have come to generally oppose government involvement within commute, road pricing has grown less unpopular than the notion that the car should be used less than before the pandemic, as there are alternatives to car usage. Perhaps this is out of fear that the encouragement of these other modalities will somehow displace the ability to use the car freely, or simply because the pandemic has further soured these respondents on other modalities like for example PT.

Statement 9; I own a car and that also won't change

Statement 12; I now believe car ownership to still be necessary, but this can change in coming decades

Statement 9 and 12 are regarded simultaneously, as they're closely related, representing change in opinion in the now and in the future. It's precisely this seemingly conflicted relation between the changed opinion on the now and then that gives insight into expectations for future policy context.

Despite factor 1 and 2 being polar opposites as the former consists of car commuters newly convinced of WFH, whereas the latter consist of car commuters that have come to dislike WFH, they feature very similar Z-scores. This shows that car users have come to expect to decreased car use in the future. Whereas multimodal commuters, like factor 5 and to a lesser extent 4 don't expect this. Does factor 3, existing of multi-modal commuters remaining steadfastly positive on car ownership and have become negative towards WFH, seem to contradict its earlier attitude towards statement 9? Yes, but this could be an interpretation issue, as these respondents simply aren't in possession of a car, and thus have come to disagree with statement 12, as they've never really used a car in the first place. This sentiment is partially shared by the respondents within factor 5 that appreciate the bike commute itself. In factor 5 statement 9 is regarded negatively as these respondents disagree that their current car ownership won't change soon or because these respondents don't currently own a car. This is reflected in the response to statement 12 that strongly believes the car to become less necessary in the future, perhaps the result of WFH having become popular among respondents.

Lastly, there are the two more ideologically driven perspectives. Where the attitude changes within factor 6 are expected, the responses by factor 8 are interesting. The group that opposes most government policy and strongly claims to have become a fervent car owners, not seeing this change soon, could slightly see themselves parting with the car in the future. This does indicate that most of the respondents have come to believe that even though they're strongly attached to the car now, they will likely require the car less in the future. This might seem like a relief to lawmakers that would like to see car usage decline to limit congestion, but if historical reference towards commute change is anything to go by, expectations to potentially lessen car use in the future oftentimes aren't met.

Statement 48; Mass working from home due to COVID now shows that government can encourage businesses to further stimulate working from home, with aims of reducing emissions.

The notion that further WFH encouragement is necessary, has gained almost unanimous positive attitude among most perspectives. The exceptions to this are factor 3, which has become neutral towards this notions, and 8, which has come to fervently oppose this statement. In both cases this is

in line with what's already known about the respondent, as commuters within factor 3 are unable to WFH due to their work situation, versus respondents within factor 8 that simply oppose government policy to achieve this goals. Particularly as environmentalist reasons are given for government policy.

Statement 35; I now enjoy working from home to a certain extent. Alternating working from home with sporadic in person work has become the ideal situation in my eyes.

Lastly, there is statement 35 that is almost unanimously agreed on by all factors, except for factor 3, because they simply can't work from home. Interestingly, many respondents that were lukewarm or downright negative towards WFH, have come to regard partial WFH positively. This is interesting, as this policy analysis might have given off the impression that factor 8 disliked WFH, which is incorrect. This factor simply indicates that enforced government policy negatively impacts respondent attitude toward WFH at that moment, but not on WFH as a whole. Policy encouraging WFH, not necessarily enforcing it for climate or other reasons, will likely be most effective on most commuters.

Lastly, regarding 'alliances' between different factors identified earlier in chapter 6. Clusters have proven useful for analysis and exploration of what different factors actually stand for, but they haven't offered any particularly useful insights into policy implications within this part of the analysis.

7.2 Additional conclusions and recommendations

There are two additional points that need consideration besides the main points in the introduction.

Firstly, just because commuters often cycle to work, doesn't mean they would like to see car use/ ownership limited. They often see it as a back-up for their multi-modal travel behaviour or use it for non-commute transport. While you could thus limit car-use within commute to limit congestion, you'll likely find popular resistance when directly trying to limit car use or ownership, even among non-car commuters. Secondly, the existence of (political) ideology prominently affecting attitude among some factors, makes interpretation of these attitudes and thus the effect of attitude on behaviour somewhat difficult. From the point of view of lawmakers, actual attitude and behaviour change could seem positive however, as the group opposed to most car use curb and COVID policy has actually come to enjoy WFH a fair bit. Whereas groups traditionally positive on government policy like road pricing or COVID related mandates, have become strengthened in their own personal car ownership, indications of their actual behaviour still show a decrease of car use in favour of WFH. Those lukewarm to the practice still engage in it, indicating that for some groups political sentiment does triumph over personal commute experience based attitude, whereas it doesn't for others.

Chapter 8. Evaluation of Dynamic Q-methodology

This chapter features evaluation of Q-methodology and related research performed within this study. It's split into three different segments. Firstly, it evaluates response of respondents towards Q-methodology and dynamism within Q-methodology. Secondly, to expand upon this data, respondent open question evaluation, as well as other feedback on the survey, will be evaluated. Evaluation of the survey is split into 5 different categories to touch upon all facets of the survey, including issues surrounding; **survey execution, technical issues, issues regarding post Q-sort questionnaire and methodology issues regarding Q-methodology and dynamic Q-methodology**. Within this section the latter two categories regarding Q-methodology specifically are discussed, whereas responses to the first 3 categories are discussed within the discussion chapter that doesn't go into methodological detail. This section offers rebuttal to issues surrounding research methodology, using respondent input and researcher experience, to review methodology. The study's identified weaknesses are addressed and a proposed changes for future research are produced. Lastly, through gained insight of respondent evaluation and researcher experience, a final evaluation of specifically Q-methodology is done. This features theoretical discussion, unlike evaluation of the practical side of the research. This evaluation delivers a synthesis of the theoretical framework, research methodology involving Q-methodology and lessons learned within this study. It will thus produce an updated dynamism appropriate programme of Q-methodology, based on the attitude-behaviour framework by van Wee et al. (2019) and researcher experience, for conducting dynamic Q-methodology in future research.

8.1 Overall response to Dynamic Q methodology

This section give an overall view of respondent experience with dynamic Q-methodology, using graphed data points gained within the post Q-sort questionnaire

Evaluation of Q-methodology

Responses to questioning on the experience of Q-methodology are interestingly even; positive, negative and neutral responses all making up more or less an equal share of all responses. It must be noted that, if even slightly, negative responses to Q-methodology make up the largest share. This still means that the majority of respondents aren't negative about Q-methodology, but it does show that there are several issues with conducting Q-methodology online or at all. As stated, performing the Q-sort in person might alleviate issues respondents might have, but it will not alleviate all of them.

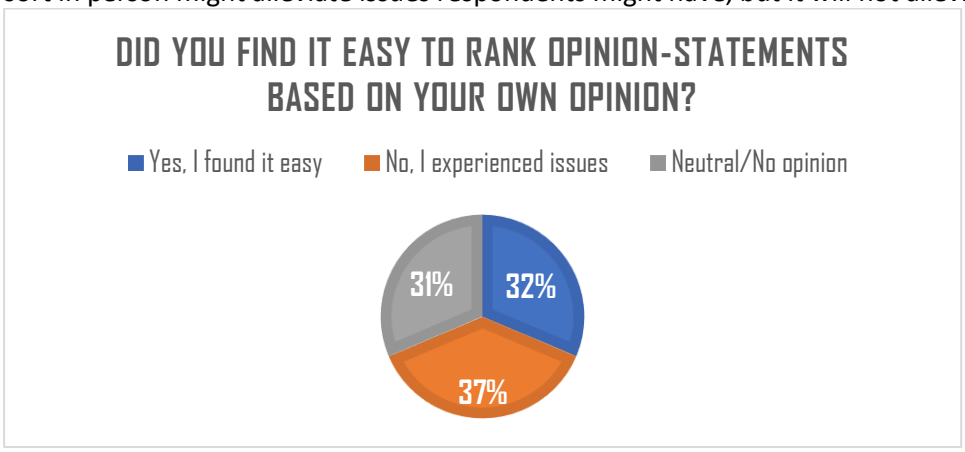


Figure 8.1 Reaction to Q-methodology

Evaluation of dynamism in Q-methodology

Interestingly, respondents appear to have found it much easier to answer questions based on the change in their attitude, than to make use of Q-methodology in general. More than three quarters of respondent do not negatively respond to this method of questioning, indicating that this change in questioning or deviation in Q-set construction is easily embraced by respondents. Their experience with the questionnaire or adaptiveness to the questioning is generally not a roadblock for further introduction of this method. Regardless of this fact, there are still some specific issues in regards to dynamic Q-methodology that need to be addressed.

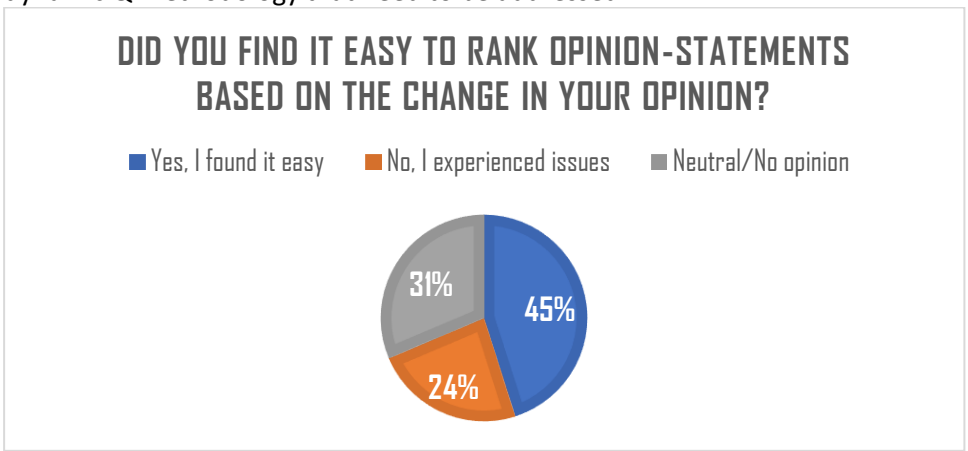


Figure 8.2 Reaction to Dynamism

8.2 Survey evaluation

This section gives an overview of the different issues respondents have mentioned within their evaluation at the end of the online survey. Respondent feedback on the different aspects of the survey, as well as researcher responses to said feedback, can be found within appendix C.

Respondent issue categorisation	Respondents
Q-methodology – Issues with methodology	17, 23, 25, 27, 28, 46
Q-methodology – Issues with dynamism	25, 46

Table 8.3 Respondent Issues

As could be expected based on the graphs presented earlier within this chapter, more respondents bring up issues regarding Q-methodology as a whole, rather than dynamism in Q-methodology.

Q-methodology

This section discusses respondent comments surrounding methodological issues experienced during the online survey and offers insight of the researcher on these issues. Methodological issues around Q-methodology refers to issues respondents might have had with the Q-sort, how they experienced it and what they would've liked to see differently within the survey. It includes researcher rebuttal.

Some respondents (**17**) experienced difficulties with the basics of Q-methodology, as they found it complicated to rank statements based on their weight in Q-sort. Furthermore there are concerns that forcing responses into the forced distribution forces respondents to make decisions that are no longer representative of reality. These issues are understandable. Q requires respondents to give an in-depth assessment of their opinion, rather than a more simple agree or disagree. This could be difficult for respondents. Furthermore, it's also understandable that the basic Q-sort template simply isn't applicable for everyone. But there is value in forcing respondents to make trade-offs between statements, as it shows the importance of certain statements over others, creating perspectives.

Respondent requests (**46**, **27**) to allow for a difference in framework aren't always justified, but could make sense. Some respondents request a flexibility of adding 5 additional 'free spaces' to the Q-sort framework. Due to the nature of Q, the Q-sort needs to approach a forced quasi-normal distribution. Adding additional spaces (exceeding the size of the Q-set) will make statistical analysis of said Q-sort far more difficult. It's essentially impossible to do while conducting Q-methodology. There's also a request (**23**) to focus the Q-sort less towards 'neutral responses' and offer more spaces within the outer categories of +/-4 and +/-5. The Q-sort framework is weighted in the middle, as it's assumed that a significant part of the statements will be ranked neutral, as the study involves 4 travel modalities, whereas it's assumed that an average respondent likely only has significant experience with one or two of those. As such, the framework isn't weighted towards the extremes, but the neutral. This would likely apply to most respondents, but not all of them. A differently shaped framework should likely be employed for future research, where the subject of study is far more focused. This last remark will show to be more poignant in the evaluation of future dynamic Q.

Statements were sometimes experienced as too lengthy or 'layered' (**25, 35**), this is specifically an issue related to dynamism that is explored later. During construction of the Q-set, statements were gathered through desk study and interview. This means that oftentimes included statements weren't necessarily fit for direct inclusion into the survey. The dilemma then became what to keep, what to cut and to what extent statements could be changed to while retaining the original spirit of what was meant by the those giving their opinions. The further shortening of statements/questions is a good respondent tip, but also not necessarily possible as some 'double' statements (as described later) are a necessity. A future solution to this as well as the need to attain more deliberate statements that require less cutting or restructuring is given in the evaluation.

Lastly, there is criticism on the value of Q as a method of gathering results as a whole, especially in comparison to other methods. An issue put forward is that respondents might answer questions based on their actual behaviour instead of their opinion/attitude, as this is required by the Q-sort which necessitates a response towards every included statement within the Q-set. This is a bit of an odd issue to have, as attitudes inform or are informed by behaviour. Unless multiple questions /statements were entirely unclear to a large degree, this is hardly an issue. The description of the study, should be, and was, very clear on that it requests respondent opinions. If respondents do not engage in certain behaviour and thus likely do not have an defined attitude towards a certain subject, then they naturally rank it neutrally or negatively. This isn't an issue on itself.

More interesting are the remarks on the use of a 7 point Likert scale, instead of Q-methodology. This study aimed to utilise Q-methodology to create perspectives, but also to test change to traditional use of Q-methodology. There's something to be said for simply observing opinions of respondents on certain statements. Likert wouldn't allow for perspective creation as possible in Q-methodology. However, you'd be able to say more about results on certain statements individually. In Q these results are mostly perspective linked and results are relative to other responses. With a Likert scale you would be able to determine held opinions by respondents in general and investigate the direct correlations between two statements, rather than their relationship as a whole. When using Likert scale you would have to divide results by variables such as age, etc.. You would also more easily be able to study the relation between opinions on statements and other variables. Furthermore, a Likert scale also requires far less time from respondents, perhaps leading to a larger quantitative response. However, it also remains unclear how well the Likert scale is suitable for dynamism in opinion. Furthermore, a Liker scale does not make the Q-set any smaller. 50 statements, with a larger initial ranking choice are perhaps just as likely to scare of respondents as this Q-method survey might be.

Dynamism in Q-methodology

This section discusses respondent comments surrounding methodological issues experienced during the online survey and offers researcher insight on these issues. When referring to the methodological issues around dynamism in Q-methodology, it refers to issues respondents might have had with the implementation of dynamism into the Q-set and how they experienced questioning that requires input on a change of opinion rather than a current opinion. It includes researcher rebuttal.

At this point it's become important to refer back to issues surrounding 'double statements'. Double statements are single statements that feature 2 different parts within a statement. An example of a double statement could be statement **15**; *I already experience public transport as unhygienic before the pandemic, that belief has only grown stronger.* Which is spread into two halves; **a static 'base' attitude, as well as a change in attitude.** Another example of a double statement could be statement **28**; *I'm more positive about working from home instead of commuting, as time loss and fatigue of travel have less of an impact on the rest of my day.* Which is spread into two halves; **a change in attitude, as well as a triggers/results of triggers influencing attitude change.**
Normally you'd like to avoid these type of more facetted longer statements, however these longer double statements were a necessity to give context to the change in attitude. This results in issues were experienced by some respondents (**25**). They mention oftentimes agreeing with the first half of a statement, whereas they disagree with the second half of the statement. Similarly, they would often recognize attitude change, but not necessarily agree with the trigger mentioned to have caused attitude change. This appears to be the main issue with involving dynamism into Q-methodology.

During the construction of the Q-set, statements were gathered through desk study and interview. This means that statements weren't necessarily fit for direct inclusion into the Q-set. Statements needed to be cut down, as brevity allows for easier understanding and unnecessary information needed to be trimmed, but also for technical reasons within the program used to create the online survey. Particularly when conducting Q-methodology online, text cuts are necessitated and could risk context or phrasing necessary for conveying dynamism to be removed. At some points statements also needed to be separated, because they involved two or more separate concepts or opinions, for example statements 39 and 40. This was mostly taken care of during Q-set construction. Only so much can be changed in the statements however, lest they lose connection to the original meaning. As such, some statements feature change, followed by reasons for or against the change. This was necessary as this statement in the Q-set needs to embody the core of the gathered statement, thus also including the reasons for changed views or opinions. Statements #15, #16, #21, #22, #23, #28, #33, #45 are examples of double statements in varying degrees. They are best avoided, because they can make interpretation more difficult; does a person (dis)agree with the first or second half of the statement? However in this Q-study, the trigger for change is newly relevant and likely applies to many respondents. Double statements including these triggers and the change were a necessity.

On top of these comments, respondents also mention missing questions surrounding commute behaviour and attitudes DURING the pandemic. These statements weren't included in the survey as they were not part of research goals. The survey as a whole focuses primarily on change from BEFORE to AFTER the pandemic, luckily this was made clear to most respondents and most found it easy to rank statements based on change in attitude. The issue of how to more properly, or rather more systematically/easily reproduceable, involve dynamism in future Q-studies, will be discussed.

8.3 Dynamic Q-methodology in the future - Synthesizing theoretical framework, methodology and lessons learned.

This chapter sought to evaluate the use of Q-methodology and implementing within this master thesis. To shortly summarise; Q-methodology clusters people in categories based on their opinions on a specific topic (Watts & Stenner, 2005), giving a fixed snapshot (Kroesen, 2013). To investigate whether dynamism can be implemented within Q-methodology, mixed method research has be applied to answer the following research question;

Sub-question 6; *What facets of Q-methodology have shown the need to be adjusted to account for dynamism and change within perspective?*

The main goal of this question is the evaluation of Q-method application. Literature research and respondent consultation on Q-methodology have been used to assist in success identification. Exploratory research on the quantitative and qualitative results of SQ 3 and 4 will aid in answering this specific sub-question and thus the efficacy of the future use of the dynamic Q-methodology.

Quantitative results show respondents are generally ready for Q-methodology and questions about dynamism in their attitude. They are, like they profess to be, perfectly able to answer questions about their changed opinions, or rank statements based on their changed opinions. This hasn't negatively impacted the quality of responses and result data. Respondents are more ambivalent on Q-methodology itself, although in depth response mostly shows that this is due to the required time investment, issues with layout when taking the survey digitally on phone or and having to abide by Q-method forced distribution. However, these issues, with the exception of the third one to a certain extent, hardly invalidate research results. They offer an insight into aspects that would make data gathering more structured in the future, avoiding pitfalls that might hamper research success.

More serious issues exist within the methodological half of the study, as when looking back at the set-up of the study, certain issues do come forth, particularly during analysis of the Q-sort result. These issues aren't necessarily related to issues within respondent participation, but they're related to later analysis. These issues come with the introduction of dynamism into the Q-set;

When conducting dynamic Q-methodology, you risk adding 'double' statements in the Q-set. This was a necessity within this study, as some statements require a trigger to specifically inform the described attitude change, etc. However, this causes some issues during the interpretation of these results, which in this study had to be, and were generally, intercepted by the post Q-sort questionnaire. However, preference would be to put full responsibility for this on Q-methodology research on its own. Missing context or different interpretation towards factor analysis results makes later analysis and interpretation of perspectives more difficult.

When investigating changed attitude, opinions or behaviour, there are at least two sides to this change in Q-methodology related analysis. Particularly in the model that was followed; the change in attitude and the trigger. As such, when setting up a survey, Q-study or perhaps another method, it's possible to investigate change in attitude. However, beforehand you need to very clearly determine how you seek to investigate changed attitude, or rather, what the set-up of the Q-set will be. There are 2 options; Firstly, focusing solely on the change in attitude itself, which contains questions primarily, if not solely, centred around the change in opinion. This method was taken within this study. Or secondly, based on experience gained within this study, setting up a study that investigates, the starting points (formerly held attitude), triggers for attitude change, the attitude change itself.

Based on experience from this study, an example of the future set-up and application of the second method will be given below. This is a method that comes forth from identified issues with the first method that were experienced during this study. It must be noted that this new method will address some of the methodological complications from the employed method, but it also features some flaws in comparison to the current method of introducing dynamism. In the case of Q-study, this latter option would need to entail a radically different set-up in how a Q-set is constructed. This is due to the fact that, instead of solely focusing on gathering the different subject related statements that are made in the public arena and opinions given therein, there must be a differentiation between statements in regards to this new framework for setting up a Q-set for dynamism.

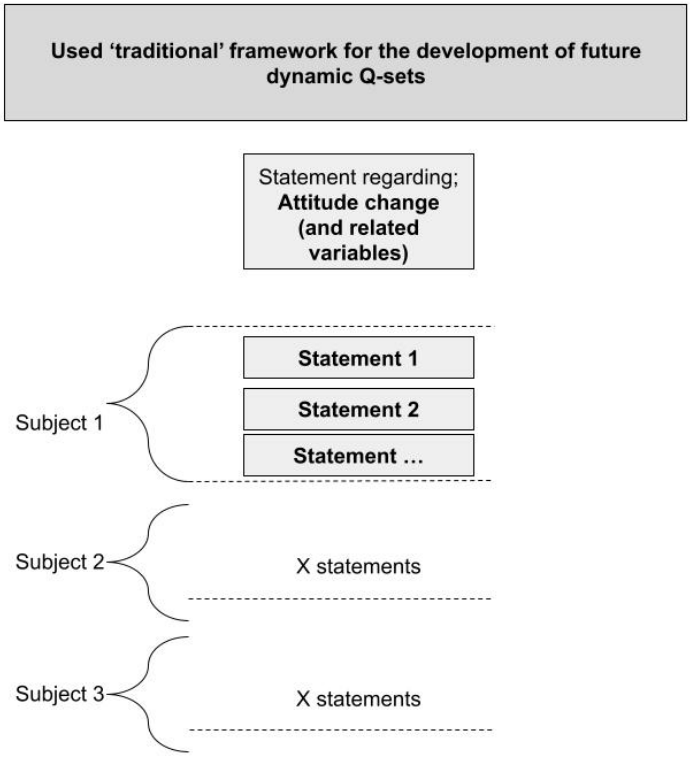


Figure 8.3 Traditional Q-set construction framework

The traditional method of Q-set construction is shown in figure 10.3. This traditional method was employed within this master's thesis, where dynamism was introduced into Q-methodology by having the contents of statements not be about static attitudes, but the change in attitudes.

This was method was developed using the attitude change framework by van Wee (2019). However, as mentioned before within the development of the conceptual framework, this framework and the method of including dynamism as whole features an issue. It's able to analyse change and reasons for change, but without the starting point of attitude from which change happens properly defined, it's hard to say whether a change in attitude is a hardening in attitude, an attitude shift from negative to positive, or simply a lessening in negativity or positivity that is finally unimpactful on behaviour. As such, this aspect of the 'base attitude' (or base variable in the case of trigger change), pre-change of attitude should be included within analysis. As such, to more practically explain how this change can be implemented within research, changes should be made to the conceptual framework and later Q-set construction to include a base or previously held attitude or opinion, as this base opinion should be made explicit for easier factor characterisation by the researcher. Similarly, triggers should be taken completely separately from the described change itself within the Q-set, allowing for easier analysis of respondent Q-sorts. This new Q-set construction model is shown in figure 8.4.

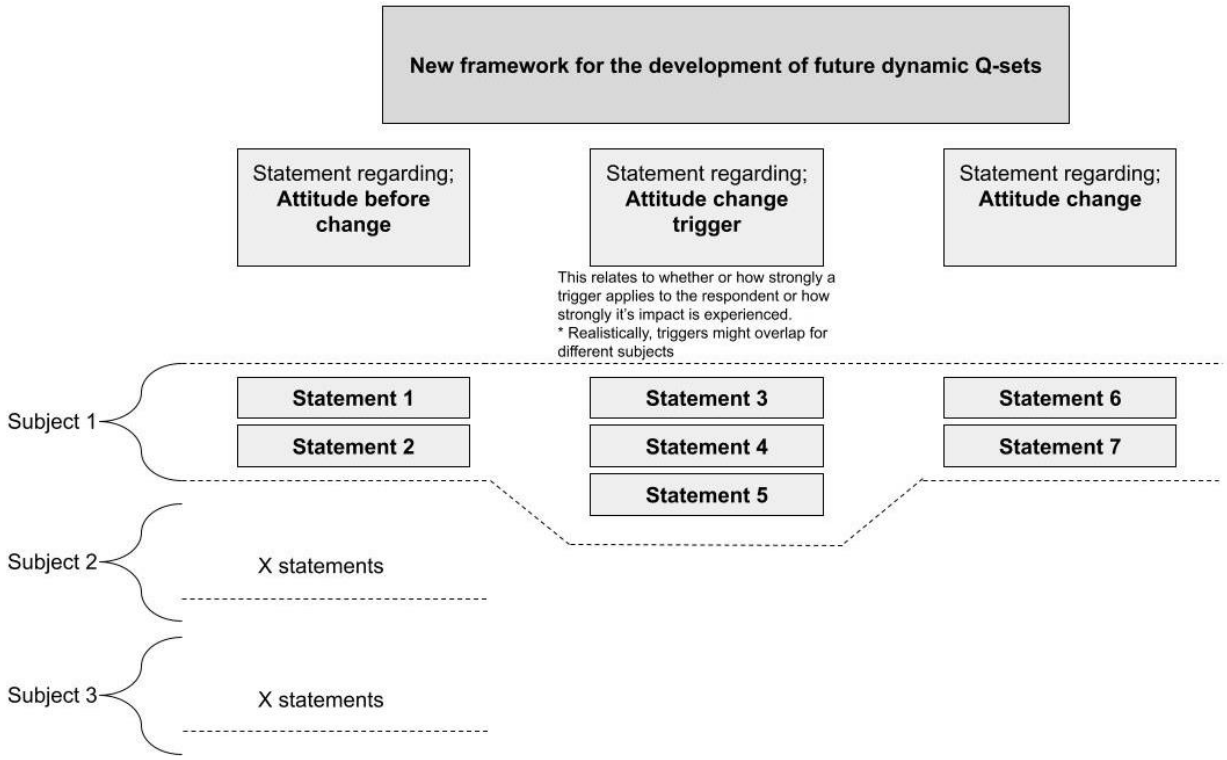


Figure 8.4 Adjusted Q-set construction framework

When setting up for such a framework, concourse gathering needs to be far more deliberate and pre set-up. A researcher ought gather statements through deliberate interviewing, with the 3 statement categories in mind, rather than gathering statements through literature review and more open interviewing you'd normally employ to ensure valuable respondent input that the researcher hadn't initially planned for. Future research thus has to be more specified. This was an issue during current factor score interpretation in general, where difference between factors might be in the more minute details. For example, factor 1 and 4 are similar, but have come to disagree on minor issues surrounding continued car use and changes in attitude towards former multi-modal commute behaviours. These groups that mostly agree have different views on some statements within some aspects, not even entire subjects. This hardly makes them that different and while discussing minutia is valuable, as these aspects might make the difference in attitude effecting behaviour, differences while statistically significant might seem subjectively arbitrary on the whole of the factor.
On the other hand, employing a method of far more researcher guided interview might lead to issues due to the researcher seeking specific answers. At such a point, the researcher might no longer be gathering information from the wider societal concourse, but pre-determining interview findings. This risks the influence of researcher bias in interview construction, essentially creating the wanted P-set themselves rather than basing it on 'natural' discourse. In a method of research that already requires a large amount of 'subjective' researcher input in Q-set construction and result interpretation, this increases the risk of researcher caused arbitrariness in set-up and evaluation a lot. Lastly and most importantly, while this new method might solve some of the issues experienced during this research, it must not be overexaggerated that the utilised method of the inclusion of dynamism into Q-methodology and the research as a whole, even with the mentioned complications in analysis, was a failure by any means. On the contrary, Q-methodology has produced strong results in that it was able to identify a number of significant changed attitude clusters that were very insightful in the investigation of behaviour changes and their relation to policy. Furthermore, employing this type of research has helped to clearly pinpoint the issue with the employed method of dynamic Q, allowing for more structured and possibly higher quality research in the future.

Additional evaluation and plans for future research

One this evaluations' takeaways is that future research ought be specified in subject, solely car usage or WFH to allow more specified Q-set construction, instead of the broader subject discussed here. It must be taken into account that this will commit more time and energy to Q-set construction, which wasn't possible within this master thesis, as all statements likely need to be gathered through in-person interview. Overall Q-methodology and dynamism were decently well received by respondents and methods like this can successfully be applied within future studies on travel behaviour.

Chapter 9. Conclusions, Policy recommendations and discussion

After evaluating the results within SQ 5 and 6, there's a need for overall evaluation of results and their meaning for this thesis. This last chapter is separated into 3 sections; Conclusions in section 9.1 that go over all research sub-questions to answer the main research question. Section 9.2 grants recommendations based on the conclusions to the sub-questions, particularly sub-question 5. Lastly, in section 9.3 a summarized reflection on the limitations of the research is given.

9.1 Conclusions

Large changes to Dutch travel behaviour occurred due to the pandemic and government policy surrounding it. Within this report abrupt and structural changes to commute were examined, as the pandemic and the widespread adoption of working from home (WFH) (CBS, 2021a) resulted in a temporary decrease in car use and congestion during rush-hour (Bremmer, 2020). Post-pandemic however, there still appears to be a structural effect on commute behaviour, as car usage and particularly public transport (PT) usage appears structurally lower and WFH adoption remains partially in place. Due to the pandemic and government COVID policy changes occurred to commuter attitude towards commute and their commute behaviour. To explore this research was done to empirically explore major societal viewpoints on this change among Dutch commuters. Thus this section aims to answer the main research question in regards to this master thesis;
What different societal perspectives on changes in attitude towards private car usage, working from home and overall commute travel behaviour can be identified as a result of the COVID-19 pandemic?

This question is answered through offering a short summary conclusion for every drafted sub-question based on the findings within their respective chapters, as well as a brief overall answer.

Sub-question 1; *What historic and societal developments and trends surrounding car ownership, car usage and government daily (commute) transport policy can be identified, including their influence on travel behaviour change?*

The introduction identified the need to gain understanding of the overall trends in Dutch car usage and commute behaviour, to determine yet unexplored longer term effects of the pandemic (Van Wee & Witlox, 2021 ; Thomas et al., 2021) on changes in these trends and travel habits. Historic literature review was conducted of a period of 35 years of government reports regarding commute, offering insight into historic behaviour changes, policy changes and overview variable changes. There has been a declining growth in individual mobility, as average daily trips per person decrease over a 30 year time period, even before the pandemic (MuConsult, 1998; G.J.A. AI, 2006; KiM, 2019). Likely as a result of increased distance travelled due to more spread living-activities (F.M. Roschar, 1997). However there has been an overall growth in mobility as travel distance increases slowly. Simultaneously, there's been a continuous growth in congestion over the years, particularly during the evening rush which is strongly related to commute traffic. More commute related congestion during morning rush is caused by an increase in task combiners (G.J.A. AI, 2006). Were it not for the 2008 recession or the 2020-2021 pandemic lockdowns which decreased total time loss by more than 70%, mobility growth would have pushed congestion to be far higher. The structural 2010's decrease caused by infra expansion and the recession was recovered within 5 years (KiM, 2021). The share of car use decreases slightly (G.J.A. AI, 2006; KiM, 2015). This is caused by growth of car operation at the expense of car passengers, growing most over the examined period pushed by the growth in task-combiners, part-timers and carpooling going out of style. Train use mostly grows at the expense of other PT through increasingly longer distance commute travel (MuConsult, 1998; G.J.A. AI, 2006). During the pandemic travel mode usage decreased more during the first than the second lockdown, causing a structural decrease in travel modality use post pandemic. This period caused a sizeable structural shift towards working from home. Relatively however, car and bike use did not shift as much as PT use did, which might indicate that encouraging WFH outside of the pandemic will see a lesser impact on the curbing of car use than PT. This might limit the impact of working from home as policy on congestion decrease, even though WFH will likely structurally remain a large new player.

Within the late 90's, it was determined that congestion would continue to grow worse, assuming that road expansion would become less possible, making changes in other parts of the car transport system necessary, like the introduction of a new compact on-demand car (F.M. Roschar, 1997, MuConsult, 1998). Predictions also put forward the certainty of the growing unpopularity of the car in general in the future. This appears partially untrue, as road expansion did take place within the early 2010's due to lane expansion, being instrumental in congestion reduction (KiM, 2019), but has hit a wall. In recent years shared mobility concept propositions have become more popular, but early 90's carpooling policy has largely disappeared from policy goals and appears to have lost popularity. The use of car too has, currently pushing towards the 2030s, not become wildly unpopular (KiM, 2021), even while policy aims of ensuring curbs on congestion haven't yet seriously occurred. New methods for public transport were expected, but realistically PT saw no great expansions outside of the doubling of tracks within the train system (G.J.A. AI, 2006). Another expectation was that government would step back from its hierarchical position in favour of private-public cooperation with employers; this hasn't changed much until the pandemic where government encourages employer travel policy more (KiM, 2021). Most interestingly, while employer-public cooperation has been put forth since the 90's, employer transport management or the effects of telecommuting and WFH, don't take priority in government policy (KiM, 2019; KiM, 2015). WFH is a fringe topic within mobility reports and even after the pandemic, where it became far more relevant, government plans to maintain a structural shift towards WFH to curb congestion appear lacking.

Methods and variables used to describe and measure mobility in the review reports that were examined tend to remain based around the same 4 econometric categories used since the 90's. Over the years, it becomes apparent that commute becomes less important in the larger scale of the mobility reports, disappearing from it. Review of mobility in the workplace has become separate. Expansions of examined variables that influence mobility occur. Yet, despite constant identification within government reports, these metrics seem to not stick around. Perhaps this is partially due to the fact that the format of mobility reviews continues to shift, only settling down to standardised format in the mid 2010's. Where societal cost of mobility, through measuring social safety and environmental factors among others, becomes most important. Within 30 years of policy reports, a standardized method of measuring attitude and its effects on commute behaviour hasn't been introduced or upheld. This emphasises the need for a method of measuring and analysing these attitudinal variables to better evaluate policy, attitude was and has remained under-investigated.

Sub-question 2; *What theory on travel behaviour, regarding the influence of attitude and habit, can be applied to identify the variables in attitude changes towards travel impacted by the pandemic?*

The introduction and SQ 1 identified the need to investigate attitude change and its effects on travel behaviour. It's necessary to identify the different variables that influence (habitual) travel behaviour through conceptualising a framework on how these variables are categorised and affect attitude. A qualitative desk study largely adapts the framework by van Wee, et al. (2019), to explicitly explore and propose improvements to the viability of the single framework.

Frameworks on the built environment and its relation to attitude and behaviour, are useful for classifying the different factors influencing travel behaviour, but limited in framework depth. The model for attitude change by van Wee et al. (2019) goes in depth, but similarly feels a little broad in how it defines environmental triggers. The model solely investigates attitude change and does this well. However, criticism of the model also considers that analysis of change is somewhat difficult without taking a baseline attitude before change into account. The nature of this study sees investigating attitude change itself as a goal of its own, as it would determine whether this more traditional, less labour and time intensive simple method of Q-methodology is able to properly catch dynamism. Rather than unnecessarily widely and impractically expanding the model and in turn the Q-set and survey. The conceptual model proves useful as a tool for explorative analysis, but is limited in its connection to the creation of a Q-set, indicating the need for changes to methodology in future research to assure a better connection. The model identifies different triggers influencing attitude

change, many of the triggers mention the importance of relation to colleagues and employers, which is a variable that wasn't considered much before. Similarly, while variables such as the effect of WFH on attitude towards other commute modalities were implicitly mentioned in the policy literature, the social effects of WFH or the effects of WFH on the attitude towards itself are newer.

Sub-question 3; *What different perspective clusters on changing attitude towards car ownership, usage and travel behaviour can be found within Dutch society, in regards to pandemic impact?*

The introduction identified the need to gather data on Dutch respondent attitudes towards commute (see method section for in-depth description of data gathering and cleaning). These findings on attitude have been bundled to identify significant societal perspectives through quantitative Q-methodology analysis that identifies attitude clusters groups that represent significant societal opinions. Respondents are Dutch nationals above legal driving age with the ability to (partially) work from home or have (partially) worked from home during the pandemic. 51 participants were examined. This has resulted in a selection of 8 different factors. The number of identified factors was rather high. Where a number of 4 factors is generally optimal, 8 were required in this study for statistical reasons. This was likely due to the fact that the subject of this thesis is relatively broad with a large Q-set featuring many different subjects. Different modality users years' of experience through commute behaviour has informed their attitudes differently. Their attitude would thus also change differently when exposed to attitude triggers created by circumstances surrounding the pandemic. Description of all factors is rather in depth, a simple overview of the factors is displayed in table 9.1, where presumed primary (former) mode of commute is compared to their attitude towards WFH.

Factor titles	Primary (former) commute based on attitude	Status of attitude towards WFH
1; Car commuters that strongly shifted to structurally working from home	**Primarily car users**	**Have embraced WFH**
2; Car commuters looking to return to pre-pandemic commute behaviour	**Primarily car users**	**Have denied WFH**
3; Multimodal opposers of working from home themselves	**Primarily multimodal cyclo-pedestrians**	**Have denied WFH (due to their work circumstances)**
4; Multimodal PT commuters shifting to WFH, remaining steadfast car owners	**Primarily multimodal PT-car users**	**Have embraced WFH**
5; Part-time cyclo-pedestrians, unchanged in their behaviour	**Primarily multimodal cyclo-pedestrians**	**Have denied WFH (due to their enjoyment of commute)**
6; Car use opposers, strengthened in THEIR own personal car use	**Primarily car users**	**Have become ambivalent to WFH**
7; Full time cyclo-pedestrians that have shifted to working from home	**Primarily multimodal cyclo-pedestrians**	**Have embraced WFH**
8; Commuters generally opposed to government & policy	**Primarily car users**	**Have embraced WFH, despite opposing (pandemic) government policy**

Table 9.1 Factor summary

Those whose attitudes indicate being formerly or still engaged in multimodal cyclo-pedestrian travel that does not primarily use the car, have often been more critical on WFH. The respondents that make up factor 2 and 5 interestingly also remain attitudinally more attached to the car than many of those whose attitudes indicate that they used to or still actually do primarily commute by car. This is likely due to multimodal travellers having experience with the belief that the car is always necessary as a back-up option to other modalities. Another interesting observation is that ideological attitudes, not investigated within this thesis, likely also impact attitude towards commute. This was the case for factor 6 and 8. On the other hand however, attitude affected by such presumed political attitudes then did not always completely match with other attitudes or actual behaviour indications based on data from the post Q-sort questionnaire, which is further evaluated in SQ 3.

Sub-question 4; *What are the possible behavioural effects on commute behaviour, of the identified changes in attitudes towards commute within perspective clusters?*

To examine the effects of attitude on behaviour, responses regarding commute behaviour are examined for the respondents within the formerly identified factors. The limited amount of responses was able to give an initial indication on whether expectations on behaviour are correct

based on identified attitudes, interestingly it was also able to see when behaviour deviated from expectations based on identified attitude. Results were somewhat successful, but there's some nuance in the overall shifts reported within this thesis. The size of the factors is too small to draw quantitatively significant conclusions, generalizing them to the Dutch populace of commuters, however, knowing the very detailed Q-sorts of these respondents, it was possible to measure whether statements made on attitude match the actual behaviour of those respondents. An additional nuance that needs to be considered is that considered respondents are or were able to WFH during the pandemic, positively skewing attitude toward WFH.

The indications of respondent commute behaviour change seem to generally conform with expectations based on respondent attitude within the identified factors. Groups that have come to strongly appreciate WFH, such as factors 1, 4, 7 and 8, generally seem to engage far more in WFH after the pandemic than before. This is a trend that is seen among most factors, where even ambivalence towards WFH seems to have resulted in a structural modal shift towards WFH. The exceptions to this shift are the car commuters within factor 2 that are explicitly opposed towards WFH, where car use remains the same, and multi-modal cyclo-pedestrians in factor 5 where bike and PT use remained roughly the same after the pandemic in comparison to before, WFH did not increase. This latter group is opposed to WFH through enjoying the commute itself, their professed eagerness to return to their old commute habits apparent within their behaviour. What must be mentioned however, is that factor 3, cyclo-pedestrians that have come to dislike WFH itself, and factor 6, car use opposers that were strengthened in THEIR own personal car use, have grown to (partially) dislike WFH, yet further engaged in the practice as a result of the pandemic. Another interesting observation is that those generally opposed to government commute and pandemic policy, now structurally WFH far more, but still use the car at the same level as pre-pandemic.

Sub-question 5; *What are the implications of the findings for government and possible impact on prevailing government policy?*

It's necessary to apply knowledge gained within SQ 3 and 4 on commute attitude and behaviour, on the information on policy gathered through SQ1, 2 and the methodology. What identified societal perspectives and their changes in attitude might mean for current prevailing government policy regarding commute are analysed through the evaluation of the trends identified. This is a qualitative interpretation of quantitative findings, that identifies the most important implications for policy.

The **first** general policy implication, is that WFH policy supporters, or at least those that strongly appreciate aspects of WFH, are widespread among most perspectives. Even government policy opposers, still like the practice of WFH on its own. Partial (non-full-time) WFH is supported by all perspectives. As such, this might be a successful popular base for policy to limit commute trips in the future if the government might wish to choose so. The **second** implication is that curbs on car use and policy, such as road pricing (rekeningrijden) or the further establishment of commute alternatives (such as PT, cycling, etc.) as a replacement to car use, remains unpopular among most perspectives. Even among strong road pricing supporters and those that tentatively seem to agree that widespread private car should no longer be as acceptable as it once used to be, there has been an increase in the sense that private car ownership (for themselves at least) and the freedom that comes with private ownership has gained new appreciation. While there are still those that support car use curbs, they themselves are newly strengthened in their personal car ownership and they do not see this changing in the future. The **third** implication is that simply because commuters often cycle to work, that doesn't mean they would like to see car use or ownership limited. They often see it as a back-up for their multi-modal travel behaviour or use it for other transport than commute. While you could thus limit car-use within commute to limit congestion, you'll likely find popular resistance when directly trying to limit car use or ownership, even among non-car commuters. **Lastly**, there's the existence of (political) ideology prominently affecting attitude among some factors, making interpretation of these attitudes and thus the effect of attitude on behaviour somewhat difficult. From the point of view of lawmakers actual attitude and behaviour change could

seem positive however, as the group opposed to most car use curb and COVID policy has actually come to enjoy WFH a fair bit. Whereas while groups traditionally positive on government policy like road pricing or COVID related mandates, have become strengthened in their own personal car ownership, yet indications of their actual behaviour still show car use decrease in favour of WFH. This is interesting, as they're lukewarm towards the practice, indicating that for some groups political sentiment does triumph over personal commute experience based attitude.

Sub-question 6; *What facets of Q-methodology have shown the need to be adjusted to account for dynamism and change within perspective?*

The introduction, SQ 2 and method execution showed that evaluation of Q-method application in this case was necessary. Literature research and respondent consultation on Q-methodology assisted in method success identification. Exploration of the quantitative and qualitative results of the former two sub-questions aided in identifying the efficacy of the future use of the dynamic Q-methodology. Based on the quantitative results respondents are ready for Q-methodology and questions about dynamism in attitude. They profess to be perfectly able to answer questions about their changed opinions, or rank statements based on their changed opinions. This has not negatively impacted the quality of responses and result data. Respondents are more ambivalent on Q-methodology itself, although in depth response mostly shows that this is due to the required time investment, issues with layout when taking the survey digitally through phone and having to abide by Q-method forced distribution. These issues hardly invalidate research results but they offer an insight into aspects that would make data gathering more structured in the future to increase research success.

More serious methodological issues exist during analysis of the Q-sort result. These issues aren't related respondent participation. These issues come with the introduction of dynamism into the Q-set, as conducting dynamic Q-methodology risks adding 'double' statements in the Q-set that can cause issues during result interpretation. Missing context or different interpretation of factor analysis results due to differently phrased or structured statements makes later analysis and interpretation of perspectives more difficult. In this study issues were intercepted by the post Q-sort questionnaire and the size of the Q-study itself. However, preference would be to fully do analysis through Q on its own. Despite some issues, the implementation of dynamism into Q methodology, focusing solely on the change in attitude itself, through questions primarily centred around change in opinion, was successful. It produced strong results being able to identify a number of significant changed attitude clusters that were insightful in the investigation of behaviour changes and their relation to policy. Employing this type of research has helped to clearly pinpoint the issue with the employed method of dynamic Q, allowing for more structured and possibly higher quality research in the future.

A more involved method to address identified issues requires a different method of Q-methodology. Based on experience gained within this study, a set-up is created that could investigate the starting points (formerly held attitude), triggers for attitude change and attitude change itself. This new method addresses the methodological complications from the employed method, but it also features flaws in comparison to the current method of introducing dynamism. It mostly focuses on a different set-up of Q-set construction through a more researcher involved method of interviewing to develop concourse, as shown in table 8.4 in chapter 8.3. This method can likely avoid unclarity in statement presentation and analysis, through better following the model by van Wee, et al. (2019) and considering additional attitude constants from before attitude change. However, this method requires far more researcher guided interview which might lead to issues due to the researcher seeking specific answers and no longer gathering information from the wider societal concourse, but pre-determining interview findings. This risks researcher bias in interview construction, creating the wanted P-set rather than basing it on 'natural' discourse.

Main research question

Through answering the sub-questions a general answer to the main research question can be given. Results of research identify the existence of 8 different societal perspectives on changes in attitude

towards commute as a result of the pandemic. Structural change in attitude among Dutch commuters able to work from home was confirmed, as well as resulting commute behaviour. Most respondents also mention structural change directly, as the majority does not seek to (fully) return to commute behaviour from before the pandemic. As SQ3 showed, societal perspectives were largely identified for what are likely car users and multi-modal commuters, primarily cyclo-pedestrians. Attitudes are roughly divided into those who've fully embraced WFH, those who've come to deny WFH due to work circumstances and attachment to their old commute (primarily full-time car users and cyclists), and lastly those more ambivalent towards WFH that often show attitude towards communication with colleagues having grown negative. Behaviour indications of perspectives generally conforms with attitude change in case of apparent single mode commute users. Behaviour conforming to attitude starts to differ among multi-modal commuters where, regardless of negative attitude, WFH appears to have grown. The exception to these groups are (car) commuters whose attitude appears affected by identified unmeasured ideological motivation, whose effects on behaviour then appear counter to effects of professed attitude on behaviour. This requires further study, as it might show a limit to the use of professed attitude to predict behaviour.

9.2 Policy recommendations

This section will features a short summary of policy recommendations based on section 9.1, focusing on policy implications identified in SQ 5 in relation to results of SQ 3 & 4. It gives recommendations for all identified societal perspectives (factor). When giving policy recommendations, these are based on identified government policy trends that seek to limit congestion and travel time loss. Policy seeks to successfully curtail (the need for) car commute and therefore car usage. Historically PT encouragement was a method of achieving this, as well as encouraging the continuation of walking and cycling to work. The surge of WFH has shown indications of causing a structural decline in car and PT usage. Such a structural car use decrease should thus be encouraged from a government perspective, based on past policy trends. What policy would successfully apply to identified factors? These recommendations are done based on positivity, neutrality or negativity in attitude.

1; Car commuters that strongly shifted to structurally working from home

Consisting of primarily car users, that have come to attitudinally embrace WFH, commuters within this factor have shown a large shift in how they observe car commute and ownership. It could be recommended to policymakers, to do further investigation through quantitative methods to examine how many commuters actually fall within this group. This factor featured most respondents by far within this study. This could indicate that this might be the case within the general population. These commuters have come to be far less critical of car use curb policy like road pricing (rekeningrijden), decreasing resistance if it were to be implemented. If this were to be the case among a significant group of Dutch commuters, this indicates a historic shift in the view on the law. Regardless, from a recent government point of view WFH should be further encouraged as it's proven that the practice was able to decrease the car in relative popularity and lessen car usage among many commuters.

2; Car commuters looking to return to pre-pandemic commute behaviour

Consisting of primarily car users that have come to attitudinally deny WFH, these commuters were unchanged in their commute behaviour. They still use of the car to an equal degree as pre-pandemic, although they've come to support WFH as a general practice for others, seeing benefits of employer encouragement for emission reduction and having the freedom to choose partial WFH. This makes it difficult to recommend policy based on this group. They'll likely never come to support car use curbs like road pricing and further encouragement of WFH will likely not lead to a large positive increase in attitude on WFH, after all it hadn't due to the pandemic. As such, recommended is the further encouragement of WFH among others, as this will not find resistance from these respondents. Car usage might decrease in the future on its own, as commuters themselves indicated within the Q-sort.

3; Multimodal opposers of working from home themselves

Consisting of primarily multimodal cyclo-pedestrians, that have come to attitudinally deny WFH due to their work circumstances, it's difficult to see what policy could be recommended to encourage WFH or discourage car usage further. These respondents have not come to like WFH due to issues surrounding their attitude towards WFH itself. Unlike all other identified perspectives, these commuters have not even come to like part-time WFH. This is perhaps not as much of an issue, as these respondents likely make little use of the car for commute in the first place. Bike usage instead of car usage is a goal that government generally strives for. To achieve its goals, government policy and recommendations could be aimed at ensuring cyclists are able to once again engage in their pre-pandemic commute patterns. Promoting WFH instead of the car in days were cycling isn't possible, will likely not be a fruitful tactic, as job characteristics and jobs sector themselves do not allow for more frequent WFH. Policy to solve such a more specific work related issue fall outside of this study.

4; Multimodal PT commuters shifting to WFH, remaining steadfast car owners

Consisting of primarily multimodal PT-car users, that have come to attitudinally embrace WFH, this factor is very similar to those in factor 1. However, the difference is that these commuters that make use of both PT and car. Both modes saw a decrease in the use of both due to their positive change in attitude towards WFH, but commuters did not become more negative, or rather less supportive, of WFH. These are multi-modal commuters strengthened in their belief of the car as a back-up to other commute modes due to the pandemic. This makes policy recommendations somewhat difficult. WFH stimulation will lessen the necessity of the car for commute and could be used by policy makers, but the structural increase of the car's popularity makes it difficult to further stimulate commuters to step down from its use through car usage curb policy. Something policymakers could keep in mind, is that a policy of PT re-popularisation might be useful once employers start rescinding WFH privileges of employees, as commuters in this factor might return from WFH to the car, rather than back to PT.

5; Part-time cyclo-pedestrians, unchanged in their behaviour

Consisting of primarily multimodal cyclo-pedestrians, that have come to attitudinally deny WFH due to their enjoyment of commute itself, it's difficult to see whether any considered policy implementation is necessary. These commuters simply like the activity itself, making them engage in it more often. Bike usage instead of car usage is a goal that government generally strives for. To achieve its goals, government policy and recommendations could be aimed at ensuring cyclists are able to once again engage their pre-pandemic commute patterns, but also engage in promoting the idea that WFH could be a decent solution for days where cycling isn't possible. To ensure this possibility, policy would also need to be made to encourage employers to be more flexible in allowing for employees to work from their homes on a day to day notice, as to allow for easier decisions on days where cyclist commute is impossible due to external variables such as weather.

6; Car use opposers, strengthened in THEIR own personal car use

Consisting of primarily car users, have become attitudinally ambivalent to WFH, these commuters support most policies to lessen car usage. As such, these respondents will not oppose the implementation of policy like road pricing (rekeningrijden), or government policy initiatives to further encourage WFH through the employer. The single point of interest here, is that one can wonder whether the actual implementation of such methods might further cause attitudinal shifts towards a sense of necessity of the car, like the pandemic did. However, these respondents did also further engage in WFH despite not growing to attitudinally like it, such growing resistance is thus unlikely.

7; Full time cyclo-pedestrians that have shifted to working from home

Consisting of primarily multimodal cyclo-pedestrians, that have come to attitudinally embrace WFH, policy to further encourage WFH will find strong support. Interestingly this is also the case for WFH encouragement with the aim of emission reduction due to lessened car usage. These respondents also support road pricing (rekeningrijden), if only because these respondents simply don't use the car themselves. What could be a priority for policy makers, is to find out what makes these multi-modal

commuters NOT feel like the car remains a necessary back-up for other modalities, unlike other multimodal commuters, primarily PT users, that have come to further appreciate the car as a back-up. If this is solely an issue of travel distance that encourages PT usage over cycling, then why didn't WFH replace the car where PT is impossible, whereas this is the case for cyclo-pedestrianism?

8; Commuters generally opposed to government & policy

Consisting of primarily car users, that have come to attitudinally embrace WFH despite opposing pandemic and commute government policy, this factor shows that implementing policy could not always be the solution to achieving policy goals. This factors shows that among these respondents any government interference in commute behaviour is met with stiff resistance, even when actual attitude change is already in line with policy goals. As such, for these kinds of respondents the best strategy of achieving car use reduction is likely facilitation of WFH, rather than enforcing some type of policy. However, actual indications of behaviour show that WFH grew, not at the expense of car usage, but other commute modalities such as PT use or cyclo-pedestrianism. This leaves an issue that isn't solved by policy measures that have gathered support from commuters within this factor. There is a dilemma presented to policy makers that no policy that can be implemented to limit car usage will find support with these commuters, possibly limiting effects.

Overall policy consensus

General promotion of continued WFH encouragement is recommended to curb congestion. Similarly, policy that seeks to directly curb car usage, such as road pricing, remains observed negatively in most perspectives and is thus advised against. However, with a sizeable group of former full-time car users becoming less negative on this policy and multi-modal commuters more negative, policy makers would do well to conduct further research on the quantitative sizes of these groups, as the apparent large size of more positive former car users and more negative cyclists might require a fundamentally different view of the subject. On the topic of WFH, a subject newly popular in government reports, ALL perspectives mention having a good home office and there's generally no feeling that the digital workspace offered by the employer is particularly lacking. Issues mostly exist in informal and on distance communication with colleagues, not professional. Government is thus not necessitated to financially or policy wise invest in business for better WFH infrastructure. But, with all perspectives having come to appreciate flexible WFH possibilities and the prominent existence of communication issues between employees, business and government would do well to find methods or schedules, possibly digital, that allow for more flexible signing-up for WFH shifts, that clearly denote tasks and proper information the nature of their tasks with communication details of all those involved.

9.3 Discussion and Reflection

Through answering the research sub-questions and the main research question, the 3 presented knowledge gaps were to be filled. Filling in these offered scientific contributions, **firstly**, the main empirical contribution, granted direct quantitative insight into the 8 statistically distinct attitudes among different Dutch societal groups about commute behaviour following the pandemic. **Secondly**, a theoretical contribution was made, validating Van Wee et al. (2019) as a basis for conducting research on attitude change. Pandemic triggers related to changes in commute attitude were successfully evaluated using that model. **Thirdly**, a methodological contribution was made through successfully adapting traditional Q-methodology for dynamism and it's efficacy in measuring attitude change was addressed through addressing results. While general success was achieved, the latter method saw issues regarding Q-set interpretation. Similarly, not all empirical findings were fully generalizable, or theoretical application flawless. Conclusively, general research suffered from a number of limitations and other points of interest requiring discussion.

This section evaluates conducted research, focusing on experienced limitations that are discussed following steps of Q-methodology. Firstly, there's evaluation of the application of literature review regarding (historical) government reports on commute. Secondly, conceptual framework application is evaluated. Thirdly, the execution of the online Q-method survey is evaluated. Fourthly, evaluation of limitations and usefulness of results is done. Lastly, limitations regarding policy recommendation

and limitations not yet covered within this chapter are discussed. When required, indications of possible future research based on limitations or emergent questions regarding the subjects is given.

9.3.1 Discussion of Literature review

This thesis was limited in size due to manpower and time constraints, requiring limitations to ensure feasibility. **The first limitation** relates to this issue. Literature review within this report was applied at different sections of the thesis, to gather specified information necessary for exploration of that section. The method was successfully able to gather necessary data. It was applied somewhat arbitrarily, as out of large numbers of papers only a relatively small selection was chosen per aspect of the master thesis. A full literature review, that explores the vast majority of search query results or literature generated on a subject, was simply impossible. This would've been a master thesis of its own, which wasn't the goal of this report. An example is the desk study of government reports on historical travel behaviour development and policy to answer SQ 1, as per every discussed 10 year period, only around 2 to 3 reports were reviewed. This was sufficient to display general development in commute over those periods, without the review requiring too much time as these reports are generally quite long and review was likely to detailed, which necessitated the shift of the full review to the appendix. Future research should either expand on the more basic review performed here, or focus entirely on identifying a single concept within these reports, such as the investigation of solely attitude variables used by government to measure developments in Dutch travel or evaluate policy success. Similarly, future research should be better designed to enable literature review for most all different chapters of the thesis to take place at the same time during the writing of the report. This was more difficult within this thesis however, as nearly each different chapter of the report required some form of extra limited literature desk study to properly answer the relevant research question.

9.3.2 Discussion of conceptual framework application

The second limitation regards limited conceptual framework application throughout steps of Q-methodology. During development of the conceptual framework, the practical and theoretical implications of implementing dynamism weren't known yet. This was to be expected as empirical evaluation of dynamism within survey set-up would only come after survey results. Yet even during the development of the framework, there were already expectations that there would be some form of issue in interpretation of the implications of identified change, as no explicit attention was given to base attitudes from which deviation takes place. This means that it could become unclear whether an attitude was simply strengthened in an already positive direction, reinforced in negativity, whether there was a tilt in attitude or even whether an attitude was developed on something a commuter was unaware of before. Is change understandable without an identified starting point? As this study seeks to explicitly investigate attitude change, the choice was made to move forward with the more basic set-up of investigating changed attitudes regardless of this doubt. It could test whether a simplified traditional method of Q is possible. Results show that this was successful. Results, like statement rankings or z-scores were well interpretable. This was in part due to the Q-set's relatively large size allowing for more context when individual statements on attitude change proved confusing. With precautions taken, the conceptual framework was well integrated in the sense that dynamism in attitude was measured and investigated. The framework could be more clearly linked to actual survey results and interpretation. This wasn't fully the case, as the conceptual model and triggers it identified were used in Q-set category creation, but mostly disappeared from the study otherwise. This was in part due to the concourse collection not being directly connected to the conceptual model. Gathered statements linked to model inspired subject categories, being derived from literature review or interview, are simply unconnected from other literature review that identified triggers. This was necessitated by the scarcity of those usable statements.
This offers the opportunity for future research that seeks to overcome these theoretical limitations by using the newly developed method of Q-set development from SQ 6. Within this master thesis such a method might have been too labour intensive for its scale. The level to which interviewing must take place, both in the number of size of those interviews required, would have been too time

consuming. Furthermore, finding enough willing respondents for such interviews would have been similarly difficult. Which leads into limitations regarding survey set-up and data gathering.

9.3.3 Discussion of survey and result gathering

The third limitation regards data gathering, as the P-set isn't large enough to generalize quantitative results to the Dutch population. Results of the post Q-sort questionnaire were sufficient for properly evaluating the identity of the P-set and give some indication, even if mathematically insignificant, of the relation of a factor's attitude with observed behaviour. Preferably there would've been more than 51 respondents. While this was enough to conduct Q-methodology, the empirical results of the post Q-sort questionnaire could have used more responses to increase the validity of results. A bigger issue regarding the P-set exists in its selection, as respondents were gathered from the researcher's personal and professional network. This might risk bias towards attitudes held within more urban areas such as the Randstad, however this was not measured and is thus unknown. The P-set shows no untenable bias in age or education, that might indicate the loss of inclusion of certain perspectives. This could lessen bias, which might warrant a re-examination of results as perspectives might be missing. Future research could focus on attaining more quantitative rather than qualitative results regarding this subject using insights gained here. Surveying a broader more numerous group of respondents could allow for attaining more generalizable quantitatively significant results.

Further limitations regarding the survey is examined through respondent input. Limitations of survey execution, technical issues and the post Q-sort questionnaire are considered. Respondent feedback to those aspects and researcher rebuttal is found in appendix C and in depth summary in appendix J.

1. Execution limitations

The fourth major limitation existed regarding conducting research online through a website at a 'distance' instead of in person like traditional Q-methodology research. One of the primary issues brought forth was the Q-sort process requiring forced distribution. Some respondents found ranking their responses straight away difficult, engaging in reranking. Some complained that the 'pre-ranked' lists of statements only shows around 2 statement at a time; Conducting Q-study online has issues. It avoids the hassle of in person study, more easily allowing for a larger amount of respondents over a longer period of study. However, lack of basic ability to assist respondents directly or allow respondents to survey all statements with paper-card in-person ranking are negatives. However while issues persist, doing the study physically instead of digitally would be practically impossible due to the untenable workload for the latter option. These are issues to keep in mind.

The fifth limitation is in the presentation of the survey, particularly being affected by on distance execution. As stated, lay-out was limited, being experienced as somewhat cluttered by some respondents, also unable to neatly rank statements on mobile. Some respondents would have liked more materials. While the survey was explicitly meant for computer and the already lengthy required documents were included, these are things to keep in mind to attract more respondents in the future. More important is the need this study's larger Q-set and post survey causing the survey to become lengthy. This was experienced negatively by some respondents, and might have discouraged participating. Consideration could be given to producing a smaller Q-set in future research, focusing on a more limited subject, offering a smaller specified Q-set to make participation more feasible

2. Technical Limitations (conducting Q-study digitally)

Technical limitations refer to how limitations of the programs used to create and conduct the survey might negatively impact survey results or respondent experience. **The sixth limitation** was technical, as a 3rd party webhost was necessary for survey conduction. The initial webhosting service Netlify, that was used for hosting the Q-sort questionnaire suffered from technical difficulties server side. This caused technical issues and errors for participating respondents. This occurred during the first days of survey conduction and many respondents might have dropped out of the study. This was resolved within a day by setting up a different website through GitHub. Backup webhosts need to be set up before spreading starts in future research. This will ensure a more robust programme of data collection and hopefully lessen respondent drop-off.

The seventh limitation was technical, but deals primarily in limited accessibility to the survey. Respondents found the Q-sort easily operable, particularly the moving around of statement blocks. Some respondents mention not being able to read statements after ranking them in the Q-sort, potentially impacting their final results. While the online q-sort featured smaller boxes with solely number (#) designation, hovering over the statement with the mouse did show its entirety. Due to the nature of conducting the survey digitally and online both the layout of the survey, as well as the inability to directly assist respondents, were somewhat hampered in comparison to a traditional in-person physical Q-study. Small issues could be more easily fixed with more directly involved researcher support. Small issues discouraging responses to a time intensive survey, might lead to respondent drop-off. With Q-sorting also not being easily accessible on phone, future research should ensure better accessibility to the survey. Layout was not intuitive on phone, requiring respondents to take the survey on computer or (larger) tablet. This was mentioned within the letters of invitation and, if completely necessary, doing the Q-sort on phone only possible as back-up.

3. Limitations regarding the post Q-sort survey

The eight limitation regards the post Q-sort survey. Some respondents mention 'missing' questions within the survey. It could have been useful to request information on the type of job (full-time/part-time) or the amount of workdays/number of jobs. This study focuses on commute and needs to be relatively short as to not discourage respondents, adding too many additional questions would have been problematic for participation. Some data might be useful for explaining certain behaviour or opinions, but outside of data on the amount of commutes, most data isn't necessary. Oftentimes questions were already partially covered within the Q-sort and post Q-sort, is it then necessary to cover even more to ensure less researcher inference? Some questions, like those on car ownership should have been rephrased, to allow for better specifics of change in or size of ownership. This would have been able to capture car owners, such as those in families or relationships, that shrunk their own car park and whether there was any other change in circumstance.

9.3.4 Discussion of result interpretation

The ninth limitation exists regarding the interpretation of results, particularly regarding the Q-sort. Results were generally satisfactory. The number of identified factors within Q-methodology was somewhat high at 8 different factors. These factors all had decently well identified characteristics and are relatively easily distinguished between one another. The broad number of identified perspectives is in part due to the Q-set being somewhat broad in subjects. This was due to it having to involve all 4 different main commute modalities, ensuring at the very least 4 different factors based on preferring one of these modalities alone. Future research should thus be more focused on the development of attitude around a specific modality like the car or working from home, if solely to limit the number of identified factors to the ideal number of 4. The bigger issue exist regarding the wrongful interpretation of results by the researcher, in part due to not all attitude change being captured by the necessarily limited number of statements in the study and in part due to the chosen statements being influenced by researcher bias on importance. This could mean that not all respondents are able to fully express their attitudes on commute through the Q-sort. This offers the necessity to focus more on specific subject in future research to more deeply explore these subjects.
The tenth limitation is based on the somewhat limited look at policy options, partially caused by the formerly mentioned broad subject requiring large amount of the P-set. The exploratory research was more aimed at finding interesting attitudes towards commute behaviour and external influences, rather than exploring more specific in-depth policy options. The exploration of policy options was satisfactory for this study, but based on these results future research ought to look more extensively into commute policy options, particularly different versions of policy proposals, while using the perspective profiles that were identified within this thesis. Furthermore, on the topic of factors and policy, it would be interesting to see to what end ideological convictions that were identified within some factors actually impact commute behaviour. As it stands this remains unclear, as it can cause z-scores that evaluate a factor to come across differently from the overall meaning of the factor.

Bibliography

Awad-Núnez, S., Julio, R., Moya-Gómez, B., Gomez, J., & Sastre Gonzalez, J. (2021). Acceptability of sustainable mobility policies under a post-COVID-19 scenario. Evidence from Spain. *Transport Policy, Vol 106*, 205-214.

Augustine, A., & Balachandran, V. (2021). A STUDY ON CHANGES IN TOURIST BEHAVIOUR DURING PANDEMIC. *International Journal of Advanced Research in Management and Social Sciences, Volume 10*.

Becken, S., Friedl, H., Stantic, B., Conolly, R. M., & Chen, J. (2020). Climate crisis and flying: social media analysis traces the rise of "flightshame". *Transport, Tourism and Environmental Crisis; Guest Editor: Debbie Hopkins, Vol. 29, Issue 9*, 1450-1469.

Bijlo, E. (2020, february 7). Hebben we vliegschaamte? Dat is aan de groei van het aantal vluchten niet te merken. *Trouw*.

Bremmer, D. (2020, November 23). Corona bewijst: thuiswerken lost files op. Retrieved from www.parool.nl: https://www.parool.nl/nederland/corona-bewijst-thuiswerken-lost-files-op~bccf71a4/?referrer=https%3A%2F%2Fwww.google.com%2F

Brůhová Foltýnová, H., Vejchodská, E., Rybováa, K., & Květoňb, V. (2020). Sustainable urban mobility: One definition, different stakeholders' opinions. *Transportation Research Part D: Transport and Environment, Volume 87*.

CBS. (2020, December 23). *Nederlanders in zomer 2020 vaker op vakantie in eigen land.* Opgehaald van CBS.nl: https://www.cbs.nl/nl-nl/nieuws/2020/52/nederlanders-in-zomer-2020-vaker-op-vakantie-in-eigen-land

CBS. (2021a, April 20). *1 op 5 werknemers kwam in 2020 (vrijwel) niemand tegen tijdens het werk.* Opgehaald van CBS.nl: https://www.cbs.nl/nl-nl/nieuws/2021/16/1-op-5-werknemers-kwam-in-2020--vrijwel---niemand-tegen-tijdens-het-werk

CBS. (2021b, August 6). *Halvering aantal vakanties naar buitenland in 2020.* Opgehaald van CBS.nl: https://www.cbs.nl/nl-nl/nieuws/2021/31/halvering-aantal-vakanties-naar-buitenland-in-2020

CBS. (2021c, August 20). *Mobiliteit in coronatijd.* Opgehaald van CBS.nl: https://www.cbs.nl/nl-nl/visualisaties/welvaart-in-coronatijd/mobiliteit

CBS. (2021d, December 2). *Mobiliteit in coronatijd*. Opgehaald van cbs.nl: https://www.cbs.nl/nl-nl/visualisaties/welvaart-in-coronatijd/mobiliteit

van de Coevering, P., Maat, K., & van Wee, B. (2021). Causes and effects between attitudes, the built environment and car kilometres: A longitudinal analysis. *Journal of Transport Geography* , 1-11.

van de Coevering, P., Maat, K., Kroesen, M., & van Wee, B. (2016). Causal effects of built environment characteristics on travel behaviour: a longitudinal approach. *European Journal of Transport and Infrastructure Research*, 674-697.

Combs, T., & Pardo, C. (2021). Shifting streets COVID-19 mobility data: Findings from a global dataset and a research agenda for transport planning and policy. *Transportation Research Interdisciplinary Perspectives, Vol 9*.

Doran, R., Pallesen, S., Böhm, G., & Ogunbodec, C. A. (2021). When and why do people experience flight shame? *Annals of Tourism Research*.

Groen, S. (2021, March 29). *Reizen na corona: kunnen we na de pandemie nog met goed fatsoen op vakantie?* Retrieved from volkskrant.nl: https://www.volkskrant.nl/cultuur-media/reizen-na-corona-kunnen-we-na-de-pandemie-nog-met-goed-fatsoen-op-vakantie~bd553c2c/?referrer=https%3A%2F%2Fwww.google.com%2F

Jansen , A. (2021, July 5). *Tweedehands auto's niet aan te slepen: '2021 gaat super tot nu toe'*. Retrieved from www.ad.nl/: https://www.ad.nl/auto/tweedehands-autos-niet-aan-te-slepen-2021-gaat-super-tot-nu-toe~a38dcf44/?referrer=https%3A%2F%2Fwww.google.com%2F

Josten, E., & Merens, A. (2021). *Thuis of terug naar kantoor - Plus- en minpunten van thuiswerken voor het.* Den Haag: Sociaal en Cultureel Planbureau.

Hamersma, M., Krabbenborg, L., & Faber, R. (2021). *Gaat het reizen voor werk en studie door COVID structureel veranderen? Verwachte veranderingen in thuiswerken, televergaderen en thuisonderwijs na COVID en de effecten op mobiliteit.* Den Haag: Kennisinstituut voor Mobiliteitsbeleid.

Hamersma, M., de Haas, M., & Faber, R. (2020). *Thuiswerken en de coronacrisis.* Den Haag: KiM.

Hensher, D., Wei, E., Beck, M., & Balbontin, C. (2021). The impact of COVID-19 on cost outlays for car and public transport commuting - The case of the Greater Sydney Metropolitan Area after three months of restrictions. *Transport Policy*, 71-80.

Immerzeel, P., & Mazajchik, T. (2021). *Onderzoek onder Nederlandse werkgevers (100+ medewerkers): inzicht in maatregelen omtrent duurzaam reisgedrag.* Ministerie van Infrastructuur en Waterstaat.

Jongen, E., Verstraten, P., & Zimpelmann , C. (2021). *Thuiswerken vóór, tijdens en ná de coronacrisis, CPB Achtergronddocument.* Den Haag: PBL.

Kantar. (2021, mei 5). *Werken op afstand blijft ook na de coronacrisis populair en transformeert de wereld van de forenzen*. Opgehaald van Kantar.com: https://www.kantar.com/nl/kantar-nieuws/mobility-futures

Kolarova, V., Eisenmann, C., Nobis, C., Winkler, C., & Lenz, B. (2021). Analysing the impact of the COVID-19 outbreak on everyday travel behaviour in Germany and potential implications for future travel patterns. *European Transport Research Review*.

van Kooten, L., & Bolink, J. (2021, June 4). *De economie gaat van het slot! Maar komt de file ook weer terug?* Opgehaald van destentor.nl: https://www.destentor.nl/economie/de-economie-gaat-van-het-slot-maar-komt-de-file-ook-weer-terug~a53b36fe/

Kroesen, M. (2013). Exploring people's viewpoints on air travel and climate change: understanding inconsistencies. *Journal of Sustainable Tourism*, 271-290.

Lee, W., Park, S., Jung, J., Mun, S., & Jung, J. (2021). A study on tourists' perceived risks from COVID-19 using Q-methodology. *Asia Pacific Journal of Tourism Research, Volume 26*, 1057-1069.

Plan Bureau voor de Leefomgeving. (2021). *THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT, Op zoek naar trends, trendbreuken en kansen als gevolg van corona.* Den Haag: PBL.

RDC. (2020, October 7). *Update marktcijfers september 2020*. Retrieved from www.rdc.nl: https://www.rdc.nl/update-marktcijfers-september-2020/

RDC. (2021a, September 1). *17 procent minder registraties personenauto's in augustus*. Retrieved from www.rdc.nl: https://www.rdc.nl/17-procent-minder-registraties-personenautos-in-augustus/

RDC. (2021b, November 1). *Tot en met oktober ruim 7 procent minder personenauto's geregistreerd*. Retrieved from www.rdc.nl: https://www.rdc.nl/tot-en-met-oktober-ruim-7-procent-minder-personenautos-geregistreerd/

Stevenson, H. (2015). Contemporary Discourses of Green Political Economy: A Q Method Analysis. *Journal of Environmental Policy & Planning, Vol. 21*, 533-548.

Thomas, F. M., Charlton, S. G., Lewis, I., & Nandavar, S. (2021). Commuting before and after COVID-19. *Transportation Research Interdisciplinary Perspectives, Volume 11*.

Thombre, A., & Agarwal, A. (2021). A paradigm shift in urban mobility: Policy insights from travel before and after COVID-19 to seize the opportunity. *Transport Policy*, 335-353.

van der Wurff, H. (2021, October 8). Plots staan we weer elke ochtend in de file, zijn we terug bij af? Niet helemaal. Retrieved from www.trouw.nl: https://www.parool.nl/nederland/corona-bewijst-thuiswerken-lost-files-op~bccf71a4/?referrer=https%3A%2F%2Fwww.google.com%2F

van Kooten, L., & Bolink, J. (2020, July 2021). De economie gaat van het slot! Maar komt de file ook weer terug? Retrieved from www.destentor.nl/: https://www.destentor.nl/economie/de-economie-gaat-van-het-slot-maar-komt-de-file-ook-weer-terug~a53b36fe/?referrer=https%3A%2F%2Fwww.google.com%2F

van Putten, S. (2021, August 5). Verkoop tweedehandsauto's stevent af op record. Retrieved from www.volkskrant.nl: https://www.volkskrant.nl/economie/verkoop-tweedehandsauto-s-stevent-af-op-record~b351ee3b/?referrer=https%3A%2F%2Fwww.google.com%2F

van Wee, B., & Witlox, F. (2021). COVID-19 and its long-term effects on activity participation and travel behaviour: A multiperspective view. *Journal of Transport Geography, volume 95*.

van Wee, B., De Vos, J., & Maat, K. (2019). Impacts of the built environment and travel behaviour on attitudes: Theories underpinning the reverse causality hypothesis. *Journal of Transport Geography, Volume 80*.

Verkeerskunde. (2021, November 18). *Mobiliteitsbeeld 2021: geen goed jaar voor ov en luchtvaart*. Opgehaald van verkeerskunde.nl: https://www.verkeerskunde.nl/artikel/mobiliteitsbeeld-2021-geen-goed-jaar-voor-ov-en-luchtvaart

Watts, S., & Stenner, P. (2005). Doing Q methodology: theory, method and interpretation. *Qualitative research in psychology, Volume 2*, 67-91.

Williamson, H. K. (2021). *THE ATTITUDES OF SOLO TRAVELERS USING Q METHODOLOGY.* Tuscaloosa, Alabama: The University of Alabama.

Appendix A – Informal interview set-up

This is the survey that was shared with respondents to attain statements for the concourse. The different questions are related to the different categories that were planned for the Q-set based on the conceptual framework and literature review.

Open vragenlijst reisgedrag input stellingen

In deze vragenlijst zal u enkele open vragen gesteld krijgen waarin u uw mening kan geven over bepaalde aspecten van mobiliteit die veranderd zijn door de pandemie. Deze meningen zullen voor het opstellen van een latere vragenlijst worden gebruikt, in combinatie met ander lopend onderzoek binnen deze TU Delft masterscriptie.

In het bijzonder gaat dit specifiek over DE VERANDERINGEN IN UW MENING over een selectie van vervoersmethoden in het woon-werk verkeer in verband met de pandemie, lockdowns of bedrijfs/overheidsbeleid, en de veranderingen in uw mening naar aanleiding van de invoer van thuiswerken.

In die zin wordt u gevraagd om kort in een handvol zinnen, al staat het u natuurlijk vrij om dieper op uw mening in te gaan, aan te geven hoe uw mening over woon/werk reizen is veranderd over de periode 2020-2022, met nadruk op de periode voor en na thuiswerken & lockdowns.

Let op! U wordt gevraagd enkel deze vragenlijst in te vullen als u;

-- Mogelijk (gedeeltelijk) thuis kan werken/studeren of in het verleden (al dan niet verplicht) thuis hebt gewerkt/gestudeerd, bijvoorbeeld als gevolg van de pandemie.
-- Over de leeftijd van 18 jaar oud bent.
-- Op het moment werkt of studeert, of in de afgelopen 2 jaar hebt gewerkt of gestudeerd.

Notities;

De vragenlijst maakt een onderscheid tussen thuiswerken vanuit het perspectief van werk/leidinggevende en werknemer in vraag 7. Mocht uw positie van werknemer of werkgever binnen een bedrijf verschillen, geeft uw mening dan aan vanuit uw positie en geef dit a.u.b. kort aan. Onder thuiswerken wordt ook gedeeltelijk thuiswerken (enkele uren/dagen) en activiteiten als online meetings en telewerken gerekend. Gelimiteerde ervaring met thuiswerken telt dus gewoon ook.

Als uw mening over een bepaald onderwerp niet significant veranderd is, mag u dit ook vermelden. Het doel van de vragenlijst is een verscheidenheid aan meningen uit de algemene discours the verkrijgen, hierover bestaan geen correcte, incorrect of oninteressante antwoorden.

De vragenlijst refereert voornamelijk naar werkverkeer. Reizen vanwege uw studie, of zelfs algemeen reisgedrag dat veranderd is als gevolg van uw veranderde werk reis gedrag bent u ook aangemoedigd te vermelden.

Question 1	**Op welke manier en in hoeverre is uw mening over autogebruik binnen dagelijks werkverkeer veranderd als gevolg van de pandemie?**
Examples for respondent	Voorbeeld; Denk hierbij bijvoorbeeld aan de auto als vervoersmiddel en factoren gerelateerd aan de auto en haar karakteristieken als dagelijks vervoersmiddel. Dus bijvoorbeeld gebruikskosten, gebruiksgemak, comfort of dergelijke. Of bijvoorbeeld uw mening over uw gedrag, dat u bijvoorbeeld de mate van uw gebruik heeft heroverwogen als gevolg van de pandemie.
Question 2	**Op welke manier en in hoeverre is uw mening over specifiek autobezit veranderd als gevolg van de pandemie?**
Examples for respondent	Voorbeeld; Het gaat hier vooral over de keuze voor het bezitten of kopen van een auto.
Question 3	**Op welke manier en in hoeverre is uw mening over OV-gebruik veranderd als gevolg van de pandemie?**
Examples for respondent	Voorbeeld; Denk hierbij bijvoorbeeld aan het OV als vervoersmiddel en factoren gerelateerd aan het OV en haar karakteristieken als dagelijks vervoersmiddel. Dus bijvoorbeeld gebruikskosten, gebruiksgemak, comfort of dergelijke. Of bijvoorbeeld uw mening over uw gedrag, dat u bijvoorbeeld de mate van uw gebruik heeft heroverwogen als gevolg van de pandemie.
Question 4	**Op welke manier en in hoeverre is uw mening over lopen of fietsen veranderd als gevolg van de pandemie?**
Examples for respondent	Voorbeeld; Denk hierbij bijvoorbeeld aan de lopen en fietsen als vervoersmiddel en factoren gerelateerd aan fietsen en lopen en haar karakteristieken als dagelijks vervoersmiddel. Dus bijvoorbeeld gebruikskosten, gebruiksgemak, comfort of dergelijke. Of bijvoorbeeld uw mening over uw gedrag, dat u bijvoorbeeld de mate van uw gebruik heeft heroverwogen als gevolg van de pandemie.
Question 5	**Op welke manier en in hoeverre is uw mening over uw dagelijkse reisgedrag in verband met werkverkeer veranderd als gevolg van thuiswerken (als vervanger voor andere vervoersmethoden)?**
Examples for respondent	Voorbeeld; Denk hierbij bijvoorbeeld aan de thuiswerken als "vervoersmiddel" en factoren gerelateerd aan thuiswerken en haar karakteristieken als vervanging dagelijks vervoersmiddel (heeft karakteristiek X van thuiswerken, vervoersmethode X minder aantrekkelijk gemaakt naar uw mening). Dat u bijvoorbeeld de mate van thuiswerken (hoeveel uren/dagen) heeft heroverwogen als gevolg van de pandemie, of dat u vanwege thuiswerken anders aankijkt naar ander reisgedrag (werkgerelateerd, of bijvoorbeeld woon/recreatief) wat u hierdoor heeft veranderd.
Question 6	**Op welke manier en in hoeverre is uw mening over thuiswerken zelf veranderd?**
Examples for respondent	Voorbeeld; Denk hier bijvoorbeeld aan uw ervaring met thuiswerken en het effect op uw werkplezier or uw eigen sociale leven, of bijvoorbeeld hoe u uitkijkt naar hoe comfortabel of efficiënt uw thuiswerksituatie is. Verschilt de lengte of mate van verplichting van het thuiswerken hier bijvoorbeeld een rol in.
Question 7.A	**Op welke manier en in hoeverre is uw mening over thuiswerken veranderd vanuit het opzicht van samenwerking met uw medewerkers?**
Examples for respondent	Voorbeeld; Hoe heeft thuiswerken bijvoorbeeld invloed gehad op uw samenwerking met collega's, of hoe heeft de samenwerking met collega's tijdens thuiswerken invloed gehad op uw mening over thuiswerken en ander reisgedrag over de afgelopen twee jaar.
Question 7.B	**Op welke manier en in hoeverre is uw mening over thuiswerken vanuit het opzicht van samenwerking met uw werkgever?**
Examples for respondent	Voorbeeld; Hebben maatregelen, genomen door uw werkgever in verband met thuiswerken, uw mening over thuiswerken veranderd. In het geval dat u zelf als leiding of werkgevende besluiten heeft genomen in verband met thuiswerken of ander reisgedrag, hoe kijkt u hier dan op terug.

Conducting this limited interview to attain additional statements to widen the concourse, has resulted in a set of answers that was used within concourse construction.

Appendix B – Q-sort data

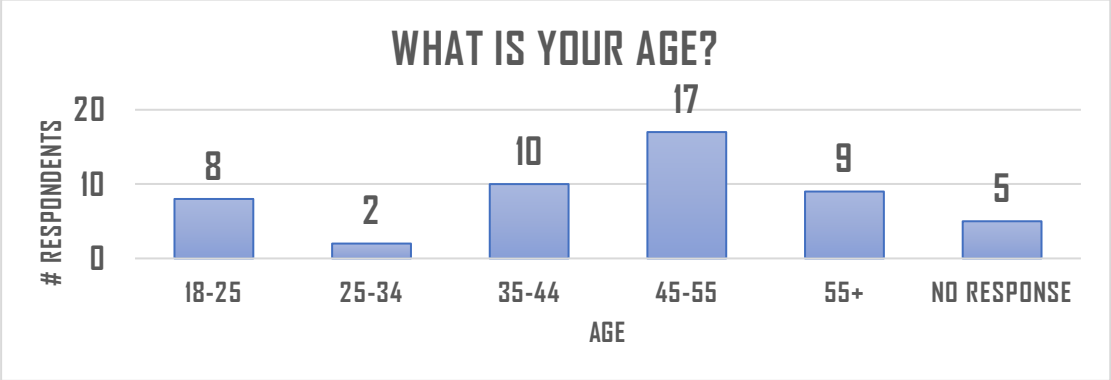
Within this appendix, the data gathered through the post Q-sort questionnaire will be provided, with the exception of the data on survey evaluation that is provided in appendix C and chapter 11 and 7. It will feature largely the same data and description that were provided within the exploration of the P-set within chapter 7. Additional data will be provided through adding the data table on which the graphs are based.

Age – form 0

The division of age among the respondents is largely evenly spread, with a skew towards respondents within the 45-55 age group. This can be seen within figure B.1. Interestingly, there appear to be only 2 respondents within the 25-34 category. This is likely due to an error that might have added some respondents that answered this question to the "No response" category. This question was mandatory and this issue does not appear in any other question within the post Q-sort questionnaire. Thus likely, the number of respondents within the 25-34 category is 7, not 2. This is in line with the average spread among the other categories. Due to uncertainty to whether this is actually the case, these respondents remain within the "No response" category.

The skew towards 45-55 year olds will likely not negatively impact the results of the Q-sort, as enough respondents are present within each category to allow for most attitudes and factors to be identified in the case that this variable might play a significant role within clusters.

Age (Leeftijd)	**#**
18-25	8
25-34	2
35-44	10
45-55	17
55+	9
No response	5

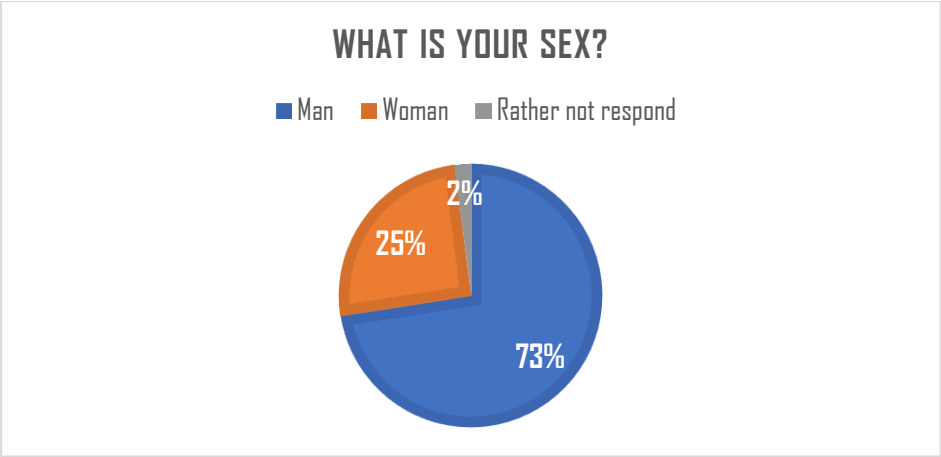


B.1 P-set age division

Sex – form 1

As shown in figure B.2, the sex of respondents is spread unevenly in a 1 to 3 proportion in favour of males. While women tend to work less than men, in the sense that they work more part-time, this spread is likely not entirely representative of all Dutch commuters. The skew towards males will likely not negatively impact the results of the Q-sort, as enough respondents are present within the male and female categories to allow for most attitudes and factors to be identified in the case that this variable might play a significant role within clusters.

Sex (Geslacht)	**#**
Man	37
Woman	13
Rather not respond	1

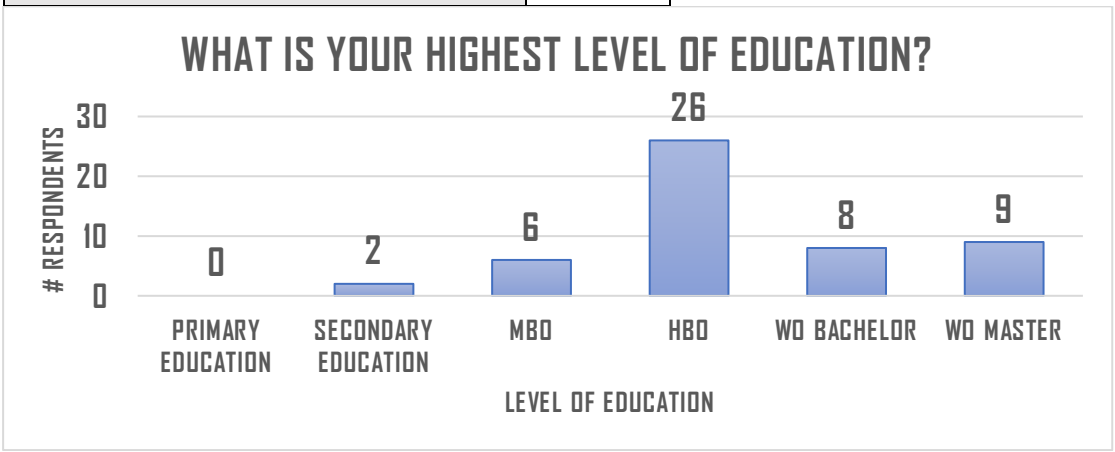


B.2 P-set sex division

Education – form 2

The highest obtained education among the respondents is relatively spread. This means that, if this factor were to be of a big impact on attitude, most perspectives are likely present within the Q-sort results. Respondent education levels can be seen in figure B.3. It must be noted however that with the relatively large skew to higher education (primarily HBO), the type of job or unmeasured variables impacting attitude on commute behaviour such as income or political preference, might be somewhat different from the average Dutch spread of education.

Education (Hoogst genoten educatie)	#
Primary education	0
Secondary education	2
MBO	6
HBO	26
WO Bachelor	8
WO Master	9



B.3 P-set education division

Job sector – form 3

Respondents operate in a wide range of different job sectors. In that sense, based on this fact alone, many different perspectives will likely be present within Q-sort results. It must be noted that there is a heavy skew to more "office-bound" job sectors, such as the largest sectors in finance or business consultancy. The number of respondents working in production type jobs are rather low. While this might indicate a loss in perspectives, it's sadly also a result of the research set-up, as respondents that did not or weren't able to work from home were asked to not fill out the survey. By design, research was done into the structural impact of the pandemic and thus WFH on commute attitudes and behaviour, this requires a base amount of WFH to have taken place.

On the other hand, there is also a relatively large representation in respondents working in respectively education and healthcare. In that sense, there is a representation of those sectors that did not necessarily lend themselves to WFH (Hamersma, et al., 2021).

Job sector (Bedrijfssector)	Sole job	Double Job	Job Total
Full-time student	4	0	4
Financiële dienstverlening	10	0	10
Informatie en communicatie dienstverlening	6	0	6
Openbaar bestuur	3	0	3
Overige zakelijke dienstverlening	7	0	7
Ingenieurs, architecten en technisch ontwerp, advies, keuring en controle	3	2	5
Kunst, cultuur en sport	0	2	2
Speur- en ontwikkelingswerk	1	0	1
Arbeidsbemiddeling, uitzenbureaus en personeelsbeheer	0	0	0
Waterbedrijven en afvalbeheer	0	1	1
Vervaardiging van machines	1	0	1
Onderwijs	3	2	5
Groothandel	0	0	0
Bouwnijverheid	0	1	1
Gezondheid, verpleging, maatschappelijke dienstverlening en wellness	5	0	5
Vervaardiging van niet metaal producten	1	0	1
Vervaardiging van metalen product	0	0	0
Vervoer en opslag	2	1	3
Vervaardiging van meudelsgoederen	0	0	0
Vervaardiging van voedingsmiddelen, dranken en tabak	0	0	0
Detailhandel	0	1	1
Beveiliging en Facility management	1	1	2
Horeca	0	0	0
TOTAL	**47**	**11**	**58**

Table B.4 P-set job sector division

Job function – form 4

Much like was assumed in the survey of the work sector, office and management jobs, the former of which appears to lend itself well to WFH, are the largest represented job functions within the P-set. Production and field service jobs are hardly represented. Again however, those jobs not lending themselves to WFH and thus not being present within the survey was to be expected. This does mean that this P-set has likely been more prone to positivity on WFH than the average Dutch populace, or even the populace that could possibly engage in WFH was more skewed to job functions more suitable for extensive home work.

Job function (Bedrijfsfunctie)	#
None, I'm a full time student	4
Office job (Kantoor)	19
Field service (Buitendienst)	1
Production (Productie)	2
Management	14
Care function (Zorgfunctie)	2
Education (Onderwijs)	6
Other	3

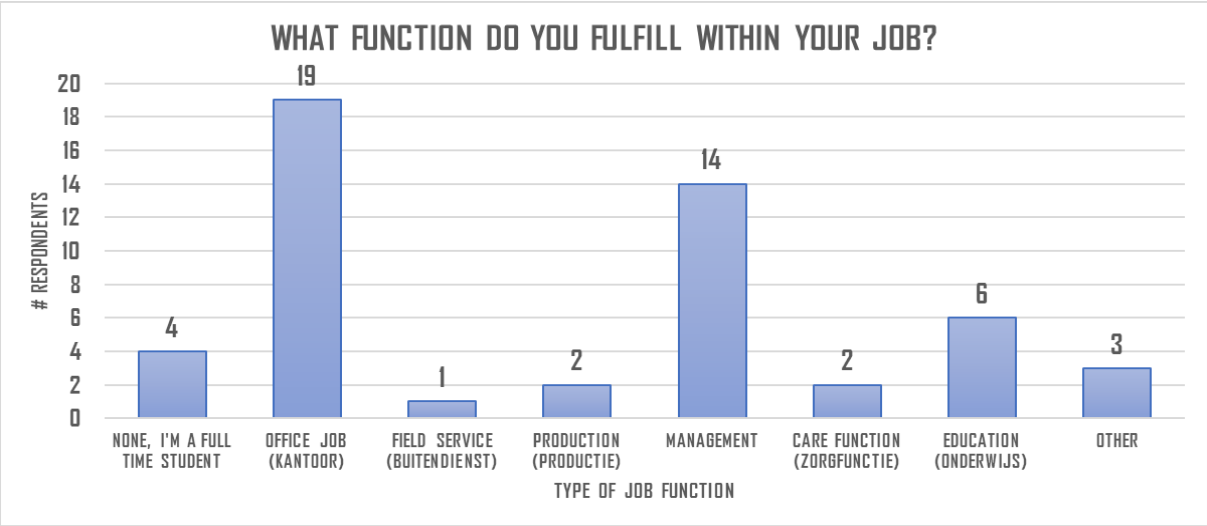


Figure B.5 P-set job function division

Job position – form 5

The spread of job positions is interesting. The majority of respondents fulfil the position of employee. While most workers generally work for some form of success and the betterment of the business/organisation, there is a clear difference in the responsibility for such organisational success. Employers and entrepreneurs generally face more risk as a result of changes to organisational operations than regular employees. Due to their different positions and responsibilities their attitudes towards commute change as a result of the pandemic might be different. The decently sized number of employers and entrepreneurs should ensure a different insight into the changes in attitude from the employee majority, in the case that this difference exists.

Job position (Bedrijfspositie)	**#**
None, I'm a full time student	4
Employee	33
Employer	7
Entrepreneur/Sole proprietorship	7

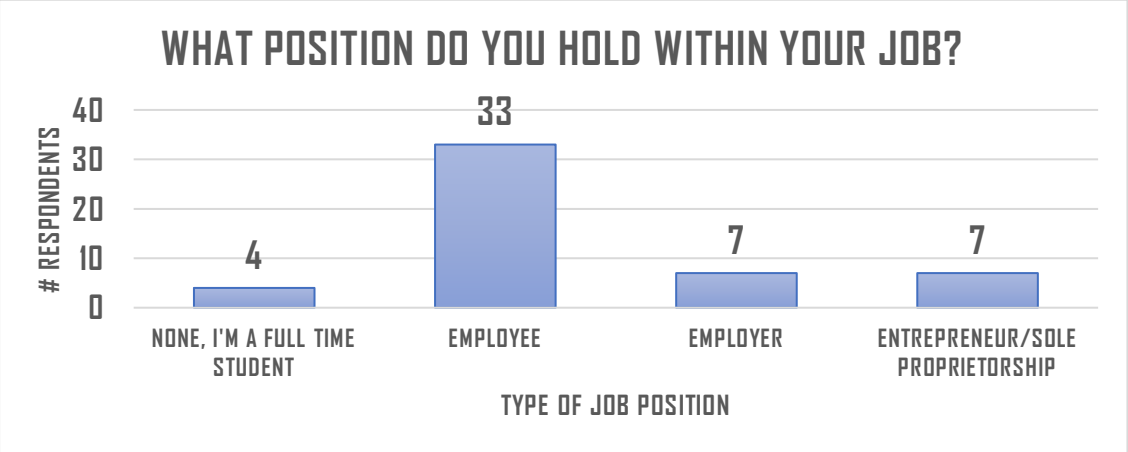


Figure B.6 P-set job position division

Car ownership – form 6

Car ownership is widespread among most respondents. This is likely due to education and age related variables. However, with 10% of respondents being non car owners, that perspective is represented decently well. There were no respondents that do not own a car anymore at all due to the pandemic. In hindsight this question should have been rephrased from "not anymore" to

something along the line of "yes, but I chose to part with a car". This would have been able to capture car owners, such as those in families or relationships, that shrunk their own car park.

Car ownership	#
Yes	46
No	5
Not anymore	0

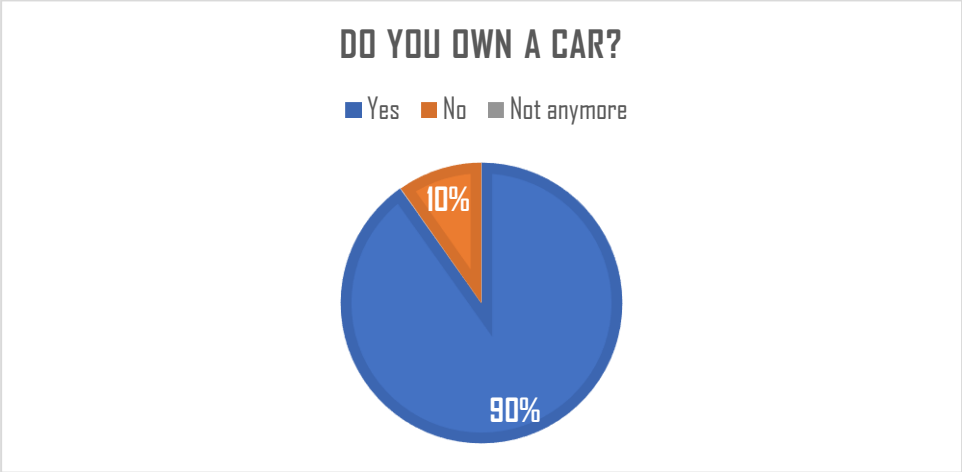


Figure B.7 Car ownership within P-set

Appendix C – Evaluation

This appendix will feature responses and rebuttals to respondent evaluation of the Q-sort, dynamism in Q-methodology and the questionnaire in general. These rebuttals are based on the open questions that were posed during the post Q-sort questionnaire. Information provided within this appendix is largely featured in chapter 8 and the discussion.

The different categorisation of respondents comments are displayed in the table below.

Respondent issue categorisation	Respondents
Survey – Execution issues	10, 23, 36,
Survey – Technical issues	10, 18, 34, 36, 50
Survey – Issues regarding post Q-sort questionnaire	23, 26
Q-methodology – Issues with methodology	17, 23, 25, 27, 28, 46
Q-methodology – Issues with dynamism	25, 46

Respondent 10	
Question	**Respondent response/remark**
#1	Neutraal/Geen mening.
#2	/
#3	Neutraal/Geen mening.
#4	/
#5	Mijn eerste rangschikking voldeed uiteraard niet aan de forced distribution dus moest aantal herschikken. Het had efficienter geweest als je een totaal lijst kon zien van je initiele rangschikking ipv 1 a 2 tegelijk in de "hokjes"
Researcher Response/ Rebuttal	*This is a technical and execution issue. This shows that doing Q-study online has large issues. It avoids the hassle of in person study, more easily allowing for a larger amount of respondents. However, technical limitations and the lack of basic ability to directly assist respondents in person was a negative aspect. You'd be able to see all your responses with in-person 'physical' ranking (making use of paper cards), but this requires in general far more work than setting up the study through digital means. While issues persist, doing the study physically instead of digitally would be practically impossible due to the untenable workload for the latter option.*

Respondent 17	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	Het was ingewikkeld om de stellingen te rangschikken naar gewicht. Bovendien werd je gedwongen in een stramien om de wegingen te doen waardoor de keuzes soms niet meer de werkelijkheid vertegenwoordigen.
#3	Nee, ik ervoer hier problemen mee.
#4	/
#5	/
Researcher Response/ Rebuttal	*These are methodological issues regarding Q-methodology. These issues are understandable. Q-methodology requires respondents to give a more in-depth assessment of their opinion including weights, rather than a more simple agree or disagree. This could be difficult for some respondents.* *Furthermore, it's also understandable that the basic Q-sort template simply isn't applicable for everyone. On the other hand, there is value in forcing respondents to make trade-offs between statements, as it shows the importance of certain statements over others, creating perspectives.* *An in-depth rebuttal to these specific issues will follow later at the end of this appendix.*

Respondent 18	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	Het verplaatsen van de stellingen gaat heel makkelijk, wat jammer is dat ik de stellingen niet meer kon lezen waardoor ik niet goed kon vergelijken of ik een bepaalde stelling misschien nog belangrijker vond t.o.v. een andere stelling op die positie, waardoor uitkomst misschien nog iets zou kunnen afwijken.
#3	Nee, ik ervoer hier problemen mee.
#4	/
#5	/
Researcher Response/ Rebuttal	*This is another technical 'issue'. Due to the nature of conducting the survey digitally and online both the layout of the survey, as well as the inability to directly assist respondents, were somewhat hampered in comparison to a traditional in-person physical Q-study.* *While the online q-sort featured smaller boxes featuring little more than the statement number (#) designation , hovering over the statement with the mouse did allow respondents to read the entire statement. While this seems like a minor issue, such small issues could be more easily fixed with more directly involved researcher support. Small issues tend to pile up and discouraging responses to a somewhat longer, more time intensive survey, might lead to further respondent drop-off.*

Respondent 23	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	De middelste kolom methode nodigt niet uit tot invullen zoals ik had gewenst Op 4+ en 5+ hadden meer punten moeten staan die voor mij essentieel zijn. Ook mis ik de vraag: op hoeveel dagen werkt u gemiddeld. Ik heb 2 banen. Dat kan ik hier niet tot uiting brengen.
#3	Neutraal/Geen mening.
#4	Indien een enquête meer uitnodigt tot invullen, b.v. door plaatjes, tekst versimpelen en kortere zinnen, is het ook makkelijker in te vullen voor hen die meer gebruik moeten maken van OV bv door lage opleiding of minder inkomsten. Zij hebben geen TU achtergrond waardoor grote kans op afhaken tijdens het invullen… ik heb in XX jaar werken veel enquêtes en online trainingen ontworpen, vandaar deze opmerking als tip.
#5	/
Researcher Response/ Rebuttal	*This response sheds light on methodological issues regarding Q-methodology, but also regarding issues with the post Q-sort survey or the execution in general.* *The framework for the Q-sort is weighted towards the middle. This is due to the fact that it's assumed that a significant part of the statements will be ranked as neutral, as the study involves 4 different 'main' travel modalities, whereas it's assumed that the average respondent likely only has extensive significant experience with one or two of those. As such, the framework isn't weighted towards the extremes, but the neutral. This would likely apply to most respondents, but naturally not all of them. Some respondents would like a differently shaped framework.* *In regards to the other remarks, it could have been useful to request information on the type of job (full-time/part-time) or simply the amount of workdays/number of jobs. However, as this study focuses mostly on commute and needs to be relatively short as to not discourage respondents, adding too many additional questions might have been to much. Furthermore, data on the amount of workdays or multiple*

	jobs isn't as important, as the number of commute trips exists per respondent, regardless of the amount of jobs. As such, this data might be useful for explaining certain behaviour or opinions, but outside of data on the amount of commutes, this data isn't necessary. *Lastly, further shortening of statements/questions is a good tip, but also not necessarily possible as some 'double' statements (as described later) are a necessity. A solution to this is given in the evaluation.* *Adding further material for respondents to increase engagement is in this case somewhat impossible for technical reasons, but also due to the fact that online execution of the survey limits these options regardless of technical issues.*

Respondent 25	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	Dikwijls was ik het eens met het eerste deel van de stelling, maar oneens met het tweede deel.
#3	Neutraal/Geen mening.
#4	Dikwijls herken ik wel de verandering, maar niet de reden die opgegeven werd in de stelling
#5	Werk met enkelvoudige stellingen
Researcher Response/ Rebuttal	*These are methodological issues regarding the Q-methodology and dynamism incorporating into Q-methodology. During the construction of the Q-set, statements were gathered through desk study and interview. This means that oftentimes the included statements weren't necessarily fit for direct inclusion into the survey.* *Statements needed to be cut down, for clarity reasons as brevity allows for easier understanding or because unnecessary information needed to be trimmed away, but also for technical reasons within the program that's used to create the online survey.* *At some points statements also needed to be separated, because they involved two or more separate concepts or opinions. This was mostly taken care of during Q-set construction. There's, however, only so much that can be changed in the statements lest they lose connection to the original meaning.* *As such, some statements feature changes, followed by reasons for or against the change. This was necessary as this statement in the Q-set needs to embody the core of the gathered statement, thus also including the reasons for changed views or opinions. Statements #15, #16, #21, #22, #23, #28, #33, #45 are examples of this in varying degrees. These kinds of 'double' statements are best avoided, because they can make interpretation more difficult; does a person (dis)agree with the first half of the statement, or with the second half? However, in the case of this Q-study the trigger for change is newly relevant and likely applies to many respondents, as such double statements including these triggers and the change were a necessity.*
Respondent 26	
Question	**Respondent response/remark**
#1	Ja, ik vond het makkelijk.
#2	/
#3	Ja, ik vond het makkelijk.
#4	/
#5	Ik vind het prettig om thuis te werken. Binnenkort ga ik hybride werken en ik ga met de fiets naar het werk
Researcher Response/ Rebuttal	*This is an issue regarding the post Q-sort questionnaire. The contents of this comment are largely covered within the Q-sort or the post Q-sort survey. It would have perhaps been useful to flat out ask whether respondents plan to continue working from home (full-time or hybrid/part-time), although this was already implicitly covered within the questions concerning pre- and post-pandemic and the question regarding whether the respondents intends to return to their old commute habits post-pandemic. This would require less inference by the researcher, although it would also neglect the return to other commute patterns outside of the move from WFH back to another modality.*
Respondent 27	
Question	**Respondent response/remark**
#1	Neutraal/Geen mening.
#2	Tijdens de pandemie werkte ik soms meer dagen in de week, ook dan ging ik met mijn auto naar mijn werk. Momenteel studeer ik ook naast mijn huidige baan en tijdens de pandemie gebeurde dit online i.p.v. op locatie en bleef de auto staan.
#3	Neutraal/Geen mening.
#4	Bepaalde stellingen waren n.v.t op mijn woon werk situatie aangezien ik weleens met het OV reis kon ik bepaalde stellingen wel beantwoorden.
#5	/
Researcher Response/ Rebuttal	*This is a methodological issue regarding Q-methodology. The fact that many of the statements wouldn't apply to every respondent was anticipated. Therefore the choice was made reserve most of the space in the Q-sort for neutral or near-neutral statement rankings.*

Respondent 28	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	Meerdere vragen gaan een scheef beeld geven zoals: Ik ga reis met het OV (dit kan al een nee zijn voor mensen) en ik doe X. Hierbij geven ze een negatief antwoord omdat ze het niet doen maar dat zegt niks over hun mening.
#3	Nee, ik ervoer hier problemen mee.
#4	De rangschikking gaat ervan uit dat ik X vragen positief X neutraal en X negatief heb beantwoord en op ALLE een rangschikking had. Deze gehele survey had beter gedaan kunnen worden aan de hand van een 7-punts Likert schaal voor iedere vraag. Hierbij verlies je de rangschikking deels maar maakt de survey een stuk korter en kan je er beter resultaten uit halen.
#5	/
Researcher Response/ Rebuttal	*This is a methodological issue regarding Q-methodology. Much like the issues posed by respondent 25, this respondent has some issues with the 'double' statements. Some statements feature changes, followed by reasons for or against the change. This was necessary as this statement in the Q-set needs to embody the core of the gathered statement, thus also including the reasons for changed views or opinions. Statements #15, #16, #21, #22, #23, #28, #33, #45 are examples of this in varying degrees. These kinds of 'double' statements are best avoided, because they can make interpretation difficult; does a person (dis)agree with the first half of the statement, or with the second half? However, in the case of this Q-study the trigger for change is newly relevant and likely applies to many respondents, as such double statements including these triggers and the change were a necessity.* *The other issue put forward is that respondents might answer certain questions based on their actual behaviour instead of their opinion/attitude. This is a bit of an odd issue to have, as opinions/attitudes inform behaviour or are informed by behaviour. In that sense (unless multiple questions/statements were entirely unclear to a large degree), this is hardly an issue. Furthermore, the description of the study, should be, and was, very clear on that it requests respondent opinions. If respondents do not engage in certain behaviour and thus do not have an defined attitude towards a certain subject, then they naturally rank it neutrally or negatively. This isn't an issue on itself.* *The remarks on the use of a 7 point Likert scale, instead of Q-methodology, is interesting however. This study aimed to utilise Q-methodology to create perspectives, but also to test changes to the traditional use of the methodology. However, there is also something to be said for simply observing the opinions of respondents on certain statements. This wouldn't allow for perspective creation as possible in Q-methodology. However, you would be able to say more about the results on certain statements individually. In Q-methodology these results are mostly perspective linked and results are relative to other responses. With a Likert scale you would be able to determine held opinions by respondents in general and also investigate the direct correlations between two statements, rather than their relationship as a whole. In the case of using the Likert scale you would have to divide results by variables such as age, etc.. You would also more easily be able to study the relation between opinions on statements and other variables.*
Respondent 34	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	Het rangschikken was niet mogelijk op de telefoon, de stelling kon je met rangschikken niet lezen
#3	Ja, ik vond het makkelijk.
#4	/
#5	/
Researcher Response/ Rebuttal	*This is a technical issue. For attaining more responses, respondent accessibility to the survey should be as easy as possible. Similarly, the layout of the survey should be intuitive. This was simply not possible for conducting Q-sort on phone, requiring respondents to take the survey on computer or (larger) tablet.*
Respondent 36	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	Enquête invullen was redelijk onoverzichtelijk. Vooral dat rangschikken is onoverzichtelijk en kost dan erg veel tijd wil je het nauwkeurig doen. Het ontbrak me aan tijd dus dan haakt "men" snel af. Ik heb pas bij een 2de poging de enquête afgemaakt. Ik denk dat veel mensen dat niet doen. Ook omdat het niet op een telefoon functioneert.
#3	Neutraal/Geen mening.
#4	/
#5	/
Researcher Response/ Rebuttal	*These are execution and technical issues. For attaining more responses, respondent accessibility to the survey should be as easy as possible. Similarly, the layout of the survey should be intuitive. This was simply not possible for conducting Q-sort on phone, requiring respondents to take the survey on computer or (larger) tablet.*

	This comment further brings up that the time requested from respondents for filling out the survey is somewhat long. In that sense, consideration could be given to producing a smaller Q-set in future research, if possible. A larger Q-set was necessary, as the subject that was investigated involved many different aspects that required input. Better allocation of the Q-set in future Q-studies (involving dynamism) will be further discussed in the evaluation.
Respondent 46	
Question	**Respondent response/remark**
#1	Nee, ik ervoer hier problemen mee.
#2	Het evenredig rangschikken van eens/oneens/neutraal is lastig. Er zou meer flexibiliteit gegeven moeten worden door bij elke mogelijkheid bijv. 5 extra vakjes toe te voegen.
#3	Ja, ik vond het makkelijk.
#4	/
#5	Ik miste de vragen over reis- en werkgedrag TIJDENS de pandemie. Maar dat is wellicht niet van belang voor het onderzoek.
Researcher Response/ Rebuttal	*These are methodological issues regarding Q-methodology and incorporating dynamism into Q-methodology. Due to the nature of Q-methodology, the Q-sort needs to approach a forced quasi-normal distribution. Adding additional spaces (exceeding the total size of the Q-set) will make statistical analysis of said Q-sort far more difficult. As such, it's impossible to do while conducting Q-methodology.* *Statements regarding commute behaviour DURING the pandemic aren't included in the Q-set. The survey as a whole focuses primarily on change from BEFORE to AFTER the pandemic, luckily this was made largely clear to most respondents and most found it easy to rank statements based on change in attitude. The issue of how to more properly, or rather more systematically/easily reproduceable, involve dynamism in future Q-studies, will be discussed within the evaluation.*
Respondent 50	
Question	**Respondent response/remark**
#1	Neutraal/Geen mening.
#2	Bij het ordenen kon je de stellingblokjes niet openen waardoor ik niet kon lezen wat de stelling was. Daardoor heb dit niet bewust kunnen doen.
#3	Ja, ik vond het makkelijk.
#4	/
#5	/
Researcher Response/ Rebuttal	*This is a technical 'issue'. Due to the nature of conducting the survey digitally and online both the layout of the survey, as well as the inability to directly assist respondents, were somewhat hampered in comparison to a traditional in-person physical Q-study.* *While the online q-sort featured smaller boxes featuring little more than the statement number (#) designation , hovering over the statement with the mouse did allow respondents to read the entire statement. While this seems like a minor issue, such small issues could be more easily fixed with more directly involved researcher support. Small issues tend to pile up and discouraging responses to a somewhat longer, more time intensive survey, might lead to further respondent drop-off. This could lead to less accurate results.*

Outside of the survey itself, reactions regarding the survey were sent in by those interested in the research. One such reaction is displayed below. It was sent in by a respondent that decided not to participate in the research due to issues with the survey's execution and methodology.

(Translated) Respondent reaction;
I've tried to fill out the survey, but have stopped as, to me, it became impossible to 'truthfully' continue to answer the questions.

The first reason for this is content-related:

The survey-questions do not feature a "not applicable" option. This would be useful when a respondent hasn't used one or more travel options before. In my case this was the car. Among others, I suspect this to be PT and/or the bike. By not adding "not applicable" data become unwantedly multi-interpretable.

The second reason for this is technical:

The answers are forcibly weighed in a type of 'normalized' shape. That normalized shape itself is discutable, but it's an issue that the entire Q-sort can only be filled out EVEN BY APPROXIMATION if you're in agreement as much as your in disagreement with the statements. You'll obtain a lot of detailed data. However, accuracy (the extent to which data correctly presents reality) will be limited.

I hope that this input helps in further adjusting your survey, or making reservations in how interpretation of survey results are interpreted.

(Translated) Researcher rebuttal;

Yes, these are the disadvantages of the methodology. The mold in which statements are ranked forces the respondent to make trade-offs between statements (showing what respondents have a stronger opinion about). The assumption is made that statements that aren't applicable are ranked within neutral categories. Especially in this study where information about multiple commute modalities are asked, allocated space for neutral allocation is rather big, as the majority of respondent likely regularly only makes use of 1 or 2 commute modalities at most. Furthermore, the survey requests this for statistical reasons to achieve a balance between agreement and disagreement with statements. Testing shows that this balance appears to mostly apply to most respondents. However, this will not be the case for every respondent. There are likely respondents that agree or disagree with the statements to such an extent that the forced distribution mold is no longer applicable. If respondents experience that this made it significantly difficult to give their opinion requiring significant adjustments, then it's understandable that they'd no longer wish to participate in the survey.

The issues brought forth due to the used methodology will be further discussed within the study and thus also lead to reconsideration on methodology application for future research. An important part of this study is testing to what extent Q-methodology is positively experienced by respondents. The important trade-off between data results and respondent experience is discussed in depth in the study.

Appendix D – Letters of invitation

Two different letters of invitation were created for inviting respondents to participate within the online survey. A simplified abbreviated version, that was sent to the average respondent within the professional network, and a slightly more indepth letter of invitation sent to respondents that study or work at the Delft University of Technology, or other organisation or respondents that were likely more familiar with the type of research than the average respondent.

Furthermore, to ensure the spread of the online survey, a short 1 minute video-pitch invitation to participate in the survey was filmed and edited together during the second week of survey spread, so that it could be posted on LinkedIn and youtube. This was done to allow for spread of the survey on multiple platforms, accruing around 300 views on LinkedIn. Sadly, this video likely only enticed less than a handfull of respondents to participate.

The video can be found through this link;

https://youtu.be/-I420H0rrUM

The survey was hosted through the following links;

http://projectwerkreisattitude2022.netlify.app/

https://projectwerkreisattitudes2022.github.io/Projectwerkreisattitude2022/#/ (Backup)

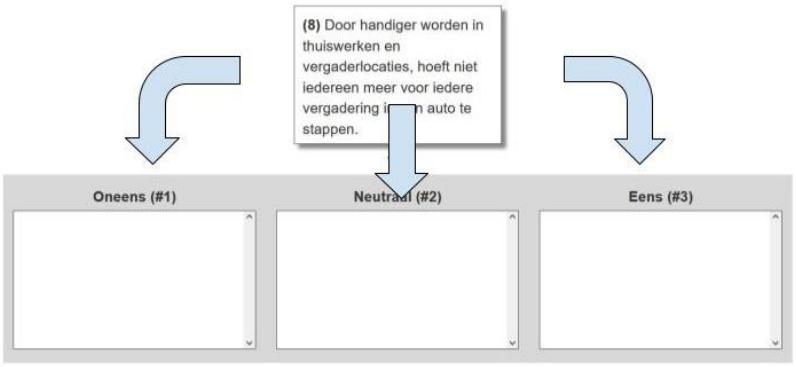
Geachte lezer,

De werkreis is structureel veranderd als gevolg de pandemie. Thuiswerken is verder ingeburgerd, de spits is beïnvloed en zo ook het gebruik van de auto en het OV. Wat vindt de Nederlander daarvan? U wordt uitgenodigd om deel te nemen aan een Master's afstudeeronderzoek naar de verandering in maatschappelijke meningen over werk gerelateerd reisgedrag als gevolg van de pandemie. Dit onderzoek wordt uitgevoerd door Jeffrey Huisman, masterstudent aan de TU Delft, als onderdeel van een trend in onderzoeken aan de universiteit naar reisgedrag veranderingen na de pandemie.
Het onderzoek wordt gedaan via een online vragenlijst die u kan bereiken via de volgende link;
https://projectwerkreisattitudes2022.github.io/Projectwerkreisattitude2022/#/

Tijdens het onderzoek bent u anoniem en verkregen data zal niet naar u te herleiden zijn. Het totale onderzoek zal zo'n 20 minuten in beslag nemen. In deze vragenlijst rangschikt u op basis van uw mening verschillende stellingen over reisgedrag. Er wordt vooral gevraagd of en hoe uw mening van voor de pandemie is veranderd tot uw mening nu.

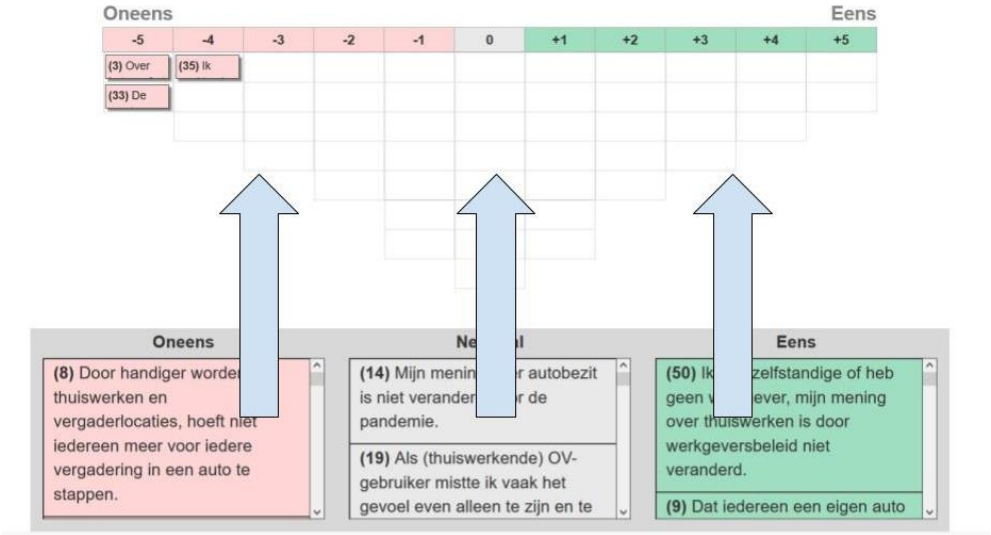
Soorteer in stap 1 eerst snel in enkele minuten uw mening over een selectie stellingen voor.

Klik op de stelling en verplaats deze naar uw mening!



Of gebruik de nummertoetsen 1 (oneens), 2 (neutraal) of 3 (eens)

Rangschik in stap 2 stellingen op basis van hoe eens of oneens u het bent met de stellingen.



Klik op de stelling en verplaats deze van meest oneens (-5) tot meest eens (5)!
U verplaatst de vakjes in een mal die u verplicht afwegingen te maken.

Tip!; Begin met de stellingen waarmee u het het meest mee eens bent, dit maakt rangschikken makkelijker.

Na het rangschikken in deze zogenaamde ‘Q-sort questionnaire’ wordt u gevraagd enkele multiple choice vragen over uzelf en uw ervaring met de vragenlijst te beantwoorden. De online survey is voornamelijk bedoeld voor onderzoek naar werk gerelateerd reisgedrag, maar leent zich ook goed voor onderzoek naar studie gerelateerd reisgedrag. Wij geven er de voorkeur aan dat u uw mening over uw werk gerelateerde reisgedrag geeft. Echter, in het geval dat u enkel fulltime student bent, kan u de survey ook doorlopen op basis van uw mening over studie gerelateerd reisgedrag en dit aan het eind van de vragenlijst aangeven. Resultaten zullen worden gepubliceerd als onderdeel van een Master scriptie afstudeerrapport.

Let op! U wordt, als Nederlandse reiziger, verzocht enkel deel te nemen aan dit onderzoek wanneer u:

- Mogelijk (gedeeltelijk) thuis kan werken/studeren of in het verleden (al dan niet verplicht) thuis hebt gewerkt/gestudeerd, bijvoorbeeld als gevolg van de pandemie.
- Over de leeftijd van 18 jaar oud bent.
- Op het moment werkt of studeert, of in de afgelopen 2 jaar hebt gewerkt of gestudeerd.

Uw deelname zou mij enorm helpen in het afnemen van dit onderzoek. Mocht u verdere vragen hebben over het onderzoek, contacteer mij dan via het volgende mailadres;

J.R.Huisman@student.tudelft.nl

Alvast hartelijk dank voor uw interesse en medewerking!

Jeffrey Huisman, masterstudent CoSEM aan de Technische Universiteit Delft

TU Delft Delft University of Technology

(This is the version of the letter of invitation sent to the average respondent, as such it was primarily used for inviting respondents)

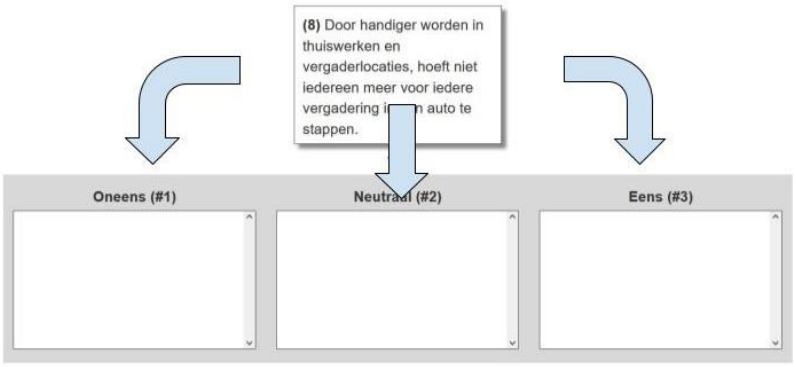
Geachte lezer,

De werkreis is structureel veranderd als gevolg de pandemie. Thuiswerken is verder ingeburgerd, de spits is beïnvloed en zo ook het gebruik van de auto en het OV. Wat vindt de Nederlander daarvan? U wordt uitgenodigd om deel te nemen aan een Master's afstudeeronderzoek naar de verandering in maatschappelijke meningen over werk gerelateerd reisgedrag als gevolg van de pandemie. Dit onderzoek wordt uitgevoerd door Jeffrey Huisman, masterstudent aan de TU Delft, als onderdeel van een trend in onderzoeken aan de universiteit naar reisgedrag veranderingen na de pandemie.
Het onderzoek wordt gedaan via een online vragenlijst die u kan bereiken via de volgende link;
https://projectwerkreisattitudes2022.github.io/Projectwerkreisattitude2022/#/

Tijdens het onderzoek bent u anoniem, wij verzamelen geen persoonlijke data en de data die wordt verzameld is niet persoonlijk identificeerbaar. Het totale onderzoek duurt ongeveer 20 minuten.
In de vragenlijst rangschikt u verschillende stellingen over reisgedrag u op basis van uw mening.
Er wordt gevraagd naar hoe uw mening van voor de pandemie is veranderd tot uw mening nu.

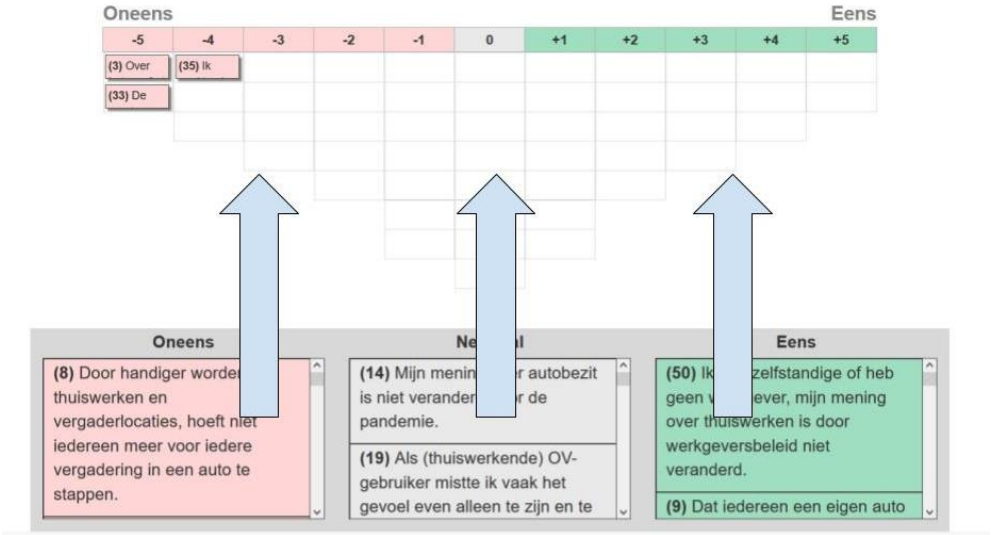
Soorteer in stap 1 eerst snel in enkele minuten uw mening over een selectie stellingen voor.

Klik op de stelling en verplaats deze naar uw mening!



Of gebruik de nummertoetsen 1 (oneens), 2 (neutraal) of 3 (eens)

Rangschik in stap 2 stellingen op basis van hoe eens of oneens u het bent met de stellingen.



Klik op de stelling en verplaats deze van meest oneens (-5) tot meest eens (5)!
U verplaatst de vakjes in een mal die u verplicht afwegingen te maken.

Tip!; Begin met de stellingen waarmee u het het meest mee eens bent, dit maakt rangschikken makkelijker.

Na het rangschikken in deze zogenaamde ‘Q-sort questionnaire’ wordt u gevraagd enkele multiple choice vragen over uzelf en uw ervaring met de vragenlijst te beantwoorden. De online survey is voornamelijk bedoeld voor onderzoek naar werk gerelateerd reisgedrag, maar leent zich ook goed voor onderzoek naar studie gerelateerd reisgedrag. Wij geven er de voorkeur aan dat u uw mening over uw werk gerelateerde reisgedrag geeft. Echter, in het geval dat u enkel fulltime student bent, kan u de survey ook doorlopen op basis van uw mening over studie gerelateerd reisgedrag en dit aan het eind van de vragenlijst aangeven.

Resultaten zullen worden gepubliceerd als onderdeel van een Master scriptie afstudeerrapport, waarin ze worden gebruikt om maatschappelijke perspectieven te identificeren. Dit biedt ons een beter inzicht in de beweegredenen van Nederlandse reizigers voor de keuzes in hun reisgedrag. Verkregen inzichten kunnen de basis vormen voor betere toekomstige evaluatie van beleid in verband met werk en studie gerelateerd reisgedrag.

Let op! U wordt, als Nederlandse reiziger, verzocht enkel deel te nemen aan dit onderzoek wanneer u:

- Mogelijk (gedeeltelijk) thuis kan werken/studeren of in het verleden (al dan niet verplicht) thuis hebt gewerkt/gestudeerd, bijvoorbeeld als gevolg van de pandemie.
- Over de leeftijd van 18 jaar oud bent.
- Op het moment werkt of studeert, of in de afgelopen 2 jaar hebt gewerkt of gestudeerd.

Uw deelname zou mij enorm helpen in het afnemen van dit onderzoek. Mocht u verdere vragen hebben over het onderzoek, contacteer mij dan via het volgende mailadres;

J.R.Huisman@student.tudelft.nl

Alvast hartelijk dank voor uw interesse en medewerking!

Jeffrey Huisman, masterstudent CoSEM aan de Technische Universiteit Delft

(This is the version of the letter of invitation sent to respondents that were likely already familiar with the type of research employed within the master thesis. As such it features a slight bit more information on the goals and methods of the research as a whole.)

Appendix E – Z-scores and other factorisation data

Statement	Statement#	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
		Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score
The car should be used far less than before the pandemic, as there are suitable commute alternatives.	*1*	-0.12	-0.74	-0.9	-1.03	1.41	1.32	0.37	-1.83
The pandemic shows that car use could be curtailed as much as possible through, for example, road pricing.	*2*	-0.34	-0.85	-1.1	-1.28	-1.7	0.84	0.64	-1.25
I'm now more positive on the comfort of the car, even when I make less use of it.	*3*	0.28	0.09	0.69	-0.34	-0.37	0.43	-0.26	0.33
I've started to miss travelling to work by car.	*4*	-0.93	-0.04	-0.74	-0.3	-1.45	-1.01	-1.3	-0.64
My opinion on car usage hasn't change as a result of the pandemic.	*5*	0.46	1.82	1.49	0.64	-1.25	-1.87	0.86	-0.03
The city has become a lot more pedestrian and cyclist friendly due to the decrease of car usage.	*6*	0.34	-0.79	-0.25	0.26	-0.09	-0.08	-0.7	-0.29
Not everyone has to use their car for every meeting, by becoming more flexible in working from home and meeting locations.	*7*	1.24	1.96	1.2	1.82	1.18	2.23	1.48	1.14
The notion that everyone should own their own car is outdated. Streets are filled with parked cars. There's hardly any room for children to play.	*8*	-0.22	-0.86	-1.35	-0.93	-1.09	0.2	0.12	-1.38
I'm in the possession of a car and this will not change.	*9*	1.36	1.48	0.06	1.78	0.39	1.39	-0.32	1.48
Living at a long distance away from public transport and shops, private car ownership remains desirable.	*10*	0.76	1.21	0.71	1.12	1.67	0.95	0.92	1.43
When living in the vicinity of a train station or other public transport, there's in my opinion nary any reason to own a personal car.	*11*	-0.66	-0.6	-2.13	-1.49	0.77	-1.09	-1.1	-1.26
I now believe that owning a personal car remains necessary, but this could change in the coming decades.	*12*	0.3	0.52	-0.22	-0.17	-0.05	1.11	0.99	0.47
I appreciate the freedom and security that comes with a private car ownership now more. Unlike public transport, access can't be as easily restricted.	*13*	0.34	1.16	0.95	0.07	1.06	1.75	-0.53	1.43
My opinion on car ownership has not changed as a result of the pandemic.	*14*	0.56	1.8	0.91	-0.52	0.44	-1.51	1.35	-0.86
Before the pandemic I already found travel by public transport to be unhygienic, this belief has only grown stronger.	*15*	0.01	-1.18	0.51	-0.01	-1.74	0.99	-1.33	-0.61
My biggest irritation in public transport, people not following rules (Silence compartment, no face masking), has grown bigger with more people not following rules.	*16*	0.7	0.07	0.63	-0.02	-0.64	0.48	-0.2	-0.85
It's now noticeably quieter on public transport, this improves the public transport use experience.	*17*	0.2	0.13	-1.71	-0.38	0.75	-0.15	-0.88	-0.35
Mandated face masking within public transport has become an annoyance.	*18*	0.13	1	-0.03	1.19	-1.29	-0.8	-1.13	1.08
Uncertainty around public transport accessibility during the start of lockdown has made public transport use (even) less attractive.	*19*	0.03	0.54	-0.34	-0.29	-0.41	-0.17	0.17	0.42
I have started to miss commuting by public transport.	*20*	-1.02	-1.18	-1.51	0.25	-0.52	-1.56	-0.76	-1.12
Before the pandemic I travelled part of my daily commute by bike. I dislike this, as I now get less exercise through commute.	*21*	-0.14	-1.46	1.19	-0.12	0.24	-0.16	0.52	-0.39
My opinion on bike use hasn't changed, as my daily commuting distance is simply to long for cycling.	*22*	-0.06	-0.55	-0.61	-0.12	-0.27	-0.12	0.21	0.03
To me, cycling to work was a method of gaining some variety to commuting by car. I now appreciate cycling as variety less due to less travel in general.	*23*	-0.85	-1.32	-0.58	-0.79	-1.64	0.74	-1.36	-0.64
I've started to miss traveling to work through walking or cycling.	*24*	-0.91	-1.29	1.36	0.06	-0.31	-0.22	1.47	-0.69

I travel significantly less hours per day due to working from home. I experience this as more pleasant.	*25*	1.7	-0.4	-0.51	1.39	0.58	0.04	0.9	1.65
I have considered working from home, but have come to find it as unrealistic in my position.	*26*	-1.57	0.02	-0.69	-1.04	-0.07	-1.16	-1.96	-0.71
Working and/or studying from home has a major impact within my line of work.	*27*	-0.25	0.36	0.85	-1.25	-0.35	-0.99	-0.91	-0.19
I've become more positive on working from home instead of commuting, as time loss and fatigue due to travel have less impact on the rest of my day.	*28*	1.33	0.56	-0.9	0.94	0.55	-0.58	0.73	0.84
Once government and working-from-home measures are repealed, I have the intention of returning to my old work and commute habits.	*29*	-1.17	1.13	1.13	-0.63	0.27	0.5	-1.73	-1.45
The popularisation of working from home has made roads and motorways more quiet. This made the predictability of commute better.	*30*	0.49	-0.51	-1.31	0.14	1.46	0.65	-0.59	0.7
COVID measures disrupt my personal living and work situation, lessening the control of my life.	*31*	-1.26	-0.59	1.15	-2.37	-0.44	-1.39	-0.52	1.08
I have gotten the feeling that my employer (and the one of my partner) has started to become the boss in my own home through working from home.	*32*	-1.56	-2	-1.03	-1.05	-1.45	-1.13	-1.52	-1.21
The first months of working from home were inconvenient, however I've gotten used to it now.	*33*	-0.34	-0.54	-1.39	1.71	-0.74	0.09	0.54	0.15
Working from home is ideal. Sometimes you miss your colleagues, but it's very efficient and saves a lot of time.	*34*	1.41	0.3	-1.16	0.88	-0.46	0.87	0.42	1.15
I find working from home pleasant to a certain level. Alternating between working from home and occasionally working on location is ideal in my eyes.	*35*	1.95	1.17	0.12	2.13	1.34	0.99	1.5	1.31
I do not have a pleasant at home office/working space.	*36*	-0.84	-1.21	-0.43	-1.33	-1.27	-1.63	-1.23	-0.49
I did not experience issues at the start of working from home, but the longer I was at home, the more it started to feel as an invasion of my privacy.	*37*	-1.83	-0.68	0.08	-0.57	0.61	-1.19	-0.19	0.42
When working from home becomes mandatory, productivity will decrease, as employees will abuse it.	*38*	-1.58	0.78	0.01	-0.09	-0.87	-1.51	-0.93	-1.68
Working from home has made some things at work easier and more well-structured, for example cooperating on a document.	*39*	1.34	-0.38	0.19	0.02	0.1	-0.72	1.45	-0.09
Due to working from home discussing in a group and the forming of collective opinions with colleagues has become more difficult.	*40*	-0.61	0.08	1.5	0.72	1.39	0.53	-0.03	1.79
(Voluntarily) working from home has made working more productive, especially due to less distraction from colleagues around me.	*41*	1.41	0.2	-0.83	0.41	-0.58	0.1	0.95	1.36
Due to working from home contact with colleagues has decreased and it's difficult to swiftly reach them when necessary. In office you can quickly engage in 1-on-1 meetings.	*42*	-1.33	1.43	0.61	1.51	2.29	1.24	1.43	1.17
I've become far more negative on online cooperation by working from home, as everyone quickly drops out during longer meeting.	*43*	-1.3	-0.58	0.45	-1.96	-1.52	-0.57	-0.03	0.77
Due working from you now start to miss the social aspect, because when there's meetings they're purely formal business related.	*44*	-0.1	0.64	2.04	0.48	1.18	0.67	1.27	-0.59
I now find that working from home has become more normal and accepted by the employer, before the pandemic they were dismissive if not rejecting of it.	*45*	1.15	0.84	1.17	-0.43	0.44	1.13	0.31	1.15
The employer now sees the benefits of working from home, as he has to spend less on employee travel expenses.	*46*	1.17	-1.65	-0.68	-0.33	0.72	0.58	0.67	-0.23
The employer (still) believes that employees are necessary at the office, because he's not proficient working with and providing systems like digital work spaces.	*47*	-1.06	-0.05	-0.69	-0.6	-0.14	-0.61	-0.72	0.02
Mass working from home due to COVID now shows that government could further encourage business to stimulate working from home, for the purpose of emissions reduction.	*48*	1.63	1.5	-0.03	0.66	0.99	0.95	1.97	-1.16
I've started to miss the opportunity of alone time, for example through listening to music, during commute.	*49*	0.1	-0.43	1.39	0.27	0.47	0.24	-0.33	-0.55
I've started to miss the enjoyment of the environment during commute.	*50*	-0.34	-0.9	0.75	1	0.41	-0.78	-0.71	-0.84

Table E.1 Z-scores

Below, the different Z-scores, corresponding to their factors, are displayed within their clusters. This shows, especially through applying colour coding, more clearly where these respondents have overlap and where they clash.

	Cluster 1			Cluster 2		Cluster 3		Cluster 4	
Statement Number	**Factor 1**	**Factor 4**	**Factor 7**	**Factor 1**	**Factor 6**	**Factor 2**	**Factor 4**	**Factor 4**	**Factor 8**
	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score	Z-score
1	-0.12	-1.03	0.37	-0.12	1.32	-0.74	-1.03	-1.03	-1.83
2	-0.34	-1.28	0.64	-0.34	0.84	-0.85	-1.28	-1.28	-1.25
3	0.28	-0.34	-0.26	0.28	0.43	0.09	-0.34	-0.34	0.33
4	-0.93	-0.3	-1.3	-0.93	-1.01	-0.04	-0.3	-0.3	-0.64
5	0.46	0.64	0.86	0.46	-1.87	1.82	0.64	0.64	-0.03
6	0.34	0.26	-0.7	0.34	-0.08	-0.79	0.26	0.26	-0.29
7	1.24	1.82	1.48	1.24	2.23	1.96	1.82	1.82	1.14
8	-0.22	-0.93	0.12	-0.22	0.2	-0.86	-0.93	-0.93	-1.38
9	1.36	1.78	-0.32	1.36	1.39	1.48	1.78	1.78	1.48
10	0.76	1.12	0.92	0.76	0.95	1.21	1.12	1.12	1.43
11	-0.66	-1.49	-1.1	-0.66	-1.09	-0.6	-1.49	-1.49	-1.26
12	0.3	-0.17	0.99	0.3	1.11	0.52	-0.17	-0.17	0.47
13	0.34	0.07	-0.53	0.34	1.75	1.16	0.07	0.07	1.43
14	0.56	-0.52	1.35	0.56	-1.51	1.8	-0.52	-0.52	-0.86
15	0.01	-0.01	-1.33	0.01	0.99	-1.18	-0.01	-0.01	-0.61
16	0.7	-0.02	-0.2	0.7	0.48	0.07	-0.02	-0.02	-0.85
17	0.2	-0.38	-0.88	0.2	-0.15	0.13	-0.38	-0.38	-0.35
18	0.13	1.19	-1.13	0.13	-0.8	1	1.19	1.19	1.08
19	0.03	-0.29	0.17	0.03	-0.17	0.54	-0.29	-0.29	0.42
20	-1.02	0.25	-0.76	-1.02	-1.56	-1.18	0.25	0.25	-1.12
21	-0.14	-0.12	0.52	-0.14	-0.16	-1.46	-0.12	-0.12	-0.39
22	-0.06	-0.12	0.21	-0.06	-0.12	-0.55	-0.12	-0.12	0.03
23	-0.85	-0.79	-1.36	-0.85	0.74	-1.32	-0.79	-0.79	-0.64

24	-0.91	0.06	1.47		-0.91	-0.22		-1.29	0.06		0.06	-0.69
25	1.7	1.39	0.9		1.7	0.04		-0.4	1.39		1.39	1.65
26	-1.57	-1.04	-1.96		-1.57	-1.16		0.02	-1.04		-1.04	-0.71
27	-0.25	-1.25	-0.91		-0.25	-0.99		0.36	-1.25		-1.25	-0.19
28	1.33	0.94	0.73		1.33	-0.58		0.56	0.94		0.94	0.84
29	-1.17	-0.63	-1.73		-1.17	0.5		1.13	-0.63		-0.63	-1.45
30	0.49	0.14	-0.59		0.49	0.65		-0.51	0.14		0.14	0.7
31	-1.26	-2.37	-0.52		-1.26	-1.39		-0.59	-2.37		-2.37	1.08
32	-1.56	-1.05	-1.52		-1.56	-1.13		-2	-1.05		-1.05	-1.21
33	-0.34	1.71	0.54		-0.34	0.09		-0.54	1.71		1.71	0.15
34	1.41	0.88	0.42		1.41	0.87		0.3	0.88		0.88	1.15
35	1.95	2.13	1.5		1.95	0.99		1.17	2.13		2.13	1.31
36	-0.84	-1.33	-1.23		-0.84	-1.63		-1.21	-1.33		-1.33	-0.49
37	-1.83	-0.57	-0.19		-1.83	-1.19		-0.68	-0.57		-0.57	0.42
38	-1.58	-0.09	-0.93		-1.58	-1.51		0.78	-0.09		-0.09	-1.68
39	1.34	0.02	1.45		1.34	-0.72		-0.38	0.02		0.02	-0.09
40	-0.61	0.72	-0.03		-0.61	0.53		0.08	0.72		0.72	1.79
41	1.41	0.41	0.95		1.41	0.1		0.2	0.41		0.41	1.36
42	-1.33	1.51	1.43		-1.33	1.24		1.43	1.51		1.51	1.17
43	-1.3	-1.96	-0.03		-1.3	-0.57		-0.58	-1.96		-1.96	0.77
44	-0.1	0.48	1.27		-0.1	0.67		0.64	0.48		0.48	-0.59
45	1.15	-0.43	0.31		1.15	1.13		0.84	-0.43		-0.43	1.15
46	1.17	-0.33	0.67		1.17	0.58		-1.65	-0.33		-0.33	-0.23
47	-1.06	-0.6	-0.72		-1.06	-0.61		-0.05	-0.6		-0.6	0.02
48	1.63	0.66	1.97		1.63	0.95		1.5	0.66		0.66	-1.16
49	0.1	0.27	-0.33		0.1	0.24		-0.43	0.27		0.27	-0.55
50	-0.34	1	-0.71		-0.34	-0.78		-0.9	1		1	-0.84

Table E.2 Factor clusters

Correlation matrix

Participant	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
1	100	36	43	58	40	42	25	17	30	6	-1	48	32	25	-12	18	37	50	-52	-11	16	-1	52	43	26	44	35	-17	38	23	15	48	12	42	49	37	38	30	42	16	8	17	24	2	20	33	30	27	28	39	28
2	36	100	16	40	43	21	32	3	17	15	20	23	42	12	1	31	38	44	-32	10	-9	5	53	50	43	54	20	-24	37	39	4	18	43	48	58	33	18	34	49	16	1	30	-12	13	27	49	33	11	27	31	20
3	43	16	100	6	40	18	15	23	17	6	-5	20	0	9	6	12	28	24	-28	-23	5	29	18	38	26	24	14	9	6	-10	20	48	4	22	27	26	17	41	17	27	8	10	5	-21	7	36	34	36	35	32	24
4	58	40	6	100	29	34	21	17	38	5	5	50	35	5	-11	19	25	37	-58	7	12	-15	55	50	25	44	32	-3	33	27	28	33	40	61	51	36	31	24	37	11	11	17	11	15	13	40	18	21	19	29	31
5	40	43	40	29	100	48	42	35	17	41	20	34	25	15	8	27	31	35	-23	14	23	13	46	53	31	45	22	0	7	39	21	46	22	41	57	39	40	62	41	36	9	14	12	2	34	62	49	39	10	56	45
6	42	21	18	34	48	100	3	30	40	24	10	39	42	18	-6	7	30	56	-53	-2	53	-14	33	41	33	37	-1	-6	25	2	-2	25	19	50	62	48	53	36	41	8	34	20	43	4	27	51	44	38	-4	40	41
7	25	32	15	21	42	3	100	36	7	42	22	35	8	11	17	25	25	-14	8	30	-5	25	39	27	19	19	32	-2	23	48	15	25	28	19	22	30	22	43	22	25	-26	42	1	38	18	48	0	12	43	28	-16
8	17	3	23	17	35	30	36	100	5	42	15	38	2	6	3	12	15	-13	-7	13	13	28	24	1	34	16	19	29	14	31	26	27	9	20	8	28	27	37	10	25	2	24	27	34	39	38	5	17	40	16	7
9	30	17	17	38	17	40	7	5	100	-1	-19	31	29	-19	-13	-5	36	38	-39	-17	15	-1	31	43	24	23	4	-35	11	-5	2	24	19	30	36	47	22	2	38	12	24	-10	11	3	-14	46	19	27	12	31	30
10	6	15	6	5	41	24	42	42	-1	100	39	40	24	24	26	14	19	-5	7	25	10	27	27	25	13	10	12	-6	29	39	7	7	24	6	34	33	33	38	23	45	18	27	34	32	38	36	17	15	11	37	0
11	-1	20	-5	5	20	10	22	15	-19	39	100	-3	27	17	23	8	7	-11	15	32	7	3	18	10	-4	8	4	-13	15	21	8	18	23	12	26	10	-7	14	35	12	13	33	11	7	27	20	-11	-13	14	9	-8
12	48	23	20	50	34	39	35	38	31	40	-3	100	25	18	17	26	34	16	-31	2	8	17	39	40	35	43	41	-4	44	36	8	25	22	42	38	48	44	33	20	20	6	-4	11	20	20	37	32	35	35	19	14
13	32	42	0	35	25	42	8	2	29	24	27	25	100	21	-19	-6	50	50	-45	6	11	-16	29	51	19	31	12	-27	17	11	-20	8	3	25	47	30	31	25	39	32	27	7	4	14	20	49	33	20	-7	11	17
14	25	12	9	5	15	18	11	6	-19	24	17	18	21	100	2	16	12	17	-26	-7	12	3	10	11	28	20	9	2	-2	27	8	3	-1	13	25	-7	32	45	13	23	14	16	40	19	29	18	21	11	15	17	-2
15	-12	1	6	-11	8	-6	17	3	-13	26	23	17	-19	2	100	12	-6	-30	22	27	34	55	-1	5	21	-1	16	3	7	17	38	16	31	5	6	29	2	17	-7	19	10	2	15	7	2	-7	-4	27	33	6	-7
16	18	31	12	19	27	7	25	12	-5	14	8	26	-6	16	12	100	9	6	-1	11	19	1	38	7	21	52	29	18	11	13	14	11	19	14	27	25	20	37	37	17	-5	1	19	30	35	21	6	21	29	18	18
17	37	38	28	25	31	30	25	15	36	19	7	34	50	12	-6	9	100	33	-25	7	-2	15	18	43	43	39	16	-21	9	18	6	31	15	26	34	36	24	36	34	12	29	10	-7	20	30	48	20	28	16	19	17
18	50	44	24	37	35	56	-14	-13	38	-5	-11	16	50	17	-30	6	33	100	-54	-35	25	-34	36	49	29	45	-3	-16	11	-7	-2	13	7	33	59	22	50	21	50	11	32	-2	7	-16	13	35	56	34	-8	46	41
19	-52	-32	-28	-58	-23	-53	8	-7	-39	7	15	-31	-45	-26	22	-1	-25	-54	100	19	-13	32	-44	-54	-22	-43	-7	17	-19	-3	11	-32	-24	-60	-49	-29	-45	-16	-25	-7	-33	-11	-22	0	-6	-32	-34	-22	0	-24	-53
20	-11	10	-23	7	14	-2	30	13	-17	25	32	2	6	-7	27	11	7	-35	19	100	-1	22	5	-2	1	-7	2	5	3	39	20	-6	24	5	3	16	-18	5	-13	12	-3	16	-8	34	15	7	-28	-7	-9	0	-14
21	16	-9	5	12	23	53	-5	13	15	10	7	8	11	12	34	19	-2	25	-13	-1	100	2	13	14	28	23	10	24	-2	-8	32	15	16	22	32	34	30	28	20	22	29	-7	38	2	20	22	25	43	11	29	22
22	-1	5	29	-15	13	-14	25	28	-1	27	3	17	-16	3	55	1	15	-34	32	22	2	100	-20	4	28	1	25	2	8	28	45	12	18	-5	0	17	-7	23	-16	23	-2	7	11	4	4	18	3	25	35	12	-7
23	52	53	18	55	46	33	39	24	31	27	18	39	29	10	-1	38	18	36	-44	5	13	-20	100	46	29	37	34	-21	54	38	9	50	24	40	57	54	33	27	62	20	1	35	7	34	22	46	22	16	29	43	30
24	43	50	38	50	53	41	27	1	43	25	10	40	51	11	5	7	43	49	-54	-2	14	4	46	100	15	42	24	-26	22	19	8	23	35	46	62	49	40	27	39	33	33	5	1	-3	13	54	36	34	9	48	45
25	26	43	26	25	31	33	19	34	24	13	-4	35	19	28	21	21	43	29	-22	1	28	28	29	15	100	47	12	4	17	28	32	26	31	33	47	35	39	59	36	16	3	18	7	20	25	47	47	57	49	25	10
26	44	54	24	44	45	37	19	16	23	10	8	43	31	20	-1	52	39	45	-43	-7	23	1	37	42	47	100	29	-9	21	23	18	31	40	52	56	24	39	46	46	30	32	10	9	8	41	47	39	48	24	32	45
27	35	20	14	32	22	-1	32	19	4	12	4	41	12	9	16	29	16	-3	-7	2	10	25	34	24	12	29	100	-8	30	42	18	35	32	7	12	32	4	23	21	19	2	6	2	39	7	19	10	23	44	8	19
28	-17	-24	9	-3	0	-6	-2	29	-35	-6	-13	-4	-27	2	3	18	-21	-16	17	5	24	2	-21	-26	4	-9	-8	100	-30	-17	29	-7	-10	-13	-23	0	5	10	-27	2	-16	-11	11	2	13	-9	-2	16	1	-8	-23
29	38	37	6	33	7	25	23	14	11	29	15	44	17	-2	7	11	9	11	-19	3	-2	8	54	22	17	21	30	-30	100	36	4	23	20	30	36	27	8	-7	20	1	-9	34	5	17	-2	16	23	-11	28	13	0
30	23	39	-10	27	39	2	48	31	-5	39	21	36	11	27	17	13	18	-7	-3	39	-8	28	38	19	28	23	42	-17	36	100	33	10	34	21	10	16	-4	28	4	36	-3	28	-4	40	22	25	16	2	24	16	6
31	15	4	20	28	21	-2	15	26	2	7	8	8	-20	8	38	14	6	-2	11	20	32	45	9	8	32	18	18	29	4	33	100	21	36	15	9	6	0	25	-2	37	3	21	0	2	16	15	15	35	29	26	8
32	48	18	48	33	46	25	25	27	24	7	18	25	8	3	16	11	31	13	-32	-6	15	12	50	23	26	31	35	-7	23	10	21	100	11	31	37	36	22	27	39	2	23	27	-1	1	16	29	18	34	30	27	33
33	12	43	4	40	22	19	28	9	19	24	23	22	3	-1	31	19	15	7	-24	24	16	18	24	35	31	40	32	-10	20	34	36	11	100	37	32	30	16	22	28	18	19	38	9	29	13	33	19	26	29	37	22
34	42	48	22	61	41	50	19	20	30	6	12	42	25	13	5	14	26	33	-60	5	22	-5	40	46	33	52	7	-13	30	21	15	31	37	100	54	30	36	32	24	5	15	15	13	-3	29	44	16	12	18	24	28
35	49	58	27	51	57	62	22	8	36	34	26	38	47	25	6	27	34	59	-49	3	32	0	57	62	47	56	12	-23	36	10	9	37	32	54	100	50	54	43	64	16	24	29	23	8	29	64	48	47	18	64	38
36	37	33	26	36	39	48	30	28	47	33	10	48	30	-7	29	25	36	22	-29	16	34	17	54	49	35	24	32	0	27	16	6	36	30	30	50	100	32	32	43	19	20	20	23	39	24	48	22	47	41	51	21
37	38	18	17	31	40	53	22	27	22	33	-7	44	31	32	2	20	24	50	-45	-18	30	-7	33	40	39	39	4	5	8	-4	0	22	16	36	54	32	100	43	35	13	12	6	34	8	32	48	44	45	20	50	37
38	30	34	41	24	62	36	43	37	2	38	14	33	25	45	17	37	36	21	-16	5	28	23	27	27	59	46	23	10	-7	28	25	27	22	32	43	32	43	100	40	41	4	26	28	22	42	57	41	48	41	39	21
39	42	49	17	37	41	41	22	10	38	23	35	20	39	13	-7	37	34	50	-25	-13	20	-16	62	39	36	46	21	-27	20	4	-2	39	28	24	64	43	35	40	100	10	13	27	17	20	17	51	29	29	27	46	32
40	16	16	27	11	36	8	25	25	12	45	12	20	32	23	19	17	12	11	-7	12	22	23	20	33	16	30	19	2	1	36	37	2	18	5	16	19	13	41	10	100	18	11	19	8	15	42	25	25	16	24	9
41	8	1	8	11	9	34	-26	2	24	18	13	6	27	14	10	-5	29	32	-33	-3	29	-2	1	33	3	32	2	-16	-9	-3	3	23	19	15	24	20	12	4	13	18	100	-1	16	-1	25	5	-1	24	-14	20	30
42	17	30	10	17	14	20	42	24	-10	27	33	-4	7	16	2	1	10	-2	-11	16	-7	7	35	5	18	10	6	-11	34	28	21	27	38	15	29	20	6	26	27	11	-1	100	8	29	21	33	14	4	30	34	-10
43	24	-12	5	11	12	43	1	27	11	34	11	11	4	40	15	19	-7	7	-22	-8	38	11	7	1	7	9	2	11	5	-4	0	-1	9	13	23	23	34	28	17	19	16	8	100	19	6	22	-5	10	11	35	12
44	2	13	-21	15	2	4	38	34	3	32	7	20	14	19	7	30	20	-16	0	34	2	4	34	-3	20	8	39	2	17	40	2	1	29	-3	8	39	8	22	20	8	-1	29	19	100	32	22	-12	11	28	25	-8
45	20	27	7	13	34	27	18	39	-14	38	27	20	20	29	2	35	30	13	-6	15	20	4	22	13	25	41	7	13	-2	22	16	16	13	29	29	24	32	42	17	15	25	21	6	32	100	33	13	22	16	21	19
46	33	49	36	40	62	51	48	38	46	36	20	37	49	18	-7	21	48	35	-32	7	22	18	46	54	47	47	19	-9	16	25	15	29	33	44	64	48	48	57	51	42	5	33	22	22	33	100	39	39	32	52	36
47	30	33	34	18	49	44	0	5	19	17	-11	32	33	21	-4	6	20	56	-34	-28	25	3	22	36	47	39	10	-2	23	16	15	18	19	16	48	22	44	41	29	25	-1	14	-5	-12	13	39	100	53	17	43	38
48	27	11	36	21	39	38	12	17	27	15	-13	35	20	11	27	21	28	34	-22	-7	43	25	16	34	57	48	23	16	-11	2	35	34	26	12	47	47	45	48	29	25	24	4	10	11	22	39	53	100	25	50	28
49	28	27	35	19	10	-4	43	40	12	11	14	35	-7	15	33	29	16	-8	0	-9	11	35	29	9	49	24	44	1	28	24	29	30	29	18	18	41	20	41	27	16	-14	30	11	28	16	32	17	25	100	24	0
50	39	31	32	29	56	40	28	16	31	37	9	19	11	17	6	18	19	46	-24	0	29	12	43	48	25	32	8	-8	13	16	26	27	37	24	64	51	50	39	46	24	20	34	35	25	21	52	43	50	24	100	33
51	28	20	24	31	45	41	-16	7	30	0	-8	14	17	-2	-7	18	17	41	-53	-14	22	-7	30	45	10	45	19	-23	0	6	8	33	22	28	38	21	37	21	32	9	30	-10	12	-8	19	36	38	28	0	33	100

Table E.3 Correlation matrix

Unrotated factor matrix

Nm	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
1	0,6502	-0,1897	-0,1216	-0,227	-0,1982	0,1226	-0,0499	-0,0714
2	0,6136	-0,0097	-0,4121	-0,0577	-0,0721	-0,3349	0,2327	0,1377
3	0,4209	-0,0372	0,3249	-0,4036	-0,0917	-0,2453	-0,2662	0,1288
4	0,6163	-0,1524	-0,289	-0,1741	-0,0114	0,2738	0,272	-0,1564
5	0,7088	0,0705	0,1278	0,0737	0,0004	-0,2672	-0,0227	0,0634
6	0,6495	-0,3327	0,1677	0,2936	0,0861	0,251	-0,1031	-0,0195
7	0,4318	0,5524	-0,2663	-0,0286	-0,1599	-0,0954	-0,2248	0,0108
8	0,3822	0,4341	0,162	0,0684	-0,2124	0,2048	-0,2184	-0,2159
9	0,4341	-0,3753	-0,0718	-0,2541	0,3171	0,1524	-0,3137	-0,1218
10	0,4282	0,4303	-0,0168	0,4653	0,143	-0,0373	-0,3096	-0,099
11	0,1999	0,3181	-0,257	0,4433	0,2101	-0,0994	0,0525	0,3476
12	0,5985	0,1199	-0,0712	-0,1952	-0,0865	0,205	-0,1179	-0,4842
13	0,4973	-0,31	-0,2429	0,3495	0,0954	-0,2445	-0,1189	-0,2834
14	0,3007	0,0925	0,1662	0,3816	-0,3543	-0,1034	0,092	-0,134
15	0,1157	0,5277	0,2666	-0,1356	0,4746	0,1134	0,0878	0,1094
16	0,3708	0,2446	0,0579	0,0155	-0,3157	0,1612	0,3707	0,1124
17	0,5231	-0,0651	-0,1057	-0,0211	0,0656	-0,3146	-0,143	-0,2914
18	0,5471	-0,6556	0,0684	0,0628	-0,0806	-0,1447	0,0719	0,0711
19	-0,5547	0,551	0,1015	0,0315	0,0425	-0,1919	-0,1197	0,189
20	0,0329	0,5102	-0,2437	0,2639	0,3287	-0,0164	0,2095	-0,1179
21	0,3567	-0,0303	0,5314	0,1525	0,2303	0,3546	0,175	0,1098
22	0,1249	0,5934	0,2727	-0,2948	0,3062	-0,209	-0,1855	-0,11
23	0,6842	0,0006	-0,4105	-0,063	-0,1374	0,2209	-0,0061	0,1958
24	0,6831	-0,2594	-0,134	-0,0585	0,3085	-0,1855	-0,0496	-0,1156
25	0,5935	0,1572	0,2379	-0,1752	-0,1689	-0,1287	0,0716	-0,0262
26	0,6954	-0,1082	0,0434	-0,0671	-0,1043	-0,1107	0,4275	-0,0692
27	0,3778	0,3158	-0,1741	-0,3555	-0,0262	0,1633	0,0836	-0,1999
28	-0,1418	0,2461	0,5267	0,027	-0,3121	0,1893	0,1935	-0,0529
29	0,3718	0,107	-0,5073	-0,1904	-0,022	0,2305	-0,1195	0,0473
30	0,3798	0,5135	-0,3518	0	0,0142	-0,1639	0,1869	-0,2879
31	0,2634	0,4271	0,3268	-0,2889	0,1981	-0,0531	0,3459	0,0757
32	0,5123	0,0177	0,001	-0,3322	0,0274	0,0989	-0,0965	0,2251
33	0,4741	0,2488	-0,1399	-0,0867	0,3422	0,073	0,3545	0,1434
34	0,6029	-0,1601	-0,1525	-0,0614	0,0266	0,1339	0,2813	-0,0883
35	0,8138	-0,2094	-0,0461	0,1325	0,0815	-0,0208	0,0064	0,2455
36	0,6573	0,1116	-0,0065	-0,0693	0,2362	0,3069	-0,2605	0,0139
37	0,6143	-0,2053	0,2786	0,1816	-0,2252	0,1329	-0,1233	-0,0682
38	0,6525	0,2682	0,3244	0,1318	-0,27	-0,2404	0,0033	0,0002
39	0,6469	-0,1603	-0,1755	0,1042	-0,079	0,0229	-0,0728	0,4206
40	0,3932	0,2594	0,1931	0,1337	0,1617	-0,2911	-0,0263	-0,2248
41	0,2694	-0,2605	0,1694	0,2532	0,5035	0,0562	0,1431	-0,1453
42	0,3343	0,3239	-0,2778	0,1465	-0,0847	-0,0333	-0,0869	0,45
43	0,2737	0,0523	0,3146	0,3854	-0,0246	0,4964	-0,1924	0,0178
44	0,2694	0,4604	-0,249	0,2365	-0,1249	0,3185	-0,0296	-0,1574
45	0,4254	0,215	0,1166	0,3926	-0,1958	-0,0712	0,2588	-0,086
46	0,7738	0,045	0,0055	0,1107	-0,0216	-0,1902	-0,2103	0,0046
47	0,5434	-0,2319	0,263	-0,1251	-0,1418	-0,3236	-0,0351	0,0612
48	0,5704	0,0015	0,5394	-0,1825	0,1027	-0,0497	0,014	-0,0056
49	0,4201	0,4585	0,0381	-0,3967	-0,2163	0,1169	-0,1322	0,1425
50	0,6535	-0,0078	0,1726	0,0921	0,1188	0,0325	-0,1612	0,346
51	0,471	-0,3864	0,134	-0,0877	0,1533	0,0172	0,2001	-0,0003
Eigenvalues	13,05986	4,827212	3,221272	2,523757	2,090118	2,021324	1,807368	1,745199
% Explained Variance	26	9	6	5	4	4	4	3

Table E.4 Unrotated factor matrix

Rotated factor matrix

Part. No.	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8
1	0,5392	0,4015	-0,1292	0,0371	0,0364	0,068	0,3269	0,0655
2	0,5035	0,1979	0,0235	0,2109	0,1667	-0,3817	0,1538	0,4532
3	0,093	0,1015	0,1009	0,08	-0,0532	0,0043	0,7514	0,0029
4	0,713	0,415	0,0524	-0,0212	0,0527	0,0104	-0,0355	0,0494
5	0,3288	0,0943	0,1546	0,3727	0,2457	0,0848	0,4172	0,2891
6	0,5544	-0,0056	-0,0948	0,2049	0,0713	0,5672	0,1602	0,132
7	-0,1225	0,5896	0,0875	0,2853	0,1473	-0,0626	0,1495	0,3859
8	-0,1127	0,5076	0,0856	0,2024	0,2868	0,3488	0,156	-0,003
9	0,4724	0,158	-0,0339	0,1837	-0,4951	0,2181	0,238	-0,0604
10	-0,1156	0,2392	0,1114	0,5828	0,1625	0,37	-0,0381	0,354
11	-0,0431	-0,0457	0,1695	0,21	0,1129	0,0548	-0,2336	0,659
12	0,357	0,6386	0,0403	0,2923	0,0696	0,1639	0,1435	-0,1979
13	0,4673	-0,0181	-0,2788	0,6092	0,0227	0,0464	-0,0192	0,1317
14	0,0637	0,0329	-0,1444	0,2252	0,5714	0,1519	0,0747	0,0548
15	-0,1571	0,0998	0,7463	0,0377	-0,0666	0,1835	0,0153	0,0879
16	0,2059	0,2637	0,1652	-0,2058	0,5116	0,0415	0,0601	0,1673
17	0,3266	0,1803	-0,032	0,5404	0,0041	-0,089	0,2399	0,0192
18	0,6983	-0,2427	-0,2753	0,1044	0,0658	0,0766	0,3547	0,0788
19	-0,7799	-0,094	0,226	-0,0486	0,0057	-0,1538	-0,0937	0,0905
20	-0,1057	0,1504	0,3947	0,2919	0,1085	-0,056	-0,4673	0,2201
21	0,2791	-0,1505	0,3866	-0,0948	0,1763	0,5928	0,1153	-0,0193
22	-0,3375	0,2385	0,5955	0,3071	-0,0844	-0,0201	0,2858	-0,063
23	0,5037	0,4908	-0,0847	-0,0307	0,0263	0,0657	0,1055	0,4772
24	0,6219	0,0742	0,0887	0,442	-0,1722	0,0121	0,2307	0,1489
25	0,2506	0,2505	0,2153	0,1367	0,3194	0,0334	0,4683	0,0461
26	0,6592	0,1202	0,1766	0,1062	0,3942	-0,0855	0,2305	0,0712
27	0,1953	0,5944	0,2609	0,0223	0,0297	-0,0901	0,0585	-0,033
28	-0,2607	-0,0076	0,1589	-0,2701	0,4706	0,2266	0,0942	-0,2905
29	0,257	0,5535	-0,0591	-0,0166	-0,199	-0,0487	-0,0481	0,3047
30	0,0981	0,5015	0,2685	0,3882	0,2532	-0,2733	-0,167	0,1612
31	0,0465	0,1075	0,708	-0,0526	0,2099	-0,052	0,2119	-0,0083
32	0,2983	0,2925	0,169	-0,0834	-0,1226	0,0818	0,4018	0,2245
33	0,3849	0,1877	0,5363	0,0402	0,0429	-0,0321	-0,0745	0,3185
34	0,6578	0,2271	0,0916	0,0538	0,1256	0,0323	0,0291	0,0921
35	0,6219	0,0511	0,0281	0,1979	0,0788	0,2254	0,3055	0,462
36	0,3264	0,4132	0,2106	0,1903	-0,1763	0,432	0,2022	0,226
37	0,3844	0,1049	-0,1673	0,1584	0,2825	0,4476	0,3544	0,0282
38	0,1217	0,1747	0,1413	0,3153	0,5479	0,1513	0,478	0,1864
39	0,4457	0,1037	-0,1177	0,0122	0,0432	0,1527	0,2837	0,588
40	0,0497	0,0583	0,2852	0,523	0,2111	0,0636	0,1717	0,0207
41	0,4225	-0,2989	0,2373	0,2901	-0,0892	0,305	-0,1369	-0,0581
42	-0,0335	0,2282	0,0403	0,0125	0,1043	0,0045	0,073	0,68
43	0,0367	0,0912	-0,0208	0,0041	0,1706	0,7516	-0,015	0,0719
44	-0,0379	0,5403	0,0392	0,1354	0,2418	0,2216	-0,2847	0,208
45	0,1731	0,0697	0,0849	0,2415	0,6023	0,1418	-0,0189	0,1707
46	0,3384	0,2309	0,0086	0,4562	0,1454	0,1697	0,3994	0,3294
47	0,3564	-0,0699	-0,022	0,1885	0,1724	-0,0132	0,6029	0,0486
48	0,2941	0,0099	0,3722	0,1366	0,1531	0,2794	0,5558	-0,0927
49	-0,0532	0,5925	0,249	-0,1142	0,1014	0,0249	0,4133	0,1822
50	0,3001	0,0372	0,1566	0,1285	0,028	0,368	0,4042	0,4406
51	0,6128	-0,1213	0,1037	0,0349	-0,0024	0,1062	0,215	-0,0312
% Explained Variance	15	8	6	6	6	6	8	7

The chosen respondents are flagged as blue when belonging to said factor, based on their factor loadings.

Table E.5 Rotated factor matrix

Appendix F – Desk study historical review

1 Commute traffic

This section of the appendix summarizes the most important findings from the desk study literature review. It divides this summary by subject and time period.

1.1 Total transport demand

1985-1995; Within this period, the total number of trips increased by about 13%. The average number of daily trips per person actually went down by 4%, whereas the total distance travelled in passenger transport increased by 36%. This distance growth is mostly pushed by a large growth in +30 kilometre trips (MuConsult, 1998).

1995-2005; Mobility growth as a whole starts to slacken within this period. The total number of trips has presumably increased far less than in former decades, as average number of daily trips decreases. The average number of daily trips per person down by 6%, as average travel distance increases by 5%. Total distance travelled in passenger transport increased by 12%, which is a slower increase than the period between ’85 and ’95. The intensive long distance car user has grown younger as those in their 30’s overtake those in their 40’s (G.J.A. AI, 2006).

2005-2015; The total number of yearly trips has remained roughly the same. The average number of trips has remained the same over this decade, at around 3 trips per day per person (KiM, 2015). Total distance travelled in passenger transport has stabilised and remained the same after 2008, continuing the trend of decreasing growth, reaching stagnation. While passenger travel has decreased by a lot, car sharing has started to gain some traction, growing slightly (KiM, 2015).

2015-2019; The total distance travelled is a point of contention between the 2021 and 2019 reports. The 2019 report indicates a slight decrease over this period (KiM, 2019), whereas the 2021 report indicates slight increase (KiM, 2021). It is interesting that the total number of yearly trips per person, as well as the amount of daily trips continues to decline, decreasing from 3 trips per day to 2,8. When observing changes in car use particularly, yearly distance travelled continues to decline for every motivation of travel, with the exception of commute related travel. This is likely due to commuters following the historical trend of living increasingly at distance from their place of work (KiM, 2019).

It must be noted that the year 2018 saw a change in the way the Dutch Central Bureau of Statistics (CBS) measures mobility. Unlike in the period 2010-2017, in which data was gathered through Onderzoek Verplaatsingen in Nederland (OViN), reports of 2019 and onwards use data gathered through Onderzoek Onderweg in Nederland (ODiN). These later reports show a fair bit of difference between the data points for the same year when compared to earlier reports. Within particularly the more recent years leading up to the switch of measuring method in 2018, more slight growth in mobility is measured, whereas the data from older methods shows stagnation and shrinking mobility (KiM, 2019, KiM, 2015). The review will take these discrepancies in mind and give a general overview that follows from both reports.

2019-2020; As already mentioned within the introduction, mobility decreased sharply in 2020, not completely recovering to pre-pandemic metrics within 2021 (KiM, 2021). Total distance travelled saw a decrease of 30% within the period 2019-2020. This change occurs mostly due to the change in regards to the distance of trips, as changes in the total number of trips do generally not percentually correspond one-to-one to changes in distance travelled (KiM, 2021).

The distance travelled by car operators saw a decrease of 27% compared to only a 16% decrease in trips. Distance travelled as a car passenger decreased by 33% compared to a 23% decrease in trips. Bike use shows an equal decrease in trips compared to travel distance at 20%. Number of walking trips stays the same but the total distance increases by 10%, likely a result of leisurely trips. Distance travelled in PT practically halved, whereas trip count isn’t measured (KiM, 2021).

1.2 Modal choice

1985-1995; Within the modal share, the share of car-operators is highest and has also grown (MuConsult, 1998). The share of car passengers remains stable, carpooling grows parallel and there is no relative increase. As shorter distance trips relatively decrease, the share of bike and scooter also decrease. PT use is only a small share, but grows particularly in train use, paralleling growth with +30 km trips (MuConsult, 1998).

1995-2005; The share of car operators remains highest, steadily growing back to 52% after a dip in 1995 wherein the number of car passengers grew larger to 28%. Car use in general saw its share increase by 1-2% (G.J.A. AI, 2006). The large share of car passengers at the time could have been a result of carpool policy, but as relative share decreased afterwards, the policy seems to have run out of effectiveness. The modal share of bike and scooter continues to slowly decrease. The share of PT decreases slightly, as bus or tram use appears to decrease in favour of train use. Expansions of train use allows PT to keep almost keep up with car use growth (G.J.A. AI, 2006).

2005-2015; Interestingly, this appears to be the first time where the distinction is starting to get made between trip and travel-distance share when describing modal share (KiM, 2015). When observing travel distance share, the metric used within the past two decades that were reviewed, car use has declined. The share of car operators decreases slightly to 50%, whereas the share of car passengers sharply decreases to 22%. As policy emphasis on carpooling seems to have disappeared from the reports in comparison to the popularity in the late 90's and early 2000's, it's effects also appear to have decreased. It's also of note, that while around three quarters of distance is travelled by car, they only account for 46% of trips (KiM, 2015).

Bike use has increased, likely due to the new popularisation of the E-bike that starts to become more popular with the general populace after becoming popular among the elderly. The small work related increase only amounts to around 1% growth however. Train use has increased by a quarter to 9% of distance, but it's hardly 2% of total trips (KiM, 2015).

2015-2019; Over this period, large changes in modal share were non-existent. Both reports indicate car use remains the prevalent mode of transport, with the share of car passengers continuing to decrease in favour of car operators (KiM, 2019, KiM, 2021). Public transport use sees slight growth, with distance travelled through both train and bus use increasing, the latter modality breaking with a trend of significant historical decline.

2019-2020; Changes to the total modal share division occurred. However, these decreases at the time aren't necessarily an indication of continued change. It is of note however, that KiM (2021) makes a distinction between four different stages in 2020, based on difference in lockdown policy.

Stages of lockdown policy	Government policy
Stage 1 – January to march 15	Pre-covid/lockdown period
Stage 2 – March 16 to May	Implementation of the intelligent lockdown that enforces the closure of non-essential business, prohibits gatherings, in-person education and non-essential PT-use.
Stage 3 – June to October 15	Iterative abolishment of most lockdown and pandemic related restrictions.
Stage 4 – October 15 to December 31 (and onwards into 2021)	Reintroduction of intelligent lockdown, where PT-use isn't curbed.

Tabel 0-1 stages of lockdown policy

Stage 2 saw a far greater decrease in car and bike trips than in stage 4, even though the restrictions imposed during lock down were similar to stage 2, being even more lenient on PT use than in stage 2. Indicating a certain impossibility or unwillingness to move back to working from home or to cancel other non-commute related trips (KiM, 2021). As mentioned earlier, car use and bike use bounces back far more than other modalities, possibly further indicating unwillingness to decrease travel

using these modalities, in favour of staying at home, or insight gained that makes working from home impossible for longer periods. Interestingly, the total distance travelled by e-bike increased during all stages of 2020. This happened in spite of the decrease in the use of the regular bike (KiM, 2021).

1.3 Moment of travel and motive

1985-1995; Growth in total trips causes growth in trips during rush hour during both morning and evening. The overall time spent in morning rush hardly increased, whereas time in evening rush increased a lot. Part-timers tend to travel primarily in the morning rush, working half days to 12 or 2. Full timers relatively tend to travel more in evening rush (MuConsult, 1998).

1995-2005; New research shows that part time workers tend to live closer to their workplace and are less likely to travel by car. On the other hand research into the growing number of 'task-combiners', for example working parents, traveling for multiple reasons within one trip, shows they tend to prefer using the car. This results in particularly a large increase of the morning rush (G.J.A. AI, 2006). New delineation into motive for travel within rush hour is given, which shows that travel related to commute (work and education related travel) hold the major share within both morning and evening rush. The share of commute during morning rush is 89% (74% work & 15% education related). Share of commute during evening rush is 89% (54% work & 6% education related) (G.J.A. AI, 2006).

2005-2015; *The 2005 report saw the addition of travel motive to the mobility review, this review focuses less on that topic.* Total traffic volume during the during both morning and evening rush continues to increase. However, time loss during the morning rush has actually shrunk to a lower number in 2014 than within 2004 after a decrease following the 2008 economic crisis. Evening rush time loss is higher however (KiM, 2015).

2015-2019; New data on congestion and travel times shows no great changes. Time loss during morning rush continues to largely be the cause of commute travel, whereas evening rush is caused by more different travel motivations. Time loss during the morning rush appears to slightly grow, being lower in 2018 than in 2010, yet time loss during evening rush increased by a lot (KiM, 2019).

2020; While it's noted that time loss due to congestion plummeted after march 2020, data on the time loss during specific times of the day is missing, although it can be inferred that congestion during rush hour decreased by a lot during stage 2 and 4 of 2020 (KiM, 2021). Changes in mobility per travel motive in particular is investigated. It was determined that 2020 largely saw a decrease in trips of work or education related commute, decreasing by 33% and 42% respectively during the entire year. This means that the drop during lockdowns was even higher than this reported average drop, as the average lies higher due to increased travel during stage 1 and 3 of 2020. It's notable that work related trip decrease is smaller during stage 4 than in stage 2 (KiM, 2021), once more indicating lessened perceived willingness or necessity to decrease trips.

2. Characteristics of employment

Employment seems to influence commute. This shows the development of different aspects.

2.1 Size of Dutch employment

1985-1995; The total growth in work years is similar to trip growth, at 14%. These two are strongly related. The number of jobs grew at 21%, indicating growth into more part-time jobs, as fulltime jobs have gotten shorter (MuConsult, 1998). It's difficult to say that this development, as well as future present day developments such as a shift in working from home, will cause the relationship between these variables to weaken. The average working distance grew by around 17%. This growth in distance is present among both sexes and in all provinces (MuConsult, 1998).

1995-2005; Within G.J.A. AI (2006), trip growth related to work isn't discussed in specific for the period 1995-2005. However, overview of the growth between 1975 to 2005 shows that the number of trips has increased for all types of household, but has remained stagnant over the last decade.

2005-2015; While work-travel is discussed within the report by KiM (2015), older reports saw a stronger need to give an overall view of the economic and job growth situation within the Netherlands in relation to commute and other traffic. This isn't done within this report and seems to not be mentioned for further investigation.

2015-2019; Overall, the link between the average work situation and travel, much like in the 2015 report, seems largely missing (KiM, 2019). This is interesting, as workplace related variables become far more important topic due to the pandemic a year later (KiM, 2021).

2020; The impact of the size of companies on mobility is no longer measured. In the KiM 2021 report emphasis is put on other characteristics regarding employment, particularly on categorising the different types of employ to measure the decrease of employee travel during the pandemic. Economic sectors that featured to be more suitable to facilitate working from home saw a larger decrease in commute trips. The office/service sector, featuring information and communications, financial service provision, special business services and Public government services, saw the largest decreases. Public transport, popular in particularly the service industry, saw a larger percentage decrease within this sector than car use. In the case of education, the largest decrease in education related trips can be seen in higher education (HBO and WO) at around 60%, whereas VO and MBO saw less of a trip decrease as these were opened more during the pandemic (KiM, 2021).

2.2 Commuter flow

1985-1995; Travel flow moves mostly towards larger cities. This is more prevalent in areas like Groningen where 52% of jobs is filled by migrants, whereas only 28% of Groningers works outside the city. The very large cities, like Amsterdam and Rotterdam, don't feature particularly large imbalance in in and out flow, as most local jobs are filled in by inhabitants (MuConsult, 1998).

1995-2005; Travel flow isn't discussed in depth (G.J.A. AI, 2006). Job growth occurs primarily at city edge and outside of it. Growth in the Randstad lags behind growth in the rest of the country.

2005-2015; The size and importance of specific commuter flows or travel routes is still not discussed in depth anymore in the KiM report of 2015. Travel into or out of cities happens largely by car. Commute within the same city often happens primarily by bike, taking a larger share of the modal split than car use. However, new research shows that travel between the large cities has grown increasingly dependent on PT use. The connections Den Haag-Utrecht, Den Haag-Leiden and Amsterdam-Utrecht are actually travelled primarily by PT, overtaking car use (KiM, 2015).

2015-2019; Specific commuter flow routes aren't discussed within the KiM 2019 report.

2020; Specific commuter flow routes aren't discussed within the KiM 2021 report.

2.3 Flexibilization of labour and contracts

1985-1995; During this period the number of flexible contracts has been steadily growing, influencing commute traffic differently based on the nature of the contract. Flexibility and changes occurred mostly to the start and end times of the workday, but have hardly made a noticeable change to traffic congestion during rush hour (MuConsult, 1998).

1995-2005; Part time work has grown, particularly due to growth in female work participation from 40% during the 90s to over half in 2005 (G.J.A. AI, 2006).

2005-2015; Data on part time contracts or other flexible contracts is missing in the 2015 KiM report.

2015-2019; The report on Het Nieuwe Werken continues to be the only report cited within the large 2019 KiM mobility review, perhaps indicating significant disinterest within this topic.

2020; KiM (2019) mentions the impact of employers and employment types on the ability to work from home, structural contract changes aren't discussed. What is mentioned however, is the fact that the pandemic will likely structurally affect the choice to work or study from home in the future. Fear of COVID infection during travel, as well as government policy to limit travel and the spread COVID, such as the closing of certain venues and travel modes or the stimulation of working from home, tele-meetings and online education, strongly decreased travel and consecutively congestion.

KiM expects that working from home and to a lesser extent at home online education will remain after the pandemic at a higher level than before the pandemic (Hamersma et al., 2021). The number of employees with the ability to (partially) work from home is estimated at around 50% of all employees. Half of these employees expects to work more from home after the pandemic. These people are primarily employed in office or management functions. Employers also expect this change. On the other side, around 25%-30% of students in higher education have come to expect that at home education will be more prevalent after the pandemic. These expected structural changes differ for different travel modes in relation to differing travel motives, as portrayed in the table below. Decreases in trips related to work and education result in very slight increases in other trips due to the constant of travel time.

Change in distance travelled by modality	**Car**	**PT (Train)**	**PT Bus, Tram, Subway**	**Bike**	**Walking**
Decrease living-working commute	**-2.5% to -4.0%**	**-5% to -7%**	**-4% to -5.5%**	**-1.5% to -2.5%**	**-1% to 0%**
Decrease business commute	**-0.5% to -0.7%**	**-0.4% to -0.5%**	**-0.1%**	**~0**	**~0**
Decrease living-education commute	**-0.1% to -0.2%**	**-1.5% to -3%**	**-2% to -4%**	**-0.4% to -0.8%**	**0.1%**
Increase of other travel due to living-working decrease	**1% to 2%**	**1.5% to 2.5%**	**1% to 2%**	**1% to 2%**	**1.5% to 3%**
Increase of other travel due to living-education decrease	**~0%**	**0.2% to 0.5%**	**0.2% to 0.4%**	**0.2% to 0.5%**	**0.3% to 0.7%**
Total effect	**-1.1% to -3.6%**	**-3.9% to -8.8%**	**-3.5% to -8.1%**	**-1.7% to +0.5%**	**+1.3% to +3.5%**

Tabel F.0-2 The structural effects on distance travelled per modality due to working from home (Hamersma et al., 2021)

More important perhaps is the data portrayed in table F.3 below, which shows that structural changes have occurred between travel modes. Perhaps it is most interesting, that PT use shows a greater percentual decrease due to a shift to working from home than car use. However, this is partially caused by the fact that car use is far more prevalent for non-commute travel than PT usually is. The table does however show, that there is also a structural shift away from PT use to car and bike use, negating effects of working from home on the decrease of car use.

Change in distance travelled by modality	**Car**	**PT (Train)**	**PT Bus, Tram, Subway**	**Bike**	**Walking**
Effect of working from home	**-2.35%**	**-6.35%**	**-5.85%**	**-0.60%**	**2.30%**
Shift from PT (train, bus, tram subway)	**+0.54%**	**-3%**	**-3%**	**+0.54%**	**0.35%**
Total structural effect	**-1.81%**	**-9.16%**	**-8.67%**	**-0.06%**	**2.60%**

Tabel F.0-3 Total structural effect on traveled distance due to modality shift (Hamersma et al., 2021)

While these changes to commute travel are projected estimations, they do paint a clear picture; Structural decrease in car use, spurred on by working from home, but dampened by the switch of PT to car use, is rather limited (Hamersma et al., 2021). The aftereffects of the pandemic on employer policy or employee/student traveller attitude will only decrease car use and accompanying

congestion temporarily. Projections show car use returning to pre-pandemic levels by 2023. This takes into account that the small structural shift to working from home remains, which in itself could be considered unsure when recalling the decreasing impact on trip decrease during stage 4 of 2020 in comparison to stage 2. Even when practically enforced by government, the push to work from home sees decreasing influence. To what extent will structural change to working from home continue to hold outside of these pandemic circumstances? Is it the result of structurally changed company travel policy or fickle attitudinal change that might wane?

3. Characteristics of transport system

Modal choice is impacted by on the one hand the quality of the traffic system, including travel time and travel cost, and on the other hand offered transport choice (MuConsult, 1998).

3.1 Infrastructure and supply of transport services

1985-1995; The roadnetwork has increased by a lot, as city grids have expanded with construction of new suburbs and the expansion of the highway network. PT saw increased train capacity due to the doubling of train tracks in the Randstad, whereas bus use appears to have decreased over the whole, as policy dictates the dissolvement of 'sparsely' occupied lines. Carpooling areas have increased, reaching around 338 carpool 'pleinen', and the number continues to grow in accordance with the new trend of government policy to encourage this practice and decrease congestion within cities (MuConsult, 1998).

1995-2005; The length of the highway network has only increased slightly, by 70 kilometres. Most expansion takes place through constructing extra lanes, expanding lane length by around 10% in 10 years (G.J.A. AI, 2006). Most road infrastructure changes have been in the installation of traffic signals. Spitsstroken, rush hour lanes, are a relatively new policy and 43 kilometres of lane have been added. The train system has hardly expanded, length increasing by barely 10 km due to doubling of some tracks (G.J.A. AI, 2006). Carpooling has started to disappear from overviews.

2005-2015; A large impact on the reduction of time loss is caused by the widespread opening of spitsstroken, causing around half of time loss reductions. The construction of several new road connections, like the A5, A30 and A50, have further decreased time loss (KiM, 2015).

2015-2019; The focus of the reports, in line with the historic trend within these reports, continues to minimize attention spend on describing changes to the Dutch (road and train) infrastructure system (KiM, 2019). This is in stark contrast to the emphasis that is put on determining more in-depth data on the metrics of travel behaviour itself.

2019-2020; No new information is given on this subject, nor is any attention given to infrastructure subjects related to WFH such as internet access or at home working space (KiM, 2021).

3.2 Travel cost

1985-1995; The report by MuConsult (1998) mentions that the real weighed cost of car and public transport use is often measured in the cost of travel divided by the distance travelled. The variable cost of train use, relative to car use, has increased greatly. In the case of car, the weighed cost of travel has largely decreased as the price of petrol has largely declined. Excise duties on petrol have not completely compensated the difference between car and PT. In the case of PT, the weighed price of train, bus and local PT has increased by roughly 15%.

1995-2005; Direct cost of transport isn't directly measured anymore. Instead as shift is made to measure the 'actual' societal cost of travel and to what extent users tend to cover these costs. Measured costs include cost such as infrastructure, accident and taxes. But also environmental cost. Gasoline cars (benzine autos) are very costly in the sense that they cover a lot of their societal cost through taxes (G.J.A. AI, 2006).

2005-2015; The description of travel cost is not much different from last report, if anything, direct travel cost seems to be even less emphasized in favour of measuring societal cost of transport in the 2015 KiM report.

2015-2019; While the societal cost of travel is discussed in the sense of time loss and environmental impact, travel cost for the individual is no longer discussed by KiM (2019).

2019-2020; Individual travel cost isn't mentioned. However, when analysing mobility, accessibility will from 2021 onwards be measured by government organisations as a product of travel speed, cost and comfort (KiM, 2021), showing an interest in mixing the older objective metrics with more subjective attitudinal metrics that have gained more attention in the 2005 report. Realistically however, these variables aren't exactly new or innovative, as travel speed and travel cost used to be far more prevalent in analysis before falling more into relative obscurity in these government mobility overview reports over the years.

3.3 Travel time or speed

1985-1995; Travel time savings during commute have generally increased for longer distances. In the case of car use this appears to have been caused by infrastructure improvements and increased maximum speed limits (MuConsult, 1998). Later years will see maximum speed decrease, but the effects of these decreases are not expressly mentioned within the other reviewed reports(G.J.A. AI, 2006; KiM, 2015). Travel time has increased for short distance train use, but has decreased for long distance busses due to the introduction of interliners and free bus lanes. Future reports also don't expressly mention any significant expansion of these bus lanes, apparently remaining largely situational happenings.

1995-2005; Average travel time generally remained the same. Car-operators tend to travel the longest per day, and general travel time as car operator has grown slightly. This might be due to the fact that car operators make car trips more often, increasing their average as it includes days or trips that don't favour PT use (G.J.A. AI, 2006). Policy goals contain the goal to ensure travel during peak rush hour travel within the Randstad be reduced to half the time cost during non-rush hour by 2020. Hindsight shows that this actually rings true for large periods of time, but that was due to lockdown (KiM, 2021). Realistically, rush hour congestion in regular conditions likely cause travel time across certain road sections to increase by more than 50% in the case of virtual standstill. Congestion wasn't entirely eliminated (KiM, 2015; KiM, 2019; KiM, 2021).

2005-2015; As mentioned, social-economic factors have been the base cause for travel time loss caused by (unreliability in) congestion. Decrease in travel time loss and congestion is caused mostly through the expansion of roadlanes, whereas unreliability, not congestion as a whole, was decreased through traffic management (KiM, 2015).

2015-2019; Time loss, with the exception of morning rush, saw a general increase during this period, particularly in the evening rush but also during the day in general (KiM, 2019).

2019-2020; Total travel times are once again prominently mentioned within the report, as the difference in travel time between 2019 and 2020 is compared. Total travel time decreased, its percentual decrease being near equal to the percentual decrease of distance travelled for the motives of shopping, education or other. On the other hand, travel time for work related travel saw a significantly greater decrease than the distance travelled, -43% to -38% respectively (KiM, 2021). This indicates the effects of congestion decrease being significantly impactful, as the majority of commuter remain car users.

3.4 Congestion and time loss

1985-1995; Time loss due to congestion is highest in the Randstad. Congestion growth occurs by increasing amounts as the years go on. Congestion in PT, specifically in trains, has increased due to a

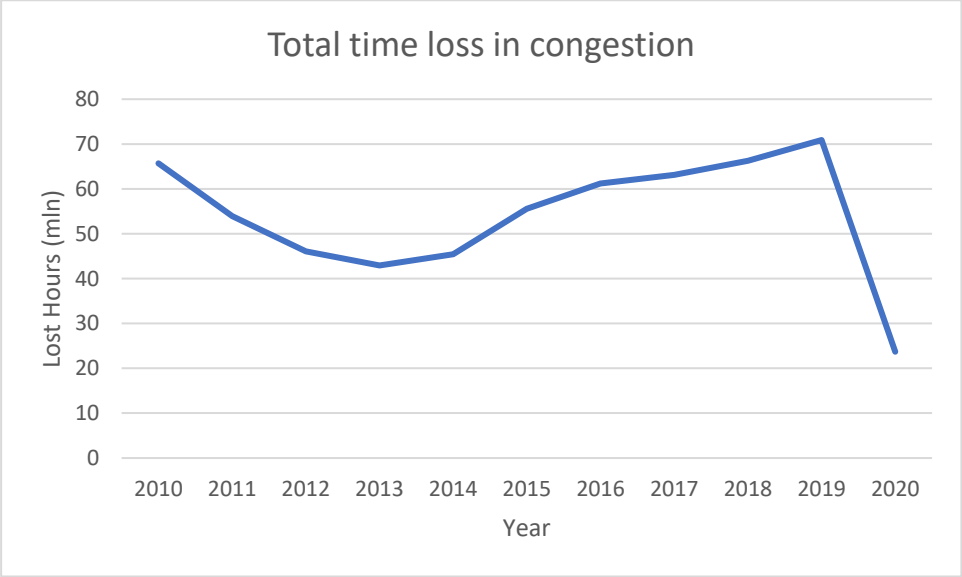
growing demand that isn't met by lacking infrastructure (MuConsult, 1998). The bike as a mode alternative has gotten slightly faster over long distance due to infrastructure construction and bike improvements (MuConsult, 1998). It will be interesting to see how the introduction of the E-bike in the late 2010's and early 2020's will further popularize the bike, especially for long distance travel.

1995-2005; Total time loss due to congestion has continued to increase. Intensity of traffic on particularly highways has grown considerably (G.J.A. AI, 2006).

2005-2015; The cost of travel time loss due to congestions has been decreasing until the early 2010's, as the cost started to increase again after 2013. The period after the economic crisis saw a small decrease in congestion at some points during the day, but total congestion ends up higher in 2015 (KiM, 2015).

2015-2019; The report publishes some numbers regarding time loss due to congestion on the main road network. What's interesting is that overall time loss saw a U-shaped trend over the last decade, with 65.7 million hours' time loss in 2010, 42.9 in 2013, 55.6 in 2015, returning to 66.3 million in 2018 (KiM, 2019). It's interesting to note, data from this report suggests that methods of measuring congestion (or other variables) has likely changed since the last report, as datapoints differ. This is an indication that while recordkeeping has thus started to be standardised for a decade for many variables, comparing current datapoints to past trends remains difficult.

2019-2020; What is definitely noticeable however, is the sheer decrease in time loss due to congestion during 2020, practically shrinking by two thirds of the past year, far surpassing the total time loss decrease that was present during the effects of the recession and infrastructure expansion in the early 2010's (KiM, 2019).



Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lost Hours (mln)	65,7	53,9	46,1	42,9	45,4	55,6	61,2	63,1	66,3	70,9	23,7

4. Policy of employers

Employer policy in regards to travel is hardly described.

4.1 Company car policy

1985-1995; In this period the total car park grew by only 22%, whereas company cars grew by 40%, largely as a result of changes in fiscal law. Company cars are also increasingly leased (MuConsult, 1998).

1995-2005; Interestingly, metrics on company transport policy appears largely missing (G.J.A. AI, 2006). This seems to be counter to government policy to involve itself in cooperation with private companies to manage transport, as it was introduced within the first review report by MuConsult (1998), or as was proposed as future policy within the prediction report by F.M Roschar (1997).

2005-2015; Metrics on company transport policy, or at the very least mention of planned research into these metrics, are once again included, unlike the 2005 report. This data is partially gathered through mobility panels (Mobiliteitspanel Nederland, 2015).

The cost for transport is measured for private companies. Amongst travel time cost and the cost of buying transport services, the cost of the company's own transport is recorded. The cost of lease cars amounts to around 10% of total transport expenses (KiM, 2015).

2015-2019; Policy undertaken by employers, with the exception of the short mention of HNW, has disappeared completely from the KiM 2019 report. This is interesting as this concept of employer policy used to be a concept of note in past reports and is set to become a far more important topic in the years to come (KiM, 2021).

2019-2020; Yet even in the 2021 report, structural government policy related to employer transport management seems to be largely missing or underreported. However, for the first time since the 2005 report, company cars are once again featured within an overall government mobility review report. This is mostly due to an apparent increased interest in company policy regarding car park electrification. 10% of the Dutch carpark exists of company cars. It must be noted that only 7% of gasoline cars is a company car, whereas 77% of electric cars is a company car (KiM, 2021).

4.2 Travel allowance policy

1985-1995; Within this period, the amount of employees receiving some form of travel allowance has grown from 48% to 67%. Such compensation contributes to increased working distances, making longer travel more attractive through that financial compensation (MuConsult, 1998).

1995-2005; This topic was not discussed in the 2006 report by G.J.A. AI.

2005-2015; Changes in corporate travel allowances are being measured within Mobiliteitspanel Nederland, a panel that follows a select sample focus group of Dutch citizens, but aren't directly mentioned within the main report (KiM, 2015).

2015-2019; This topic was not discussed in the 2019 KiM report.

2019-2020; Travel compensation isn't mentioned. However, it must be stated that this type of compensation seems to be in for an overhaul due to increased numbers of employees working from home (KiM, 2021) requiring some type of workplace compensation themselves in place of the past travel compensation.

4.3 Transport management policy (vervoersmanagement)

1985-1995; As of the mid 90's, the government has embarked on relatively new policy of stimulating companies to implement transport management, with the aim of decreasing commute traffic. Larger companies implement transport plans relatively more often than smaller companies. The majority of polled companies believe that they're partly responsible in solving national or regional traffic or transport problems, but don't appear to act on it through policy. 65% of respondent companies believe companies and government should cooperate, whereas only 12% actually implement transport management (MuConsult, 1998).

1995-2005; This topic was not discussed in the report by G.J.A. AI (2006).

2005-2015; This topic was not discussed in the KiM 2015 report.

2015-2019; This topic was not discussed in the KiM 20119 report..

2019-2020; While the influence of employers on the ability to work from home are clear, actual structural policy around future transport management plans isn't mentioned (KiM, 2021). Furthermore terms like 'Het Nieuwe Werken' aren't mentioned in this report, unlike earlier reports. It must however be stated that further exploration of government documents shows

5. Evaluation of future goals and consideration of attitude

Written at the end of the period 1985-1995, the director general Westerduin of the ministry of Verkeer en Waterstaat describes the current and projected future state of Dutch traffic issues based on the input of a wide range of government specialists within the field (Raadgevend Bureau F.M. Roschar, 1997). Remarking on the fact that it's of the utmost importance that policy development is based on proper rumination around prospected long term changes, rather than by the issues of the day, advice is given for future policy.

The report identifies that the most pressing traffic challenge at the time appears to be similar to the one of the current day, namely congestion, the cost of said congestion and the fact that the issue of that congestion isn't easily solved. The Dutch citizen is committed to the car, as it offers freedom, privacy and comfort, as well as serving as a status symbol. While PT is referred to as a possible solution to congestion, it's also identified as too slow, infrequent or unreliable to be a real alternative to the car. Limitless road construction is seen as impossible and costly, leaving only options for policy that limits car use itself. Propositions of roadpricing are already mentioned, but seen as unsupported. Outside of the competition between car and PT, other modalities aren't really mentioned.

Based on these challenges, 10 predictions are given for future traffic and policy developments until 2030, a date that we're slowly approaching a good 25 years later (Raadgevend Bureau F.M. Roschar, 1997). Two different 2030 point-of-view travel experience scenarios are drawn up as well. The most important parts of the predictions will be quickly summarized;

1. As transport becomes faster and people will live further apart, car use will explode, exacerbating congestion issues. The car will make itself impossible as mobility growth will decrease and mostly come through PT.

2. Congestion means car travel will continue to cost more time, lowering its reliability. Societal change will see the car becoming less of a status symbol. Furthermore, parked cars will clog the streets making travel more difficult, as recreational activities close to home will become impossible as parks and environments are sacrificed for car parks. Ergo, the car loses societal appreciation.

3. In need of alternatives to car ownership, politicians are encouraged by their constituents to tackle the car and its issues with policy. The writers expect a significant growth of resentments towards the car, envisioning a situation where owning and operating an automobile becomes so expensive that people will only own a car out of necessity. Bikes become an alternative in the city, car-on-demand services replace ownership, and the number of company lease cars decreases. One can wonder whether this prediction of anti-car sentiment, especially considering where the car has ended up in general at the present moment, was truly that reasonable or wistful thinking on the part of those opposed, rightfully or not, to further expansion of car use.

4. Car use, and mobility in general will start to increase in price, more closely matching its 'real' cost. In other words, travel will become far more expensive. Unprofitable trainlines will be scrapped

whereas new PT-chipcards (OV-chipkaart) and flexible pricing will inadvertently eventually increase travel cost. Car use will demand an increasing share of household money.

5. Technological advancement will improve the comfort of PT through expanded telecommunication facilities and the ability to plan travel post train-trip.

6. As PT gains a stronger position within the Randstad, through the introduction of new (unmanned) transport systems like people movers, the car is pushed out of the city, reigning in rural areas of the country.

7. New types of car will be developed. Small plastic 'urban' hybrid cars, using gas on highways and electricity within the city, will become the dominant car and eventually completely switch to be self-driving to facilitate comfort and the ability to work during commute. Interestingly, while electric and hybrid cars have become more popular in the modern day and self-driving concepts are being tested, those cars have certainly not decreased in size the way its predicted here.

8. Public transport and car use will start to resemble one another as 'call-a-car' concepts overtake car ownership and car leasing turns into a right to call a car for certain moment. On the other hand self-driving car concepts, coordinated by government infrastructure, will decrease the freedom of the traveller in a similar to PT. Interestingly, video-conferences are mentioned here for the first time in the review, serving as a replacement for a car ride when a, what we'd nowadays refer to as a, MAAS service is unable to offer a car, not a modality of alternative of its own.

9. As the car made spread living and working increasingly accessible, the role of PT significantly declined. This lead to spatial planning aiming to create urban cores that mix living, working and recreation to limit long distance movement and avoid congestion. It's questionable however to what extent this will have added to fixing problems around environment and congestion, while it's become clear that spatial planning will hardly fix the future issues.

10. Government and the ministry making laws from a higher position of power will start to fade more and more, as hierarchical policy implementation makes way for necessitated cooperation between companies, citizens and government. Transport policy becomes a joint venture.

Additional added variables and points of interest added to mobility review are considered below for the reports considering 1995-2005 and 2005-2015.

In the 1995-2005 report by G.J.A. AI (2006), an addition to these variables is added. There's a new focus on the more societal and qualitative aspect of traffic, as the societal costs and benefits of transport are examined. The report also starts examining factors mentioned within the 1997 prediction report that were deemed important, but are generally missing in favour of more easily measurable quantitative factors. This includes concepts such as (social) safety, livability (leefbaarheid) and most importantly for the research within this master thesis, the experience (beleving) of Dutch travellers.

It describes several important factors influencing the experienced costs and benefits of travel;
Safety; The main points made in the safety category is the fact that traffic safety has gotten increasingly better over the years, the number of traffic deaths decreasing by a lot, and that risk differs for different age groups.
Social safety; Perhaps security is a better word, as special identification of human threats is made. This identifies that in the case of PT, the factors of theft and violent threats become relevant, whereas car use suffers from possible theft or vandalism threats.
Livability; This factor mostly deals with the concepts of local environmental effects of transport. Noise disturbance is experienced by half the dutch populace in the case of road traffic and 30% for rail traffic, but how this, including pollution caused by traffic, influences traffic or opinions on transport isn't mentions.

Ecnomy; Simply put, economic variables such as employment opportunities or the societal costs and benefits of transport are discussed.

Experience of travellers; The variable that is perhaps most important and gives an insight into what specifics characteristics of travel modes travellers find most significant, how they impact their mode choice and what this means for their priorities for transport policy. This includes, what the report refers to as, the 13 most important aspects of commute modes. These factors are **Comfortability, Annoyance, Ease of use, tranquility, (traffic) delays, cost, punctuality, solitude/privacy, speed, enjoyablity, safety, independence and flexibility.** Based on these aspects preference is given to different travel modalities. Some of these variables seem to be related more to personal attitude towards a travel mode, rather than directly measurable characteristics of travel modalities. It will be interesting to see how they can be categorised using the framework of Van Wee et. al. (2019).

The 2005-2015 report by KiM (2015) saw two major additions to the way in which changes in mobility are measured, when analysing what changes in discussion concretely relate to commute travel. Firstly, the report saw the introduction of a selection of several variables that were identified and further investigated to explain the differences in travel mode use for commute within different areas. These area (environmentally) dependent variables influencing mode choice include demographic characteristics based on age, demographic characteristics based on household type, socio-economic characteristics, socio-cultural characteristics and urban spatial structure and planning. These variables don't exactly return in other reports and seem to only be used for this specific report, yet some of these variables are likely useful for categorisation in the framework of van Wee, et al (2019) in chapter 4.

Secondly, there is the mention of "Het nieuwe werken en telewerken" – the new way of working and teleworking – a term for the larger efforts of flexibilization and digitalisation that, according to other report has been used sporadically since the 80's. Here's the issue however, Het Nieuwe Werken (HNW) and its effects and changes, and in particular the concept of working from home, has not concretely been discussed before in other past reports. The report even mentions that government research into the topic of HNW is a bit scarce and that the results of a singular recent report on the effect of HNW might not offer significant results due to uncertainty about its results due to inadequate data. As such it's uncertain whether metrics on the lessening of congestion due to teleworking are correct. The data that is there has ascertained that teleworking and other online methods of work have resulted in a decrease of traveltime loss of 5% over the period 2004-2014. Furthermore, it determines that the percentage of employees partially working from home rose from 1 percent in 2000 to 20% in 2014. It's uncertain whether these percentages are correct as other reports that will be discussed in chapter 3 disagree on the numbers.

Appendix G – Statements comprising the Q-set

This appendix is split between the statements comprising the Q-set and the questions within the post Q-sort questionnaire. Within the table below, the different statements, their source (be it literary or survey based) and their original version are displayed, along with their assigned number. The statements are in Dutch due to the fact that the proposed P-set, the respondents to the survey, consists of Dutch citizens.

	Category topic; **Car use**	**Sources;**
#1	De auto zou veel minder gebruikt moeten worden dan voor de pandemie, want er zijn goede vervoersalternatieven. ***The car should be used far less than before the pandemic, as there are suitable commute alternatives.***	
Original	Naar mijn mening moet de auto veel minder gebruikt worden dan voorheen. Thuiswerken zou normaler moeten worden. Ook dient het OV meer gebruikt te worden.	Survey
#2	De pandemie toont aan dat autogebruik zoveel als mogelijk kan worden teruggedrongen door bijv. rekeningrijden. ***The pandemic shows that car use could be curtailed as much as possible through, for example, road pricing.***	

Original	Ik ging altijd al met de trein. Mijn mening over Autogebruik is eigenlijk niet veranderd en kan naar mening zo veel als mogelijk teruggedrongen worden en een goede manier is volgen mij rekening rijden.	Survey
#3	Over het comfort van de auto ben ik nu positiever, zelfs wanneer ik hem soms minder gebruik. ***I'm now more positive on the comfort of the car, even when I make less use of it***	
Original	Over het comfort van de auto ben ik positiever, al gebruik ik hem minder. Ik reis sowieso veel minder voor werk en studie.	Survey
#4	Met de auto naar het werk reizen ben ik gaan missen. ***I've started to miss travelling to work by car.***	
Original	Respondenten die met de auto naar werk reizen missen forenzen het minst: 51%.	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?*, p.5
#5	Mijn mening over autogebruik is niet veranderd door de pandemie. ***My opinion on car usage hasn't change as a result of the pandemic.***	
Original	Mijn mening over autogebruik is niet veranderd door de pandemie.	Survey
#6	De stad is een stuk vriendelijker geworden voor de voetgangers en fietsers door de afname van auto's. ***The city has become a lot more pedestrian and cyclist friendly due to the decrease of car usage.***	
Original	Relatief weinig verschil in het zelf gebruiken van een auto, echter zijn locaties waar ook voetgangers en fietsers zijn een stuk vriendelijker geworden voor de voetgangers en fietsers door de afname van auto's.	Survey
#7	Door handiger worden in thuiswerken en vergaderlocaties, hoeft niet iedereen meer voor iedere vergadering in een auto te stappen. ***Not everyone has to use their car for every meeting, by becoming more flexible in working from home and meeting locations***	
Original	Doordat we handiger zijn geworden in het thuiswerken en het vergaderen / samenwerken op afstand, hoeft er niet meer voor iedere vergadering iedereen in een auto te stappen naar een vergadering. selectief omgaan met vergaderlocaties kan tegenwoordig leiden tot minder autogebruik.	Survey
	Category topic; Car ownership	Sources
#8	Dat iedereen een eigen auto heeft, is niet meer van deze tijd. Straten staan vol met stilstaande auto's. Er is amper plek voor kinderen om te spelen. ***The notion that everyone should own their own car is outdated. Streets are filled with parked cars. There's hardly any room for children to play.***	
Original	Dat iedereen een eigen auto heeft is niet meer van deze tijd. Straten staan vol met auto's die meestal stilstaan. Er is amper plek voor kinderen om te spelen.	Survey
#9	Ik ben in het bezit van een auto en dat zal ook niet anders worden. ***I'm in the possession of a car and this will not change.***	
Original	ik ben in het bezit van een auto en dat zal ook niet anders worden. wonend op vrij grote afstand van openbaar vervoer en winkels (> 2km) is het bezit van een auto wenselijk.	Survey
#10	Wonend op vrij grote afstand van OV en winkels blijft het bezit van een auto wenselijk. ***Living at a long distance away from public transport and shops, private car ownership remains desirable.***	
	ik ben in het bezit van een auto en dat zal ook niet anders worden. wonend op vrij grote afstand van openbaar vervoer en winkels (> 2km) is het bezit van een auto wenselijk.	Survey
#11	Als je in de buurt van een treinstation of ander OV woont, is er in mijn opinie bijna geen reden om een eigen auto te bezitten. ***When living in the vicinity of a train station or other public transport, there's in my opinion nary any reason to own a personal car.***	
Original	Als je in de buurt van een treinstation woont en niet regelmatig over de grens hoeft, is er bijna geen reden om een eigen auto te bezitten	Survey
#12	Ik vind nu dat een auto bezitten nog noodzakelijk is, maar dat kan de komende decennia veranderen. ***I now believe that owning a personal car remains necessary, but this could change in the coming decades.***	
Original	Auto bezitten is nog noodzakelijk maar dat kan de komende decennia veranderen.	Survey
#13	Ik waardeer de vrijheid en zekerheid die een privé auto biedt nu meer. Anders dan het OV, kan auto toegang niet zomaar worden afgesloten of ingeperkt. ***I appreciate the freedom and security that comes with a private car ownership now more. Unlike public transport, access can't be as easily restricted.***	
Original	Ik waardeer de vrijheid en zekerheid die het bezit van een privé auto biedt nu meer. In tegenstelling tot het OV, kan de auto niet zomaar worden afgesloten of ingeperkt.	Survey
#14	Mijn mening over autobezit is niet veranderd door de pandemie. ***My opinion on car ownership has not changed as a result of the pandemic.***	
Original	Niet veranderd.	Survey
	Category topic; Public transport use	Sources
#15	Voor de pandemie vond ik reizen met het openbaar vervoer al onhygiënisch, dat beeld is alleen maar sterker geworden. ***Before the pandemic I already found travel by public transport to be unhygienic, this belief has only grown stronger.***	
Original	Voor de pandemie vond ik reizen met het openbaar vervoer al naar en onhygiënisch, dat beeld is alleen maar sterker geworden.	Survey

#16	Mijn grootste irritatie in het OV, dat men zich niet aan regels houdt (stiltecoupe, geen mondkapjes), is toegenomen met meer mensen die regels omzeilen. ***My biggest irritation in public transport, people not following rules (Silence compartment, no face masking), has grown bigger with more people not following rules.***	
Original	StudentOV dus kosten zijn irrelevant, het comfort van het OV kan beter voor mensen maar er komt binnenkort een nieuwe intercity trein. Mijn grootste irritatie in het OV is de groep mensen die zich niet aan de regels houd (stiltecoupe, geen mondkapjes). Deze irritaties zijn naar mijn mening toegenomen, met meer mensen die de regels omzeilen waardoor medewerkers harder moeten optreden."	Survey
#17	Het is nu aanmerkelijk rustiger in het OV, dit maakt OV gebruik fijner. ***It's now noticeably quieter on public transport, this improves the public transport use experience.***	
Original	Niet, vond het altijd al fijn de laatste jaren. Weinig of geen verstoringen of uitval op mijn traject vind het fijn. Is nu aanmerkelijk rustiger. Vind alleen mondkapjes vervelend	Survey
#18	De verplichting van mondkapjes in het OV is vervelend geworden. ***Mandated facemasking within public transport has become an annoyance.***	
Original	Niet, vond het altijd al fijn de laatste jaren. Weinig of geen verstoringen of uitval op mijn traject vind het fijn. Is nu aanmerkelijk rustiger. Vind alleen mondkapjes vervelend	Survey
#19	De onzekerheid van het OV tijdens het begin van de lockdown heeft OV-gebruik (nog) minder aantrekkelijk gemaakt. ***Uncertainty around public transport accessibility during the start of lockdown has made public transport use (even) less attractive.***	
Original	Ik maakte al weinig gebruik van het OV vanwege de kosten. De onzekerheid van het OV tijdens begin Lock down maakt het nog minder aantrekkelijk.	Survey
#20	Ik ben met het OV naar het werk reizen gaan missen. ***I have started to miss commuting by public transport.***	
Original	Ik ben met het OV naar het werk reizen gaan missen.	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?*
	Category topic; Bicycle use and walking	Source;
#21	Ik legde voorheen een gedeelte van het woon-werk verkeer op de fiets af. Ik beweeg nu minder, dat vind ik jammer. ***Before the pandemic I travelled part of my daily commute by bike. I dislike this, as I now get less exercise through commute.***	
Original	Ik legde een gedeelte van het woon-werk verkeer op de fiets af. Minder training…	Survey
#22	Mijn mening over fietsgebruik is niet veranderd, de afstand van het werkverkeer is net te lang om te fietsen. ***My opinion on bike use hasn't changed, as my daily commuting distance is simply to long for cycling.***	
Original	Niet veranderd, afstand woon werkverkeer is net te lang om te fietsen	Survey
#23	Fietsgebruik was voor mij afwisseling van autogebruik voor werkverkeer. Ik waardeer door minder reizen de fiets als afwisseling minder. ***To me, cycling to work was a method of gaining some variety to commuting by car. I now appreciate cycling as variety less due to less travel in general.***	
Original	Voor kortere ritten die ik vroeger fietste, ben ik meer de auto gaan gebruiken. Fietsgebruik was voor mij meestal afwisseling van autogebruik. Ik ben door minder reizen in het algemeen de fiets als reguliere afwisseling minder gaan waarderen.	Survey
#24	Ik ben lopend of op de fiets naar het werk reizen gaan missen. ***I've started to miss traveling to work through walking or cycling.***	
Original	Forenzen die met een fiets naar het werk gaan missen deze reizen het meest, 92% van hen mist in ieder geval enkele aspecten van de reis.	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?,p.5*
	Category topic; **General impact on travel behaviour by working from home and COVID policy**	**Source;**
#25	Ik reis door thuiswerken aanzienlijk minder uren per dag. Ik ervaar dit als prettig. ***I travel significantly less hours per day due to working from home. I experience this as more pleasant.***	
Original	Ik reis aanzienlijk minder uren per dag. Ik ervaar dit als prettig. Ik heb meer tijd voor bijv. hardlopen of de kinderen uit school halen. Ik gebruikte de auto al weinig, maar nu nooit meer als vervoer naar het werk.	Survey
#26	Ik heb thuiswerken wel overwogen, maar ik vind het niet realistisch in mijn positie. ***I have considered working from home, but have come to find it as unrealistic in my position.***	
Original	Wel thuiswerken overwogen maar niet realistisch in mijn positie.	Survey
#27	Het thuiswerken/studeren heeft in mijn tak van werk een gigantische impact. ***Working and/or studying from home has a major impact within my line of work.***	
Original	"Het thuiswerken/studeren heeft in mijn tak (educatie) een gigantische impact. Online lesgeven is vrijwel onmogelijk en de leerlingen kunnen zich minder concentreren.	Survey

	Door de popularisatie van thuiswerken was het echter op de autoweg een stuk rustiger en was de voorspelbaarheid significant beter"	
#28	Ik ben positiever over thuiswerken in plaats van reizen, omdat tijdsverlies en vermoeidheid van reizen minder impact heeft op de rest van mijn dag. ***I've become more positive on working from home instead of commuting, as time loss and fatigue due to travel have less impact on the rest of my day.***	
Original	Ik ben positiever over thuiswerken in plaats van reizen, omdat tijdsverlies en vermoeidheid van reizen minder impact heeft op de rest van mijn dag.	Survey
#29	Wanneer de overheids- en thuiswerk maatregelen worden opgeheven, heb ik de intentie heeft om de oude werk en reisgewoontes weer op te pakken. ***Once government and working-from-home measures are repealed, I have the intention of returning to my old work and commute habits.***	
Original	Wanneer de maatregelen worden opgeheven, een groot deel van de respondenten de intentie heeft om de oude werkgewoontes weer op te pakken.	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?, p.7*
#30	Door de popularisering in thuiswerken is het op de autoweg een stuk rustiger. Dit maakte voorspelbaarheid in de werkreis beter. ***The popularisation of working from home has made roads and motorways more quiet. This made the predictability of commute better.***	
Original	Het thuiswerken/studeren heeft in mijn tak (educatie) een gigantische impact. Online lesgeven is vrijwel onmogelijk en de leerlingen kunnen zich minder concentreren. Door de popularisatie van thuiswerken was het echter op de autoweg een stuk rustiger en was de voorspelbaarheid significant beter	Survey
#31	De coronamaatregelen ontregelen mijn woon-en werksituatie, waardoor ik het gevoel heb gekregen minder grip op mijn leven te hebben. ***COVID measures disrupt my personal living and work situation, lessening the control of my life.***	
Original	De coronamaatregelen ontregelen mijn woon-en werksituatie, waardoor ik het gevoel heb gekregen minder grip op mijn leven te hebben.	**Literature** *Thuis of terug naar kantoor Plus- en minpunten van thuiswerken voor het welbevinden van werknemers, p.40*
#32	Ik heb het gevoel dat mijn werkgever (en die van mijn partner) de baas wordt in mijn eigen huis door thuiswerken. ***I have gotten the feeling that my employer (and the one of my partner) has started to become the boss in my own home through working from home.***	
Original	Ik heb het gevoel dat mijn werkgever (en die van mijn partner) de baas wordt in mijn eigen huis.	**Literature** *Thuis of terug naar kantoor Plus- en minpunten van thuiswerken voor het welbevinden van werknemers,p.38*
	Category topic; General impressions on working from home itself	Source;
#33	De eerste maanden van thuiswerken waren vervelend, nu ben ik eraan gewend. ***The first months of working from home were inconvenient, however I've gotten used to it now.***	
Original	De eerste 3 maanden waren vervelend, nu ben ik eraan gewend.	Survey
#34	Thuiswerken is ideaal. Soms mis je collega's wel maar het is enorm efficiënt en scheelt veel tijd. ***Working from home is ideal. Sometimes you miss your colleagues, but it's very efficient and saves a lot of time.***	
Original	Ideaal. Soms mis je collega's wel maar het is enorm efficiënt en scheelt veel tijd.	Survey
#35	Ik vind thuiswerken nu tot op zekere hoogte fijn. Thuiswerken afwisselen met af en toe naar kantoor is in mijn ogen een ideale situatie. ***I find working from home pleasant to a certain level. Alternating between working from home and occasionally working on location is ideal in my eyes.***	
Original	Thuiswerken is tot op zekere hoogte zeer fijn. afwisselen met af en toe naar kantoor is in mijn ogen een ideale situatie. voor mij zou dat zijn 3 dagen thuis en 1 dag op kantoor per week.	Survey
#36	Ik heb thuis geen fijne werkplek. ***I do not have a pleasant at home office/working space.***	
Original	Prima alternatief. Alleen erg stil en leeg soms. Mis ook een echt goede werkplek	Survey
#37	In het begin had ik geen probleem met thuiswerken, maar hoe langer ik thuis zat, werd het op een gegeven moment wel een invasie op mijn privacy. ***I did not experience issues at the start of working from home, but the longer I was at home, the more it started to feel as an invasion of my privacy.***	

Original	In het begin had ik er geen probleem mee, maar hoe langer ik thuis zat en hoe meer ik thuis zat, werd het op een gegeven moment wel een invasie op mijn privacy. […] Ik liep erlangs en ik zag het werk liggen.	**Literature** THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT Op zoek naar trends, trendbreuken en kansen als gevolg van corona, p.28
#38	Wanneer thuiswerken verplicht wordt, zakt productiviteit, want werknemers zullen hier misbruik van maken. ***When working from home becomes mandatory, productivity will decrease, as employees will abuse it.***	
Original	Thuiswerken kan voor bepaalde groepen, wanneer het geforceerd wordt zal de productiviteit zakken. Maar, mocht iedereen de keuze krijgen om in de ochtend in bed de blijven liggen een half uur langer en een half uur eerder klaar zijn door 0 reistijd. Kunnen we vrij zeker voorspellen dat hier ook misbruik van gemaakt gaat worden.	Survey
	Category topic; **Employee cooperation related variables**	**Source;**
#39	Sommige zaken gaan door thuiswerken nu makkelijker en beter, samenwerken aan een document bijvoorbeeld. ***Working from home has made some things at work easier and more well-structured, for example cooperating on a document.***	
Original	Sommige zaken gaan makkelijker en beter; samenwerken aan een document bijvoorbeeld. In een groep discussiëren en een gezamenlijke mening vormen gaan minder goed.	Survey
#40	Door thuiswerken gaat in een groep discussiëren en een gezamenlijke mening vormen nu minder goed. ***Due to working from home discussing in a group and the forming of collective opinions with colleagues has become more difficult.***	
Original	Sommige zaken gaan makkelijker en beter; samenwerken aan een document bijvoorbeeld. In een groep discussiëren en een gezamenlijke mening vormen gaan minder goed.	Survey
#41	(Vrijwillig) thuiswerken heeft werken productiever gemaakt, vooral door minder collega's om mij heen. ***(Voluntarily) working from home has made working more productive, especially due to less distraction from colleagues around me.***	
Original	Thuiswerken kan voor bepaalde groepen, wanneer het geforceerd wordt zal de productiviteit zakken. Maar, mocht iedereen de keuze krijgen om in de ochtend in bed de blijven liggen een half uur langer en een half uur eerder klaar zijn door 0 reistijd. Kunnen we vrij zeker voorspellen dat hier ook misbruik van gemaakt gaat worden. & Thuiswerken heeft niet veel invloed op de samenwerking met collega's, wel merk ik dat ik veel productiever ben zonder collega's om mij heen	Survey Survey
#42	Door thuiswerken is contact met collega's verminderd en het is lastig om ze snel te bereiken wanneer nodig. Op kantoor heb je snel 1-op-1 overleg. ***Due to working from home contact with colleagues has decreased and it's difficult to swiftly reach them when necessary. In office you can quickly engage in 1-on-1 meetings.***	
Original	Het contact met collega's is sterk verminderd en het is vaak lastig om snel te bereiken als je ze nodig heb, dit omdat ze vaak in online overleggen zitten. Als ze op kantoor zouden zitten heb je snel 1op1 overleg.	Survey
#43	Over online thuis samenwerken ben ik een stuk negatiever geworden, omdat iedereen al snel afhaakt tijdens langere meetings. ***I've become far more negative on online cooperation by working from home, as everyone quickly drops out during longer meeting.***	
Original	Online samenwerken ben ik een stuk negatiever over geworden. Het gaat een stuk minder goed omdat iedereen al snel afhaakt tijdens langere meetings.	Survey
#44	Door thuiswerken mis je nu natuurlijk wel het sociale aspect, want als er overleg is, dan is dat puur inhoudelijk. ***Due working from you now start to miss the social aspect, because when there's meetings they're purely formal business related.***	
Original	Je mist natuurlijk wel het sociale aspect, want als er overleg is, dan is dat puur inhoudelijk.	**Literature** *THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT Op zoek naar trends, trendbreuken en kansen als gevolg van corona, p.27*
	Category topic; Employer cooperation related variables	Source;
#45	Ik vind dat thuiswerken nu meer normaal is geworden en geaccepteerd door de werkgever, voor de pandemie stond hij daar afwijzend tegenover. ***I now find that working from home has become more normal and accepted by the employer, before the pandemic they were dismissive if not rejecting of it.***	
Original	Thuiswerken is nu veel meer normaal geworden en geaccepteerd door de werkgever. Maar ik weet wel dat ze voor corona best wel afwijzend stonden tegen thuiswerken. Een paar mensen (…) hadden een thuiswerkaccount, maar nu denken ze daar wel wat anders over, gelukkig.	Survey **Literature** *THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT Op zoek naar trends,*

		trendbreuken en kansen als gevolg van corona, p.30
#46	De werkgever ziet nu wel de voordelen van thuiswerken, want hij hoeft minder reiskosten te betalen. ***The employer now sees the benefits of working from home, as he has to spend less on employee travel expenses.***	
Original	"Ja, hij (de werkgever) ziet wel de voordelen want hij hoef minder reiskosten te betalen".	**Literature** *THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT Op zoek naar trends, trendbreuken en kansen als gevolg van corona, p.30*
#47	De werkgever vind dat werknemers nodig zijn op kantoor, omdat hij met systemen zoals digitale werkomgevingen niet handig is. ***The employer (still) believes that employees are necessary at the office, because he's not proficient working with and providing systems like digital work spaces.***	
Original	Mijn baas die zegt: ik heb je nodig. Je moet naar kantoor. Omdat hij gewoon niet handig is met bepaalde dingen. Met systemen en computers en…	**Literature** *THUISWERKEN EN DE GEVOLGEN VOOR WONEN, WERKEN EN MOBILITEIT Op zoek naar trends, trendbreuken en kansen als gevolg van corona, p.30*
#48	Massaal thuiswerken door corona toont nu aan, dat overheid bedrijven verder kan aansporen om thuiswerken te stimuleren, met oog op uitstoot verlaging. ***Mass working from home due to COVID now shows that government could further encourage business to stimulate working from home, for the purpose of emissions reduction.***	
Original	De nieuwe regering gaat thuiswerken stimuleren om het milieu te sparen, zo staat te lezen in het regeerakkoord. Nu een deel van Nederland onder druk van de pandemie al massaal thuis werkt, heeft dit kans van slagen. …. Dat is welkom, aangezien de uitstoot fors omlaag moet om te voorkomen dat de aarde deze eeuw met meer dan 1,5 graad opwarmt, met alle gevolgen van dien. Het loont zodoende de moeite voor werkgevers om thuiswerken te stimuleren.	**Literature** *Stimuleren thuiswerken helpt klimaat, maar kan negatief doorwerken op welzijn werknemers, hrpraktijk.nl*

Table G.1 Questions Post Q-sort

Based on insight gained during concourse and Q-set development, a separate category is created that focuses specifically on commute characteristics. This allows the Q-set to decouple these characteristics from specific modality. The assumption, based on research by Rubin et al. (2021), is that the evaluation of these commute characteristics by respondents will show connection to certain modalities through evaluation the relation between the developed factors (perspective clusters) with the questions regarding modality use within the post Q-sort questionnaire. A perspective that highly values experiencing the environment during the commute trip, will likely be a perspective cluster that more strongly features bike users than other clusters. Decoupling these characteristics also offers more room within the Q-set to measure for other statements.

	Category topic; **Commute characteristics**	**Sources;**
#49	Het even alleen zijn en bijvoorbeeld naar muziek luisteren tijdens de werkreis ben ik gaan missen. ***I've started to miss the opportunity of alone time, for example through listening to music, during commute.***	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?,* p.5-6
Original	Aspecten die auto-forenzen misten waren naar muziek luisteren en het gevoel even alleen te zijn.	
#50	Het genieten van de omgeving tijdens de werkreis ben ik gaan missen. ***I've started to miss the enjoyment of the environment during commute.***	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?,* p.5-6
Original	Voor fietsers was dat (Missing parts of the commute trip) vooral de reis zelf en het genieten van de omgeving.	
Optional	At some point, a consideration was made to replace statement 4, 20 and 24 with a more generic statement regarding the missing of the main commute modality. This would have opened up more room in the Q-set, but was conclusively decided against as expected perspectives around commute modalities might become muddled into more generic ones, making interpretation impossible. Ik ben mijn meest gebruikte vervoerswijze van voor de pandemie gaan missen. ***I have started to miss my preferred commute modality from before the pandemic.***	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?*, p.5

	This question would have served as a possible replacement for questions 4, 20 & 23, but using data from the post Q-sort questionnaire, which comes from outside of the Q-sort, might give a distorted view of factors when solely observing z-scores and factor rankings.	
Original	Respondenten die met de auto naar werk reizen missen forenzen het minst: 51%.	

Within the tables below, the different questions regarding variables important to identifying P-set characteristics are displayed, including their source (be it literary or survey based. The statements are originally in Dutch due to the fact that the proposed P-set, the respondents to the survey, consists of Dutch citizens. Thought behind picking the questions are described in the method section. To give a slight bit more context on specifics not mentioned before, statement 6 was added because the researcher hypothesises that a different level of responsibility over the organisation at which a person is employed, might play a role in the way WFH introduction is perceived, as function does to.

	Question and choice options	**Variable;**	**Source;**
#1	Wat is uw leeftijd? ***What is your age?***	Age	(Rubin, et al, 2021).;(Buitelaar, et al.,2021)
	Multiple choice: 18-25;25-34;35-44;45-55;55+		
#2	Wat is uw geslacht? ***What is your sex?***	Sex	(Rubin, et al, 2021).; (Hamersma, et al., 2020, p.50)
	Multiple choice: Man;Vrouw;Vermeld ik liever niet		
#3	Wat is uw hoogst genoten opleiding? ***What is your highest level of education?***	Education	(Rubin, et al, 2021).; (Hamersma, et al., 2021 p.122) (Hamersma, et al., 2020, p.51)
	Multiple choice: Lager onderwijs;Middelbaar onderwijs;MBO;HBO;WO Bachelor;WO Master		
#4	In welke bedrijfssector bent u werkzaam? ***In what job sector are you employed?***	Job sector	(Hamersma, et al., 2021 p.20)
	Multiple choice: Full-time student;Financiele dienstverlening;Informatie en communicatie dienstverlening;Openbaar bestuur;Overige zakelijke dienstverlening;Ingenieurs, architecten en technisch ontwerp, advies, keuring en controle;Kunst, cultuur en sport;Speur- en ontwikkelingswerk;Arbeidsbemiddeling, uitzenbureaus en personeelsbeheer;Waterbedrijven en afvalbeheer;Vervaardiging van machines;Onderwijs;Groothandel;Bouwnijverheid;Gezondheid, verpleging, maatschappelijke dienstverlening en wellness;Vervaardiging van niet metaal producten;Vervaardiging van metalen product;Vervoer en opslag;Vervaardiging van meudelsgoederen;Vervaardiging van voedingsmiddelen, dranken en tabak;Detailhandel;Beveiliging en Facility management;Horeca		
#5	Welke functie vervult u binnen uw bedrijf? ***What function do you fulfil within your company?***	Job function	(Hamersma, et al., 2020 p.20)
	Multiple choice: Geen, ik ben full time student; Kantoor; Buitendienst; Productie; Management; Zorgfunctie; Onderwijs; Anders		
#6	Welke positie vervult u binnen uw bedrijf? ***What position do you fulfil within your company?***	Job position	**Researcher input**
	Multiple choice: Geen, ik ben full time student; Werknemer; Werkgever; Zelfstandige-Eenmansbedrijf		
#7.A	Hoeveel dagen per week reisde u in een gemiddelde werkweek met de auto naar uw werk of studie VOOR de pandemie en (geforceerd) thuiswerken? ***How many days per week did you commute by car within an average workweek BEFORE the pandemic and (forced) working from home?***	Prepandemic Commute Car	(Hamersma, et al., 2020, p.51), Survey
	Multiple choice: 0;1;2;3;4;5;6;7		
#7.B	Hoeveel dagen per week reisde u in een gemiddelde werkweek met het OV naar uw werk of studie VOOR de pandemie en (geforceerd) thuiswerken? ***How many days per week did you commute by public transport within an average workweek BEFORE the pandemic and (forced) working from home?***	Prepandemic Commute PT	(Hamersma, et al., 2020, p.51), Survey
	Multiple choice: 0;1;2;3;4;5;6;7		
#7.C	Hoeveel dagen per week reisde u in een gemiddelde werkweek fietsend of lopend naar uw werk of studie VOOR de pandemie en (geforceerd) thuiswerken? ***How many days per week did you commute by walking and cycling within an average workweek BEFORE the pandemic and (forced) working from home?***	Prepandemic Commute WalkCycling	(Hamersma, et al., 2020, p.51), Survey

	Multiple choice: 0;1;2;3;4;5;6;7		
#7.D	Hoeveel dagen per week werkte of studeerde u in een gemiddelde werkweek VOOR de pandemie (gedeeltelijk) thuis? ***How many days per week did you work from home within an average workweek BEFORE the pandemic and (forced) working from home?***	Prepandemic Commute WFH	(Hamersma, et al., 2020, p.51), (Hamersma, et al., 2020 p.34), Survey
	Multiple choice: 0;1;2;3;4;5;6;7		
#8.A	Hoeveel dagen per week reist u in een gemiddelde werkweek met de auto naar uw werk of studie NA de pandemie en (geforceerd) thuiswerken? ***How many days per week do you commute by car within an average workweek AFTER the pandemic and (forced) working from home?***	Postpandemic Commute Car	(Hamersma, et al., 2020, p.51), Survey
	Multiple choice: 0;1;2;3;4;5;6;7		
#8.B	Hoeveel dagen per week reist u in een gemiddelde werkweek met het OV naar uw werk of studie NA de pandemie en (geforceerd) thuiswerken? ***How many days per week do you commute by public transport within an average workweek AFTER the pandemic and (forced) working from home?***	Postpandemic Commute PT	(Hamersma, et al., 2020, p.51), Survey
	Multiple choice: 0;1;2;3;4;5;6;7		
#8.C	Hoeveel dagen per week reist u in een gemiddelde werkweek fietsend of lopend naar uw werk of studie NA de pandemie en (geforceerd) thuiswerken? ***How many days per week do you commute walking or cycling within an average workweek AFTER the pandemic and (forced) working from home?***	Postpandemic Commute WalkCycling	(Hamersma, et al., 2020, p.51), Survey
	Multiple choice: 0;1;2;3;4;5;6;7		
#8.D	Hoeveel dagen per week werkt of studeert u in een gemiddelde werkweek NA de pandemie (gedeeltelijk) thuis? ***How many days per week do you work from home within an average workweek AFTER the pandemic and (forced) working from home?***	Postpandemic Commute WFH	(Hamersma, et al., 2020, p.51), (Hamersma, et al., 2020 p.34), Survey
	Multiple choice: 0;1;2;3;4;5;6;7		
#9	Bezit u een auto? ***Are you in possession of a car?***	Car ownership	**Researcher input**
	Multiple choice: Ja.;Nee;Niet meer;		
#10	Bent u van plan na de COVID-19 pandemie terug te keren naar uw oude reispatroon? ***Are you planning to return to your old commute pattern after the pandemic?***	Commute-post	**Literature** *Wat kan de COVID-19 pandemie ons leren over hoe we thuiswerken en forenzen ervaren?*, p.7
	Multiple choice: Ja, volledig;Nee;Gedeeltelijk		

Table G.2 Questions Post Q-sort

		Choice options
#1	Vond u het makkelijk om op basis van uw mening opinie-stellingen te rangschikken? ***Were you able to easily rank statements based on your opinion?***	**Multiple choice:** Ja, ik vond het makkelijk.; ***Yes, I found this easy.;*** Nee, ik ervoer hier problemen mee.; ***No, I experienced difficulties with this.;*** Neutraal/Geen mening.; ***Neutral/No opinion.;***
#2	Heeft u nog hier nog verdere opmerkingen over? ***Do you have any further comments on this topic?***	***Open ended***
#3	In dit onderzoek is specifiek gekeken naar dynamiek in attitude, ofwel stellingen die doorgaans een verandering in mening (als gevolg van de pandemie) omvatten, in plaats van een statische mening op zich. ***This study specifically looks at dynamism in attitude, i.e. statements that usually feature a change in your opinion as a result of the pandemic, instead of a current static opinion.*** Vond u het makkelijk om stellingen te rangschikken als gevolg van de verandering in uw mening? ***Were you able to easily rank statements based on change in your opinion?***	**Multiple choice:** Ja, ik vond het makkelijk.; ***Yes, I found this easy.;*** Nee, ik ervoer hier problemen mee.; ***No, I experienced difficulties with this.;*** Neutraal/Geen mening.; ***Neutral/No opinion.;***
#4	Heeft u nog hier nog verdere opmerkingen over? ***Do you have any further comments on this topic?***	***Open ended***
#5	Heeft u in het algemeen nog opmerkingen over de vragenlijst die u heeft ingevuld? ***Do you have other general comments or feedback on this survey that you'd like to share?***	***Open ended***

Table G.3 Questionnaire evaluation Post Q-sort

Appendix H – Work breakdown structure

The initial work breakdown structure is displayed below within a Gantt-chart.

	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	Thesis (25 wks + 3 wks downtime)	28 wks	Thu 25-11-21	Wed 8-6-22		
2	Kick-off preparation	4 wks	Thu 25-11-21	Wed 22-12-2		
3	Fine tuning research proposal	2 wks	Thu 25-11-21	Wed 8-12-21		
4	Preparing kick off meeting	1 wk	Thu 9-12-21	Wed 15-12-2	3	
5	Kick off meeting	1 day	Thu 16-12-21	Thu 16-12-21	4	
6	Implementing feedback	6 days	Fri 17-12-21	Fri 24-12-21	5	
7	Write introduction - Chapter 1	6 days	Fri 17-12-21	Fri 24-12-21	5	
8	Christmas holiday (no work on project)	2 wks	Mon 27-12-2	Fri 7-1-22		
9	Chapter 2 - SQ 1 (Including 2 weeks of Christmas holiday down time)	5 wks	Thu 23-12-21	Wed 26-1-22	2	
10	Literature review	4 wks	Thu 23-12-21	Wed 19-1-22		
11	Categorizing results into 3 sections	2 wks	Thu 6-1-22	Wed 19-1-22	10	
12	Write chapter 2	2 wks	Thu 13-1-22	Wed 26-1-22	10	
13	Chapter 3 - SQ 2 (Including 2 weeks of Christmas holiday down time)	5 wks	Thu 23-12-21	Wed 26-1-22	2	
14	Expand upon framework Van Wee	3 wks	Thu 23-12-21	Wed 12-1-22		
15	Literature review + desk study (daily concours)	1 wk	Thu 13-1-22	Wed 19-1-22	14	
16	Categorize factors impacting behaviour	1 wk	Thu 20-1-22	Wed 26-1-22	15	
17	Spring holiday (no work on project)	1 wk	Mon 31-1-22	Fri 4-2-22		
18	Chapter 4 - SQ 3 - Method (Including 1 week of spring break down time)	4 wks	Thu 27-1-22	Wed 23-2-22	13	
19	Describe (dynamic) Q-methodology	2 wks	Thu 27-1-22	Wed 9-2-22		
20	Draw up q-method fitted questionnaire	3 wks	Thu 27-1-22	Wed 16-2-22	16	
21	Draft questions on respondent experience	1 wk	Thu 10-2-22	Wed 16-2-22	19	
22	Test out questionnaire (interview & desk study)	1 day	Thu 17-2-22	Thu 17-2-22	20	
23	Finalize questionnaire	4 days	Fri 18-2-22	Wed 23-2-22	22	
24	Chapter 5 - SQ 4	6 wks	Thu 24-2-22	Wed 6-4-22	18	
25	Sending out and spreading survey	4 wks	Thu 24-2-22	Wed 23-3-22		
26	Data gathering and cleaning	1 wk	Thu 24-3-22	Wed 30-3-22	25	
27	Preliminary factor clustering	1 wk	Thu 31-3-22	Wed 6-4-22	26	
28	Chapter 6 - SQ 5	4 wks	Thu 7-4-22	Wed 4-5-22	24	
29	Relate respondent input on dynamism to literature	1 wk	Thu 7-4-22	Wed 13-4-22		
30	Discussion with supervisor regarding result validity	1 wk	Thu 14-4-22	Wed 20-4-22	29	
31	Write chapter 6 & write appendices	3 wks	Thu 21-4-22	Wed 11-5-22	29	
32	Chapter 7 - SQ 6	4 wks	Thu 7-4-22	Wed 4-5-22	24	
33	Describe perspective clusters & compare to policy	1 wk	Thu 7-4-22	Wed 13-4-22		
34	Discussion with supervisor regarding empirical result	1 wk	Thu 14-4-22	Wed 20-4-22	33	
35	Write chapter 6 & write appendices	3 wks	Thu 14-4-22	Wed 4-5-22	33	
36	Green light meeting 1	1 wk	Thu 5-5-22	Wed 11-5-22	32	
37	Improve master thesis report	2 wks	Thu 12-5-22	Wed 25-5-22	36	
38	Prepare master thesis presentation	2 wks	Thu 19-5-22	Wed 1-6-22	37	
39	Defense presentation	1 wk	Thu 2-6-22	Wed 8-6-22	38	

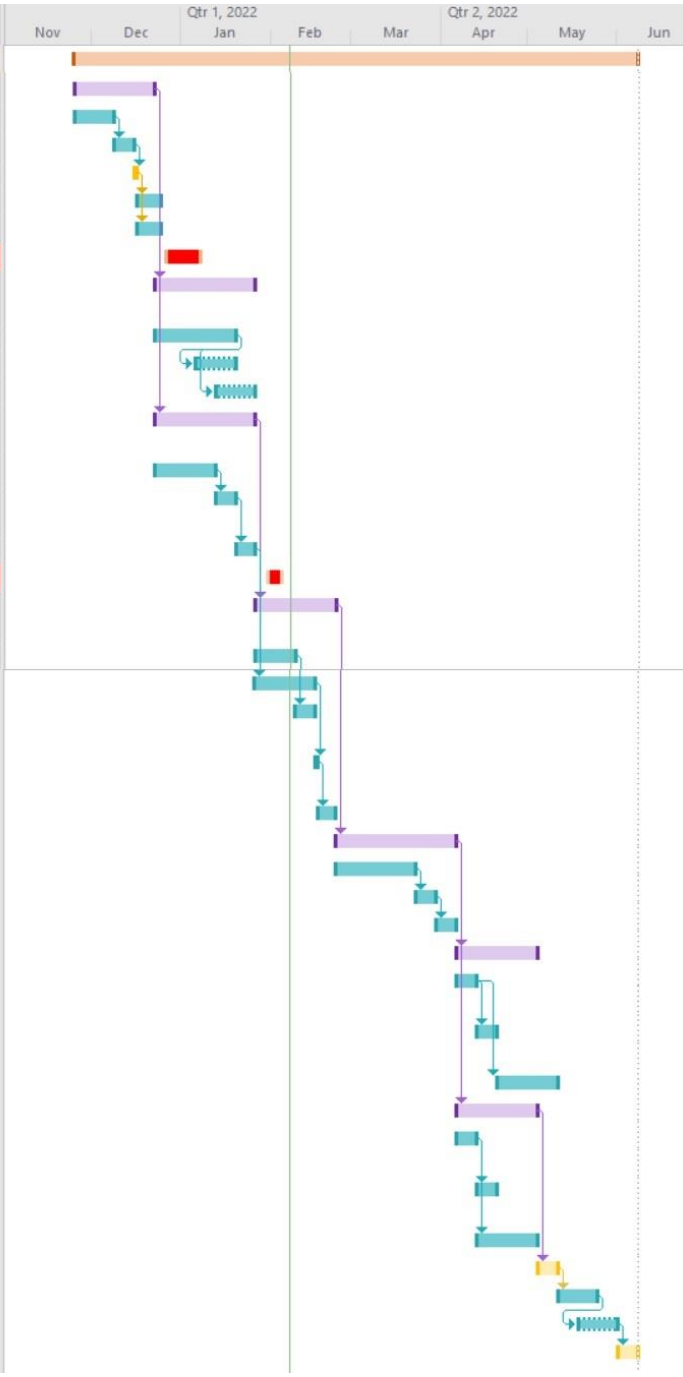


Figure H.1 – Gantt chart

Planning was adjusted as two additional weeks were added due to planning delays and for report improvement. The master report was delivered on June 9th, defense was planned on June 23rd

Appendix I – Data tables in relation to graphs

This appendix will feature data table on which figures within chapter 5 and 6, it's split between tables regarding P-set characteristics and tables regarding respondent characteristics within certain factors identified through the factor-analysis.

Tables regarding P-set characteristics

Car usage is shown below in table I.1. Car usage saw a structural decrease of 44%.

Days commute by car	# Respondents pre-pandemic	%	# Respondents post-pandemic	%
0	18	35%	18	35%
1	4	8%	8	16%
2	6	12%	11	22%
3	7	14%	6	12%
4	11	22%	7	14%
5	5	10%	1	2%
6	0	0%	0	0%
7	0	0%	0	0%
Average number of workdays	**2.04**		**1.6**	**-28%**

Table I.1 Car usage before and after pandemic

PT usage is shown below in table I.2 PT usage saw a large structural decrease of 56%.

Days commute by PT	# Respondents pre-pandemic	%	# Respondents post-pandemic	%
0	35	69%	18	80%
1	3	6%	8	8%
2	3	6%	11	8%
3	4	8%	6	2%
4	4	8%	7	2%
5	2	4%	1	0%
6	0	0%	0	0%
7	0	0%	0	0%
Average number of workdays	**0.94**		**1.6**	**-56%**

Table I.2 PT usage before and after pandemic

Cyclo-pedestrianism is shown below in table I.3. It saw a moderate structural decrease of 34%.

Days commute by walking & cycling	# Respondents pre-pandemic	%	# Respondents post-pandemic	%
0	24	47%	27	53%
1	5	10%	4	8%
2	4	8%	8	16%
3	5	10%	4	8%
4	5	10%	1	2%
5	6	12%	6	12%
6	2	4%	1	2%
7	0	0%	0	0%
Average number of workdays	**1.76**		**1.42**	**-19%**

Table I.3 Cyclo-pedestrianism before and after pandemic

Working from home is shown below in table I.4. WFH saw a large structural increase of 154%.

Days commute by WFH	# Respondents pre-pandemic	%	# Respondents post-pandemic	%
0	22	43%	7	14%
1	18	35%	8	16%
2	5	10%	7	14%
3	3	6%	12	24%
4	1	2%	13	25%
5	1	2%	2	4%
6	1	2%	2	4%
7	0	0%	0	0%
Average number of workdays	**1.02**		**2.56**	**151%**

Table I.4 Working from home before and after pandemic

The data used within figure 7.7 within chapter 5 is shown below.

Are you planning to return to your old commute habits after the pandemic	# Respondents	%
Yes, completely	13	25%
No	15	29%
Partially	23	45%

Table I.5 Working from home after the pandemic

Tables regarding factor characteristics in SQ 4

This appendix section will feature additional figures that were referenced in the graphs used to portray the results examined within chapter 6 to answer SQ 4.

Factor 1

Days commute by car	# Respondents pre-pandemic	# Respondents post-pandemic	
0	2	2	
1	1	5	
2	2	3	
3	2	1	
4	3	1	
5	2	0	
6	0	0	Percentual decrease
7	0	0	
Average number of workdays	2.75	1.5	-46%

Table I.10 Car use change factor1

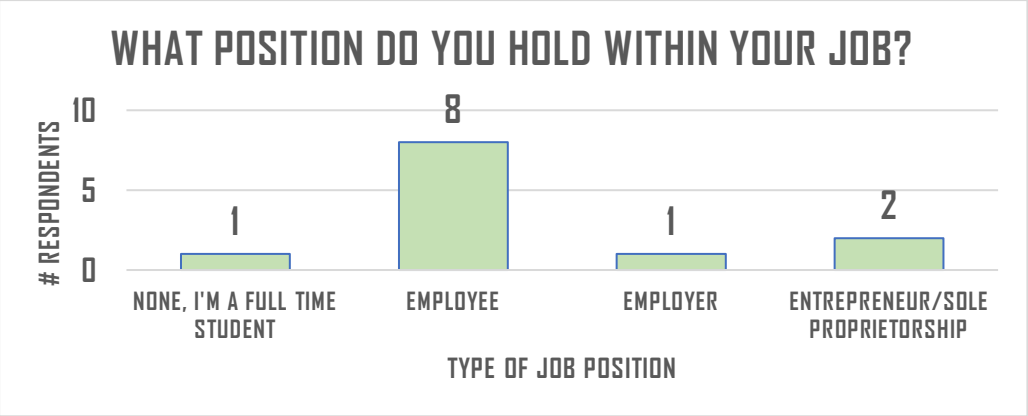


Figure I.1 Factor 1 job position

Factor 2

Days commute by car	# Respondents pre-pandemic	# Respondents post-pandemic	
0	1	1	
1	1	1	
2	1	1	
3	3	2	
4	1	1	
5	1	2	
6	0	0	Percentual decrease
7	0	0	
Average number of workdays	2.625	2.875	10%

Table I.11 Car use change factor 2

Factor 4

Days commute by car	# Respondents pre-pandemic	# Respondents post-pandemic	
0	3	3	
1	0	0	
2	0	2	
3	0	0	
4	2	0	
5	0	0	
6	0	0	Percentual decrease
7	0	0	
Average number of workdays	1.6	0.8	-50%

Table I.12 Car use change factor 4

Factor 5

Days commute walking and cycling	# Respondents pre-pandemic	# Respondents post-pandemic	
0	1	2	
1	1	0	
2	1	1	
3	0	0	
4	0	0	
5	2	2	
6	0	0	Percentual decrease
7	0	0	
Average number of workdays	2.6	2.4	-8%

Table I.13 Factor 5 cyclo-pedestrianism change

Are you planning to return to your old commute habits after the pandemic?	# Respondents
Yes, completely	2
No	2
Partially	1

Table I.14 Return to old commute habits

Factor 6

Days commute by car	# Respondents pre-pandemic	# Respondents post-pandemic	
0	1	2	
1	1	1	
2	1	1	
3	0	0	
4	1	1	
5	1	0	
6	0	0	Percentual decrease
7	0	0	
Average number of workdays	2.4	1.4	-42%

Table I.15 Factor 6 car use change

Days commute by WFH	# Respondents pre-pandemic	# Respondents post-pandemic	
0	3	1	
1	1	1	
2	0	0	
3	0	1	
4	0	1	
5	0	0	
6	1	1	Percentual increase
7	0	0	
Average number of workdays	1.4	2.8	100%

Table I.16 Factor 6 WFH change

Tables regarding survey evaluation

The data used within figures 8.1 and 8.2, within chapter 8 are displayed below. Table I.10 corresponds with figure 8.1, whereas table I.11 corresponds with figure 8.2

Did you find it easy to rank opinion-statements based on your own opinion?	# Respondents	%
Yes, I found it easy	16	31%
No, I experienced issues	19	37%
Neutral/No opinion	16	31%

Table I.10 Data on Q-methodology response

Did you find it easy to rank opinion-statements based on the change in your opinion?	# Respondents	%
Yes, I found it easy	23	45%
No, I experienced issues	12	24%
Neutral/No opinion	16	31%

Table I.11 Data on Dynamism in Q-methodology

Appendix J – Evaluation of Q-methodology survey and research gathering execution

Most of the data evaluated within this section is derived from the open question evaluation at the end of the online survey. Responses by respondents, as well as other received feedback on the survey, will be evaluated. The evaluation of the survey is split into 5 different categories to touch upon all facets of the survey. This section will more briefly evaluate issues surrounding; survey execution, technical issues, issues regarding post Q-sort questionnaire. This section will give an overview of the different issues that were not evaluated as part of Q-methodology review. Respondent feedback on the different aspects of the survey can be found within appendix C. A summary of this section is given in chapter 11.3.

Respondent issue categorisation	Respondents
Survey – Execution issues	10, 23, 36,
Survey – Technical issues	10, 18, 34, 36, 50
Survey – Issues regarding post Q-sort questionnaire	23, 26

Table J.1 Respondent Issues

1 Execution issues

This section will discuss respondent comments surrounding issues in the execution of the online survey and offer insight of the researcher on these issues brought forward. When referring to the 'execution' of the survey, it refers to conducting research online through a website at a 'distance' instead of in person like traditional Q-methodology research.

One of the primary issues brought forth by respondents (**10**), was a practical issue brought forth during the Q-sort process. As the Q-sort requires forced distribution, it might be difficult for respondents to rank their responses in such a manner straight away. Some respondents thus engaged in reranking. This caused the complaint that the total ‘pre-ranked’ lists of statements only shows around 1 to 2 statement blocks at a time. This shows that doing Q-study online has issues. It avoids the hassle of in person study, more easily allowing for a larger amount of respondents over a longer period of study. However, the lack of basic ability to directly assist respondents in person was a negative aspect. You’d be able to see all your responses with in-person ‘physical’ ranking (making use of paper cards), but this requires in general far more work than setting up the study through digital means. While issues persist, doing the study physically instead of digitally would be practically impossible due to the untenable workload for the latter option.

Other comments put forward by respondents (**23**) were tips surrounding how inviting the survey was for the average respondent, recommending further use of images and simplified shortened text. Largely due to the fact that they were concerned with lesser invested or educated respondents having issues with the survey and dropping out of the survey. These methods were recommended as a way to further involve lower education and income respondents, that are likely more prone to for example PT use.

From the researcher point of view, adding further material for respondents to increase engagement is in this case somewhat impossible for technical reasons, but also due to the fact that online execution of the survey limits these options regardless of technical issues. The survey was already accompanied by a letter of invitation, an introduction video and the necessary information within the

online survey itself as required by TU Delft policy. More material might prove as more of a deterrent than an invitation depending on the respondent. Furthermore, most responses gained from dropouts mention issues with length of the survey or technical errors, not a lack of understanding of the survey, indicating that the material provided was sufficient for most respondents.

These last issues put forward seem more pressing, as respondents (**36**) mention that the sorting procedure was lengthy and its layout somewhat clustered. This causes drop out, especially on phone, where the survey layout did not function well. This comment further brings up that the time requested from respondents for filling out the survey is somewhat long. In that sense, consideration could be given to producing a smaller Q-set in future research, if possible. A larger Q-set was necessary, as the broad subject that was investigated involved many different aspects that required input. Better allocation of the Q-set, particularly in future Q-studies (involving dynamism) will be further discussed in the latter half of this evaluation.

Perhaps a larger issue during execution of the survey was that the initial webhosting service that was used for hosting the Q-sort questionnaire suffered from technical difficulties at server side. This caused technical issues and errors for respondents participating in the study, as the webhost's issues destabilised website api causing errors like respondents being unable to continue to the next step of the survey or statements being missing during the Q-sort. This issue presented itself sadly during the first few days of spreading the survey and it's unclear how many respondents dropped out of the study altogether. This was resolved within a day by setting up a different website at another webhost (adding a website at GitHub, rather than solely using Netlify services), but hurt the quantity or responses as the first few days of data gathering were most fruitful in reaching respondents. In the future, a backup webhost, as was set up a day after respondent complaints of technical issues were received, needs to be set up before gathering data starts. This will ensure a more robust programme of data collection and hopefully lessen respondent drop-off.

2 Technical issues (conducting Q-study digitally)

This section will discuss respondent comments on technical issues experienced during online survey and offer insight of the researcher on these issues brought forward. When referring to the 'technical' issues, it refers to issues surrounding the online survey itself and how limitations of the program used to create the survey might negatively impact survey results or respondent experience.

The first issue technical issue brought forth (**10**) refers back to issues also brought forth in the execution section. When digitally conduction Q-study you suffer from technical limitations mostly in layout and clarity for respondents, that you would not be facing when conducting the study traditionally in person using paper cards. But, as stated, this save an enormous amount of work, both for researcher and respondent. More important however, it increases respondent accessibility.

Issues around respondent accessibility (**18**, **50**) is perhaps the biggest point of contention for conducting Q-study digitally. Respondents found the Q-sort easily operable, particularly the moving around of statement blocks. Issues arose once those statements were ranked within the forced distribution reducing the statements to their statement number in the Q-sort. Some respondents mention not being able to read statements after ranking them, potentially impacting their results.

Due to the nature of conducting the survey digitally and online both the layout of the survey, as well as the inability to directly assist respondents, were somewhat hampered in comparison to a traditional in-person physical Q-study. While the online q-sort featured smaller boxes, featuring little more than the statement number (#) designation, hovering over the statement with the mouse did allow respondents to read the entire statement. While this seems like a minor issue, such small issues could be more easily fixed with more directly involved researcher support. Small issues tend to pile up and discouraging responses to a somewhat longer, more time intensive survey, might lead to further respondent drop-off.

A further accessibility issue (**34**, **36**, **50**) existed due to the Q-sorting not being properly accessible on phone. For attaining more responses, respondent accessibility to the survey should be as easy as possible. Similarly, the layout of the survey should be intuitive. This was simply not possible for conducting Q-sort on phone, requiring respondents to take the survey on computer or (larger) tablet. This was however already mentioned within the letters of invitation and, if completely necessary, doing the Q-sort on phone was still possible.

3 Issues regarding the post Q-sort survey

This section will discuss respondent comments surrounding the post Q-sort survey and offers insight of the researcher on these issues brought forward. It will also include researcher critique on survey contents and plans for change in the future.

Some respondents mention 'missing' several questions or response options within the survey (**23**). For example questions surrounding the length of their workweeks (# days) or the number of jobs that are used. It could have been useful to request information on the type of job (full-time/part-time) or simply the amount of workdays/number of jobs. However, as this study focuses mostly on commute and needs to be relatively short as to not discourage respondents, adding too many additional questions might have been too much. Furthermore, data on the amount of workdays or multiple jobs isn't as important, as the number of commute uses per respondent, regardless of the amount of jobs. As such, this data might be useful for explaining certain behaviour or opinions, but outside of data on the amount of commutes, this data isn't necessary.

Similarly, some respondents (**26**) mention aiming to engage in hybrid working in the post survey comments. The contents of this comment are largely covered within the Q-sort or the post Q-sort survey. It would have perhaps been useful to flat out ask whether respondents plan to continue working from home (full-time or hybrid/part-time), although this was already implicitly covered within the questions concerning pre- and post-pandemic commute behaviour and the question regarding whether the respondents intends to return to their old commute habits post-pandemic. This would require less inference by the researcher, although it would also neglect the return to other commute patterns outside of the move from WFH back to another modality.

To add to these potentially missing aspects, in hindsight the questions regarding car ownership should have been reworked. As mentioned in the discussion of this variable, in hindsight this question should have been rephrased from "**Yes**", "**No**" and "**I don't own a car anymore**" to something along the line of; "**I used to own a car(s), but I chose to part with all**", "**I still own a car, but I parted with one or more**", "**I owned no car and still own none**", "**I owned no car and bought a car**", "**I owned a car and bought a car"** and "**I still own the same amount of cars**". This would have been able to capture car owners, such as those in families or relationships, that shrunk their own car ownership and whether there was any other change in circumstance.