Messaging for environmentally sustainable commuting post disruption

By

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Submitted in accordance with the requirements for the degree of Doctor of Philosophy

University of Leeds

Institute for Transport Studies

April 2024

The candidate confirms that the work submitted is her own and that appropriate credit has been given where reference has been made to the work of others

Acknowledgments

I would like to firstly thank my supervisors, Dr Kate Pangbourne and Professor Susan Grant-Muller, for their continued support and valuable guidance provided to me over the years spent working on this thesis.

A big thank you to the case study organisations who generously gave their time to help me undertake the case study research and act as research participants themselves. I hope the research will provide some valuable insights of use to both organisations. Thank you also to the research participants who kindly gave their time for interviews and surveys. This has been essential to the completion of this thesis and the time provided is greatly appreciated.

This research was made possible through funding from the Engineering and Physical Sciences Research Council (EPSRC) Doctoral Training Partnership studentship. Thank you to EPSRC, as well as the University of Leeds.

A massive thank you to my partner, Matt. You have been infinitely supportive and patient, and I couldn't have done it without you (and our cats, Jinx and Juno, who have provided much needed thesis writing companionship!).

Finally, thank you to my family and friends, especially to my Mum, Ed, Nana, and Grandad, who have continued to encourage me, particularly during the final thesis stages. The continued support has meant a lot to me, and I look forward to celebrating the completion of this thesis with you all.

Abstract

This thesis examined the impacts of Covid-19 disruption on commuter travel, and the role of persuasive messaging to promote environmentally sustainable travel. The examination of these issues is achieved through the study of organisational cases, including surveys and a longitudinal interview study.

The research found that at the cases selected for study, reduced commuter travel is the main behavioural impact resulting from Covid-19 disruption. In response to the Covid-19 control measures implemented, the organisations introduced progressive flexi-work policies with substantial home working for desk-based employees. The disruption accelerated trends towards increased flexi-work and established norms of home working which were accepted among employers and employees.

Organisations invested substantially in hybrid working with sustainable travel initiatives viewed as lower priority. Commute modes remained relatively unchanged, albeit with some reported increases in car commuting and reduced public transport. However, reluctance to use public transport was typically not a permanent change with evidence demonstrating a softening of attitudes and switch back to public transport over time.

Notions of flexibility, reliability, convenience, travel time and cost are important to commute mode choice (Barr and Prillwitz, 2014). This often results in a car commute, particularly for those with multi-stop commutes such as the school-run (Cass and Faulconbridge, 2016; Burkinshaw, 2018). However, the evidence shows that car parking restrictions can result in sustainable modes becoming viewed as the preferred option.

The study identified the importance of providing packages of measures to enable modal shift, including information provision and financial support. Persuasive messaging can be used as a tool to encourage behaviour change. Post Covid-19, messages promoting the health benefits of walking are perceived as the most persuasive. Cycling messages should be targeted to those with an existing interest in active modes (such as leisure cyclists), and bus messages should promote value for money.

Contents

List of Tables

List of Figures

List of Abbreviations

Abbreviation	Meaning
B&NES	Bath and North East Somerset
CAZ	Clean air zone
CMP	City mobility plan
Covid-19	Coronavirus disease
CPZ	Controlled parking zone
CR	Critical realism
DfT	Department for Transport
ECC	Edinburgh City Council
EV	Electric vehicle
GHG	Greenhouse gas
HDH	Habit disruption hypothesis
HQ	Headquarters
ICT	Information communication technology
ISM	Individual social material model
LEZ	Low emission zone
LMM	Linear mixed-effects model
ONS	Office for National Statistics
PSD	Persuasive systems design model
RQ	Research question
SESTRAN	South East Scotland regional transport partnership
SRBAI	Self report behavioural automaticity index
TfL	Transport for London
UK	United Kingdom
VTBC	Voluntary travel behaviour change
WfH	Work from home
WPL	Workplace parking levy

Chapter One – Introduction

This thesis provides a theoretically informed empirical study exploring persuasive messaging and environmentally sustainable commuting to large employers. The doctoral study began in September 2019, however the subsequent spread of the Coronavirus disease (Covid-19) resulted in significant disruption to the transport system with measures in place to slow the spread of Covid-19 throughout the study period. This provided a research opportunity which altered and expanded the original research proposal. In addition to the original research aim, the research seeks to examine the behavioural impacts of Covid-19 disruption on commuter travel, and to understand the role of large employers and messaging to promote environmentally sustainable commuting (including telecommuting) in the context of major disruption. The cities of Bath (England) and Edinburgh (Scotland) are the two case study locations. The remainder of this chapter sets out the research context (including the impact of the Covid-19 pandemic on travel trends), the study's research aim and questions, key definitions, and thesis outline.

1.1. Introducing the research context

Background / rationale

While the rise of motor transport has brought undoubted societal benefits, the United Kingdom's (UK) current dependence on private car use has created challenges of greenhouse gas emissions (GHG), air pollution, road safety, congestion and sedentary lifestyles (Department for Transport [DfT], 2022). Impacts are particularly severe in urban areas, with a forecast increase of 4.7 million people living in urban areas in England between 2016 and 2041 likely to exacerbate negative effects (Office for National Statistics [ONS], 2018). Considering the urgent need to reduce GHG emissions to act against climate change, the UK Government announced a transport decarbonisation plan with the aim of net zero transport emissions by 2050 (DfT, 2021). In 2021, transport produced 26% of total UK GHG emissions with 52% of emissions coming from cars; technological advances such as the electrification of transport will likely be insufficient to achieve net zero (DfT, 2023a; Marsden et al., 2020). To meet decarbonisation targets, a series of bold actions, including individual travel behaviour change, will need to occur.

Recognising the need for voluntary travel behaviour change (VTBC), policymakers have implemented a range of transport policy measures aiming to reduce car use (Andersson, Winslott Hiselius and Adell, 2018). Measures take a variety of forms, including land use, infrastructure, management and service, information provision, pricing, and attitudinal and behavioural measures (Konsult, 2016). Conventional transport planning approaches such as road user charging have proven to be effective in helping to reduce car use yet are often

unpopular with large subgroups of the population and difficult to implement, as evidenced through the rejection of congestion charging schemes in cities such as Manchester (Hitchcock et al., 2014; Stopher, 2004; Sturke, 2008). Attitudinal and behavioural policy measures have become increasingly popular as they adopt a cognitive-motivational approach with the aim of motivating and empowering car users to voluntarily switch to more sustainable modes of travel (Richter, Friman and Gärling, 2011; Cellina et al., 2019). Information provision is a type of measure recently bolstered by technological advances, with real-time information and messaging able to enhance the attractiveness of environmentally sustainable modes of travel (Konsult, 2016). Through combining attitudinal and behavioural measures with information provision, persuasive technologies designed to promote VTBC have increased in popularity within the transport sector over the past decade. Persuasive technologies have the potential to encourage modal shift yet remain in relatively early stages of development, with the academic literature demonstrating a need to improve the design of persuasive systems through better integration of theory and underutilised techniques such as tailoring, alongside robust impact evaluation (Anagnostopoulou et al., 2018; Sunio and Schmocker, 2017).

The early months of the research study saw the global spread of Covid-19, with shockwaves sent through society and the transport system. In an attempt to reduce the transmission of the disease, the UK Government implemented a national lockdown on the 23 March 2020 with citizens allowed outside only for food, health reasons or essential work. The lockdown resulted in unprecedented disruption to travel behaviour with drastic reductions in public transport and car use accompanied by increases in active travel (De Vos, 2020). A timeline of key Covid-19 milestones throughout the study period is outlined in Figure 1. Covid-19 restrictions caused ongoing disruption to the transport system from March 2020 until spring 2022, with an end to domestic restrictions following the national rollout of Covid-19 vaccines and widely available tests to detect Covid-19 (Chao Fong, 2022). The arrival of the pandemic and its associated disruption provided a research opportunity which altered and expanded the study's research questions, as set out in section 1.2.

Figure 1. Timeline of key Covid-19 milestones (Institute for Government, 2022; Scottish Parliament, 2023; Marsden and Docherty; 2021)

1.1.1. Summary of Covid-19 on UK travel trends

A summary of the impact of Covid-19 on UK travel trends is presented to provide the necessary context for the research study. In England, the key travel trends are summarised below, comparing 2021/2022 travel statistics (the study period) to a pre pandemic baseline.

- Bus travel has steadily grown back to 90% of pre Covid-19 levels, the highest levels seen since the initial lockdown (Urban Transport Group, 2022).
- Nationally, car travel has remained between 90-93% of pre Covid-19 levels (Urban Transport Group, 2022).
- Rail travel has seen growth back to around 90% of pre Covid-19 levels (Urban Transport Group, 2022).
- The number of cycling trips made in 2021 decreased back towards pre-pandemic levels following a peak during 2020. The decrease in cycling between 2020 and 2021

contrasts with an increase in trips for both cars and public transport during the same period following large falls during the pandemic (DfT, 2023b).

- Walking trips remained at a similar level in 2021 compared to 2020 but decreased compared to 2019, with a 6% decrease in average 2021 walking trips compared to 2019 (DfT, 2022).

Travel trends from Scotland are additionally reported below, using a snapshot of travel across main modes to compare August/September 2021 to a pre-pandemic baseline (Transport Scotland, 2021a).

- Walking journeys down by 40%.
- Cycling journeys up by 10%.
- Concessionary bus journeys down by 35%.
- Rail journeys down by 50%.
- Car journeys at the same level as the previous time period.

1.1.2. Covid-19 and UK travel grey literature

In addition to national statistics, two non-peer reviewed studies ('TRANSAS' and 'All Change?') provide an analysis of changes to UK travel behaviour since the onset of Covid-19. As part of the TRANSAS study, Anable et al. (2022) used a longitudinal panel survey in ten parts of the UK in addition to national data sources to examine the impact of Covid-19 on travel. The panel survey found evidence of increased home working and decreased travel; 11.6% of worked days were spent working from home pre Covid-19 compared to 41% in June 2021, with those who worked from home for some or all of their working hours reporting to use their car less frequently than those who didn't work from home. Using TomTom (2022) data, the authors report that congestion levels in September and October 2021 were down 6% from 2019 levels in both the morning and evening peak, with no change during the day, suggesting that reduced travel since the onset of Covid-19 has had a particular impact on peak hour traffic. The survey additionally found that 14% of households with two cars before the pandemic reduced to one; 43% of survey respondents who reduced their car ownership agreed that Covid-19 was likely to have contributed to the decision.

The 'All Change?' study conducted by Marshall, Bizgan and Gottfried (2021) similarly used a longitudinal nationally representative UK-wide survey to identify changes in travel behaviour in response to the Covid-19 pandemic. The authors found that use of public transport varied in line with national restrictions, with public transport use increasing in times when Covid-19 restrictions were eased and decreasing as restrictions were re-introduced. The authors additionally found that the profile of public transport users during the pandemic became

markedly different in comparison to pre Covid-19, with younger age groups (16-34), those from ethnic minority communities and those living in London forming a greater share of those who recently travelled by public transport compared to the period before the pandemic.

At the time of the final 'All Change?' survey (November 2021), 40% of UK adults surveyed said they had changed the way they made some journeys in the previous four weeks compared to before the pandemic. Supplementary qualitative research indicates that several types of change were likely to have been made by respondents; changes in journey times, childcare duties, mixing working at home and commuting, working from home on different days to previously, commuting at different times/on different days, as well as changes in the modes used for commuting and leisure travel. Those who changed how they made journeys were more likely than average to have avoided public transport due to concerns about Covid-19 and to recall walking or cycling for pleasure/exercise. The study found that there was not a 'mass' return to commuting after the lifting of restrictions in summer 2021, with the proportion who worked from home 5 days a week in November 2021 (17%) more than double the equivalent proportion in the period before the pandemic (8%). The incidence of home working varied according to sector and employer guidance as well as flexibility constraints. Interviews conducted found that commuting and travel patterns were perceived to be in a state of flux, with participants reporting a preference for hybrid working to remain in place (consisting of a mix of working from home and commuting to the workplace) (Marshall, Bizgan and Gottfried, 2021).

Demonstrating findings similar to the TRANSAS study, 'All Change?' found evidence of people questioning the necessity of more than one car in their household due to increased home working. There was also some interest in options around purchasing or leasing an electric vehicle in the immediate or near future, with ongoing government support and policies such as clean air zones flagged by participants as potential factors contributing to changes in behaviour and ownership. Convenience, comfort and cost, underpinned by habit, were identified as the most important factors influencing travel decisions, as opposed to the Covid-19 pandemic or associated restrictions (Marshall, Bizgan and Gottfried, 2021).

1.1.3. Covid-19 and international travel literature

Several authors have sought to understand the impact of Covid-19 on commuter travel, and travel behaviour more generally, at the international level. Shibamaya et al. (2021) carried out an international online survey (n=11,555) about changes in everyday mobility during the Covid-19 outbreak. The authors analysed responses related to commuter travel from the 14 countries with 100 or more responses, namely Austria, Brazil, Bulgaria, Czechia, Germany, Hungary, Iran, Italy, Japan, Malaysia, Slovakia, Slovenia, Thailand, and the UK. The survey

found that, between March and May 2020, a telecommute (i.e., working from home) was undertaken by 40 to 60% of working respondents during each country's most severe lockdown, rising to 60 to 80% among office workers. The highest proportions of home working were reported in UK and Italy. Respondents from other European countries, as well as Brazil and Malaysia, also reported high levels of home working. Thailand, Japan and Iran reported lower rates of home working. Across all countries, likelihood of working from home was associated with being young, highly educated, and living in an urban area.

Shibamaya et al. (2021) also found evidence of changing commute mode across most of the countries surveyed, mainly a switch away from public transport to home working or other modes. Slovenia suspended all public transport services during lockdown, with no reported public transport users in Slovenia during the Covid-19 outbreak. There were also no reported public transport users based in the UK, despite public transport services not being fully suspended. Within Southeast Asia, both Thai and Malaysian survey respondents tended to commute by motorcycle which remained unchanged in response to Covid-19, with low rates of reported home working.

Paul, Chakraborty and Anwari (2022) conducted a literature review on the impact of Covid-19 on daily travel behaviour, considering 56 international academic articles. The authors found that, in almost all regions, public transport was reported as the least preferred mode to travel. In addition, there was a decreased reported preference for ride-sharing vehicles and ride-hailing services, with active travel, including walking and cycling, and car being the most preferred modes (Figure 2). Changes in commute trips varied across countries; several European countries reported significant decreases in commuting with a high reported use of virtual mediums for work purposes, whereas work trips remained a primary trip purpose during the pandemic in East Asian countries. Several studies revealed a rise in walking as a mode of travel alongside a noticeable increase in cycling activity; increases in active travel were reported mostly in European countries.

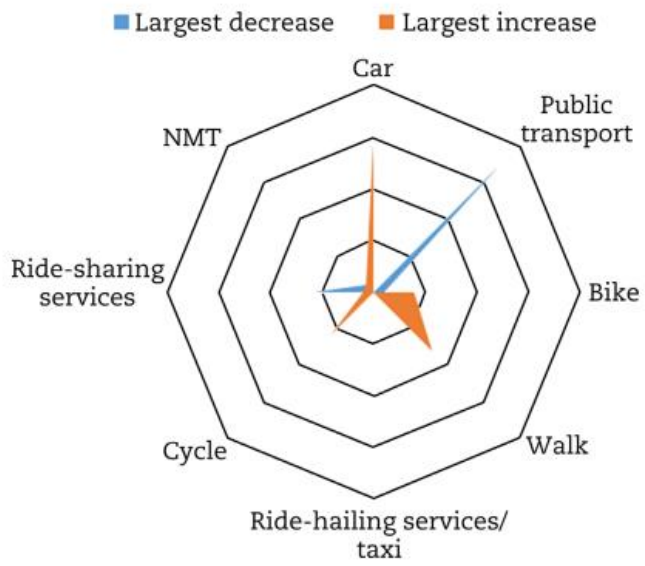


Figure 2. Changes in mode in response to Covid-19 (Paul, Chakraborty and Anwari, 2022)

1.1.4. Summary of Covid-19 travel trends

In summary, national travel statistics from England and Scotland show that public transport has made a gradual recovery since the onset of Covid-19 with users gradually returning as restrictions eased, although with usage remaining below pre pandemic levels. Car travel has remained similar or slightly lower compared to pre pandemic levels. Considering active travel, travel statistics from both England and Scotland show a decline in walking journeys compared to pre pandemic, alongside a slight increase in cycling journeys. Both TRANSAS and 'All Change?' studies demonstrate increased home working for certain sectors of the workforce compared to pre pandemic, with evidence of reduced peak travel demonstrated in Anable et al. (2022). Both sets of studies additionally found evidence of reducing multiple car ownership, with a portion of households reducing from two cars to one.

The international literature suggests that trends evident in the UK, namely an initial decrease in the use of public transport accompanied by increases in active travel, were also occurring in many other European countries. Likewise, countries within Europe were the most likely to report increases in home working with a notable reduction in commuting trips. The evidence suggests that travel patterns in East Asia were the least affected by the Covid-19 pandemic, noting primarily unchanged habits of motorcycle commuting.

1.2. Research aims and questions

This doctoral thesis will provide a theoretically informed empirical study exploring persuasive messaging and environmentally sustainable commuting to large employers in the context of

major Covid-19 disruption. The research aims to examine the behavioural impacts of Covid-19 disruption on commuter travel, and to understand the role of large employers and messaging to promote environmentally sustainable commuting (including telecommuting) in the context of major disruption. This work will help to inform the development of sustainable transport policy, alongside offering guidance for employers on how to encourage and enable environmentally sustainable commuting via messaging. Bath and Edinburgh are the study's two case study locations. The research is funded by the Engineering and Physical Sciences Research Council (EPSRC).

The objectives are:

- To understand the behavioural impacts of a major disruption event (Covid-19) on commuter travel to large employers in two UK cities (Bath and Edinburgh).
- To identify whether Covid-19 disruption has altered the perceived persuasiveness of previously validated messages promoting walking, cycling, and bus.
- To understand the role of large employers in encouraging and enabling environmentally sustainable commuting post disruption in two UK cities (Bath and Edinburgh).
- To explore how messaging interventions targeting commuter travel can be designed to help meet transport decarbonisation targets.

In order to address the research aim and objectives, four research questions (RQs) have been developed. The questions are:

- **RQ1.** What are the behavioural impacts of a major disruption event (Covid-19) on commuter travel for selected large employer cases?
- **RQ2**. Has the Covid-19 disruption altered the perceived persuasiveness of previously validated messages promoting walking, cycling and bus?
- **RQ3.** What is the role of large employers in encouraging and enabling environmentally sustainable commuting post disruption?
- **RQ4.** How should messaging interventions be designed to help meet transport decarbonisation targets?

1.3. Key definitions

- **Persuasive messaging.** Persuasion is defined as "a symbolic process in which communicators try to convince other people to change their attitudes or behaviour regarding an issue through the transmission of a message, in an atmosphere of free choice" (Perloff, 2003, p.8). In this study, persuasive messaging is defined as a type of strategy used to promote VTBC, with persuasive messages understood as types

of informal arguments, appealing to both reason and value to attempt to persuade (Pangbourne, Bennett and Baker, 2019).

- **Environmentally sustainable commuting**. Environmentally sustainable commuting is defined as:
    - Commute modes with low environmental impact, such as commute modes with zero or low emissions e.g. walking and cycling;
    - Commute modes that transport more than one passenger simultaneously, such as public transport and carsharing;
    - Commute modes that replace fossil fuels with renewable energy such as electric vehicles; and
    - Telecommuting where employees can work remotely and avoid commute trips.
- **Disruption**. The formal definition of disruption is, “a break or interruption in the normal course or continuation of some activity, process, etc.” (Merriam-Webster, 2020). In the context of this study, disruption is defined as the interruption in the normal course of commuter travel in relation to the measures implemented to slow the spread of Covid-19.

1.4. Thesis outline

Following Chapter One, the rest of the thesis is structured as follows.

Chapter Two - Literature Review. This chapter will draw on the multidisciplinary literature relevant to the project including theories and concepts, persuasive technology to promote behaviour change, work and commute practices, and disruption and travel behaviour. Finally, the chapter will discuss the gaps identified in the literature and how the study aims to address them.

Chapter Three - Methodology. This chapter will discuss philosophical issues in research and justify the research methods being used. There will be a discussion of a critical realist paradigm and how it fits with selected research methods and interdisciplinary research, alongside an introduction to the selected theoretical framework. This chapter will discuss the case study research design and each research method including surveys, semi-structured interviews, and ethical matters.

Chapter Four – Approach to Analysis. This chapter introduces the analytical approaches undertaken to investigate the RQs, including quantitative and qualitative data analysis. The chapter provides a description of the analytical approaches used to analyse the research methods in addition to triangulation.

Chapter Five - Case Studies. This chapter will describe the two selected case study locations: Bath and Edinburgh. The case study selection criteria will be discussed, alongside the context of both the Bath and Edinburgh cases and participating organisations.

Chapter Six – Employee Surveys. This chapter describes the design and evaluation of the quantitative employee surveys. The chapter will discuss the results from the surveys implemented in both case studies, considering both individual case and cross-case analysis.

Chapter Seven – Longitudinal Interview Study. This chapter will consider the design and practical aspects of the qualitative semi-structured interviews as it sets out the interview contexts and typologies. The chapter will then report the main themes arising from the semi-structured interviews.

Chapter Eight – Messaging Survey. This chapter describes the design and evaluation of the walking, cycling and bus messaging survey. The chapter will discuss the results from the survey, comparing findings to those reported as part of the ADAPT study.

Chapter Nine – Discussion of Findings. This chapter brings together the results of the different stages of the project. There will be a discussion of the overall findings in the context of the current literature and how the research questions have been answered. The strengths and weaknesses of the project will also be discussed.

Chapter Ten – Conclusion. This chapter provides the overall conclusion and policy and employer recommendations. Final findings will be summarised along with a discussion of future directions and recommendations arising from the research.

Chapter Two – Literature Review

2.1. Introduction

The purpose of this literature review is to place the empirical research within the context of the current academic literature. As outlined in Chapter One, the RQs aim to understand the behavioural impacts of a major disruptive event (Covid-19) on commute travel behaviour, and what this means in terms of persuasive technology and messaging used to promote environmentally sustainable travel.

A literature search was conducted across three electronic databases (Web of Science, Scopus, Google Scholar). The review followed PRISMA literature review guidelines with four key phases: identification, screening, eligibility and included papers evaluation (Moher et al., 2009). To obtain multiple perspectives, the search included several fields alongside transport including public health and persuasive technology. Keywords and phrases were developed from four preliminary RQs and the original timeframe was set for 1990 to 2020 with English only papers. The initial search was performed in April 2020 and repeated with updated timeframes in April 2022 and April 2023 to reflect the dynamic nature of the topic and ensure inclusion of recent research. The majority of the literature consists of peer-reviewed journal articles, with a small number of books, theses, and conference materials. After an initial screening of abstracts to exclude papers not relevant to the RQs, a snowball review was conducted with references from relevant articles screened for additional eligible papers.

From the full list of literature identified, only a limited set were directly related to the RQs and included in this review. The conceptual diagram (Figure 3) demonstrates the scope of this review; topics in green are directly related to the RQs and included within the review, whereas topics in red, while having general relevance, are not directly related to the RQs and not discussed in-depth.

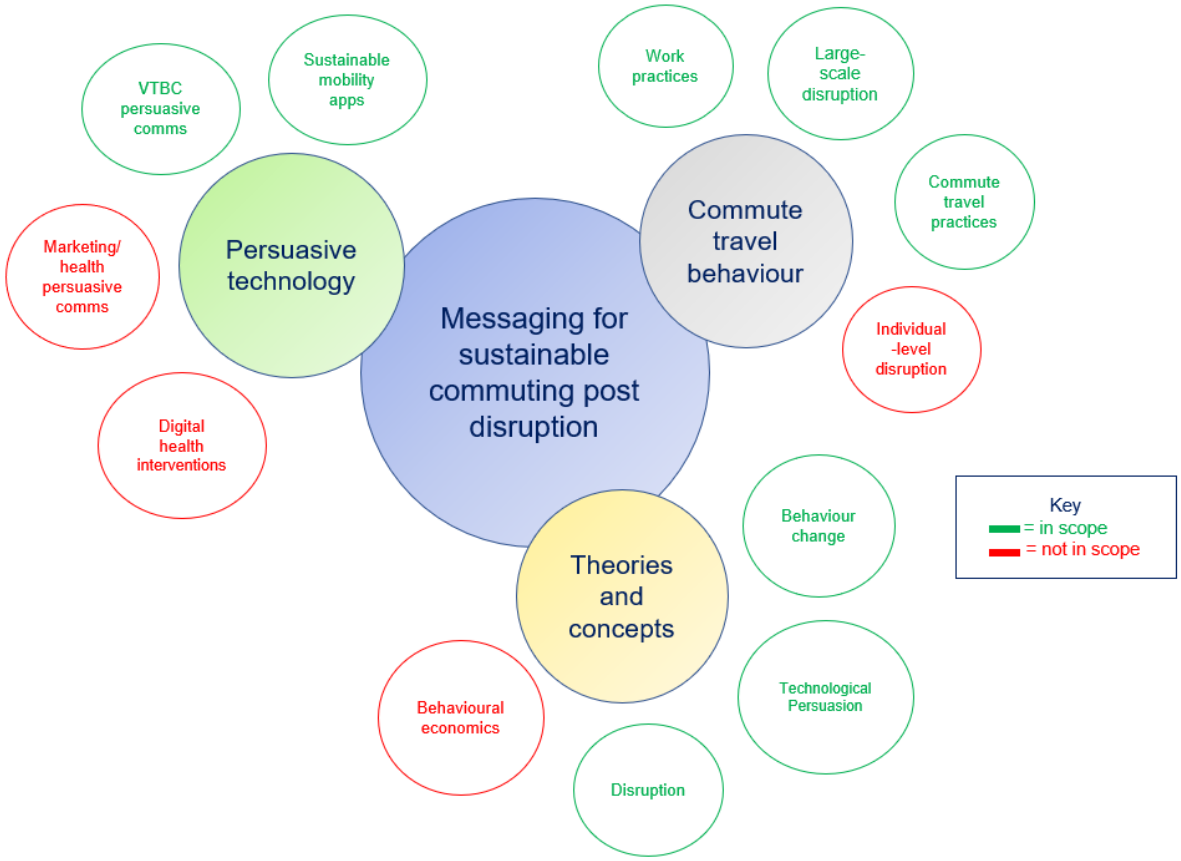


Figure 3. Literature review conceptual diagram

The second section of this Chapter (2.2.) introduces the theories and concepts commonly used to explain (a) technological persuasion, (b) travel behaviour change, (c) the behavioural impacts of disruptive events, and subsequently introduces the selected theoretical framework for the research. Section 2.3. examines the use of persuasive technology to promote modal shift, including sustainable mobility apps and persuasive messaging. Section 2.4. provides a discussion of empirical studies examining commute and work behaviour, along with the travel behavioural impacts of macro-level disruptive events, including specifically Covid-19 disruption. Finally, the identified research gaps are addressed with a discussion of how this research project aims to overcome such gaps.

2.2. Theories and concepts

As an interdisciplinary review, it is useful to briefly summarise the differing histories of the disciplines. Table 1 provides an overview of the key theories included in this review.

Social psychology	Sociology	Theories of disruption (psychology)	Technological persuasion	Interdisciplinary
Transtheoretical Model of Behaviour Change: Prochaska and DiClemente (1982)	Social Practice Theory: Schatzki (1996), Shove (2003), Shove et al. (2012)	Self-Activation Hypothesis: Verplanken and Holland (2002)	Persuasive System Design Model: Oinas-Kukkonen and Harjumaa (2008)	Individual Social Material (ISM) Model: Darnton and Horne (2013)
Theory of Planned Behaviour: Ajzen (1991)		Habit Discontinuity Hypothesis: Verplanken et al. (2008)	Fogg Behaviour Model: Fogg (2009)	
MaxSem: Bamberg (2013)				

Table 1. Theory overview

Social psychological theories of behaviour change are well established with influential theories dating back to the 1980s. Yet the field remains dynamic, as evidenced by the introduction of new theoretical frameworks such as the MaxSem model first published in 2013. Social psychological theories of disruption originated in the mid-2000s but remain somewhat limited in their use compared to more general theories of behaviour change. Taking a theoretically distinct view of behaviour compared to social psychology, theories of practice originated in the late 1970s (King, Booth and Lamond, 2014). Social practice theory regained prominence in the late 1990s and early 2000s through a second wave of practice theorists, with Shove et al. (2012) translating theories of social practice into a popular conceptual framework (Figure 7). Theories of technological persuasion are relatively young with popular theories emerging in the 2000s. Evidence suggests theories of technological persuasion base their understanding of human behaviour from social psychology, with Fogg's (1997) early persuasive technology work leveraging principles from psychology. Signifying the current trend towards interdisciplinary research, the most recent theory included in the review is the Individual Social Material (ISM) model, which brings together social psychology, sociology, and behavioural economics to understand human behaviour.

2.2.1. Technological persuasion

Pioneered by B.J. Fogg, persuasive technology is technology that aims to change people's attitudes and behaviours with persuasion implying a *voluntary* change (Ijsselsteijn et al., 2006). Understanding how to promote healthy, sustainable travel behaviour is necessary to meet policy challenges, with the past decade witnessing a growing academic interest in the use of persuasive technology to promote modal shift. There are two key frameworks related to persuasive technology from within that field itself: the Fogg Behaviour Model (FBM) and Persuasive Systems Design Model (PSD).

Designed by Fogg (2009), the FBM states that, for a behaviour to occur, motivation, ability and a trigger must converge at the same time. Mohr et al. (2014) note the FBM's usefulness in the design and analysis of persuasive technologies as persuasive technology should aim to be responsive to an individual's motivation, alongside simplifying the desired behaviour and creating suitable triggers. Yet the FBM's simplicity fails to account for the complex nature of individuals, with evidence of individuals who are highly motivated, able to perform the behaviour and know the triggers reporting that they are unable to achieve consistent behaviour change (Lawley, 2013). The model's simplistic approach means it is more applicable to persuading small, clearly defined behaviours as opposed to complex travel behaviour.

The second key model more commonly cited in the sustainable mobility literature is the PSD. Expanding on Fogg's (2003) persuasive technology principles, Oinas-Kukkonen and Harjumaa (2008) put forward the PSD as a framework for designing and evaluating persuasive systems, considering both the persuasion context and persuasive system features. The persuasion context includes identifying the intent (who is the persuader, what type of change does the persuader target), the event (use, user, and technology contexts), and the strategy (message and route) (Sunio and Schmocker, 2017). Regarding persuasive system features, the PSD model comprises four distinct design categories (Figure 4). The model's inclusion of the persuasion context and design features provides an effective method to evaluate persuasive technology. However, the model lacks guidance on how to incorporate persuasive design principles into content development processes, with outstanding questions such as how to measure behaviour changes caused by the system and how to understand the persuasion effects of specific design features (Yu and Li, 2016).

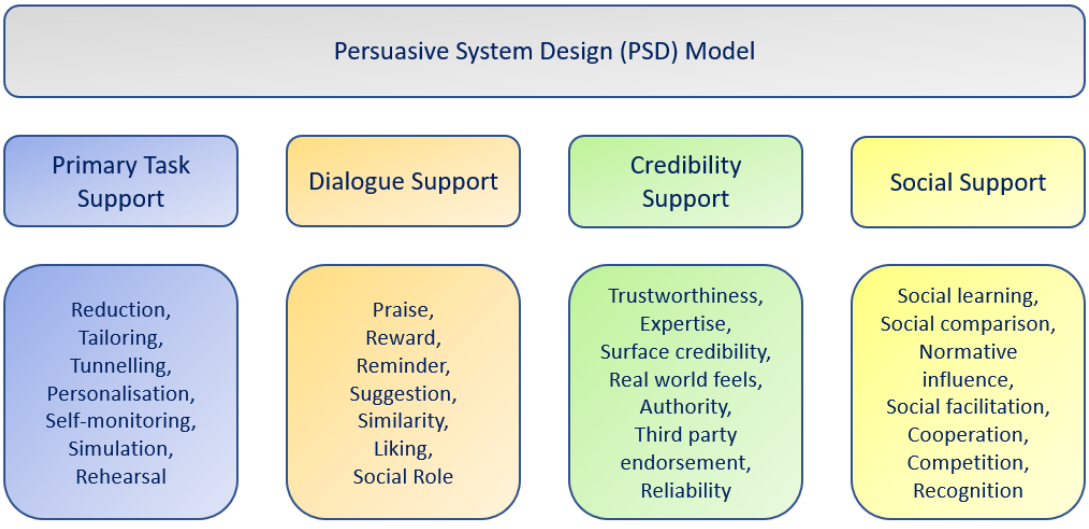


Figure 4. Persuasive systems design model (Oinas-Kukkonen and Harjumaa, 2008)

Both the FBM and PSD offer frameworks to design and evaluate persuasive technology promoting VTBC, which is a strength given that most persuasive technology systems either do not explicitly reference a theoretical foundation, or do not have one at all (Wiafe, 2012). However, both frameworks fail to describe or explain the psychological processes relating to persuasion, including the individual differences found in susceptibility to persuasion (Kaptein et al., 2015). This has resulted in a knowledge gap in the implementation of many persuasive systems, with theoretical frameworks required to describe, explain, or predict persuasive systems' effects on individual behaviour (Kaptein et al., 2015).

2.2.2. Psychological and sociological theories for understanding VTBC

Social psychological and sociological theories are frequently adopted to identify and understand the relationships between different factors in relation to behaviour change. Halpern et al. (2004) distinguish between three categories of psychological behaviour change theories: individual, interpersonal, and community, with ecological models bringing the three together.

One of the most cited individual-level theories within the travel behaviour change literature is the Transtheoretical Model of Behaviour Change (Figure 5) (Prochaska and DiClemente, 1982). The theory proposes that behaviour change occurs in five stages of motivation/readiness to change, with individuals applying cognitive, affective, and evaluative processes to progress through the stages (LaMorte, 2018). With its origins in the health domain, the model has become increasingly popular as a basis for the design of travel behaviour change interventions (Anagnostopoulou et al., 2018; Cellina et al., 2019). However, the model has received criticism from practitioners as it does not take account of the social context in which change occurs, alongside somewhat arbitrary lines between the stages with no clear criteria for how to determine an individual's stage of change or the length of time needed for each stage (Darnton, 2008; LaMorte, 2018).

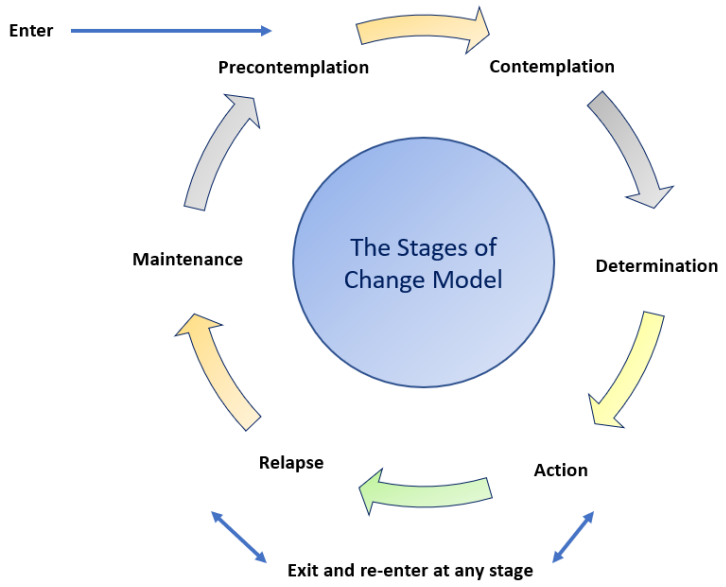


Figure 5. The transtheoretical model (Prochaska and DiClemente, 1982)

Similar to the Transtheoretical model is the MAX-Self Regulation model (MaxSem) (Figure 6). Created by Bamberg (2013), the MaxSem model adjusted popular health frameworks specifically for sustainable transport, with the stages of change model explaining individual travel behaviour change across four stages. However, the assumption that VTBC is a transition through a “temporally ordered sequence of different stages” has been identified as a significant limitation (Sunio and Schmocker, 2017, p.563). With transport interventions often being dynamic and adaptive, Riley et al. (2011) argue that the static nature of stages of change models are inadequate to inform sustainable travel intervention development, with more flexible frameworks required.

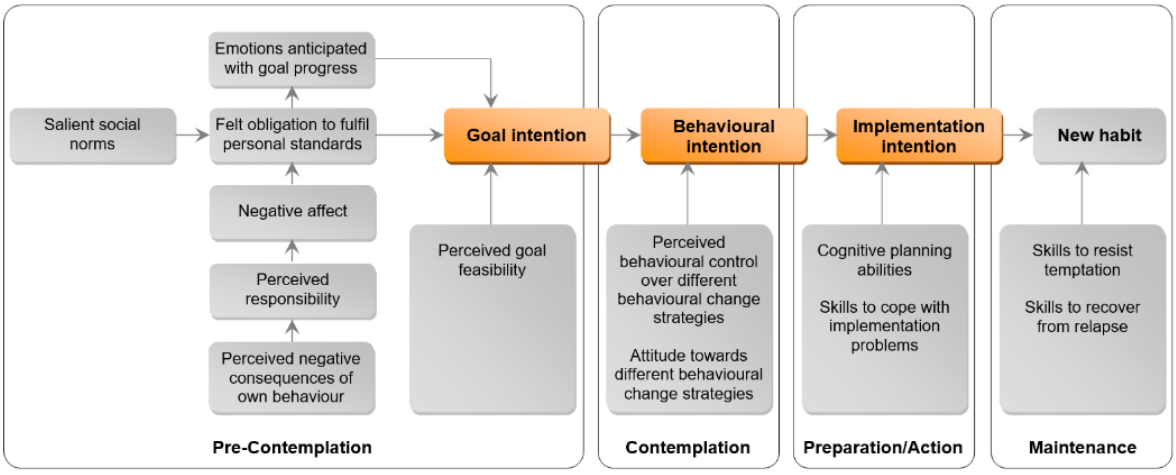


Figure 6. MaxSem (Bamberg, 2013)

An alternative theory that is frequently cited within the travel behaviour change literature is the Theory of Planned Behaviour (TPB) (Figure 7). The central claim of TPB is that behaviour is controlled by intentions, which are influenced by attitudes toward the behaviour, subjective norms, and perceived behavioural control (Ajzen, 1991). Similar to the Transtheoretical model, several persuasive mobility apps base their design on the TPB (Jariyasunant et al., 2015). However, the assumed link between intentions and actual behaviour is questionable given the uncertainty surrounding changes in intentions leading to actual behavioural change (Wiafe, 2012). Furthermore, the TPB has been found to have poor predictive efficacy due to an insufficient number of variables explaining the reasons behind individual behaviour change (Tommasetti et al., 2018).

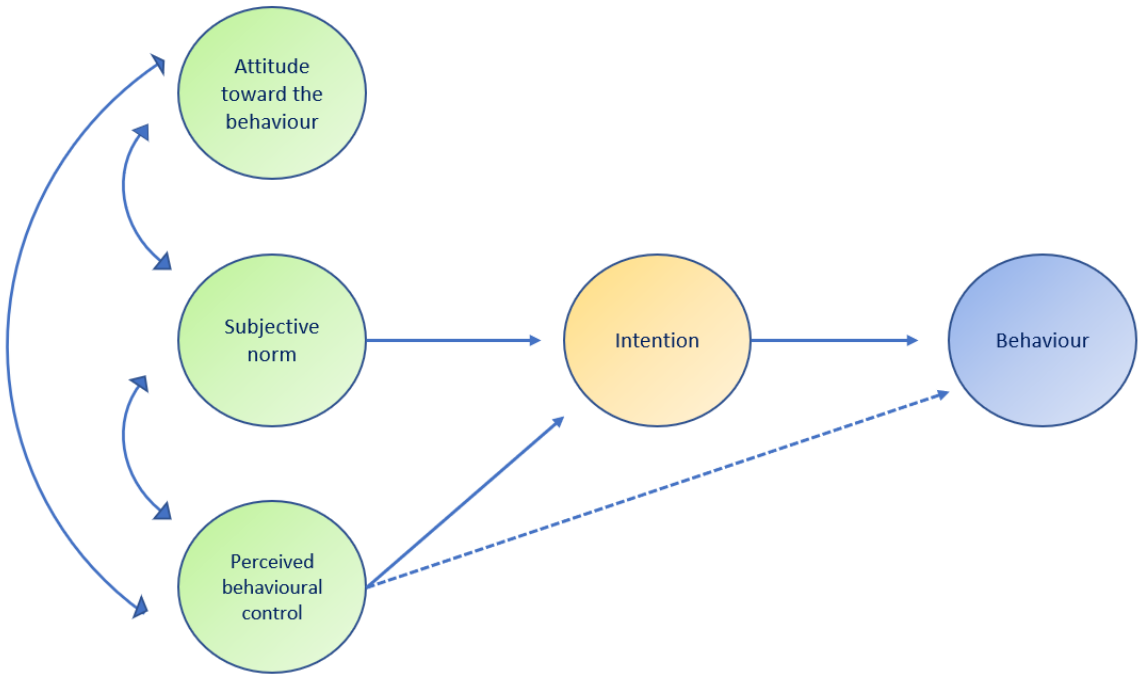


Figure 7. Theory of planned behaviour (Ajzen, 1991)

Overall, despite their popularity within the VTBC literature, individual-level psychological theories are limited in their explanation of behaviour change as they are unable to incorporate the wider context in which behaviour occurs. By contrast, social practice theory (SPT) considers practices as opposed to behaviour, with practices existing as entities in the social world reproduced by individuals who perform them (Darnton et al., 2011). With origins in philosophy (Schatzki, 1996) and sociology (Shove, 2003), SPT seeks to understand the connections between practices and the social institutions and material infrastructures that produce and sustain them (Cass and Faulconbridge, 2016, p.3). Individuals are seen as carriers of practice, rather than originators of practice, with key three elements making up practices: (1) meanings (symbolic meanings, ideas and aspiration); (2) materials (objects,

infrastructure, tools, hardware and the human body); and (3) competences (practical knowledge of the practice, and the skills to execute it) (Jüttner, 2017; Williams, Chatterton and Parkhurst, 2012).

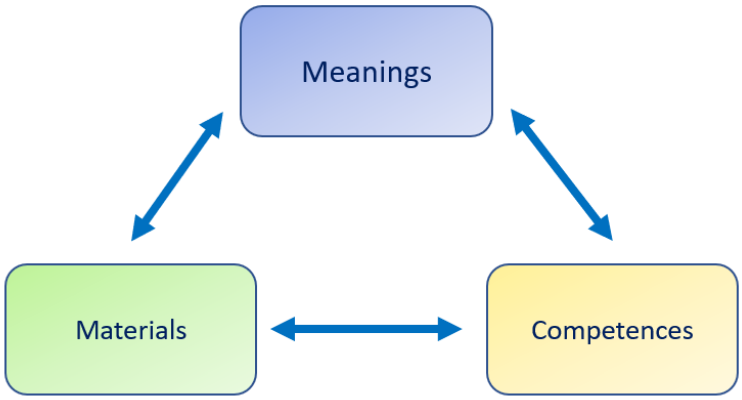


Figure 8. Social practices conceptual framework (Shove et al., 2012)

SPT has gained prominence as a framework within transport studies as it enables a greater understanding of complex travel practices such as commuting (Cass and Faulconbridge, 2016; Guell et al., 2012; Barr and Prillwitz, 2014). Understanding travel behaviour as practices has provided an alternative method of considering VTBC, focussed on the elements of the social and physical world that retain and support high carbon travel as opposed to the individual (Williams, Chatterton and Parkhurst, 2012). SPT thus provides a useful framework to understand complex behaviours and large-scale transitions. Yet understanding the individual-level factors relating to travel behaviour remains important, with challenging net zero targets requiring consideration of both the individual and wider social structures (Darnton et al., 2011).

Recognising the benefits of both the psychological and sociological perspectives of behaviour change, Darnton and Horne (2013) created the Individual Social Material (ISM) model. The model was designed to understand and influence human behaviour, particularly where significant levels of social change are required (Adams and Hampton, 2018). The model encompasses behavioural science and social practice theory and frames factors influencing behaviours within three key contexts (Table 2). The tool has been used by the Scottish government to promote change across a variety of behaviours, including promoting the uptake of electric vehicles and walking for short journeys (Darnton and Horne, 2013; Adams and Hampton, 2018).

Context	Description
Individual context	Factors held by the individual that affect the choices and behaviours he or she undertakes. These include an individual's values, habits, attitudes, and skills, as well as the calculations he or she makes before acting, including personal evaluations of costs and benefits.
Social context	Factors that exist beyond the individual in the social realm yet shape his or her behaviours. These influences include understandings that are shared among groups, such as social norms and the meanings attached to particular activities, as well as people's networks and relationships, and the institutions that influence how groups of individuals behave.
Material context	Factors that are 'out there' in the environment and wider world, which both constrain and shape behaviour. These influences include existing 'hard' infrastructures, technologies, and regulations, as well as other 'softer' influences such as time and the schedules of everyday life.

Table 2. The ISM model (Darnton and Horne, 2013)

2.2.3. Disruption, habits, and travel behaviour

Life-course work on travel behaviour has found that disruptive events at both the micro- and macro-level (such as residential relocation or transport system changes) often act as triggers for changing travel habits (Chatterjee, 2016). An established theory that describes the impact of disruptive events on travel behaviour is the Habit Discontinuity Hypothesis (HDH) (Verplanken and Wood, 2006). With its origins in social psychology, the HDH posits that habits require frequency, automaticity, and a stable context, with fully formed habits such as commuter travel difficult to change (Darnton et al., 2011; Verplanken et al., 2008). However, the HDH theorises that habits can be weakened or broken if a significant disruptive event causes the connection between contextual cues and the behaviours they promote to be disrupted (Verplanken and Wood, 2006). In states of disruption, a window of opportunity arises within which behaviour-relevant information may become more salient and influential, with a higher likelihood of habitual behaviour being (re)considered (Verplanken and Wood, 2006; Verplanken et al., 2008). The window of opportunity arising from disruptive events can be strategically used to promote behaviour change, with evidence of sustainable travel behaviour change successfully occurring in the context of life change events (Verplanken and Roy; 2016; Fuji, Garling and Kitamura, 2001; Verplanken et al., 2008).

Verplanken et al. (2008) combine the HDH with the self-activation hypothesis, where values incorporated in the self are activated amid disruption and increasingly likely to guide behaviour. For example, in a study examining travel mode choice for commuting to work (n=433), Verplanken et al. (2008) found environmentally concerned individuals were more likely to make environmentally friendly travel choices under conditions of context change (moving house) compared to environmentally concerned individuals who did not face context change. The HDH and self-activation hypothesis suggests that disruptive events such as Covid-19 have the potential to act as a large-scale trigger and window of opportunity to

promote VTBC, particularly among those who already hold values related to sustainable travel (Verplanken and Roy, 2016).

2.2.4. Theory summary

To understand the impact of Covid-19 disruption on commute travel behaviour and the potential for persuasive messaging to facilitate VTBC, there is a need to consider the wide range of factors affecting commuting behaviour, including disruptive events and persuasive messaging. This research has adapted the ISM to integrate the HDH and PSD to provide a theoretical framework considering the wide range of factors affecting commute travel behaviour (including persuasive messaging) and the specific impact of Covid-19 disruption (Figure 9). The ISM disruption framework was selected over other frameworks due to its interdisciplinary nature; the framework's inclusion of a wide range of factors affecting complex behaviour provided an integrated, whole-systems perspective suitable to the research topic. The ISM was applied as a framework as opposed to a model, providing a comprehensive overview of the factors believed to influence the research topic. The framework has been used to design and conduct the research, including structuring interview topic guides and surveys, alongside deductive analyses.

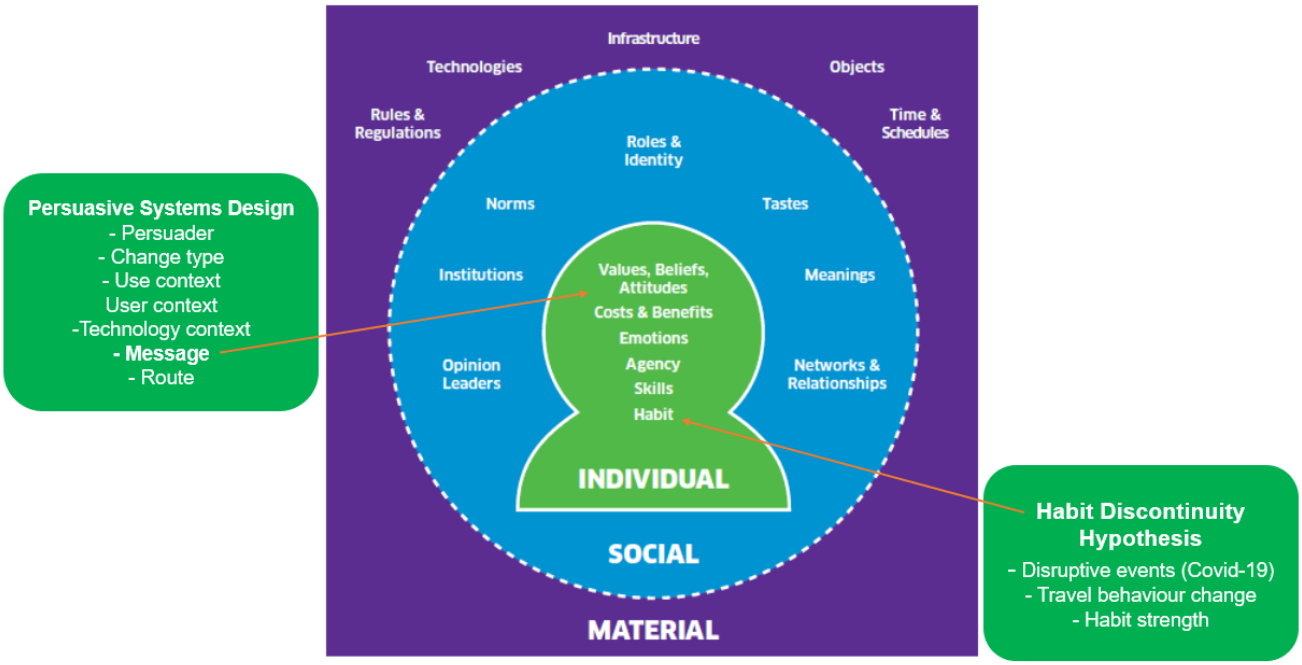


Figure 9. The ISM disruption framework (Darnton and Horne, 2013; Verplanken et al., 2008; Oinas-Kukkonen and Harjumaa, 2008)

2.3. Persuasive systems and VTBC

This section of the literature review examines the current state of persuasive systems designed to support a switch from single occupancy car journeys to more environmentally

friendly modes, including specifically the role of persuasive messaging which can be delivered via persuasive systems to promote VTBC.

Sunio and Schmocker (2017) report a growing body of research developing persuasive technologies in an attempt to foster long-term, sustainable changes in behaviour, with a recent increase in the number of published papers describing digital interventions to promote VTBC. A wide range of designs and persuasive strategies are used, with a review of 44 papers identifying a set of 11 persuasive strategies used in persuasive technologies for sustainable mobility (Table 3) (Anagnostopoulou et al., 2018).

Persuasive Strategy	Definition
Challenges & Goal Setting	Offering challenges and setting goals that incentivise the user to show an intended behaviour in a self-competitive context through a comparison of the present and a desirable future situation.
Self-monitoring and Feedback	Applying computing technology to eliminate the tedium of tracking performance or status helps to achieve predetermined goals or outcomes.
Persuasive messaging	Information provided by computing technology will be more persuasive if it is tailored to the individual's needs, interests, personality, usage context, or other factors relevant to the individual.
Social comparison	System users will have a greater motivation to perform the target behaviour if they can compare their performance with the performance of others.
Gamification & Rewards	To (virtually) reward target behaviours influences people to perform the target behaviour more frequently and effectively.
Suggestion	Suggestion technologies are premised on the idea of intervening at the 'Right Time'. People feel more motivated to perform some behaviours at certain times over others, so suggestion technologies are designed to identify these times and then remind users to perform the behaviours.
Framing	Framing is a way of presenting a message in such a way that people see it one way as opposed to the other.
Reduction	Reduction technologies make a complex task simpler, usually by eliminating some of the steps of a sequence required to achieve a certain goal.
Tunnelling	Tunnelling technologies are designed to reduce 'uncertainty', by leading users through a predetermined sequence of actions or events, step by step, to encourage certain behaviours.
Simulation	Systems that provide simulations can persuade by enabling users to observe immediately the link between cause and effect.
Cooperation	Systems that motivate users to adopt a target attitude or behaviour by leveraging human beings' natural drive to cooperate.

Table 3. Sustainable mobility persuasive strategies (adapted from Anagnostopoulou et al., 2018)

Anagnostopoulou et al. (2018) found all 23 persuasive systems reviewed shared a similar goal of using persuasive strategies to change travel behaviour. Most were implemented as mobile apps (n=16), with three combined web and mobile apps and four solely web. Self-monitoring (n=20) and gamification and rewards (n=20) were the most frequently used persuasive strategies, with self-monitoring typically taking the form of carbon dioxide (CO_2) emissions feedback. The third most popular strategy was social comparison (n=17), followed by challenges and goal setting (n=13). All other strategies were much less frequent, with cooperation the least used strategy identified in only one intervention. Regarding efficacy,

analysis suggests persuasive systems can encourage modal shift, with Anagnostopoulou et al. (2018) identifying 65% of the studies as reporting successful results and 33% partially successful. However, the review identifies several limitations frequently found among persuasive systems, with a lack of largescale and longitudinal evaluations making it difficult to determine the long-term impact of persuasive technology promoting VTBC. The underutilisation and limited development of personalisation and tailoring techniques is evident, with most interventions implemented for a general audience. Furthermore, no papers reviewed by Anagnostopoulou et al. (2018) considered the transport system where the persuasive technologies were deployed, with unsuccessful projects potentially due to a lack of practical travel alternatives for intervention participants.

In a separate review, Sunio and Schmocker (2017) use the PSD model to evaluate nine sustainable mobility apps' persuasive potential: IPET, MatkaHupi, Peacox, Tripzoom, Superhub, I-TOUR, QT, PEIR and UBIGREEN. Findings are similar to Anagnostopoulou et al. (2018), with self-monitoring (n=8) the most commonly utilised primary task support technique and CO_2 emissions the most common form of feedback. Techniques of similarity (n=9) and liking (n=8) were commonly used in terms of dialogue support, with social learning (n=6) and social comparison (n=6) often used as social support. However, Sunio and Schmocker (2017) identify a lack of theory underpinning the design of the apps. This is a major limitation of sustainable mobility apps, with Webb et al. (2010) reporting that theory-based behaviour change interventions are found to be more efficacious than non-theory-based interventions. A lack of robust impact evaluation additionally makes it difficult to determine the efficacy of sustainable mobility apps, with Sunio and Schmocker (2017) reporting that no definitive conclusion can be made regarding the effectiveness of sustainability mobility apps in promoting modal shift.

In an attempt to overcome the common limitations of sustainable mobility apps, Cellina et al. (2019) designed a large-scale, one-year long field experiment testing the 'GoEco!' smartphone app. With its design guided by the Transtheoretical model, the app incorporated automatic mobility tracking with persuasive strategies including eco-feedback, social comparison, and gamification. The effectiveness of the app in promoting modal shift was tested in two distinct regions of Switzerland: one dense urban area characterised by high quality public transport and cycle lanes, and one characterised by urban sprawl with less efficient public transport and limited cycling infrastructure. A statistically significant decrease in CO_2 emissions and energy consumption per kilometre was found for routes frequently travelled in car-dependent urban areas. Qualitative interviews with trial participants indicate the importance of tailoring techniques in persuasive systems, with interviewees favouring feedback tailored to their individual context and values as opposed to generic eco-feedback.

Yet issues of external and internal validity limit the study's generalisability and stresses the importance of minimal user burden in persuasive system design, with reported challenges of high abandonment and attrition rates and volunteer selection bias.

Overall, the literature identifies the potential for persuasive systems to successfully promote VTBC, yet the behavioural impacts are unclear with a need to improve intervention design. High-quality experimental design, integration of theory, and robust long-term impact evaluation with consideration of the wider context will help to provide a robust evidence base to understand whether persuasive technologies can enable widespread modal shift.

2.3.1. Persuasive messaging and VTBC

As demonstrated above, sustainable mobility apps are often understood and evaluated through a distinct set of persuasive strategies. Persuasive messaging is a type of persuasive strategy which can be implemented through the persuasive systems described above, to help promote VTBC. However, persuasive messaging is often overlooked within the sustainable mobility literature, with the content and structure of persuasive messages receiving minimal attention in Sunio and Schmocker (2017) and Anagnostopoulou et al. (2018). By contrast, the health field has explored the role of messaging as a persuasive strategy in-depth. Persuasive message interventions delivered via mobile technology demonstrate a large degree of success in promoting health behaviour change; messages tailored to individual factors such as psychographic variables are reported as significantly more persuasive than those designed for a general audience (Fjeldsoe, Marshall and Miller, 2009; Head et al., 2013; Muench et al., 2017). Within the transport field, a limited set of literature seeks to understand the most effective content and structure of persuasive messages seeking to promote VTBC.

One popular method of tailoring within VTBC research is based on travel attitude segmentation. Anable (2005) found that individuals can be segmented into distinct psychographic groups based on their travel attitudes, with each group varying in their degree of mode switching potential. Expanding on these findings, Anable and Wright (2013) developed eight attitudinal segments with a set of 'Golden Questions' to allocate individuals (Table 4). Anable (2005) states that allocating individuals to their attitudinal segment can enable policymakers to produce more persuasive communication, through targeting and tailoring communications to each distinct group.

Segment	Description
Devoted Drivers	Prefer to use a car more than any other mode of transport and they are not interested in reducing their car use
Image Improvers	Like to drive, do not want their ability to drive to be restricted, but recognise that it would be good if they all reduced car use a little
Malcontented Motorists	They want to cut down their car use but find that there are a lot of practical problems and issues with using alternative modes
Active Aspirers	They feel that they drive more than they should, and would like to cut down
Practical Travellers	They regard the car as a practical means of getting from A-B and largely use it only when necessary. They also walk and/or cycle a lot and would not change much about how they currently travel
Car Contemplators	They do not have a car now but would like one at some point in the not-so-distant future
Public Transport Dependents	Although they are not against cars in any way and think people should be allowed to use them freely, they do not like driving very much
Car-Free Choosers	They are not keen on driving and believe that cars and their impacts are something that need to be urgently addressed

Table 4. Travel attitudinal segments (Anable and Wright, 2013)

Pangbourne and Masthoff (2016) assessed whether the travel attitude of individuals is correlated with their receptivity to messages explaining the drawbacks/benefits of different transport modes. Recruiting participants from United States (US) via Amazon Mechanical Turk (n=133), the authors segmented participants by travel attitude using Anable and Wright's (2013) Golden Questions and asked them to rate the effectiveness of different messages promoting VTBC for different transport modes. Findings demonstrate statistically significant interactions between the travel attitude segment of participants and their receptivity to the drawbacks/benefits of different modes, suggesting a personalised approach tailored to users' travel attitude segment can maximise the persuasion potential of messages promoting VTBC. However, the limited sample size and exclusive US focus limits the transferability of findings to a UK context.

Expanding on the research undertaken by Pangbourne and Masthoff (2016), Pangbourne, Bennett and Baker (2019) examined the role of personality traits, age, gender and travel behaviour alongside travel attitude in the relative persuasiveness of arguments for walking and cycling through two UK Amazon Mechanical Turk experiments (n=809). In addition to Anable and Wright's (2013) attitudinal segmentation, the authors use the Big Five Personality Traits framework, a popular personality framework with widespread application and empirical validity (Table 5).

Trait	Description
Openness	The tendency to be imaginative/creative. Those high in openness tend to be curious and open to new experiences.
Conscientiousness	The tendency to be self-disciplined, well-organised and goal orientated. Those high in this trait tend to follow norms and rules.
Extraversion	The tendency to associate with others. Those high in extraversion tend to be warm, assertive, and seek excitement and positive emotions.
Agreeableness	The tendency to be kind, altruistic and compliant. Those high in agreeableness tend to be very compassionate, modest, and friendly to others in addition to being less competitive and outspoken.
Neuroticism	The tendency to be sad and nervous. Those high in neuroticism tend to be anxious, unconfident, and insecure.

Table 5. OCEAN personality traits (Oyibo, Orji and Vassileva, 2017)

Pangbourne, Bennett and Baker's (2019) study focussed on persuasive messages as pieces of informational argumentation with a distinction made between "argument type" (the way in which an argument's premises give rational support to its conclusion), and "argument value" (the value to which the argument appeals and from which it derives its motivational force). For both walking and cycling, argument type was not found to be a significant factor in perceived persuasiveness, although authority arguments were generally perceived as the most persuasive, with arguments ad populum (e.g., other people do x, so you should do x) the least persuasive. In contrast, argument value was predictive of argument persuasiveness and had several significant interactions with other variables. Health arguments were ranked as the most persuasive in general, yet a complex relationship between personality and persuasion was evident with argument values and overall persuasiveness ranked differently depending on personality traits. A summary of the key relationships identified between individual factors and persuasion is provided in Table 6.

Individual factor	Finding
Personality trait	
High in Extraversion	Most likely to be persuaded by arguments for active travel in general
High in Conscientiousness	Most likely to be persuaded by arguments for active travel in general
High or Mid Agreeableness	More likely to be persuaded by environmental arguments
Low in BOTH Agreeableness and Openness	Unlikely to be persuaded by an active travel argument. But if individuals are Low in one and High in the other, or high in both, they become persuadable
Age	
Under 30	More likely to be persuaded by environmental arguments than those 30 and over
Over 40	More likely to be persuaded by convenience arguments than those under 40
Gender	
Women/men	Gender differences are minimal, but women are less likely to be convinced by convenience arguments for active travel than men
Travel behaviour	
Car drivers & PT users	Less likely to be persuaded by active travel arguments than walkers or cyclists
Cyclists	Rate arguments for cycling as significantly more persuasive than participants who primarily use other modes

Table 6. Individual factors and perceived persuasiveness (Pangbourne, Bennett and Baker, 2019)

Notably, travel attitude was not found to be predictive of persuasiveness ratings for both walking and cycling arguments, suggesting that messages tailored to personality traits are likely to be more persuasive than focusing on travel attitude alone. Yet people with certain combinations of personality traits were found to be disproportionately clustered in certain attitudinal segments, potentially explaining the results reported in Pangbourne and Masthoff (2016). Pangbourne, Bennett and Baker (2019) provide novel insights into the complex relationship between individuals and messaging promoting VTBC. However, the study's external validity is limited with a generally younger and male skewed sample compared to the UK population. Furthermore, the behavioural impact is unknown with research required to understand whether perceived persuasiveness translates into actual behavioural change, alongside testing of messages on additional sustainable transport modes.

Anagnostopoulou et al. (2020) sought to explore whether tailored messages could translate into actual behavioural change via a six-week pilot study in Vienna, Austria. The study tested a personalised message approach integrated into a route planning mobile app, with tailored routes and messages delivered to participants via persuadability profiles built based upon personality and mobility type. Upon registering for the app, users answered a series of questions to determine their strongest OCEAN personality trait (Table 5), and their travel attitudinal segment (Table 4). The app used the personality and travel segment data to identify initial user susceptibility to the app's different persuasive strategies (self-monitoring, comparison, and suggestion), with a ranked list of persuasive strategies containing different

combinations of personalities and mobility types. The personalised behavioural change approach incorporated two complementary services that structured the route results (the route recommendation service) and attached persuasive messages to these results (the persuasive messages service). The authors designed 98 messages with each one implementing a single persuasive strategy (self-monitoring, comparison, suggestion), with tailored messages delivered to participants throughout the pilot study.

The pilot study ran from April to May 2017, with users downloading the app to plan everyday urban trips. 30 participants took part in the pilot study, including 15 females and 15 males aged between 21 and 70 (mean age = 39.5). Pre- and post-trial questionnaires and interviews were employed to evaluate the success of the pilot alongside app data. A successful persuasive interaction was defined as one where the user declared that the message affected their route choice; the study received user feedback for 51 messages with positive feedback for 30% of these messages (n=15). Post-trial survey and interview data showed that participants generally reported finding the messages useful, with high reported willingness to see persuasive messages in their daily mobile applications. The persuasiveness of the personalised messages was perceived as somewhat convincing, with feedback that the personalisation of messages could be improved by considering trip purpose. Overall, findings suggest that the personalised approach had some impact on motivating users to change their mobility behaviour to more sustainable choices, with users reporting favourable views of tailored persuasive messages. However, the pilot study was limited in its ability to measure the impact on behavioural change due to the short study period with limited use of the GPS tracking functionality. In addition, the validity of findings is limited due to the small sample size with a reliance on self-reporting the effectiveness of tailored messages, with the actual behavioural impact unknown.

In summary, the persuasive VTBC messaging literature is an evolving field; the research suggests messages tailored to a user's personality traits, age, and travel behaviour can maximise the perceived persuasiveness of VTBC messages. The behavioural impacts of VTBC messages remains unknown, with one pilot study demonstrating limited positive results. Moreover, there is a need to explore other elements of messages which could plausibly influence perceived persuasiveness, such as message framing (positively or negatively framed), and any types of media accompanying messages (pictures, branding) (Pangbourne and Masthoff, 2016). Considering the context of this study, there is evidence to suggest that Covid-19 has influenced people's value systems in addition to their travel behaviour, with potential impacts on the perceived persuasiveness of VTBC messages (Daniel et al., 2022). To identify whether any shifts in persuasiveness has occurred, this

research undertook a post Covid-19 persuasive messaging survey based on the work of the Pangbourne, Bennett and Baker (2019), described in Chapter Eight.

2.4. Disruption and travel behaviour

Mobility is typically conceptualised as hard to change with concepts of stability and habit dominating transport policy, with society seeking a return to pre-event conditions as quickly as possible when faced with disruptive events (Marsden and Docherty, 2013; Williams, Chatterton and Parkhurst, 2012). Marsden et al. (2020, p.89) argue that this current approach has failed to put transport on a "robust low carbon transition pathway", with new approaches to policy and research required. With disruption often resulting in behavioural adaptations, the study of disruptive events can help to understand how the levels of behaviour change required for net zero can be achieved (Marsden et al., 2020). Prior to Covid-19, the academic literature studying the impacts of disruption on travel behaviour was limited and often reliant on post-hoc evaluation, due to the often-unanticipated nature of major disruptive events (Marsden et al., 2020). However, the limited set of studies available provides valuable insight into the varied behavioural responses, and how such responses can be used to achieve sustainable change.

The next section of this review briefly explores commute and work practices in the UK prior to Covid-19 (in addition to organisational decision-making), to understand how disruptive events can change such behaviour. The impact of disruptive events on travel behaviour is subsequently examined, considering major disruptive events prior to Covid-19, and finally the impact of Covid-19 disruption.

2.4.1. Pre Covid-19 UK commute practices

Pre Covid-19, several studies provided an in-depth exploration of commuter travel behaviour in a UK context. Considering how travel behaviour is embedded in and shaped by commuters' social worlds, Guell et al. (2012) undertook interviews (n=67) with Cambridge commuters and identified three key facets of commuting as a social practice. First, participants' depictions highlight the fluid and changing nature of experiences; most experience fairly frequent disruptions in their everyday lives, such as moving house or a car breaking down, which provide windows of opportunities to influence how daily travel decisions are considered, negotiated and altered. Second, commuting is marked by numerous ambiguities, with some cherishing a commute by bus to talk to friends whereas others find it to be a waste of time. In contrast to Anable and Wright's (2013) travel attitudinal segmentation, Guell et al. (2012) found many participants could not ascribe to identities such as cyclists or car drivers, with commute narratives often identifying ambiguous or paradoxical identities. Third, photo-elicitation interviews reveal both positive and negative

accounts of ‘experiencing commuting’. The emotional aspect of commuting often is overlooked by practical concerns, but recognising the emotional aspects of commuting, such as enjoyment of exercise or ‘me time’, is important to fully understand commute travel behaviour. The interviews demonstrate how participants do not engage in commuting as individuals but rather within the wider contexts of family, work, and local infrastructure.

Commute practices are arguably not as stable as commonly assumed, with many lacking clear transport identities and frequent disruptions providing windows of opportunity for behaviour change interventions. For interventions to succeed, it is important for policymakers to take a holistic approach considering the “messiness” of everyday life (O’Brien, 2009, p.5). Yet the findings identified in Guell et al. (2012) are not generalisable to the wider UK population with the in-depth research focussed on the particular setting of Cambridge; the sample of highly educated participants with significantly higher levels of cycling compared to the UK average may enable more fluid travel practices compared to the wider population.

Considering the stubbornness of the car commute, Cass and Faulconbridge (2016) use SPT to develop insights into what might help to accelerate transitions to bus- and cycle-commuting. Over a two-year period, the authors analysed 101 interviews about everyday mobility in two UK cities (Lancaster and Brighton and Hove) and found that the more social (competence and meaning) aspects of mobility were tied to the specificities of the practice of commuting by a particular mode. For example, materials tied to cycle-commuting are more complex than providing a bicycle and suitable pathway, with suitable lights and waterproof clothing also required. Additionally, important time-space contingencies related to practice sequencing affect recruitment to bus- and cycle-commuting. Many sequenced practices, such as the school run or healthcare trips, make commuting by car more likely as they create a need to move between separate sites or impose inflexible time constraints. Thus, to accelerate a transition to bus- and cycle-commuting, policymakers must consider the necessary materials, competences and meanings tied to each mode, alongside the varied temporalities and spatialities affecting commuting. Cass and Faulconbridge (2016) argue that there is an additional need to reshape practices such as education and healthcare in ways that generate time-space contingencies conducive to bus- and cycle-commuting, with policies focused on shaping individuals’ choices unlikely to succeed in large-scale transitions to sustainable commuting.

Barr and Prillwitz (2014) explore approaches towards sustainable mobility with mixed methods research in Exeter (focus groups n=7, survey n=2000). The authors found that, when travel behaviour was discussed, individualistic discourses emerged with themes such

as convenience, time, personal comfort, and reliability featuring as factors driving current travel practices. Participants noted the ways in which urban form and planning led to a sense of inevitability regarding car use, with individuals 'locked in' to mobility practices. To alter mobility practices towards more sustainable practices, participants felt that the structure of everyday life would need to shift. Similar to Cass and Faulconbridge (2016), Barr and Prillwitz (2014) highlight the limitations of an individualistic approach to transport policy, with wider social practices and time-space contingencies limiting the ability of many individuals to feel capable of switching to more sustainable modes.

Overall, these studies provide detailed insights into UK commute practices. The in-depth, exploratory nature of all three studies is recognised, with the commute practices described dependent on the local context and not generalisable to the UK as a whole. However, some conclusions can be made. From the four cities covered by these works, commuting is found to be a complex practice; where suitable infrastructure exists, commute practices are often more fluid and changing than policymakers recognise, with commute behaviour embedded in the social, economic and cultural contexts of family and work. Commuters can feel 'locked in' to car commuting and enabling transitions to more sustainable commute practices must require a recognition of the distinct materials, competences and meanings attached to each commute mode. Moreover, the potential reshaping of certain practices such as work and education can help to generate time-spaces conducive to sustainable commuting.

2.4.2. Pre Covid-19 work practices

Understanding work practices is important as changes to the size, scope and nature of employment are likely to influence commute travel behaviour, with the term 'flexible working' referring to forms such as homeworking, temporal flexibility, teleworking, telecommuting and Information Communication Technology (ICT) substitution (Burkinshaw, 2016). This section outlines the pre Covid-19 work practices literature, with the impact of Covid-19 on work practices described in section 2.4.3.2.

The UK has seen trends of declining manufacturing and agriculture employment accompanied by increases in business services, real estate and self-employment (ONS, 2022). As Burkinshaw (2016, p.1) states, "this changing nature of the economy and technology is not only influencing what work is done, but where, when and how it is done", with new forms of employment highlighting an increase in flexibility and enhanced use of ICT. Flexible working arrangements can involve employees working remotely from the workplace (telecommuting) or working at times different from standard workplace hours (flexi time), with the 1996 UK Employment Rights Act enabling the legal right for employees to request flexible working (Burkinshaw, 2018; ACAS, 2014). An examination of UK commuter

travel demonstrates a steady decline in the number of commute trips made per person per year over the past 20 years, potentially explained by an increase in flexible work practices (LeVine et al., 2017).

ICTs (including the internet, intranets, wireless networks, laptops, tablets, mobile telephones, cloud computing and videoconferences) have played a key role in supporting and fostering the implementation of flexible work practices (Faulconbridge et al., 2020). ICTs can enable remote working, with organisations able to operate with little or no face-to-face contact. Line et al. (2011, p.1495) notes that "ICTs remove the need to be in certain places physically, when your presence can be felt virtually". The ability for ICTs to change working practices is demonstrated in Figure 10 below.

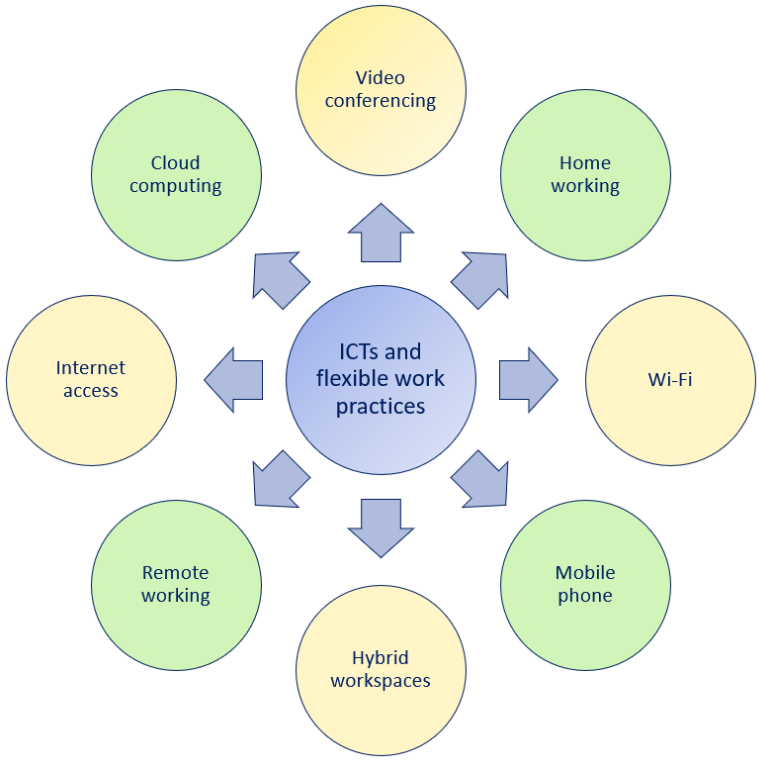


Figure 10. ICTs and flexible work practices, adapted from Burkinshaw (2018)

In addition to ICTs, land use patterns, socio-demographic characteristics, the presence of children at home, public transport access and cost of travel and fuel can all influence rates of telecommuting (Caulfield, 2015). Considering the drivers and constraints of pre Covid-19 telecommuting, O'Keefe et al. (2016) undertook a survey exploring telecommuting trends in the Greater Dublin Area (n=230). Findings indicate that requiring contact with colleagues was the most influential constraint to telecommuting, while greater flexibility and avoiding travelling in peak periods were the most important drivers in the propensity to telecommute. Key identified barriers included when participants' jobs or managers did not allow telecommuting to happen. For those that did partake in telecommuting (44% at least once a

month), survey respondents generally reported that it had a positive impact on quality of life and reduced the numbers of trips and distances travelled.

Exploring the relationship between work, ICT and travel, Faulconbridge et al. (2020) used case study research from civil engineering and design consulting firms with a strong global presence. The authors found ICTs had weakened the “spatial fixity of the workplace”, enabling employees to work remotely with colleagues around the world (Felstead, 2012, p.32; Faulconbridge et al., 2020). Yet the authors conclude that a high uptake of ICT at the workplace does not necessarily reduce the need to travel, but instead interacts with “expectations of and easy access to travel to co-constitute a set of new work practices and organisational structures” (Faulconbridge et al., 2020, p.210).

Examining the role of ICT and business travel practices, Roby (2014) undertook semi-structured interviews (n=8) and a survey (n=150) with key actors in London-based private sector organisations. Roby (2014) found that the role of existing travel and meeting habits and the idea that travelling is a perk linked to status symbols proved to be hard barriers to overcome in relation to reducing the amount of business travel. However, a digitally literate younger generation of the workforce are challenging established work practices, with ICT identified by participants as an effective method of reducing business travel. The extent to which substitution is possible is dependent on the type of meeting, who it is with and the complexity of data that needs to be transmitted. Roby (2014) found that shorter, regular meetings where people have already developed a relationship are more likely to be substituted by virtual communications, whereas relationship building, and long, creative meetings are more suited to face-to-face.

Both Burkinshaw (2018) and Munch (2020) explored the importance of social norms influencing work practices. Munch’s (2020) field survey of large organisations in the Paris region (n=3,202) found two types of social norms on working hours that directly contribute to peak-time transport congestion: ‘the norm of the disciplined worker’ and the ‘norm of the dedicated executive’. These norms have their origin in the evaluative process, whereby a worker’s integrity is “judged by the time at which he or she arrives at work”, with those arriving early perceived as dedicated and committed compared to those arriving later (Munch, 2020, p.22). Burkinshaw’s (2018) qualitative study of professionals in Leeds (n=29) found minimal evidence of flexible work practices temporally or spatially altering commuter travel, with workplace structure instead influencing the times at which employees start and finish work. Burkinshaw (2018) additionally found evidence of practices outside of work having an influence on work practices. Similar to findings reported in Cass and Faulconbridge (2016), practices such as childcare were found to be particularly influential,

with start times of work often coinciding with the morning school run and departure times aligning with after school or extra-curricular activities.

In sum, pre Covid-19 work practices were continuing to adapt to an increasingly flexible workforce. ICTs play an integral role in helping to facilitate flexible work practices, including telecommuting and flexi time. However, the assumption that pre Covid-19 ICTs directly substituted work travel has little empirical evidence to support it, with many employers requiring meetings to take place face-to-face and some evidence of ICTs encouraging travel. Work practices are complex and often reliant on a combination of external factors including household practices, commuting practices and workplace social norms. Capturing these complexities is key to understanding the changing role of work practices and what this means in relation to commuter travel post Covid-19 disruption.

2.4.2.1. Organisational decision-making

When considering work practices and commute behaviour, it is relevant to briefly consider the literature on organisational decision-making, including decision-making in relation to travel. While organisations are shaped by societal contexts, they are also able to strongly shape these contexts through setting rules and regulations (Tolbert and Hall, 2009). Considering the context of this study, the decisions made by organisations in terms of policies around commuter/business travel and work practices played an important role in influencing employees' travel behaviour.

Koziol-Nadolna and Beyer (2021) undertook a series of in-depth interviews with managers of various levels across different organisations (n=29) and secondary research to identify the key determinants of decision-making processes in organisations. The authors found that organisations currently operate in conditions characterised by high complexity, volatility and instability, with decision-making an important managerial domain. The process of making decisions in organisations is determined by various factors, including economic, social, organisational, personal and psychological, with economic and organisational factors considered the most important. Managers typically identify the resources held by the company, its business objective and the economic account as the most important factors influencing decision-making processes. Leadership style and organisational structure additionally have important influence over the efficiency of decision-making. In most organisations, the authors identified that the decision-making process follows the hierarchy of the organisational structure where most decisions are taken by top-level management while taking into account the opinions of lower-level managers and subordinates. Common problems identified during the decision-making process includes uncertainty from a lack of information and data, time, and availability of resources and funding.

The organisational decision-making literature additionally identifies an important public-private difference (Rodriguez and Hickson, 1995; Schwenk, 1990). Nutt (1999) describes the different roles public and private sector organisations have in society, with private organisations focussed on making profits for shareholders compared to public organisations which are typically engaged in the provision of public services. These different roles dictate the governance arrangements for different types of owners, such as elected officials or shareholders, with different governance arrangements influencing decision-making processes (Nutt, 2005; Yamamoto, 1997).

A classification originally produced by Rainey, Backoff and Levine (1976) identifies several factors which impact organisational decision-making processes, including the environmental market, cooperation versus competition, data availability, constraints, political influence, transactional scrutiny, ownership, organisational process goals, and authority limits. Nutt (2005) states that these factors typically result in smoother decision-making processes for private organisations compared to public organisations. Namely, Nutt (2005) identifies greater interruptions and conflict in public sector decision-making which can be attributed to the difference in expectations and accountability for public sector organisations. Furthermore, public sector organisations often face challenges of greater resource constraints and increased need for consensus compared to private sector organisations.

Considering specifically the role of organisations in influencing employee travel, Roby (2014) undertook a series of stakeholder interviews with predominantly London based organisations and a survey (n=150) of business travellers. The interviews identified several concepts which were found to influence business travel policy making, including cost savings, productivity, carbon emissions, customers, public accountability, organisational culture and individual behaviours, technology, and recruitment and retention. Cost saving measures were particularly important in influencing organisational decision-making, with cost savings often considered alongside corporate responsibility issues (including carbon reduction), staff wellbeing, working time regulation and reputation, and habitual behaviour. Measures to reduce business travel typically involved replacing face to face meetings with virtual meetings. Roby (2014) also identified several instances of reduced business travel occurring as a result of organisations consolidating their number of offices available, with employees encouraged to work more from home. Businesses recognised the need to implement a mixture of hard mandatory policies and softer policies to encourage travel behaviour change, with employees used to meeting face-to-face and business travel sometimes viewed as a perk linked to status.

Considering organisations that wish to encourage modal shift, Roby (2014, p.33) notes that policies that encourage staff to switch mode of transport are not easy to implement, because they "conflict with policies to reduce costs, could adversely affect work life balance or alternative modes may not exist or be a viable option". The author concludes that there are a huge variety of needs and practices regarding business travel with change driven by both internal and external stakeholders; technology was recognised as key to reducing both business and commuter travel.

Considering whether senior managers perceive the promotion of sustainable transport as relevant to their business concerns, and how this might vary between different types of organisations, Bartle and Chatterjee (2019) undertook 45 in-depth interviews with senior managers of employers located in peri-urban areas in south west England. The authors examined the implementation of workplace-based mobility management measures, including on-site cycle parking, information and advice on sustainable travel, loans of cycles, and ride-sharing partnership services funded by government. The research found that employers were willing to engage with public authorities on mobility management measures, as employers recognised their role in influencing commuter travel. All managers interviewed believed that measures to encourage VTBC for commuting and local business trips could be beneficial for their business, even if these benefits were indirect. Overall, the authors conclude that, for commuting and business trips, employers are "effective mediating organisations which can help reduce single-occupancy car use among their staff", with evidence of support for and engagement with mobility management measures across a range of employers (Bartle and Chatterjee, 2019, p.33).

In sum, organisational decision-making is a complex process influenced by various factors, particularly economic-related factors and those related to the organisation itself. There is an important difference between private and public sector decision making, with public sector organisations typically facing greater constraints in terms of limited resource available and increased need for consensus. Organisations have significant influence on commuter and business travel and can act as successful mediating organisations to deliver policies to encourage VTBC.

2.4.3. Macro disruption and travel behaviour/work practices

Considering the impact of planned macro disruption, Parkes, Jopson and Marsden (2016) undertook a longitudinal study of commute travel behaviour change associated with the London 2012 Olympic and Paralympic Games. Using a panel survey (n=1,132), the authors examined the effect of Transport for London's (TfL) behaviour change measures introduced to reduce demand on the network, focussed on reducing, retiming, rerouting, or remoding

journeys. Here, ‘reducing’ includes working from home, working elsewhere, or taking annual leave (TfL, 2013). A significant amount of commute behaviour change occurred during the Games with 54% making at least one change, and retiming or reducing journeys the most likely adaptations made (33% and 32% of respondents respectively, compared with 19% rerouting and 14% changing mode). However, the long-term behavioural impacts were small; changes made during the Games significantly relapsed once the Games ended, with just 6% of people sustaining their commute changes two to three months post-Games. The limited number of travellers continuing their adapted journeys demonstrates how disruption can enable behaviour change, although a longer follow-up period is required to fully understand any long-term impacts. Yet more generally findings suggest that, although individuals can adapt their behaviour, the majority either choose not to or are unable to sustain their changes when the transport system returns to normal.

Considering unplanned disruption, both Guiver (2011) and Williams, Chatterton and Parkhurst (2012) examined the travel behavioural response to the 2009 Workington floods. The flooding, which resulted in road closures and community severance, saw the building of a temporary railway station with free-of-charge train services and a new footbridge, with travel by train and foot “significantly quicker and cheaper than travelling by car” (Williams, Chatterton and Parkhurst, 2012, p.8). Guiver’s (2011) survey of residents (n=400) found frequent adaptations made included remoding, retiming, rerouting and reducing journeys. Commute trips were the most prone to remoding, with the share of car journeys dropping from 79% to 58% and modes such as rail, bus and cycling increasing (Williams, Chatterton and Parkhurst, 2012). However, one-year post disruption saw the system return to normal with an end to supportive behaviour change policies, resulting in car journeys increasing to 72%, and train, bus and multi-modal trips reduced (Williams, Chatterton and Parkhurst, 2012). This supports findings reported in Parkes, Jopson and Marsden (2016), whereby individuals have the ability to adapt their behaviour but the majority either choose not to or are unable to sustain these changes when the system returns to normal. Yet the sustained 7% decrease in car trips demonstrates how disruptive events can facilitate long-term shifts in travel behaviour, even in the absence of supportive policies.

Marsden et al. (2020) drew empirical evidence from a range of UK disruptive events (snow and ice event, major flooding, major bridge closure and everyday disruptions), with four large sample surveys investigating changes in travel behaviour. Data was collected during each disruptive event, helping to overcome limitations of forgetting or confusing what changes were made and why (Marsden et al., 2020; Behrens and Mistro, 2010). The evidence demonstrates that travellers make a much wider range of behavioural adaptations than often assumed, with common adaptations applicable across a wide range of places and people.

Reducing and retiming journeys are viable adaptations for many, with 84% of flooding survey respondents (n=520) reporting working from home and 90% reporting flexible working as possible adaptations. However, the authors recognise that certain sectors of the population find working from home or flexible working more challenging due to non-transport factors, such as nature of employment or childcare responsibilities.

Marsden et al. (2020) conclude that, for disruption to enable permanent sustainable travel practices, eight behavioural responses should be goals of policy (Table 7). The eighth 'renorming' category reflects how the boundaries of social norms can be renegotiated or reinterpreted during moments of disruption. For example, disruptive events can cause an intensification of flexible working, which can help to establish new working practices.

Adaptation	Description
Remoding	Using a different form of transport for at least the main leg of the trip
Rerouting	Taking a different route from that which was planned or would typically be taken
Retiming	Modifying the time at which a trip starts by either bringing it forward or pushing it back without altering where in the sequence of activities it occurs
Rescheduling	Changing when in the week a trip is made. This is distinct from retiming as the trip is seen to be moved in a sequence of activities
Relocating	Changing the destination of a journey such as shopping somewhere else
Reallocating	Passing over the responsibility for a journey to someone else (e.g. childcare pick up or caring trip)
Reducing	Not conducting a trip at all but conducting the activity through ICT
Renorming	The boundaries of norms are renegotiated or reinterpreted during moments of disruption

Table 7. Expanded categorisation of adaptive behaviours (Marsden et al., 2020)

Overall, the literature demonstrates how behavioural adaptations and innovation frequently occur during periods of disruption, yet such changes generally fail to be sustained once normality is restored (Graham and Thrift, 2007; Williams, Chatterton and Parkhurst, 2012). Although there is some evidence to suggest that certain behavioural adaptations persist after disruptive events, these represent a limited number of travellers (circa 6-10%) (Marsden et al., 2020; Parkes, Jopson and Marsden, 2016; Williams, Chatterton and Parkhurst, 2012). Considering the adaptive behaviours set out by Marsden et al. (2020) (Table 7), policymakers should aim to identify and understand what opportunities for sustainable travel practices may exist during disruptive events and to incorporate these in the response process, utilising any windows of opportunity with appropriate behaviour change interventions (Williams, Chatterton and Parkhurst, 2012).

2.4.3.1. Pandemics, epidemics and travel behaviour

Despite great medical interest in pandemics, literature searches identified a limited number of papers seeking to examine real or hypothetical travel behavioural responses to pandemics or epidemics prior to Covid-19 (Goodwin et al., 2011). The majority of these

studies sought to understand the impact of pandemics or epidemics on public transport use, recognising that public transport is commonly identified as conducive to infectious transmission (Wang, 2014; Goscé and Johansson, 2018).

Considering a hypothetical influenza pandemic, Sadique et al. (2007) conducted an international survey to understand precautionary actions (n=3,436). The reported pattern of precautionary action was broadly similar across the 5 European and 3 Asian regions; roughly 75% of respondents stated they would avoid public transport, with public transport consistently reported as the most likely precautionary behaviour and identified as the riskiest place by respondents from 6 of the 8 regions. Similar behavioural responses were found across different socio-demographic groups, yet the low response rate (varying 21%-81% across regions) combined with the hypothetical nature of the questionnaire limits the study's validity. Taking a similar approach, Goodwin et al. (2011) examined the key predictors of worry and behavioural responses to the early stages of the swine flu pandemic via a cross-sectional internet survey (n=186). The authors found those who were more concerned reported being less willing to travel by public transport, with 22% of survey respondents anticipating using public transport less frequently. The data suggests that initial 'emotional' concerns are significant predictors of behavioural responses to a pandemic, with concerns likely to be influenced by a variety of individual factors such as personal values as well as normative pressures. However, the small convenience sample is a limitation of the study, with the potential for the voluntary sample to differ significantly on certain personality traits such as neuroticism due to the subject matter.

Examining actual behavioural response, Wang (2014) used data from underground ridership in Taipei City and daily reported Severe Acute Respiratory Syndrome (SARS) cases in Taiwan to model the impact of SARS public fear on underground ridership. Wang (2014) found that, for each new reported SARS case, there was an immediate loss of about 1,200 passengers on the underground with a 50% reduction of daily passengers (500,000) during the 2003 SARS peak. A sharp drop in reported SARS cases resulted in a gradual increase of passengers, with Wang (2014) identifying a 'perception of risk' period lasting around 28 days. The relatively short perception of risk period resulted in passengers returning to the underground system sooner than predicted, with no new reported SARS cases resulting in the normal use of the underground in terms of daily passengers one-year post-peak. However, certain long-term behavioural adaptations were identified such as an increase in the number of individuals wearing masks on public transport.

Similar to Wang (2014), Kim et al. (2017) used public transport smart card data to understand the travel behavioural response to the 2015 Middle East Respiratory Syndrome

(MERS) outbreak in Seoul, South Korea. Kim et al. (2017) found that the public fear surrounding MERS resulted in a reduction in public transport use in the Seoul Metropolitan Area (SMA), with a peak of fear in June 2015 resulting in an 11.8% decrease in the number of trips taken and the number of individuals travelling reduced by 10.8%. Exploring the differing effects among socio-demographic groups, the authors found children (<11) and seniors (>65) drastically reduced their use of public transport whereas adults and youths only slightly reduced their use, potentially due to work and school demands. Higher land value was associated with a higher reduction in trip frequency and public transport use, suggesting those on higher incomes were able to better adapt their behavioural response compared to those on lower incomes. Subway use was much more affected compared to bus use, possibly explained by differing socio-demographic characteristics linked to each mode, with findings suggesting potential social inequities relating to behavioural adaptations.

Overall, the limited set of pre Covid-19 pandemic/epidemic travel behaviour literature examined both real and hypothetical behavioural adaptations, with a universally reported desire to decrease public transport use in the context of a major public health event. Only Wang (2014) identified long-term impacts, reporting a resumption of normal public transport use following a short perception of risk period.

2.4.3.2. Covid-19 and UK commuter travel / work practices

There has been substantial interest in understanding the impacts of Covid-19 on travel behaviour and work practices. For this literature review, a decision was made to limit the inclusion criteria to UK based peer-reviewed findings focussed on commuter and work travel. This decision was made to ensure the inclusion of robust evidence relevant to the RQs, noting the varied international response to Covid-19 (with a timeline of UK restrictions presented in Chapter One). At the time of the final literature search, there was limited published peer-reviewed literature looking specifically at the impact of Covid-19 on UK commuter and work travel, with two papers discussed below. However, relevant research has been more widely published within the grey literature, as discussed in Chapter One.

Harrington and Hadjiconstantinou (2022) report on changes in UK commute behaviours in response to the Covid-19 pandemic. The authors conducted an online survey (n=1,125) to ask about individuals' transport mode to and from work before and during Covid-19, in addition to likely future transport modes once Covid-19 restrictions were lifted. The surveys were live from May - June 2020, distributed through social media posts and emails to networks. Analysis was limited to car and public transport commuters (n=725), with the sample made up of 72.4% car commuters and 27.6% public transport commuters prior to Covid-19. Car commuters reported their future behaviour as being likely unchanged due to

Covid-19, with 81.9% of car commuters being likely to continue to commute by car once Covid-19 restrictions were lifted, and 3.6% and 6.5% reporting a potential change to walking and cycling, respectively. By contrast, 49% of public transport commuters reported potentially switching modes, including 20.5% reporting a potential switch to walking or cycling, and 10% reporting a switch to no commute with full-time home working. Findings show that, in the early stages of the Covid-19 pandemic, adaptation of a public transport commute was viewed as much more likely compared to a car commute. However, there was evidence of increased interest in switching to an active travel commute among both car and public transport commuters (10.1% and 20.5% respectively), in addition to 15.5% of the sample reporting no anticipated commute from increased home working. Yet the study's findings are limited and not generalisable to the national population, with a non-representative sample (skewed towards England) and an absence of contextual factors relevant to commute mode choice, such as distance from home to the workplace.

Angell and Potoglou (2022) report on the impacts of Covid-19 on work-related travel behaviours in the Cardiff capital region in Wales, UK. The study employed an online cross-sectional survey (n=211) to determine the immediate and anticipated long-term impacts of Covid-19, specifically focussed on mode choice, travel frequency and departure times. Respondents were limited to those in employment before the pandemic, over 18 years of age and living within the Cardiff Capital Region; the survey was live between June and July 2020, distributed through social media posts, mailing lists and online newsletters. The sample overrepresented full-time workers in professional and managerial occupations, predominantly aged between 35 and 65 (80.6%). Prior to Covid-19, the main mode for work-related travel within the sample was private car (56.9%), with 29.4% reporting public or shared transport, and 13.7% reporting active travel. At the time of data collection (amid Covid-19 restrictions), private car was the most popular mode of travel followed by cycling, with a reported 98% reduction in public transport use. Considering future mode choice, car remained the dominant choice with a 2.3% increase, alongside a 9% increase in active travel and a 11.4% decrease in public transport. The survey asked about travel attitudes, with 83.2% of the sample population stating that they strongly or somewhat agreed to avoid the use of public transport for a while following the pandemic.

Angell and Potoglou (2022) found a statistically significant difference between the mean number of days per week respondents commuted to work before the pandemic (4 days) and the intended frequency after the pandemic (2.9 days), with 39.8% of the sample believing it was very unlikely or somewhat unlikely to continue travelling with the same frequency for work as before the pandemic. Anticipated hours commuting from home to work were reported as similar to before Covid-19, although 7.7% of respondents indicated an intention

to travel after peak travel hours following the pandemic, whilst 13.3% indicated future departure time uncertainty. Overall, the survey's findings show that Covid-19 disruption significantly reduced travel frequencies for office-based Cardiff workers, with a high level of reported certainty that reduced work-related travel and increased number of days spent working from home would be a long-term outcome of Covid-19. Modal shift was identified as a likely post-lockdown impact, with increased car dependency and reduced use of public transport. However, findings are limited by the convenience sampling approach in addition to the non-representative sample, with the sample underrepresented by part time employees, lower-level occupations, and lower proportions of those under 35 and above 65. Additionally, the reliance on reported stated intentions for future behaviours is a limitation, with potentially limited accuracy due to the ongoing disruption at the time.

In sum, both papers exploring the impact of Covid-19 disruption on UK commuter travel and work practices in the early stages of Covid-19 disruption found that car travel was likely to remain the dominant commute mode, alongside a reported increased interest in active travel and concerns over future use of public transport. Additionally, both surveys reported intentions to increase home working, with Angell and Potoglou (2022) identifying this as an anticipated long-term change. However, both studies are limited by their convenience sampling approach; non-representative samples mean findings cannot be generalised, instead providing a snapshot of behaviours and attitudes in the early stages of Covid-19 disruption.

2.5. Addressing gaps in the literature

This research is addressing the impact of the macro disruption caused by the Covid-19 pandemic on UK commuter travel behaviour. Pre Covid-19, most disruption studies had limitations of relatively short follow-up periods and several relied on recall data, with limitations of forgetting why changes were made (Marsden et al., 2020). Preliminary findings from the post Covid-19 literature have limitations of reporting uncertain future reported intentions, with small convenience samples. This research aims to address these gaps by conducting a longitudinal interview study examining the behavioural impacts of Covid-19 disruption on commute travel and work practices. The longitudinal interview study enabled the medium- and long-term behavioural impacts of Covid-19 disruption to be identified, overcoming limitations of recall data and uncertain future intentions, and enabling the tracking of changes in attitudes and behaviours across different socio-demographic groups with in-depth research to understand why changes were being made.

A second identified gap in the literature is the lack of high-quality interventions testing the efficacy of persuasive technology to promote VTBC. Reviews cite issues of low-quality

experimental designs, lack of theory, and no or short-term behavioural impact evaluation. Additionally, there is a need to better understand and incorporate promising techniques such as tailoring in the design of sustainable mobility persuasive systems via long-term, robust impact evaluation. The disruption caused by the Covid-19 pandemic meant that it was out of the remit of this research to address these identified gaps. Instead, the research sought to address the lack of knowledge related to the role of persuasive systems promoting VTBC in the context of major disruption. The persuasive systems reviewed assume the status quo within society and the transport system, yet the magnitude of Covid-19 disruption has had the potential to influence how people interpret and react to persuasive technology and transport modes. To address this uncertainty, this research has carried out a messaging survey to understand whether Covid-19 disruption has altered the perceived persuasiveness of messages promoting VTBC.

Chapter Three – Methodology

3.1. Introduction

This chapter discusses the philosophical issues in research and justifies the research methods used. There will be a discussion of a critical realist paradigm and how critical realism (CR) fits with the selected research design, alongside an introduction to the selected theoretical framework. The chapter will additionally discuss the case study research design and the selected research methods including cross-sectional quantitative surveys, a longitudinal qualitative semi-structured interview study, the strengths and limitations of the selected data collection methods, and finally a discussion of ethical matters.

3.2. Research questions

The research aims to examine the behavioural impacts of Covid-19 disruption on commuter travel, and to understand the role of persuasive messaging to promote environmentally sustainable travel in the context of major disruption.

The objectives are:

- To understand the behavioural impacts of a major disruption event (Covid-19) on commuter travel to large employers in two UK cities (Bath and Edinburgh).
- To identify whether Covid-19 disruption has altered the perceived persuasiveness of previously validated messages promoting walking, cycling and bus use.
- To understand the role of large employers in encouraging and enabling environmentally sustainable commuting post disruption in two UK cities (Bath and Edinburgh).
- To explore how messaging interventions targeting commuter travel can be designed to help meet transport decarbonisation targets.

In order to address the research aims and objectives, four research questions (RQs) were developed.

RQ1. What are the behavioural impacts of a major disruption event (Covid-19) on commuter travel for selected large employer cases?

RQ2. Has the Covid-19 disruption altered the perceived persuasiveness of previously validated messages promoting walking, cycling and bus use?

RQ3. What is the role of large employers in encouraging and enabling environmentally sustainable commuting post disruption?

RQ4. How should messaging interventions be designed to help meet transport decarbonisation targets?

For RQ2, the following hypotheses were developed to test in the messaging survey, based upon the HDH and pandemic disruption literature discussed in Chapter Two:

- H1. Post Covid-19 disruption, users perceive previously validated walking messages as more persuasive compared to pre Covid-19
- H2. Post Covid-19 disruption, users perceive previously validated cycling messages as more persuasive compared to pre Covid-19
- H3. Post Covid-19, users perceive previously validated bus messages as less persuasive compared to pre Covid-19

3.3. Theoretical framework

To fully understand the impact of Covid-19 disruption on commuter travel and the potential for persuasive messaging to facilitate VTBC, there is a need to consider the wide range of factors affecting human behaviour. Created by Darnton and Horne (2013), the ISM model was designed to understand and influence human behaviour, particularly where significant levels of social change are required (Adams and Hampton, 2018). The model encompasses various aspects of behavioural science and social practice theories (discussed in Chapter Two) (Table 8).

Context	Description
Individual context	Factors held by the individual that affect the choices and behaviours he or she undertakes. These include an individual's values, habits, attitudes, and skills, as well as the calculations he or she makes before acting, including personal evaluations of costs and benefits.
Social context	Factors that exist beyond the individual in the social realm yet shape behaviours. These include understandings that are shared among groups, such as social norms and the meanings attached to activities, as well as people's networks and relationships, and the institutions that influence how groups of individuals behave.
Material context	Factors that are 'out there' in the environment and wider world, which both constrain and shape behaviour. These influences include existing 'hard' infrastructures, technologies, and regulations, as well as other 'softer' influences such as time and the schedules of everyday life.

Table 8. The ISM model (Darnton and Horne, 2013)

In addition to the factors listed in the ISM model, disruptive events have been shown to alter human behaviour. With Covid-19 representing a major disruptive event, it is important that the role of disruption is integrated into the study's theoretical framework. The HDH is a theory originating from social psychology which posits that habits can be weakened or broken if a disruptive event causes the connection between contextual cues and the behaviours they promote to be disrupted (Verplanken and Wood, 2006). In states of disruption, a window of opportunity may arise with a higher likelihood of habitual behaviour

being (re)considered (Verplanken and Wood, 2006; Verplanken et al., 2008). Finally, the research topic requires that the role of persuasive technologies, specifically persuasive messaging, is factored into the framework. Oinas-Kukkonen and Harjumaa (2008) put forward the PSD model as a framework for designing and evaluating persuasive systems, considering both the persuasion context and persuasive system features. The persuasion context includes identifying the intent (who is the persuader, what type of change does the persuader target), the event (use, user, and technology contexts), and the strategy (message and route) (Sunio and Schmocker, 2017). Regarding persuasive system features, the PSD model comprises four distinct design categories, including primary task support, dialogue support, credibility support, and social support.

This research has integrated the HDH and PSD model into the ISM model, to provide a theoretical framework considering the wide range of factors affecting commute travel behaviour in the study context including Covid-19 disruption and persuasive technologies. The adjusted theoretical framework is provided in Figure 9. The framework has been used to design and conduct the research, including structuring surveys and interview topic guides, alongside deductive analyses.

3.4. Research philosophy: critical realism

Assumptions and views about the nature of the social world and how knowledge is produced have influence on the research process (Clark et al., 2022). Moon and Blackman (2014) note three fundamental elements of research philosophy: ontology (what is real, the nature of reality); epistemology (our knowledge of reality); and philosophical perspective (the philosophical orientation of the researcher). Different research philosophies with distinct ontological and epistemological positions have been historically aligned with certain disciplines and data collection methods; the positivist paradigm has been associated with scientific, quantitative data, whereas the interpretivist paradigm originated within the social sciences with a focus on ethnographic, qualitative methods (Cohen and Crabtree, 2006a).

The positivist paradigm was founded on the idea that individuals can best gain an understanding of human behaviour through observation and reason (Nel, 2016a). It poses that the discovery of general laws is the goal of scientific requirement and advocates for hypothesis testing as a procedure to generate and validate knowledge (Coolen, 2012). Key concepts shared among positivists include validating truth claims by empirical inquiry, seeking standards in terms of definitions and concepts, and favouring an approach which seeks to establish generalisations about the world (Coolen, 2012). By contrast, interpretivists believe that social reality is viewed and interpreted by the individual. Knowledge is personally experienced, with interpretivists noting the multi-layered complexity of reality; a

single phenomenon could have multiple interpretations (Nel, 2016b). Thus, the interpretivist paradigm favours qualitative research due to a belief that it is not possible to answer complex human problems with systematic, precise answers. Research findings are limited in their generalisability but are used to provide clarity on how people make meaning of phenomena in specific contexts, resulting in a greater understanding of society (Nel, 2016b).

CR is a branch of research philosophy that recognises concepts from both positivism and interpretivism, attributed to a series of books written by Roy Bhaskar in the late 20th century (O'Mahoney and Vincent, 2014). This research is committed to a CR research philosophy, which is interested in both how and why change occurs (Smith and Elger, 2014). One of the most important tenets of CR is that ontology (i.e., what is real) is not reducible to epistemology (i.e., our knowledge of reality), with human knowledge only able to capture a small part of reality (Fletcher, 2017). The CR paradigm posits that an objective world exists independently of people's perceptions, language or imagination, while also acknowledging that subjective interpretations influence the ways in which the objective world is perceived and experienced (O'Mahoney and Vincent, 2014).

Bhaskar identifies reality as the most important philosophical consideration, as he states that "we will only be able to understand – and so change – the social world if we identify the structures at work that generate those events and discourses", with such structures only identifiable through the work of social sciences (Bhaskar, 1989, p.2 in Clark et al., 2022, p.25). Recognising a structured and layered ontology is essential as the primary goal of CR is to "explain social events through reference to causal mechanisms and the effects they can have throughout the three-layered reality" (Fletcher, 2017, p.5) (Figure 11).

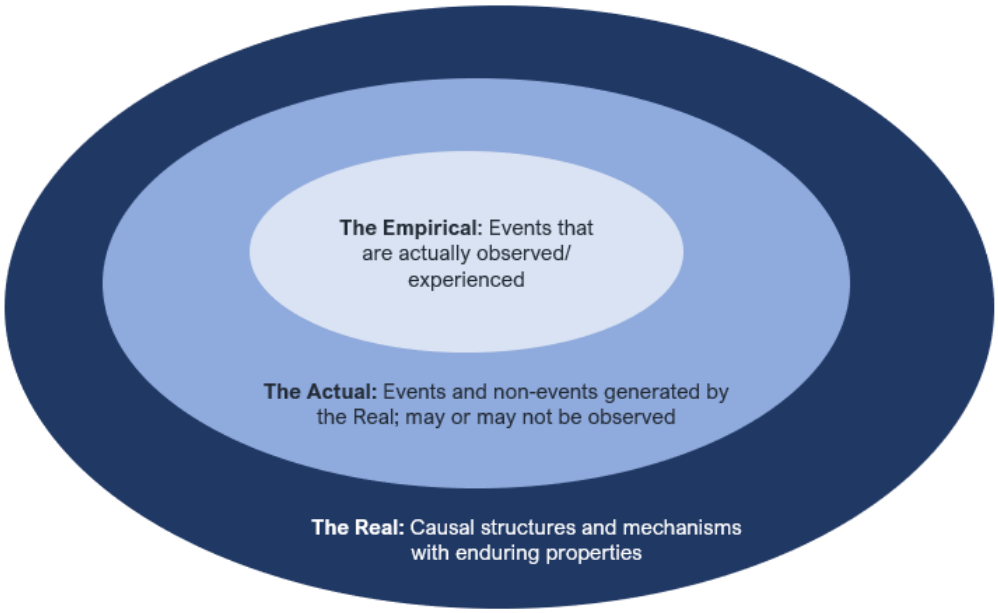


Figure 11. Critical realist stratified ontology (Fletcher, 2017)

The first empirical level of the CR stratified ontology is the realm of events as we experience them, where events or objects can be measured empirically but are “mediated through the filter of human experience and interpretation” (Fletcher, 2017, p.5). At this level of reality, social ideas, meanings, decisions and actions occur, and can be causal. The middle level consists of the actual, where there is no filter of human experience; events occur whether or not we experience or interpret them, and these occurrences are often different from what is observed at the empirical level (Danermark et al., 2002, p. 20). The final level is the real; this is where causal structures exist, referring to the inherent properties in an object or structure that act as causal forces to produce events (i.e., those appearing at the empirical level) (Fletcher, 2017).

The CR stratified ontology overcomes the epistemic fallacy evident in both positivism and interpretivism, which Bhaskar (1998, p.27) defines as the limitation of reality to what can be empirically known, in addition to interpretivist perspectives which view reality as entirely constructed through and within human knowledge (Fletcher, 2017). By contrast, CR accepts complexity, multi-causality, and shies away from disciplinary imperialism by recognising reality as multiply determined with no single mechanism determining the whole result (Sayer, 2000; Bhaskar, 1978). Critical realists accept the objective world existing outside of the individual but also accept the important role of agency, with people able to exist within certain ‘real’ social structures and the ability of individuals to change and form these structures (Hurrell, 2009).

Bhaskar (1989) writes that we can identify what we do not see through the processes of social science research, with critical realists seeking to provide explanations for observable events by looking for the underlying causes and mechanisms through which social structures shape everyday life (Saunders et al., 2009). The search for causation helps CR researchers to explain social events and additionally suggest practical policy recommendations to address social problems (Fletcher, 2017).

Overall, this study opted for a CR approach noting its complex, multi-causality understanding of reality with an interest in both how and why change occurs, which was considered suitable to the research study's topic focussed on understanding changes in travel behaviour and work practices amid Covid-19 disruption. CR is not associated with a particular set of data collection methods and accepts the need for both quantitative and qualitative methods (Fletcher, 2017). However, a commitment to a CR philosophy does have consequences for the possibilities and limitations of the research methods, techniques, and analyses employed. In particular, the commitment to a CR approach had implications in terms of the selected research methods, with a preference for detailed interviews to gain access to richly textured accounts of events and underlying processes (noting different categories of interviewees), and a preference for quantitative approaches to supplement qualitative methods to reveal different features of the same reality. The implications of the CR approach for the selected data collection methods are described in detail throughout the remainder of this chapter (O'Mahoney and Vincent, 2014).

3.5. Case study research

The intention of case study research is to gain an in-depth understanding of the phenomena of interest in a real-life setting (Dobson, 2001). The basic case study design involves detailed and intensive analysis of a single case, concerned with the complexity and particular nature of the case in question (Stake, 1995; Clark et al., 2022, p.59). Case study research is a flexible methodology which can be undertaken in a multitude of ways. Cases can take various forms, for example a community, an organisation, a family, or a single event. As Cavaye (1996, p. 227) states, "case research can be carried out taking a positivist or an interpretive stance, can take a deductive or an inductive approach, can use qualitative and quantitative methods, can investigate one or multiple cases". Case study research can therefore be defined as a research method that involves investigating one or a small number of social entities about which data are collected using multiple sources of data and developing a holistic description through an iterative research process (Easton, 2010). Darke et al. (1998) write that the use of the case study in research is useful in newer, less well-

developed research areas, particularly where examination of the context and the dynamics of a situation is important.

Following the development of the research aim and objectives, a case study research design was selected as an appropriate methodology to enable an in-depth examination of the behavioural impacts of novel Covid-19 disruption on commuter travel, and to understand the role of persuasive messaging to promote environmentally sustainable travel in the context of major disruption. Yin (2009) distinguishes between five types of cases commonly used within case study research: the critical case, the extreme or unique case, the representative or typical case, the revelatory case, and the longitudinal case, with any case study able to involve any combination of these elements (Clark et al., 2022, p.61). For this study, two typical cases were selected (B&NES Council and NatWest Bank, introduced in Chapter Five), whereby "the objective is to capture the circumstances and conditions of an everyday or commonplace situation" (Yin, 2009, p.48). The two cases were selected not because they were extreme or unusual, but because they epitomise a broader category that they are members of (desk-based large employers); large employers are a source of authority with significant influence over their employees' work related travel behaviour, and as such the selected organisations and their employees provided suitable contexts for the RQs to be answered (Clark et al., 2022, p.60). In addition, both private and public sector organisational cases were selected to provide varied insights into the roles of employers on commuter travel and work practices, noting the differences in public versus private sector decision-making discussed in Chapter Two.

A common criticism of case study research is that "a single case cannot be sufficiently representative that it might produce findings that can be applied more generally to other cases" (Clark et al., 2022, p.61). A multiple case design aims to overcome this limitation, which occurs whenever the number of cases examined exceeds one (Clark et al., 2022). The main argument in favour of the multiple case study is that it improves theory building; by comparing two or more cases, the researcher can better establish the circumstances in which a theory will or will not hold (Clark et al., 2022, p.63). Thus, a multiple case study can help to understand causality from a CR perspective. The type of causality inferred from a multiple case study is referred to as 'generative', whereby causal mechanisms explaining how and why events happened are accessible indirectly by developing theory, as opposed to wholly based on empirical observations (Blom and Morén, 2011). Critical realists view multiple cases as important to research because the intensive nature of cases enables the researcher to examine how generative causal mechanisms operate across different or similar contexts (Ackroyd, 2009; Clark et al., 2022, p.64). A comparative case study design

allows the distinguishing characteristics of two or more cases to act as a foundation for theoretical reflections about any contrasting findings (Clark et al., 2022, p.65)

For this research, a typical mixed methods multiple case study approach was selected with a combination of extensive (quantitative) and intensive (qualitative) research methods within two organisational cases. As previously discussed, the use of comparative cases is an approach advocated among critical realists. The mixed methods case study design allows the role of generative causal mechanisms to be established, accepting that the same phenomena may have multiple contextual causes (Sayer 2000; Hurrell, 2014). The two organisational cases are discussed in Chapter Five, with a detailed description of the individual research methods used in each case provided below.

3.6. Research methods

3.6.1. Research design

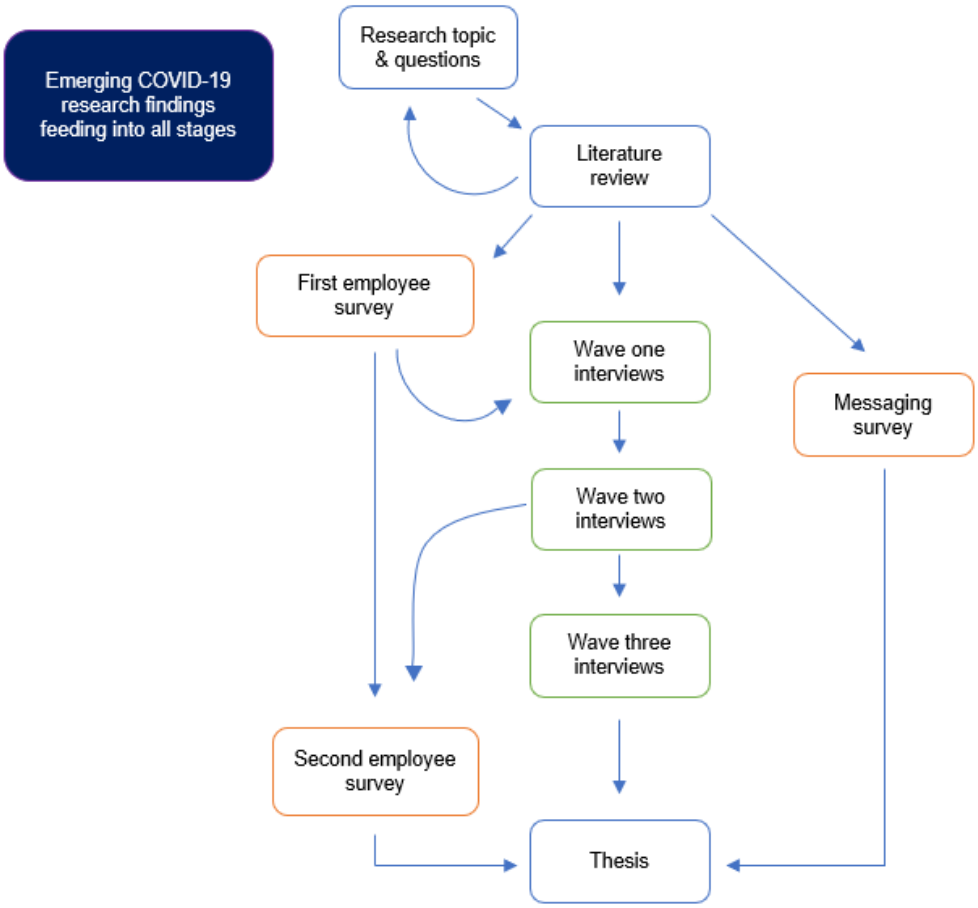


Figure 12. Research design diagram

Figure 12 shows the study's iterative mixed methods design. An iterative approach is one where the content of the methodology is adapted over the course of the study, with learning from initial research used to influence subsequent research (AQR, 2020). The research

employs complementary quantitative and qualitative data collection and analyses throughout the study period. Recognising the dynamic nature of the research topic, various feedback loops are present with emerging Covid-19 findings informing all stages of the research.

Within CR, the difference between quantitative and qualitative methods can be understood as the difference between extensive and intensive research (Hurrell, 2014). Extensive research methods search for large numbers of observations that can describe significant relationships (i.e., quantitatively), whereas intensive methods are concerned with "what makes things happen in specific circumstances" via examining the qualitative nature of phenomena and the intricacies of context (Sayer, 2000; Hurrell, 2014). Hurrell (2014) advocates for combining extensive and intensive approaches to "reveal different features of the same layered reality". Hence, the inclusion of surveys and a longitudinal qualitative interview study are appropriate choices for this CR guided research.

A summary of the data collection methods chosen to answer the RQs within the case study methodology is provided in Table 9, with the selected data collection methods enabling both an intensive and extensive examination of the impact of Covid-19 disruption on commuter travel and work practices within the two cases. The remainder of this chapter provides a summary of quality criteria for mixed methods research, followed by detailed descriptions of the selected data collection methods.

Research questions	**Data collection method(s)**
RQ1. What are the behavioural impacts of a major disruption event (Covid-19) on commuter travel for selected large employer cases?	Repeat cross sectional survey, longitudinal interview study
RQ2. Has the Covid-19 disruption altered the perceived persuasiveness of previously validated messages promoting walking, cycling and bus use?	Messaging survey
RQ3. What is the role of large employers in encouraging and enabling environmentally sustainable commuting post disruption?	Repeat cross sectional survey, longitudinal interview study
RQ4. How should messaging interventions be designed to help meet transport decarbonisation targets?	Repeat cross sectional survey, longitudinal interview study, messaging survey

Table 9. Research questions and data collection methods

3.6.2. Quality criteria for mixed methods research

Different quality criteria are typically used to assess the rigour of quantitative and qualitative research. For quantitative research including surveys, concepts of reliability and validity are essential to evaluate the quality of studies (Clark et al., 2022). Within survey research, reliability is concerned with ensuring that measures devised for understanding concepts are consistent over time (Clark et al., 2022, p.40). Validity is concerned with the integrity of conclusions derived from a piece of research, including measurement validity, internal validity, and external validity (Clark et al., 2022). Measurement validity relates to whether a

measure used to assess a concept really does reflect that concept, with a preference for pre-tested, validated measures to be used within survey research. Internal validity relates to the issue of causality, i.e., whether a conclusion that proposes a causal relationship between two or more variables is convincing. Finally, external validity refers to whether the results of a study can be generalised beyond the specific research context. If the research is not externally valid, it will apply only to the group of participants or respondents involved in that research, whereas if it is externally valid, findings can apply to the wider groups of people who are represented by the individuals involved (Clark et al., 2022). To ensure high quality survey research, this research ensured the inclusion of pre-tested valid measures where possible alongside careful consideration of data collection procedures including sampling when assessing the validity of survey research findings.

For qualitative research, Lincoln and Guba (1985) propose the concept of trustworthiness to evaluate a study's worth. Trustworthiness requires the establishment of:

- Credibility, the confidence in the truth of findings;
- Transferability, showing that findings have applicability in other contexts;
- Dependability, showing that findings are consistent and could be repeated; and
- Confirmability, a degree of neutrality or identifying the extent to which the findings of a study are shaped by the respondents and researcher bias, motivation or interest (Cohen and Crabtree, 2006b).

Lincoln and Guba (1985) describe a series of techniques that can be used to conduct qualitative research that achieves trustworthiness. Techniques to establish credibility include prolonged engagement (spending adequate time speaking with a range of people and developing relationships), and triangulation (using multiple data sources to produce understanding). A technique for establishing transferability includes the use of thick description, where researchers describe a phenomenon in sufficient detail so that readers can evaluate the extent to which the conclusions drawn are transferable to other settings (Cohen and Crabtree, 2006b). Considering dependability, an audit process should be used which includes having an independent researcher examine both the process and product of the study. Finally, for confirmability, Lincoln and Guba (1985) recommend the use of methods triangulation and reflexivity, where researchers acknowledge how their background and position have affected their investigation, findings, and conclusions (Malterud, 2001, p. 483-484).

3.6.3. Surveys

Survey research is a flexible method of data collection involving the process of collecting information about a group of people by asking them questions and analysing the results (McCombes, 2019a). Survey research is traditionally aligned with a positivist epistemology where researchers derive hypotheses from theory, collect data in the form of responses to closed-ended questions, analyse the data and, on a probability basis, confirm or deny the hypotheses (Harvey, 2022). Surveys can generate large scale, representative data which can be used to make generalisations about the population of interest via statistical procedures (Ragin, 1994). However, surveys do not enable in-depth understandings of the experiences and meanings of the population of interest (Clark et al., 2022). Furthermore, positivist researchers seek to achieve objectivity within survey research by establishing closed-ended questions prior to data collection. However, this may result in emergent concepts relevant to RQs being missed from analysis. Combining quantitative survey data with qualitative data can enhance survey findings as the triangulation of different data types allows for a level of depth to explore causal mechanisms that surveys alone do not allow. The triangulation of quantitative and qualitative methods is discussed in more detail in Chapter Four.

As shown in Figure 12, the research design implemented three surveys in total: two employee surveys with a repeat cross-sectional design, and one cross-sectional messaging survey. As advocated by Sayer (1992), the study's surveys are largely descriptive, and the survey findings have been triangulated with in-depth qualitative data.

3.6.3.1. Employee repeat cross-sectional survey

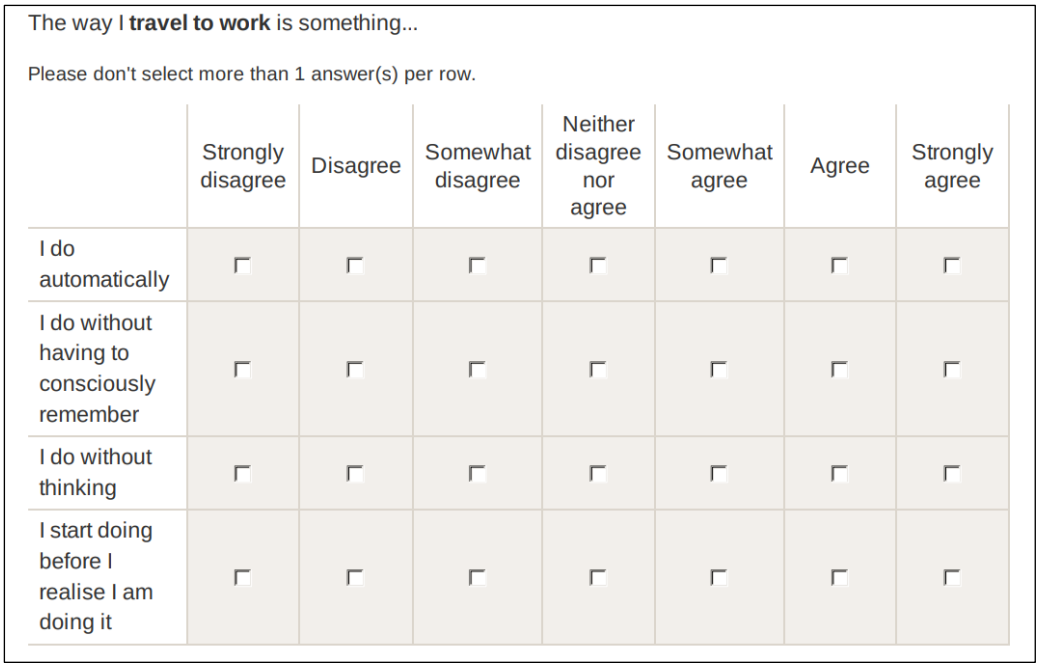
Cross-sectional surveys are commonly used to find out about the characteristics, preferences, opinions, or beliefs of a group of people at a specific point in time; the surveys can detect patterns of association and identify relationships between variables (McCombes, 2019a; Clark et al., 2022). Cross-sectional surveys can be repeated periodically to estimate changes occurring over time, with strong external validity depending on the sample used (Lavrakas, 2008; Clark et al., 2022). Considering RQ1 and RQ2 (Table 9), two cross-sectional surveys administered one year apart were selected as an appropriate method to learn about employees at the selected cases' travel to work and working from home behaviour and attitudes, including how this might have changed throughout the Covid-19 disruption. However, repeat cross-sectional surveys are limited by weak internal validity with an inability to determine causal relationships, in addition to limited depth of exploration due to the preference for closed-ended questions (Clark et al., 2022). To address these limitations and to better identify causal mechanisms relevant to the RQs, the repeat cross-

sectional surveys were administered as a supplementary data collection method alongside a longitudinal interview study (discussed in section 3.6.4.).

Both cross-sectional surveys were designed on Online Surveys, a General Data Protection Regulation (GDPR) compliant online platform where users can access and complete structured questionnaires via a weblink. Although postal surveys have typically higher response rates, research has shown there is often minimal differences between different types of survey delivery; online surveys were selected due to the significant time and cost savings compared to postal surveys with advantages of automatic coding, better data accuracy and ease of administration amid Covid-19 disruption (Clark et al., 2022).

A pilot survey was created and shared with postgraduate staff members from the University of Leeds (n=38), with pilot respondents asked to fill in a feedback form to check the length of the survey, question clarity, survey structure and format, whether the survey omitted any important issues, and to check any difficulties completing the survey. Minor edits were made to incorporate pilot feedback, including the restructuring of question order.

The final surveys contained a series of closed-ended questions including Likert scale questions to identify commute and work from home satisfaction, in addition to four open-ended comment boxes for respondents to expand on certain measures of interest, including commute and home working satisfaction. To measure commute mode habit, the surveys included the Self-Report Behavioural Automaticity Index (SRBAI) (Figure 13). The SRBAI is a four-item automaticity subscale based upon the twelve-item Self Report Habit Index (SRHI), which is a validated measure of habit strength (Gardner et al., 2012). Gardner et al. (2012) note that the SRBAI “offers a parsimonious measure that adequately captures habitual behaviour patterns”, which is appropriate for use in studies tracking habit formation or disruption. The analysis considered changes to each component of habit strength to identify any changes to different components of habitual behaviour, in addition to scale mean to measure overall habit strength.



The way I **travel to work** is something...

Please don't select more than 1 answer(s) per row.

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
I do automatically	☐	☐	☐	☐	☐	☐	☐
I do without having to consciously remember	☐	☐	☐	☐	☐	☐	☐
I do without thinking	☐	☐	☐	☐	☐	☐	☐
I start doing before I realise I am doing it	☐	☐	☐	☐	☐	☐	☐

Figure 13. Self-report behavioural automaticity index (Gardner et al., 2012)

The surveys additionally included monitoring questions featured in both Transport Scotland (2021b) and Transport Focus (2021) to monitor public attitudes to transport and travel during the Covid-19 outbreak (Table 10). Transport Focus asked the monitoring questions to a nationally representative English sample and Transport Scotland asked the questions to a nationally representative Scottish sample. The rationale behind the inclusion of the monitoring questions in this study's employee surveys was to understand respondents' attitudes towards the long-term impact of Covid-19 on travel behaviour, and to enable a comparison of findings between the study's sample and the wider population.

Thinking about a year from now, to what extent do you agree or disagree with the following regarding the long-term impact on your travel behaviour?	
Q1. I will be avoiding public transport and using my car or other vehicle more than I did before Covid-19.	Likert scale: Strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree, don't know, not applicable
Q2. I will be doing all of the things I did before Covid-19 including vacations and travel.	Likert scale: Strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree, don't know, not applicable
Q3. I expect to be working from home more often than before Covid-19.	Likert scale: Strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree, don't know, not applicable
Q4. I will be walking or cycling more than before Covid-19.	Likert scale: Strongly agree, somewhat agree, neither agree nor disagree, somewhat disagree, strongly disagree, don't know, not applicable

Table 10. Covid-19 attitude monitoring questions (Transport Scotland, 2021b; Transport Focus, 2021)

All other questions, including question wording on travel behaviour, were designed by the researcher. Open text responses were inductively coded and grouped into themes.

The first employee survey took approximately five to seven minutes to complete, split into the following sections: pre Covid-19 travel to work and work from home behaviour and attitudes; first Covid-19 lockdown travel to work and work from home behaviour and attitudes; current travel to work and work from home behaviour and attitudes; long-term travel attitudes; and socio-demographics. The survey was launched in January 2021 and ran until March 2021. The second survey similarly took approximately five minutes to complete and asked about current behaviour including travel to work and working from home behaviour and attitudes, in addition to changes to travel behaviour since Covid-19, long-term travel attitudes, and socio-demographics. The second survey was launched in February 2022 and ran until April 2022. A copy of questions asked in both surveys is provided in Appendix 1.

The surveys' population of interest was the entire staff of the organisational cases (B&NES Council and NatWest bank). The surveys were shared to all staff via case study gatekeepers; the gatekeepers promoted the surveys via email and posts on intranets, including text promoting the chance to join a raffle to win a £50 voucher dependent on survey completion. Once the surveys had been advertised among all staff, the surveys recruited participants via voluntary response sampling where people volunteered themselves to complete the online survey (McCombes, 2019b). The number of responses were monitored throughout and gatekeepers re-advertised surveys in an attempt to increase the number of responses. The first survey had a total of 143 respondents (B&NES n=79, NatWest n=64). The second survey had a total of 80 respondents (B&NES n=33, NatWest n=47). As the gatekeepers advertised the surveys via company intranets, it is not possible to accurately estimate how many employees were invited to the survey and hence, to establish survey response rates.

A limitation of the sampling procedure for the surveys is the non-probability approach, where individuals are selected based on non-random criteria with a higher risk of sampling bias (McCombes, 2019b). Furthermore, the surveys' samples represent a low response rate and are not representative of the selected cases' employees. Weighting the sample was considered unsuitable as bias may have been accentuated due to low response rates. Thus, while the surveys provide insights into participants' travel and home working behaviour and attitudes, the surveys have weak external validity, and it cannot be said that survey findings are epressentative of the organisations' employees. Furthermore, despite the carefully considered survey design, the samples are likely to contain self-selection bias (where people with specific characteristics are more likely to agree to take part in a study than others), in addition to social desirability bias (where people have the tendency to underreport socially undesirable attitudes and behaviours and overreport more desirable attributes), and recall

bias (where participants do not remember previous events or experiences accurately) (Bhandari, 2020; Latkin et al., 2018; Spencer et al., 2017).

Overall, the two employee cross-sectional surveys enabled the research to identify trends in relation to commute and working from home behaviour and attitudes amid Covid-19 disruption among survey participants, with survey data used to triangulate in-depth qualitative interview findings. However, the surveys are significantly limited by their small, non-representative, non-probability samples with additional challenges of self-selection, social desirability and recall bias. Caution must be taken in the interpretation of findings with survey findings not generalisable to all B&NES Council and NatWest Bank employees. Findings from the surveys are described in Chapter Six.

3.6.3.2. Messaging survey

The research designed a messaging survey to answer RQ2 and RQ4 (Table 9). A survey was identified as the most suitable data collection method to enable statistical analysis to identify which variables were associated with messages' perceived persuasiveness (discussed further in Chapter Four). The structure of the survey was developed based upon the ADAPT study's surveys, including questions on socio-demographics, travel behaviour and specific survey measures to assess personality, message persuasiveness, message type and message value (University of Leeds, 2016).

Previously validated messages promoting walking, cycling and bus use were identified from research undertaken as part of the ADAPT study. Within ADAPT, Pangbourne, Bennett and Baker (2019) distinguished messages by 'message type' and 'message value'. Considering message type, the ADAPT study tested messages constructed with several argument types identified from a sustainable travel dataset to understand which message type was found to be persuasive in messages to promote sustainable transport. The ADAPT study reported that message types *authority*, *ad populum* and *consequence* were rated as the most persuasive, with these three message types selected for inclusion in this study's messaging survey. Examples of the three different message types are shown in Table 11.

Message Type	Example
Authority	**Doctors and scientists agree** that walking short distances has substantial health benefits
Ad Populum	**Over 90% of people agree** that cycling is a healthy way to travel
Consequence	Commuting by bus instead of by car **could save you an average of £1200 a year**

Table 11. Message argument types (Pangbourne, Bennett and Baker, 2019)

Considering message value, Fogg (2002) writes that, without an appeal to value, messages provide little if any motivational force. The ADAPT study wished to understand which value, if

any, was found to be persuasive when appealed in a message to promote sustainable transport. Pangbourne, Bennett and Baker (2019) identified four values from their sustainable travel message dataset, including health (health benefits of sustainable transport), finance (the cost savings to the individual as a result of using sustainable transport), environment (the environmental benefits and reduction in emissions as a result of using sustainable transport modes), and convenience (the ease and time-savings of sustainable transport modes). Results from the ADAPT surveys found that values of health and finance were typically rated as the most persuasive, with messages containing health and finance values selected for inclusion in this study's messaging survey.

Considering message mode, the ADAPT study ran three surveys with each examining a different sustainable transport mode: walking, cycling, and bus. This study's messaging survey incorporated questions for each mode including authority, ad populum and consequence message type, and health and finance message values. The messaging survey had a total of 18 messages; each participant was asked to rate the persuasiveness of six messages, including a walking health message, a walking finance message, a cycling health message, a cycling finance message, a bus health message, and a bus finance message, with messages randomised based on message type (authority, ad populum, consequence). Each respondent rated a total of six messages (one walking/health, one walking/finance, one cycling/health, one cycling/finance, one bus/health, and one bus/finance, with messages randomised by message type (e.g. authority/ad populum/consequence).

Message structure (mode/value/type)	Respondents (n)
Walking/Health/Authority	132
Walking/Health/Ad Populum	149
Walking/Health/Consequence	124
Walking/Finance/Authority	128
Walking/Finance/Ad Populum	136
Walking/Finance/Consequence	141
Cycling/Health/Authority	140
Cycling/Health/Ad Populum	145
Cycling/Health/Consequence	120
Cycling/Finance/Authority	156
Cycling/Finance/Ad Populum	131
Cycling/Finance/Consequence	118
Bus/Health/Authority	139
Bus/Health/Ad Populum	133
Bus/Health/Consequence	133
Bus/Finance/Authority	135
Bus/Finance/Ad Populum	152
Bus/Finance/Consequence	118

Table 12. Messaging survey list

To rate message persuasiveness, participants followed the same approach used in the ADAPT study where users completed an amended version of a self-report measure of perceived argument strength developed by Zhao et al. (2011). This involved rating eight questions on a Likert scale (Figure 14), with the mean of these scores calculated to create an overall persuasiveness rating score (Cronbach's alpha coefficients: mean $\alpha = 0.90$, range = 0.82 –0.96).

The persuasiveness measure was selected to understand what factors influence a message's perceived persuasiveness, with perceived persuasiveness encompassing multiple persuasive appraisal methods such as believability, self-efficacy, and likelihood it would convince a friend (Pangbourne, Bennett and Baker, 2019). The persuasive message was selected as the only dependent variable as the survey replicated the approach undertaken in ADAPT. Whilst intention is undoubtedly an important factor in understanding behavioural choice, it was not included as a dependent variable due to potential issues of participant burden, noting the inclusion of questions around existing preferences (rather than intentions), actual recent behaviours, demographics, personality traits, and attitude. Since the survey aimed to compare findings to the ADAPT study (and the ADAPT surveys did not include intention), a decision was made to not include intention. Understanding the role of

intention in relation to messages' perceived persuasiveness is an area to consider exploring in future research.

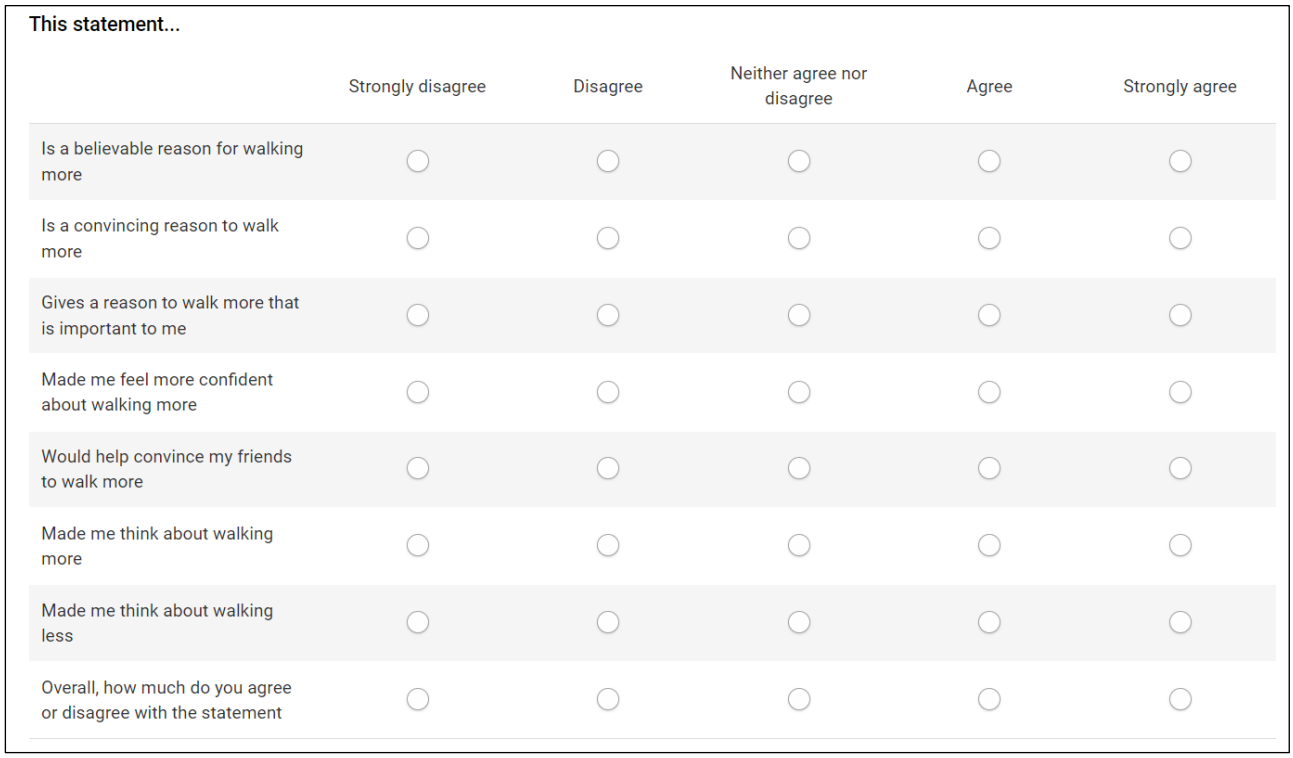


Figure 14. Self-report measure of perceived argument strength (Zhao et al., 2011)

The Mini-IPIP question battery was selected to measure personality in the messaging survey, with the Mini-IPIP measuring a popular theory that people differ on five broad personality traits (Table 13) (Donnellan et al., 2006). The Mini IPIP is a 20-item short form of the 50 item Internationality Personality Item Pool measure, which was selected due to its shorter length and comparable validity compared to its parent measure (Goldberg, 1999).

Personality trait	**Associated characteristics**
Openness to Experience	Imagination, artistic interest, adventurousness, intellect, liberalism
Conscientiousness	Self-efficacy, orderliness, dutifulness, self-discipline, cautiousness
Extraversion	Friendliness, gregariousness, assertiveness, cheerfulness
Agreeableness	Trust, morality, altruism, modesty, sympathy, cooperation
Neuroticism	Anxiety, anger, impulsiveness, self-consciousness, vulnerability

Table 13. Mini-IPIP (Donnellan et al., 2006)

A small pilot study was launched to ensure the smooth-running of the survey, recognising that the selected survey measures had already been piloted on a large scale via the ADAPT surveys. Following the survey pilot (n=10), participants were recruited to participate in the messaging survey via Prolific in September 2021. Prolific is a service dedicated to online recruitment and was selected due to the ability to recruit a robust, nationally representative sample within the limited time and budget available. Peer et al. (2017) report that the use of

Prolific results in high quality data, with Prolific participants less exposed to common research tasks compared to participants on other platforms such as Amazon Mechanical Turk. A power analysis was conducted via G*Power to determine the sample size required for statistical analysis and the survey was launched with a total of 405 participants completing the survey.

Prolific provided a quota sample stratified by age, sex and ethnicity, resulting in a sample representative of the demographic distribution of the UK. Participants were paid an average reward of £10.79 per hour for completing the survey, with the survey taking between 10-15 minutes to complete on average. Attention check questions were included within the survey to ensure participants were accurately reading and answering questions. As the population of interest for the messaging survey is the entire UK (following the approach set out in ADAPT), the survey's nationally representative sample is a strength of the survey. However, quota stratified sampling remains a non-probability sampling method resulting in sampling bias, with an inability to determine the possible sampling error and to make statistical inferences from the sample to the population (Lund Research, 2012). Furthermore, the sample is limited as it was only accessible only to internet users, with users who complete online surveys often more educated and wealthier than a general sample of the population (Goodwin, 2020).

Overall, the messaging survey was a suitable data collection method to examine whether the perceived persuasiveness of messages promoting walking, cycling and bus use had altered since Covid-19 disruption, with a sample representative of the UK by age, gender, and ethnicity. However, the external validity of findings is limited by the non-probability online sample and findings cannot be statistically inferred to the wider population. Findings from the messaging survey are reported in Chapter Eight and a copy of the messaging survey is provided in Appendix 4.

3.6.4. Interviews

Qualitative interviews are a flexible, dynamic data collection method with semi-structured interviews used where researchers require rich, detailed answers to explore a topic in depth (Mason, 2002; Clark et al., 2022). Longhurst (2009, p.580) defines semi-structured interviews as "'a verbal interchange where one person, the interviewer, attempts to elicit information from another person by asking questions". Interviewers typically prepare a list of predetermined questions within a topic guide but allow the interviews to unfold in a conversational manner with participants having the chance to freely explore issues that they feel are important (Longhurst, 2009).

From a CR perspective, interviews are an intensive research method which enable the researcher to gain access to the attitudes and emotions of information in addition to “richly textured accounts of events, experiences and underlying conditions and processes, which represent different facets of a complex and multi-layered social reality” (Smith and Elger, 2014, p.111) Smith and Elger (2014) highlight the importance of interviews informed by an appropriate analytical framework to guide questions and suggest probes, to enhance the depth and complexity of the selected cases. Pawson and Tilley (1997) distinguish between two categories of interviewees in relation to organisational case studies: practitioners and subjects. Practitioners are recognised as having expert knowledge about the mechanisms, contexts and outcomes related to specific organisational policies. Yet practitioners are unlikely to be able to offer a full and systematic account, with potentially polished accounts of activities. Thus, interviews with subjects are useful to provide detailed contextual information relating to experiences of organisational policies (Smith and Elger, 2014).

3.6.4.1. Longitudinal interview study

A longitudinal qualitative interview study was identified as an appropriate data collection method to answer RQ1 and RQ3, in addition to the two employee surveys (Table 9). A longitudinal interview study is where interviews are conducted with “the same people over a time period sufficient to allow for the collection of data on specified conditions of change” (Ruspini 1999, in Hermanowicz, 2013). A longitudinal interview study is well-suited to CR with the aim of exposing process and evaluating causality and was determined to be an appropriate data collection method to enable a rich, depth exploration of changes in behaviour and attitudes over time.

A semi-structured interview was selected as the most appropriate type of interview for the longitudinal interview study, as semi-structured interviews enable all participants to be asked the same or similar open-ended questions within a pre-determined yet flexible topic guide. The open-ended nature of the semi-structured interviews was viewed as important to producing the detailed, rich answers required for thematic analysis (George, 2022). However, it is recognised that semi-structured interviews are likely limited by a certain degree of participation bias including social desirability bias, where participants answer questions in a way that they think will be socially accepted by the interviewer and recall bias, where participants do not remember previous events or experiences accurately or omit details (Spencer et al., 2017).

3.6.4.2. Participant selection and recruitment

Employees working at the selected cases (B&NES Council and NatWest Bank) were the population of interest for the longitudinal interview study. Purposive maximum variation

sampling was identified as the most appropriate sampling procedure for the longitudinal interview study. Clark et al. (2022, p.379) notes that “the logic of maximum variation sampling is to describe common features or themes that exist across a wide variety of contexts”, where researchers identify characteristics that might reasonably be thought to influence data, and then sample to ensure as wide a variation as possible in terms of those characteristics. Participants who completed the first employee cross-sectional survey had the option to provide their email if they were interested in follow-up research. This resulted in a database consisting of employees’ email addresses with corresponding socio-demographic and travel behaviour information. From the database, maximum variation sampling was undertaken to identify a range of participants to invite to participate in the longitudinal interview study, ensuring variation by age, gender, income level, pre covid-19 commute mode, and presence of children in the household. Sampling additionally differentiated between practitioners and subjects, with separate invitations sent out to purposively sampled expert practitioners who were identified from conversations with case study gatekeepers.

As discussed in Vasileiou et al. (2018, p.1), choosing a suitable sample size in qualitative research is an area of “conceptual debate and practical uncertainty”. Whilst quantitative research has established rules to determine sample sizes, qualitative research offers no clear-cut guidelines or principles. Qualitative samples tend to be small compared to quantitative samples to support the depth of case-orientated analysis (Sandelowski, 1996). Furthermore, qualitative samples are purposive, that is, “selected by virtue of their capacity to provide richly textured information relevant to the phenomenon under investigation” (Vaseileiou et al., 2018). Sandelowski (1996, p.183) recommends that qualitative sample sizes are large enough to allow the unfolding of a new and richly textured understanding of the phenomenon under study, but small enough so that the deep, case-orientated analysis of qualitative data is not precluded. Ritchie et al. (2003) suggest that studies employing individual interviews conduct no more than 50 interviews so that researchers can manage the complexity of the analytical task, and Adler and Adler (2012) advise a range of between 12 and 60 interviews. Considering the fairly homogenous nature of the sample (primarily desk-based employees working at large organisations), a decision was made to invite ten participants from each organisation to participate in the longitudinal interview study. The decision was made based on offering three semi-structured interviews for each participant, anticipating some likely attrition throughout the duration of the study in addition to the practical considerations of the time-consuming process of conducting and transcribing the interviews.

Email invitations were sent out to purposively sampled employees with an invitation to participate in the longitudinal interview study. A total of 14 subject participants were recruited to wave one of the longitudinal interview study (B&NES n=8, NatWest n=6), in addition to three practitioner participants (B&NES n=1, NatWest n=2). There was one subject drop out within B&NES between wave one to wave two. All remaining 16 interviewees participated in all three waves of the study, with a total of 49 interviews.

3.6.4.3. The interview process

Two separate topic guides were created for the practitioner and subject interviews. The topic guides were formulated to ensure that the interviews would provide insights to answer the RQs and fulfil the criteria set out in Clark et al. (2022) for successful interviewing, with a natural flow of questions, prompts, and the possibility for flexibility. To ensure that the interviews were suitably structured with clear, understandable questions that yielded rich, relevant information, pilot interviews were carried out with four office-based individuals who were separate to the populations of interest. Post-interview, pilot participants were asked for feedback so that the interviews would meet the criteria for successful interviewing. Following pilot feedback, minor changes were made to the structure of the topic guides to ensure a better flow. Copies of the practitioner and subject topic guides are provided in Appendix 2.

The first wave of interviews began in April 2021 and ran until May 2021 with a total of 17 interviews. The second wave ran through October and November 2021 with 16 interviews, and the final third wave ran in February 2022 with a further 16 interviews.

Interview wave	Subject interviews	Practitioner interviews	Interview mode
Wave one: April – May 2021	14	3	13 video 4 telephone
Wave two: Oct – Nov 2021	13	3	12 video 4 telephone
Wave three: February 2022	13	3	12 video 4 telephone

Table 14. Longitudinal interview study schedule

Face-to-face interviews have been established as the norm for conducting qualitative interviews within social research (Saarijärvi and Bratt, 2021). However, the Covid-19 pandemic accelerated the need to explore alternative methods with video and telephone interviews increasingly used. As face-to-face interviews were not a suitable option throughout the entire data collection period due to Covid-19 restrictions, participants were offered a choice of video or telephone interview depending on personal preference. A decision was made to offer this choice in recognition of the fact that some individuals feel

more comfortable talking over telephone as opposed to video, in addition to concerns of 'zoom fatigue' whereby many individuals reported feeling overwhelmed by the amount of time spent on video calls in the early stages of the Covid-19 pandemic.

The video interview is typically considered to be the most similar to the face-to-face interview, with Krouwel, Jolly and Greenfield (2019) writing that face-to-face interviews are only marginally superior to video interviews. Video interviews enable people to participate regardless of where they live with increased convenience, flexibility and time and cost savings benefits, and no obvious decline in rapport (Saarijärvi and Bratt, 2021; Clark et al., 2022). During video interviews, the interviewer can see and observe the interviewee and interpret facial expressions and body language. Nevertheless, there are certain limitations; video interviewing requires reliable technology where both the interviewer and participant have a stable internet connection, good quality camera and microphone, with a risk that technological problems such as fluctuating quality can interrupt the interview flow (Clark et al., 2022).

Telephone interviews additionally offer benefits of increased convenience, flexibility and time and cost savings compared to face-to-face, with the additional advantage of fewer technological requirements than a video interview, simply requiring a stable telephone line. However, a disadvantage of telephone interviews is that facial expressions and body language cannot be observed, and telephone interviews for participants with hearing difficulties may be inappropriate (Saarijärvi and Bratt, 2021). These limitations have led to concerns among some researchers that telephone interviews might have a negative impact on the richness and quality of interview data, with challenges of building rapport and an inability to respond to visual and emotional cues (Azad et al., 2021). However, a review conducted by Azad et al. (2021) found that telephone interviews generate the same amount of data richness as in-person interviews in terms of word count and topic-related information with only modest differences in depth of data. Telephone interviews can additionally benefit the researcher–participant relationship by providing a more balanced power dynamic between the two (Vogl, 2013). Thus, offering participants a choice of either video or telephone interview was decided to be an appropriate choice to help participants feel at ease, with minimal expected differences in terms of interview data quality. Interviews were recorded by either Microsoft Teams or telephone with participants' consent, with interviews typically lasting between 30 to 60 minutes.

Techniques advocated by Lincoln and Guba (1985) were employed to enhance the trustworthiness of the longitudinal interview study, including spending adequate time speaking to and developing relationships with interviewees to enhance credibility, providing

sufficient detail of the interview context in the study write-up for transferability, and triangulation of research methods via the employee surveys for confirmability. Unfortunately, it was not possible to have an independent researcher examine the process and product of the interviews, limiting the dependability of the interview study.

Despite the numerous benefits of a longitudinal interview study, limitations remain from a CR perspective. With a layered ontology, interviews are necessary for accessing participants' thoughts, meaning and experience, but they are not themselves an adequate basis for analysing the multiplicity of causal factors in play (Smith and Elger, 2014). CR interviewing is most valuable when it is conducted and analysed as part of a wider research design, both in terms of iterative interviewing and other research methods. Hence, interview findings have been compared with each other (both at each wave and over time), in addition to being triangulated with the employee survey findings.

3.7. Triangulation

Triangulation in research refers to the use of multiple datasets, methods, theories and/or investigators to answer a research question (Bhandari, 2022). This research identified methodological triangulation as a suitable option to enhance the robustness of the study, which refers to the use of different methods to approach the same research question, typically via combining qualitative and quantitative research methods in a single study (Bhandari, 2022). The philosophy of science has increasingly recognised the benefits of integration of distinct methods, with triangulation able to cut across the qualitative-quantitative divide to improve knowledge of the real world (Olsen, 2004).

Methodological triangulation can help to avoid the flaws and bias present when reliant on a single research technique, with the use of both qualitative and quantitative methods able to provide a more complete answer to the research questions (Clark et al., 2022). Triangulation was used to cross-check evidence for RQ1 and RQ3 via comparing case study interview and survey findings (discussed in Chapter Nine). The comparison of separate data sources was chosen to help improve the credibility of findings, that is, the confidence that findings reflect reality via gaining insights from multiple perspectives and levels (Bhandari, 2022). The more the data converges, i.e., agrees with each other, the more credible the results are. Triangulation additionally improves the validity of the research via combining complementary methods (such as interviews and surveys) that account for each other's limitations (Bhandari, 2022). In this study, combining the selected cases' interview and survey findings was chosen to help overcome the limitations of each method as discussed above, and therefore improve the credibility and validity of the case study findings.

3.8. Ethical matters

The consideration of ethical matters is important to any research project, particularly projects involving the use of participants to collect new data. As the methodology described above involved collecting new data by both qualitative and quantitative methods, an ethical review was required. The research submitted an ethics application which was received by the University of Leeds Business, Environment and Social Sciences (AREA) Faculty Research Ethics Committee and received favourable ethical opinion (Appendix 3). Gaining ethical approval required careful consideration of participant recruitment, risks and benefits of participation, informed consent, use of incentives, and privacy, anonymity and confidentiality, which will be discussed in turn throughout the remainder of this chapter.

Considering ethical recruitment, the research had to consider the most ethical way to recruit participants in a way which minimised intrusion and burden to the population of interest. Trusted gatekeepers within the organisational case studies were used to recruit participants to the two cross sectional surveys via emails and posts within internal intranets, with promotional text agreed in collaboration with the gatekeepers prior to recruitment. When completing the first cross-sectional survey, participants had the option to provide an email address if they wished to enter the raffle prize and to hear about further research. This database of email addresses was used to recruit individuals to the longitudinal interview study via email invitation, which clearly outlined why they were being contacted, what participating in the longitudinal interview study would involve, the rationale for the interview study, incentives available for participating, and a set date for potential participants to confirm their interest in participating in the study. A decision was made to recruit individuals to complete the messaging survey separately from the organisational cases to reduce user fatigue and burden on the organisational case studies' employees, in addition to following the protocol set out in the ADAPT study. A GDPR compliant online survey recruitment platform (Prolific) was selected as an effective, ethical method of recruiting individuals to the messaging survey.

Considering the benefits associated with the research, benefits of participation were clearly outlined in participants' information sheets for all data collection methods. Various incentives were used to ethically encourage participation and to recognise the value of participants' time. A raffle game was conducted for each of the employee surveys, selecting two random winners from each organisation (four winners in total, two winners in 2021 and two winners in 2022). The prize was an e-voucher worth £50 from the winner's desired vendor. A £50 e-voucher was selected as it represented an incentive which was not excessive or inappropriate and within the research budget. In addition to the raffle, the information sheets

outlined how participating in the surveys would help to generate insights into how organisations could respond to major disruptive events and support employees in enabling environmentally sustainable commuting. For the messaging survey, participants were individually paid for their time spent completing the survey via Prolific. As discussed previously, Prolific is a dedicated online survey recruitment platform which has an ethical rewards principle; participants were paid an average reward of £10.79 per hour for completing the messaging survey. For the longitudinal interview study, a decision was made to offer participants a £15 e-voucher per interview, with a total of £45 worth of e-vouchers available if all three interviews were completed. The wider benefits of participation were additionally made clear, including the ability to provide detailed insights into employees' needs in relation to supporting environmentally sustainable commuting. No risks to the researcher were identified with no travel for data collection due to Covid-19 restrictions, and there were no risks anticipated for participating in the research as measures were put in place for each data collection method to reduce the possibility of identities being revealed.

The provision of clear, easy to understand information sheets, research privacy notices and consent forms ensured that informed consent was achieved for each data collection method. Online surveys obtained and documented informed consent from research participants at the start of each survey. The first page of each survey was an information sheet with participants required to check a box to indicate informed consent before accessing the survey, with the information sheet making it clear that anyone wishing to withdraw consent could do so by exiting the survey before completing the survey and up to two weeks after the survey launch date. Prior to each interview, participants were sent a participant information sheet, research privacy notice and consent form. Participants were asked to read through the documents and if they agreed to participate in the interview, to sign the consent form. The information sheet made details of participation clear, along with a set deadline to withdraw from the research. The consent form asked participants to add initials to statements that they agreed with and to provide their name, signature and date, which was then sent electronically to the researcher where the researcher also signed and dated the form. Examples of survey and interview consent forms are provided in Appendix 3.

Issues of privacy, anonymity and confidentiality are essential to ethical consideration, with secure storage of personal data of utmost importance. Considering the employee surveys, the only personal data that was collected was an email address which was deleted from all records at the end of data collection. All other survey data did not contain any personally identifiable information and responses to the online survey were exported from Online Surveys and stored on an encrypted laptop and the GDPR compliant University of Leeds OneDrive cloud storage system. No personally identifiable data was collected for the

messaging survey, with responses similarly exported from SmartSurvey and stored on an encrypted laptop and OneDrive.

Interviews were recorded on either Microsoft Teams or mobile phone with recordings used only for transcription; immediately after each interview, the recordings were transferred onto the encrypted laptop and the University's OneDrive system and the original recording deleted. Anonymised transcripts were then produced, where any direct or indirect identifiers were replaced with pseudonyms following the UK Data Service anonymisation protocol in addition to a typology system where each interviewee was provided with a typology reference number (UK Data Service, 2020). Once each transcript was produced, the corresponding recording was deleted. All transcripts were stored on an encrypted laptop and OneDrive.

3.9. Chapter summary and conclusions

This chapter has provided a comprehensive overview of the study's methodology, including the use of a CR philosophy, the rationale behind the case study framework, the selected data collection methods and their varied strengths and limitations, including considerations of quality criteria. The next chapter provides a detailed account of analytical procedures selected for the data collection methods outlined in this chapter.

Chapter Four – Approach to Analysis

4.1. Introduction

This chapter introduces the analytical approaches undertaken to investigate the RQs, including quantitative and qualitative data analysis. The chapter provides a description of the analytical approaches used to analyse the survey and interview data collected throughout this study in addition to triangulation, with a summary provided at the end of the chapter.

4.2. Quantitative data analysis

Quantitative data analysis refers to the process of turning raw numbers (for example collected through questionnaires) into meaningful data (Dudovskiy, 2022). A range of techniques can be used to conduct various analyses depending on the types of variables and samples collected during survey research. Analytical software is often used to assist with the analysis of quantitative data via software packages such as SPSS (SPSS Statistics, 2023). There is a distinction between descriptive statistics, which includes analysis to describe data and their characteristics, and inferential statistics, which involves making inferences (estimates or predictions), moving beyond a random sample to suggest something greater about a population (Clark et al., 2022, p.318). Consideration of how to analyse survey data was a key consideration prior to all quantitative data collection to ensure the inclusion of appropriate variables and sample size (Clark et al., 2022, p.317).

4.2.1. Employee survey analysis

The two employee surveys were conducted via Online Surveys with a series of quantitative variables collected. Results were exported into the data analysis software package SPSS Statistics. Certain variables were transformed within SPSS prior to analysis, for example to group together separate transport modes into modal categories such as ‘active travel’, which included walking and cycling modes, noting the small sample sizes for separate walking and cycling categories. If sample sizes were bigger, it would have been preferable to analyse walking and cycling as two separate categories to understand any differences between the two, noting they are two distinct forms of travel.

4.2.2. Analysis of the data

Descriptive statistics (which describes the basic features of the data to provide simple summaries about the survey’s sample and measures) was conducted for all employee surveys, with bar charts to visually show categorical variables and crosstabulations to describe the relationships between sub-groups. Due to the small sample size, it was not possible to test whether the relationships identified in the crosstabulations have a statistically

significant association or not. Small samples of certain sub-groups, such as active travel commuters, are recognised as a limitation of the survey. Care should be taken when interpreting results with findings not generalisable to all B&NES Council and NatWest bank employees. In addition to descriptive statistics, qualitative thematic analysis was undertaken to identify themes from the free text comments where participants could provide context to their answers on questions related to commute and working from home satisfaction. Findings from the employee survey analyses are provided in Chapter Six.

4.3. Messaging survey analysis

A statistical analysis plan was produced for the messaging survey based upon analysis undertaken in the ADAPT study (Pangbourne, Bennett and Baker, 2019). Prior to the messaging survey's launch, a G*Power analysis was undertaken to determine the minimum required sample size. G*Power software requires the input of null and alternative hypotheses, effect size, alpha, type I and type II error and required statistical test to calculate the desired sample size (Kang, 2021). as an a priori analysis provides a method for controlling type I and II errors to prove the hypothesis, it was an ideal method of sample size and power calculation. However, there were limitations in conducting a G*Power analysis to determine sample size, mainly due to a degree of uncertainty of variances. Once the desired sample size had been determined and the messaging survey was complete, the dataset was exported into Excel and was transformed into a multilevel dataset structuring each row of data at the message level, with individuals nested within this structure via unique individual identifiers. The dataset was imported into SPSS for linear mixed-effects model analysis.

4.3.1. Linear mixed effect modelling

Linear mixed effect models (LMMs) are an extension of simple linear models used to analyse data that are non-independent, multilevel/hierarchical, longitudinal, or correlated (UCLA, 2021). LMMs are increasingly used for data analysis within experimental psychology and social science where within-participant designs are common (Magezi, 2015). Like many statistical models, the LMM describes the relationship between a response variable and other explanatory variables that have been obtained along with the response. A LMM was deemed to be appropriate for the messaging survey dataset analysis as it allowed both fixed and random effects and non-independence in the data. A core feature of LMMs is that they classify explanatory variables as either fixed or random effects, where a fixed effect is a parameter that does not vary. At least one of the explanatory variables must be a categorical grouping variable that represents an experimental unit, which in this case was the message persuasiveness score. LMM is available in SPSS software, where tests are performed and the test statistics and degrees of freedom are reported along with a p-value, to indicate the

probability that the value of the test statistic or greater would have been obtained under the null hypothesis (Magezi, 2015).

The LMM was used to account for variation between participants in the messaging survey. The effects of message value, message type, message mode, gender, age, primary transport mode, preferred transport mode, bus, walking, cycling frequency compared to pre Covid-19 frequency, and the five personality factors (Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism) on the persuasiveness ratings of 18 messages were assessed along with two-way interactions. The model specified random effects, which adjusted for errors for clustering within-participants using a random intercept model. All other variables were included as fixed effects in the model. All significance values were tailed with $\alpha = 0.05$. Interactions that did not reach significance were removed from the final model. Analysis was conducted in SPSS with the LMM code provided in Appendix 4.

The LMM resulted in 30 significant interactions. However, the LMM performed multiple hypothesis tests which can potentially increase type I error, which is the error of rejecting a null hypothesis when it is true (UC Berkeley Statistics, 2023). To address this, the Holm-Bonferroni method was carried out as a post-hoc test. The Holm-Bonferroni method is used to account for familywise error rates for multiple hypothesis tests, i.e., the method reduces the possibility to getting a statistically significant result (type I error) when performing multiple tests (Statistics, 2022). The formula shown in Figure 15 was applied, reducing the number of statistically significant interactions from 30 to 11. Findings from the messaging survey analysis are reported in Chapter Eight.

$$\frac{\text{Target Alpha Level}}{\text{n - rank number of pair (by degree of significance)} + 1}$$

Figure 15. Holm-Bonferroni method formula (Statistics, 2022)

4.4. Qualitative data analysis

There are many ways to approach qualitative analysis; the analysis of text is typically a key focus with such text often derived from interview transcripts, with analysis used to understand what participants in particular settings really thought or did in a situation or at some point in time with the meanings of texts negotiated by the researcher(s) (Clark et al., 2022). This study identified a recurrent cross-sectional thematic approach as suitable to analyse the longitudinal interview data. A detailed description of the analytical procedure is provided below.

4.4.1. Transcription of the interviews

Transcription is the process of transcribing audio or video forms of data (including recordings of interviews) into written form for closer study, requiring judgements about the level of detail to choose, data interpretation, and data representation (Bailey, 2008). Transcription is the first step in data analysis with close observation of the data through repeated careful listening resulting in familiarity with the data and attention to what is there (Bailey, 2008). As discussed in Chapter Three, the semi-structured interviews were recorded digitally. All interviews were transcribed verbatim by the researcher, with the inclusion of laughter and nonverbal cues that conveyed meaning such as sighs. Each hour of interview took between two to three hours to fully transcribe with transcriptions completed using Express Scribe transcription software and subsequently exported into Nvivo for thematic analysis (NCH Software, 2023; Lumivero, 2023). In total, 49 semi-structured interviews were recorded and transcribed verbatim over three separate waves. Data analysis began once all interviews had been completed for each interview wave, with three separate rounds of transcription and data analysis throughout the study period.

4.4.2. Longitudinal interview analysis

The qualitative research literature typically assumes two approaches to analysing longitudinal data: recurrent cross-sectional and trajectory (Table 15) (Grossoehme and Lipstein, 2016). The recurrent cross-sectional approach can be thought of as a series of smaller studies given that at each time point the data from all participants are analysed as a unit. After this analysis is completed, a second analysis focuses on differences and similarities between time points. An advantage of this approach is that analysis of early interview waves can be completed before data is collected for subsequent interview waves. The ability to have flexibility in the cohort at each time point (to account for attrition) and to analyse at each time point while still gaining depth understanding of the differences between time points was viewed as suitable to answering the study's RQs (Table 9) and recurrent cross-sectional analysis was selected as the analytical approach.

Considerations	Recurrent cross-sectional analysis	Trajectory analysis
Research focus	Describe the differences between time points	Describe how process or experience changes over time
Sample	The cohort at each time point may be the same or different	Must maintain same cohort
Theoretical approach	Determined by the RQ	Determined by the RQ
Level of data analysis	Whole sample (or subsamples)	Individual people or individual groups
Timing of analysis	May analyse as each time point is completed	Must wait until data is collected at all time points

Table 15. Longitudinal analysis approaches (Grossoehme and Lipstein, 2016)

Thematic analysis was selected as a suitable analytical technique to analyse each set of interview waves. Thematic analysis is “a method for identifying, analysing and reporting patterns (themes) within data” to summarise issues across the data set (Braun and Clarke, 2006, p.6). Thematic analysis is a common analytical technique as its flexible approach means it is suited to many types of qualitative data and a range of theoretical and epistemological approaches, including both inductive and deductive analysis (Grant, 2019; Braun and Clarke, 2006). Inductive analysis allows themes to be generated during the analysis process, whereas deductive thematic analysis can involve themes being pre-specified to ensure that the analysis answers the RQs (Grant, 2019). Researchers can use an approach that is both deductive and inductive, for example starting off with an idea of the important themes to answer the RQs but allowing the addition of new codes in an inductive fashion (Grant, 2019). It was considered sensible to approach the analysis using a deductive form of thematic analysis, with the initial coding frame developed based on the study’s RQs, and theoretical framework (Figure 9). Where new codes were identified, a decision was made to inductively add new codes to the coding frame. A copy of the initial and final coding frame is provided in Appendix 5.

All interview transcripts were subjected to thematic analysis, following the six-step process proposed by Braun and Clarke (2006) as outlined in Grant (2019, p.49), noting that this is not necessarily a linear process:

1. Familiarisation with the data (interview transcripts), transcribing and reading through the data and making notes of any ideas;
2. Generating initial codes, by coding interesting features across the entire data set;
3. Searching for themes;
4. Reviewing themes;
5. Defining and naming themes; and
6. Producing the report.

Codes were produced in Nvivo software which were ultimately consolidated into themes. Clark et al. (2022, p.537) defines a theme as, “a category of interest identified by the analyst, relates to the research focus, builds on codes identified in transcripts”. An example of the overarching Nvivo coding frame is shown in Figure 16. The same coding frame was used for each interview wave to enable comparison between interview waves, allowing the addition of new inductive codes where appropriate. A copy of the coding frame is provided in Appendix 5.

Once thematic analysis of each set of interview waves was complete, findings were subjected to the recurrent cross-sectional analysis described above to identify differences

and similarities between time points across each case study, including the production of change matrices to visually demonstrate change over time. There was a final inter-case comparison, comparing findings from B&NES Council and NatWest Bank.

Quotes were selected for inclusion in the qualitative write up (Chapter Seven) on the basis that the quotes were illustrative of the points being made about the data, representative of the patterns in the data, and distributed across participants (Lingard, 2019). A decision was made to also include quotes where a point made by a single participant was considered to be particularly pertinent to the RQs.

Findings from the longitudinal interview study analysis are reported in Chapter Seven.

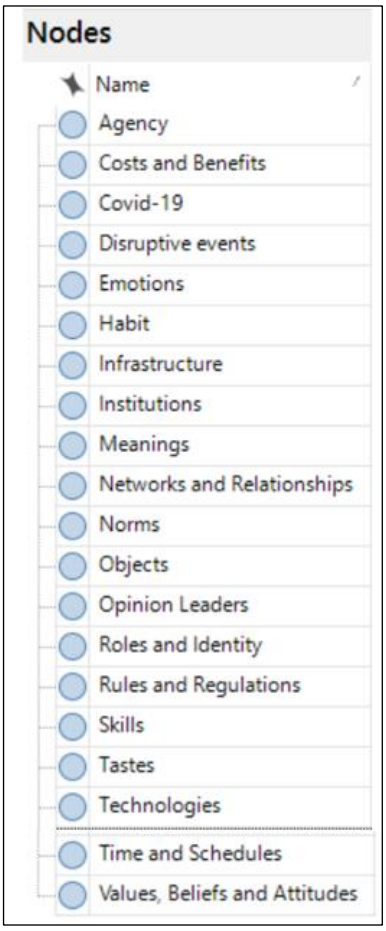


Figure 16. Interview coding framework

4.5. Summary

In sum, this chapter has introduced the quantitative and qualitative analytical approaches undertaken to investigate the RQs. There was careful consideration of the most appropriate analytical procedures, ensuring that the approaches selected were suitable for the data and would enable the RQs to be answered. Findings from the quantitative and qualitative analyses undertaken are discussed in Chapter Six, Chapter Seven, and Chapter Eight.

Chapter Five – Case Studies

5.1. Introduction

This chapter will describe the two organisation cases: Bath & North East Somerset (B&NES) Council and NatWest bank. It is noted that NatWest was originally named Royal Bank of Scotland with a rename to NatWest established in 2020, during the study period. The case study selection criteria will be discussed alongside the context of both participating organisations, followed by a summary including similarities and differences between the two cases.

5.2. Case study selection

Edinburgh was confirmed as the first case study city for the research, as determined by South East Scotland's Regional Transport Partnership's (SEStran) in-kind support to the study. A case study selection matrix was produced to compare Edinburgh to three other cities of interest including Bath, Leeds, and Nottingham. From a review of the matrix including the cities' transport characteristics, city characteristics, socio-demographics and transport policies, Bath was selected as an appropriate second case study city. Both Bath and Edinburgh are local employment hubs in addition to popular tourist destinations with UNESCO world heritage status and numerous historic sites. The popularity of the two cities combined with issues of traffic congestion and air pollution has created a widely recognised need to reduce local car use. Both cities' councils have declared a climate emergency and share numerous transport policies to aid the reduction of conventionally fuelled vehicles, including low emission/clean air zones, the expansion and improvement of public transport and active travel infrastructure, parking and traffic management schemes, alongside measures such as car clubs, car sharing and cycle hire schemes, workplace travel plans, and supporting ultra-low emission vehicles. Both cities have an extensive public transport network with frequent bus services, Park & Ride and commuter rail, plus a tram service in Edinburgh. In addition, both cities are home to a mix of large employers including universities, hospitals, and financial services, with many large employers offering workplace travel plans to encourage environmentally sustainable commuting among staff.

Contrasts between the two cities include size and population, with Edinburgh representing a larger city with a wider travel to work area. The two cities are geographically distinct with approximately 386 miles between the two destinations. Edinburgh is in the South East of Scotland, North of the UK, while Bath is in the South West of England, South of the UK. However, both are compact cities with historic centres including a significant number of listed buildings and narrow, hilly streets. The two cities share a similar age profile with the majority

of the population being working age and economically active, and both Bath and Edinburgh have above-average employment rates with above average property prices compared to their national average.

Feature/ Location	B&NES District	City of Edinburgh
Population	196,357	488,050
Location	South West England	South East Scotland
Average house price	£468,060	£318,014
Average salary	£35,300	£35,678
Economically active population	82.2%	75.4%
Urban form	Compact city with steep gradients surrounded by rural areas. Georgian architecture with high buildings and narrow streets.	Compact city with minimal urban sprawl. Medieval and Georgian architecture with narrow streets and steep gradients.

Table 16. Case study city contexts (ONS, 2020; National Records of Scotland, 2020)

Figure 17. Map of B&NES district (B&NES Council, 2022)

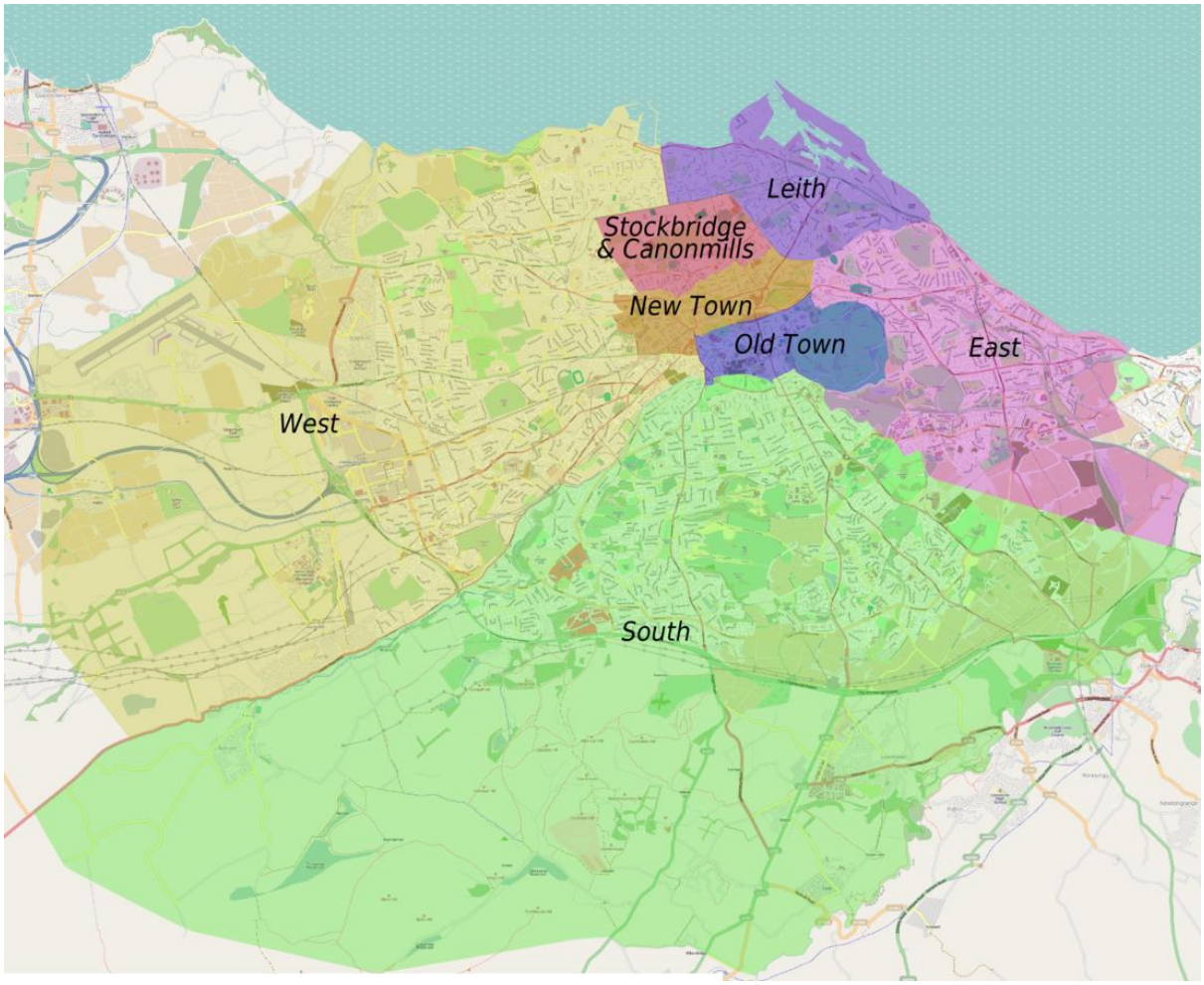


Figure 18. Map of Edinburgh districts (Fitzgerald, 2009)

Noting the similarities between the two cities including urban form, public transport network, sustainable transport policies, and a politically recognised need to reduce car use, Bath was selected as a suitable second research location in addition to Edinburgh and a decision was made to identify and recruit organisations to participate in the research. A list of inclusion criteria was produced, specifying organisations with over 500 employees, sustainable travel infrastructure to office locations, and internal sustainable transport goals. Meetings took place with local travel experts (SEStran staff in Edinburgh and a local councillor in Bath) to identify suitable organisations who might want to participate as organisation cases with engaged staff members to act as gatekeepers. Throughout this process, the research acquired two case organisations to participate in the study: B&NES Council based in and around Bath, and NatWest based in Edinburgh. A summary of the two organisations is provided in Table 17.

Feature/Organisation	B&NES Council	NatWest
Institution Type	Local authority	Finance
Sector	Public	Private
Number of staff	3,040	8,500
Office locations	• HQ in Keynsham Civic Centre (8 miles west of Bath city centre) • Small number of offices in Bath city centre and rural North East Somerset	• HQ in Gogarburn (6 miles west of Edinburgh city centre) • Small number of offices in and around Edinburgh city centre
HQ transport options	• Low-cost public car park • Nearby local train station • Limited cycle storage with showers/lockers	• Free employee car park • Free shuttle bus service from Edinburgh train stations • Park & Ride with free bus service • Cycle storage/showers/lockers

Table 17. Case study organisations

A discussion of the participating organisations and their geographical context is provided throughout the remainder of this chapter.

5.3. Case one: B&NES Council

B&NES Council is the local council for the Bath and North East Somerset district in Somerset, South West England. The Council is a unitary authority comprised of 59 councillors who are elected every four years and democratically accountable to residents of their ward. Elected councillors decide an overall framework of policies governing how services are to be provided, with staff providing advice, implementing decisions and managing the delivery of services, with most day-to-day service decisions taken by Council employees (B&NES, 2020a). As of 2023, the Liberal Democrats had control of B&NES Council with 41 seats (in addition to 7 Labour, 5 Independent, 3 Conservative and 3 Green). The Council employs approximately 3,400 staff with 58 senior managers and a wide range of departments and service teams responsible for the provision of all local government services within the Bath and North East Somerset district. Of the 3,400 staff, there is a total of 2,040 full-time workers and 1,360 part-time or causal workers. Approximately 1,400 staff are classified as ‘desk-based workers’ with 2,000 staff classified as ‘deskless’, for example those working at depots. Prior to Covid-19, the majority of desk-based staff worked in central Bath locations (including the Guildhall, Lewis House), or in the Keynsham Civic Centre headquarters (HQ) based in the town of Keynsham approximately 8 miles west from Bath. The Council offered a range of flexible working options to employees, with offers of flexi-time and homeworking available dependent on service requirements.

In March 2019, B&NES Council declared a climate emergency with a pledge to “provide the leadership to enable B&NES to become carbon neutral by 2030 and make the council itself carbon neutral by the same date” (B&NES, 2019). As of 2020, transport made up 66% of the B&NES district CO_2 emissions with car use responsible for most transport emissions

(B&NES, 2020c). Considering staff commuter travel, the Council had implemented various measures to promote environmentally sustainable travel to work among staff including virtual conferencing facilities, the provision of information including personal travel planning and promotion of sustainable travel programmes, showers, secure cycle parking, changing facilities and lockers, salary sacrifice scheme for cycle purchase, staff pool cycles, cyclist training, a web-based car-sharing scheme, electric pool cars, interest-free loans for public transport season tickets, bus commuting staff discounts, and passenger mileage payments for shared in-work car travel with colleagues. However, a pre Covid-19 B&NES staff survey (2020e) identified the car as the predominant employee commute mode, with 55% of those surveyed travelling to work by car, compared to 22% active travel, and 20% public transport.

As a result of Covid-19, B&NES Council moved staff out of offices in March 2020 with an instruction for employees to work from home where possible. Several of the central Bath offices were leased out to external companies and a decision was made to relocate the majority of Bath based staff to Keynsham Civic Centre HQ. A blended working charter was published in 2021 which emphasised choice-based working and the Council's commitment to enable flexibility on where and when employees work, with the aim of encouraging increased home working where appropriate among desk-based employees. The uptake in home working was evident in the B&NES March 2021 staff survey, with 75% of those surveyed reporting to work from home full time, with 16% reporting hybrid working. From staff who continued to travel in, there was a reported 20% increase in car commuting and 15% decrease in public transport, with 75% reporting a car commute compared to 18% active travel and 5% public transport (B&NES, 2021b).

5.4. Research location one: Bath and North East Somerset

The Bath and North East Somerset region is divided into four sub-areas: Bath city, Keynsham town, Somer valley, and rural areas (Hardisty Jones Associates [HJA], 2020). Two thirds of the region lie in the Green Belt with a total of 37 conservation areas, 6,408 listed buildings and the city of Bath having World Heritage status (B&NES, 2020b). The estimated mid-2020 B&NES population was 196,357, with a growing population including a significant student population (approximately 20%) and a projected large increase in the number of older people (B&NES, 2020d). Around 53% of the B&NES population resides within the Bath city sub area, with 23% in Somer valley, 18% in rural areas, and 9% in Keynsham (HJA, 2020). The working age population (16-64 years) is concentrated in the Bath city area, making up 63% of the B&NES total (HJA, 2020).

Bath is a major economic hub within the West of England, acting as a key centre for employment and economic activity and contributing much of the economic output generated

across the wider B&NES area (B&NES, 2020c). The region has above average employment in public sector activities such as education and health, and relatively large concentrations of employment in sectors such as tourism and retail. Tourism is a significant contributor to the B&NES economy, with nearly five million day trips and one million overnight trips by domestic and international visitors in 2014 (B&NES, 2020c). The Covid-19 pandemic resulted in a reported £17 million loss in tourism income, resulting in B&NES Council working with local businesses and education providers to support a renewed economy less reliant on tourism income and better able to support a more resilient and greener future (University of Bath, 2020). The 'One Shared Vision' report set out ten key recommendations for a future B&NES economy, including greater collaboration between urban and rural communities, adopting Net Zero Carbon as a central organising principle, introducing Local Connectivity Hubs, and growing the digital economy (B&NES, 2021a).

As a result of its economic activity, the B&NES district is a local employment hub and experiences a net inflow roughly 5,000 workers each day (HJA, 2020). As of 2017, there were approximately 8,210 businesses in B&NES accommodating 104,000 jobs, with 53% of B&NES employed residents working as Managers, Directors and Senior Officials, or Associate Professional and Technical Occupations (HJA, 2020). Most trips made within Bath relate to work travel, including commute trips (46%) and business trips (20%) (B&NES, 2020c). Table 18 shows the dominant mode of travel to work within the B&NES district is car (60%), followed by active travel (20.2%), and public transport (10.2%). There are notable differences between urban and rural commuter travel, with more car use in rural areas (76% rural car commute vs. 56.1% urban), in addition to less active travel (7.6% rural vs. 23.6% urban), and less public transport (7.1% rural vs. 11.3% urban).

Method of travel to work	B&NES (Total)	Urban (Total)	Rural (Total)
Work mainly at or from home	6,512 (7.7%)	4,635 (7%)	525 (6.6%)
Underground, metro, light rail, tram	121 (0.1%)	103 (0.2%)	3 (0.04%)
Train	3,051 (3.6%)	2,742 (4.1%)	106 (1.3%)
Bus, minibus or coach	5,472 (6.5%)	4,667 (7%)	457 (5.7%)
Taxi	221 (0.3%)	203 (0.3%)	11 (0.1%)
Motorcycle, scooter or moped	891 (1.1%)	677 (1%)	108 (1.4%)
Driving a car or van	47,051 (55.5%)	34,200 (51.5%)	5,701 (71.5%)
Passenger in a car or van	3,891 (4.6%)	3,082 (4.6%)	412 (5.2%)
Bicycle	2,537 (3%)	2,222 (3.4%)	153 (1.9%)
On foot	14,579 (17.2%)	13,460 (20.3%)	453 (5.7%)
Other Method	532 (0.6%)	401 (0.6%)	49 (0.6%)
Total	84,858 (100%)	66,392 (100%)	7,978 (100%)

Table 18. B&NES method of travel to work (Nomis, 2011)

More recent analysis (Figure 19) shows a slight decline in car use as a commute mode. However, the car is still the predominant mode with all other modes remaining fairly stable aside from a slight rise in bus use (B&NES, 2020c). Most people who drive to work in Bath

do so from outside the city boundary (75%), with many commute trips made from surrounding rural areas (B&NES, 2020c). As most car commute trips made are over ten kilometres (83%), there is a need to address modal shift on longer-distance trips, for example via improved bus services, car sharing, electrification of the fleet, and increased home working (B&NES, 2020c).

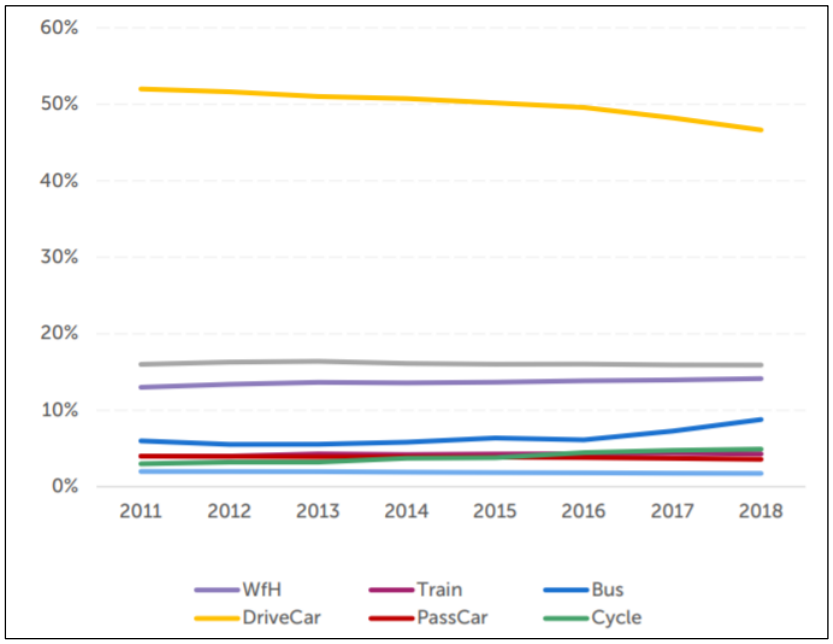


Figure 19. B&NES method of travel to work, 2011 – 2018 (B&NES, 2020c)

5.5. Transport within B&NES

B&NES Council published their Transport Strategy for Bath in 2014 with an aspiration to "enhance its [Bath] unique status by adopting measures that promote sustainable transport and reduce the intrusion of vehicles" (B&NES, 2014a, p.5). The strategy was adopted in 2015 to cover the period to 2029, and the Joint Local Transport Plan 4 was additionally adopted in March 2020 to cover the period to 2036, prepared by the West of England Combined Authority (WECA) to set out a well-connected West of England sustainable transport network (Travelwest, 2020). B&NES Council additionally published the Climate Emergency Outline Plan as part of the declared climate emergency, outlining ambitious transport targets including a 25% reduction in vehicle kilometres per person, a 7% reduction in car travel (via modal shift), 100% passenger rail electrification, and 76% pure battery electric vehicles by 2030 compared to a 2019 baseline (B&NES, 2020c). A summary of travel trends for each mode within the B&NES district is provided below.

5.5.1. Rail

Bath Spa station is the principal rail gateway to Bath with approximately 20,000 boardings per day. Usage of rail stations in Bath has grown significantly over the last decade in line with national trends for rail patronage growth, with an average of 3% growth per annum since 2008-09 at Bath Spa, and the introduction of new trains, a new timetable and improved reliability saw customer satisfaction rise from 2015-2020 (B&NES, 2020c). The planned growth in rail capacity and range of services available as part of the Great Western Main Line electrification scheme and the development of MetroWest aims to support more rail journeys to Bristol, and better services will be promoted to link Bath with the west Wiltshire towns. B&NES Council recognise that access to local stations requires ongoing improvements and new stations may be required (B&NES, 2020c).

5.5.2. Bus

Most bus services in the B&NES district are provided by commercial operators, with B&NES Council providing infrastructure such as bus stops and shelters, timetable displays, bus priority measures and real-time information screens, in addition to services that are not commercially viable but socially necessary. Projects with the aim of improving bus services, such as the Bath Transport Package and Better Bus Fund, have helped to deliver a 28% increase in bus patronage in B&NES between 2009/10 and 2017/18 in contrast to decreases elsewhere in England (B&NES, 2020c).

Bath has generally good bus accessibility with a wide range of destinations accessible within 60 minutes and many bus services operate at relatively competitive speeds across the city centre. Punctuality on key corridors across Bath has been increasing, up from 54% in 2016/17 to 78% in 2018/19, yet many rural areas around Bath are poorly served by public transport with infrequent services with most services focused on core radial routes (B&NES, 2020c). Bus users report relatively high levels of satisfaction in terms of bus space and availability of seating, journey time, and the condition of the buses, but lower satisfaction in terms of punctuality and value for money, with variation in the reliability of services due to high levels of congestion and limited bus priority measures on certain corridors (B&NES, 2020c). Planned improvements to bus services include ticketing improvements and additional bus priority to help improve reliability and encourage increased bus use.

5.5.3. Park & Ride

Park & Ride facilities provide the opportunity for people living outside of Bath who do not have easy access to public transport to transfer from private car to public transport for

onward journeys into Bath. Park & Ride sites are an integral part of Bath's transport system, serving over two million passengers per year with a significant increase in patronage during the Christmas market season (B&NES, 2020c). Bath has three Park & Ride sites on the outskirts of the city (Newbridge, Lansdown and Odd Down), providing over 2,700 spaces contributing towards a 20% reduction in traffic entering the centre of Bath since the year 2000 (B&NES, 2020c). The Council recognise the issue of suppressed demand from the east of the city due to a lack of a convenient facility and is considering alternative solutions to limit people driving into Bath from the east (B&NES, 2020c).

5.5.4. Road

Bath has seen a steady reduction in motor vehicle flows over the past 20 years (Figure 19), which is likely to be in part down to successful policies to encourage sustainable transport measures and the ongoing policy of relocating parking from the central area to the outskirts of the city at Park & Ride sites. Yet despite the steady reduction in road traffic, there is still heavy congestion in areas of Bath during peak periods with several constraint points on the network resulting in detrimental impacts on health, air quality, and quality of life for residents (B&NES, 2020c). The climate emergency requires further action on road traffic including a rapid electrification of the vehicle fleet and a significant reduction in total vehicle miles to be achieved by 2030. Policies to reduce and/or decarbonise car use including parking management, electric vehicles and a clean air zone are briefly discussed.

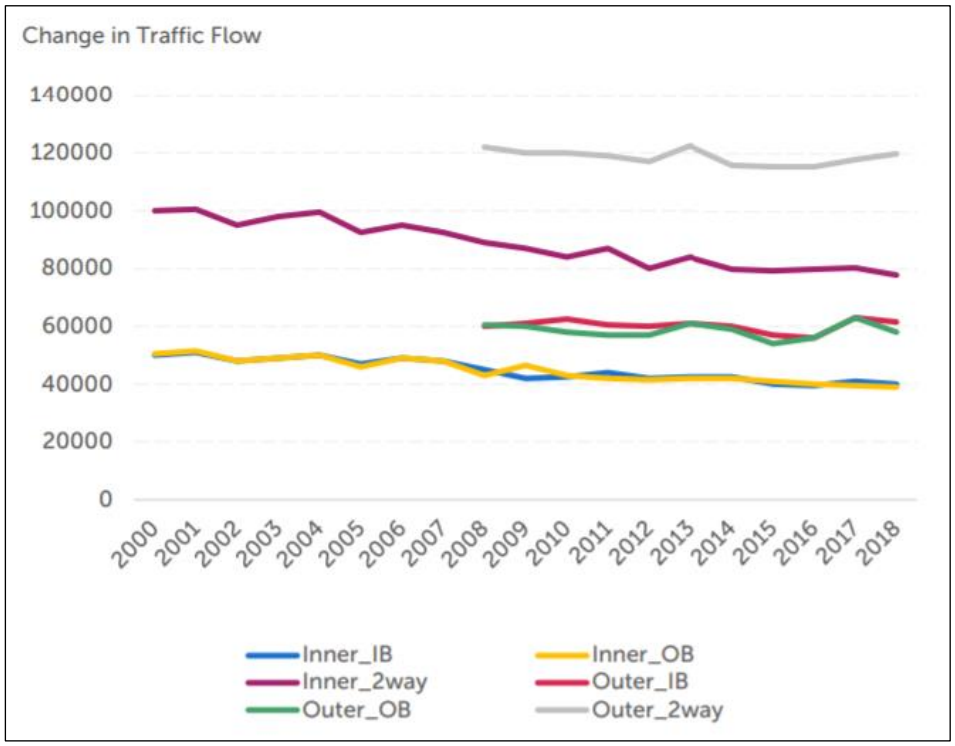


Figure 20. Bath traffic flow (B&NES, 2020d)

5.5.4.1. Parking

Parking policy plays a key role in managing Bath's traffic management, with the availability and pricing of parking influencing the travel choices that people make. Progressive reductions in the supply of public parking in the central area alongside Residents Parking Zones and long stay parking at Park & Ride sites have contributed to a reduction of central Bath traffic (B&NES, 2020c). The 'Getting Around Bath' transport strategy recommends parking management policies to be strengthened and extended including further removal of central area parking (B&NES, 2020c). However, a significant amount of private non-residential parking is not owned by the Council and therefore harder to influence, with key sites including the Royal United Hospital (1,300 spaces) and the University of Bath (2,200 spaces).

5.5.4.2. Electric Vehicles (Evs)

In 2018, there were 418 Ultra Low Emission Vehicles (ULEV) registered in Bath and North East Somerset representing 0.37% of total vehicle registrations, although a significant increase from the 40 ULEVs registered in 2014 (B&NES, 2020c). Bath has favourable conditions for ULEV growth, with above representation of socio-economic groups with characteristics which increase the likelihood of ULEV purchase in addition to large numbers of small and medium enterprises with associated above average annual rates of purchase of company cars, who benefit from national changes to taxation for electric company cars. Additional measures and incentives include increasing electric vehicle charging infrastructure to help encourage ULEV take up. However, for ULEVs to become mainstream a much wider cross section of society will need to make the switch to Evs and local solutions to on-street charging will likely be required (B&NES, 2020c).

5.5.4.3. Clean Air Zone (CAZ)

B&NES Council agreed to introduce a CAZ in 2018 following orders from the Government to reduce the illegal nitrogen dioxide levels in the city as quickly as possible. Launched on 15th March 2021, the CAZ charges high-emission taxis, buses and other large vehicles to travel through the city centre (RAC, 2022). The CAZ is a class C which means it does not charge private cars and motorbikes, and the scheme covers the main roads in Bath city centre (RAC, 2022).

5.5.5. Walking

The layout and size of Bath are conducive to walking with a visually attractive street scene in many places. A high proportion of journeys are made on foot within Bath compared to other cities, with a 37% increase in walking as a mode of transport by 2017/2018 compared to

2015 (B&NES, 2020c). Certain areas of the city contain pedestrianised areas catering for large numbers of pedestrians, but these are intertwined with or crossed by trafficked routes with a lack of consistency for those walking around the city (B&NES, 2020c). The Public Realm and Movement Strategy identifies a lack of investment in public realm over several years, however recent improvements to the public realm have been implemented and further improvements are planned with an ultimate vision of becoming the most walkable city in the UK (B&NES, 2020c).

5.5.6. Cycling

B&NES Council recognise the need to provide high quality cycling infrastructure to encourage cycling, and the city is cross sectioned by route 4 of the National Cycle Network, with the surrounding countryside containing scenic cycle routes including the Two Tunnels, Bristol and Bath Cycle Path, Colliers Way, and the Kennet and Avon Canal path. Several public realm improvement schemes have funded cycling improvements within the city, and Bath has seen a 37% increase in cycling as a mode of transport in 2017/2018 compared to 2015 (B&NES, 2020c). Bath's hilly topography is a deterrent to increased cycling for many residents, however a fleet of electric hire cycles have been purchased to help overcome this challenge (B&NES, 2020c). In addition, there is a current lack of cycle routes to the north and fragmented city centre routes are a likely barrier to increased growth, with more work and investment required to develop a fully integrated cycle network (B&NES, 2020c).

5.6. Case two: NatWest

NatWest bank is a major retail and commercial bank, formerly known as the Royal Bank of Scotland. The bank's HQ is located in Gogarburn, which is a vast campus site approximately six miles west of Edinburgh city centre comprising office space, a conference centre, a business school, and a range of retail and leisure facilities (NatWest, 2022). The HQ hosts approximately 8,500 NatWest staff, with 300 senior management staff.

In 2020, NatWest announced a corporate overhaul including the introduction of environmental targets such as halving the carbon impact of its financing activity by 2030 with a newly appointed climate change adviser to drive its environmental strategy (Partridge, 2020). The bank has historically implemented a wide range of measures to promote environmentally sustainable travel to work, including free shuttle bus and Park & Ride services to Gogarburn, the provision of secure cycle storage, lockers, showers and changing rooms, virtual conferencing facilities, information provision including personal travel planning, salary sacrifice schemes for cycle purchase, and the installation of over 350 EV charging points at Gogarburn car parks. NatWest additionally has a 'Bicycle User Group' (BUG)

created by an employee with the aim of encouraging and supporting cycling commutes to Gogarburn. The BUG was formed in 2013 and has grown to over 600 members; the group undertakes a range of activities including regular communication, recruitment campaigns, training interventions including cycle buddy schemes, and campaigns to improve or maintain cycling facilities (both within Gogarburn and beyond the site). NatWest's Gogarburn HQ has a car park available to staff free of charge, although use of the car park can be limited depending on employment type. Pre Covid-19, 62% of commuting to Gogarburn was made by car compared to 30% public transport and 8% active travel. Internal NatWest surveys suggest that car commuting increased by 20% since Covid-19, with 82% of employees surveyed reporting commuting by car in 2022.

Prior to Covid-19, the bank had a mature flexible working environment with most colleagues who could work from home able to do so two to three days a week. As a result of Covid-19, NatWest moved staff out of offices in March 2020 with an instruction for staff to work from home where possible, with employees able to order a wide range of home working equipment including laptops, desks, and chairs. In 2021, the bank launched a hybrid working initiative as a more permanent response to the Covid-19 disruption with colleagues categorised as follows: Office First, where people will work mostly at their designated hub (20% of Gogarburn staff); Remote First, where people will work mostly from home (55% of Gogarburn staff); and Hybrid, where people split their time more evenly between their designated hub and home (25% of Gogarburn staff).

5.7. Research location two: City of Edinburgh

Edinburgh is Scotland's capital city with historical significance including UNESCO World Heritage status, the largest concentration of listed buildings in the UK outside of London, and 50 conservation areas (Edinburgh City Council [ECC], 2020). The estimated mid-2020 Edinburgh population was 527,620, with a population increase of 18.2% between 1998 and 2020 and a projected further 12% increase to 2043 (National Records of Scotland, 2020; ECC, 2020).

Edinburgh has a knowledge-based economy with a wide academic offering and a data-driven agenda (ECC, 2022a). As of 2020, the city was ranked the 4th largest financial centre in Europe and the city's economy has grown 12.5% over the past ten years with one of the highest rates of successful business start-ups in the UK (Scottish Financial Review, 2020). Key drivers of growth include the city's highly skilled population (with over 50% of working-age residents being graduates), in addition to tourism and a strong higher education sector (ECC, 2020). Productivity is high with low unemployment and high gross disposable income (ECC, 2020). The Council is increasingly focussed on ensuring growth is sustainable and

inclusive with programmes to ensure that all residents benefit from the city's success (ECC, 2022a).

Edinburgh is the largest employment centre for the South East of Scotland. There are nearly 285,500 people working in the City of Edinburgh area, with one third of people working in the city commuting in from other areas (ECC, 2016). Two thirds of workers commuting from other council areas do so using a car, compared to one third of trips that start and finish within the city being made by car. When compared to other modes of transport, car journeys are most prevalent to employment centres on the periphery of the city, with public transport more prevalent for journeys to the city centre (ECC, 2016).

Method of travel to work	**City of Edinburgh (Total)**
Work mainly at or from home	22,795 (10.3%)
Underground, metro, light rail, tram	173 (0.1%)
Train	4,169 (1.9%)
Bus, minibus or coach	56,580 (25.6%)
Taxi	803 (0.4%)
Motorcycle, scooter or moped	962 (0.4%)
Driving a car or van	81,046 (36.7%)
Passenger in a car or van	7,001 (3.2%)
Bicycle	9,478 (4.3%)
On foot	36,059 (16.3%)
Other Method	1,607 (0.7%)
Total	220,673 (100%)

Table 19. Edinburgh method of travel to work (Scotland Census, 2011)

Table 19 shows the dominant mode of travel to work within Edinburgh reported by the 2011 Census is by car (39.9%) followed by public transport (27.6%) and active travel (20.6%). However, more recent 2019 analysis shows that trips to work or education are most likely to be taken by bus (43%) compared to 30% by car and 20% who walk (ECC, 2020a). The distance travelled to work tends to be between 2 and 5 miles (32%) or under 2 miles (32%), with 24% travelling over 5 miles (ECC, 2020a). Commuting by car is more common among self-employed people, men, people aged between 45-64, those in lower socio-economic groups, and those with children (ECC, 2020a). Findings from a citywide travel survey found that those who commuted by car stated their top reasons for doing so being due to the car commute being faster (53%), needing their car for work (48%) and because it is more comfortable/provides shelter from the weather (44%) (ECC, 2020a).

5.8. Transport within City of Edinburgh

ECC's (2020b) strategy to expand the range of public transport and active travel options as an alternative to car use has achieved considerable success. Pre Covid-19, more people used public transport, cycled, and walked than in any other Scottish city and most UK ones, and bus and tram patronage was consistently high. However, just over one third of Edinburgh's CO_2 emissions were derived from road transport in 2020, with deficiencies in the

transport network including roads in need of maintenance, limited cycle and bus lane networks, and poorly maintained public transport facilities in some locations (ECC, 2020b). Furthermore, certain areas of the city have low levels of public transport accessibility with lengthy public transport journey times, and congested journeys cost Edinburgh's economy an estimated £177 million per annum (ECC, 2020b).

ECC declared a climate emergency in May 2019, committing to reach zero-carbon status within its own operations by 2030 and calling on actors across the city region's public, private and third sectors to follow suit (Edie, 2019). To help achieve net zero status, ECC produced a City Mobility Plan (CMP), outlining how the Council plans to deliver a more sustainable, integrated, efficient and inclusive transport system from 2020 to 2030. A summary of travel trends and policies for each transport mode within Edinburgh is provided below.

5.8.1. Rail

Rail plays a key role in Edinburgh's connectivity to its city region and to the rest of Scotland and the UK. There are 11 railway stations in the Edinburgh City area, with Waverley station used by over 22 million passengers a year (ECC, 2013). Rail services within Scotland are operated by ScotRail with cross border services provided by a range of private transport operators. Between 2004 and 2010, journeys to or from the rest of Scotland grew from 15.3 million to 19.8 million, and trips to or from the rest of the UK grew from 2.2 million to 3.1 million with the most frequent trips to Glasgow, Fife, West Lothian, and within Edinburgh (ECC, 2013).

ECC (2020b) recognises that reliability and overcrowding across the city region rail network needs to be improved and plans to work with Transport Scotland, Network Rail and rail operators to support improvements to the efficiency and quality of services, including plans to transform Waverley Station to meet future capacity demands. ECC additionally recognises the need to better integrate rail with the rest of Edinburgh's public transport and active travel network (ECC, 2020b).

5.8.2. Bus

More than 97% of bus services in Edinburgh are provided by commercial bus operators, with ECC financially supporting a limited number of non-commercial bus services in addition to the infrastructure that buses use including roads, bus priority measures, and bus shelters (ECC, 2013). Bus patronage has consistently grown within Edinburgh with a clear correlation between expanding the bus lane network and bus patronage growth (ECC, 2013). Edinburgh has the highest bus use in Scotland, with almost 30% of adults using buses every

day with high passenger satisfaction and low fares (ECC, 2020b). Bus services are currently concentrated in the city centre with service gaps and deficiencies across the wider city. Better connections linking peripheral areas of the city are required to improve areas with poor public transport accessibility (ECC, 2020b).

Several bus companies operate services around and into Edinburgh with their own routes, timetables, and ticket options. The high proportion of different buses using the same routes within the city centre has contributed to lengthy bus journey times throughout the city centre, in addition to exceeding air quality targets (ECC, 2020b). ECC recognise the need to review the bus network to improve issues of integration and reduce congestion, including the potential for increased council supported bus services, new bus priority corridors and integrated, flexible ticketing (ECC, 2020b).

5.8.3. Park & Ride

Edinburgh is the hub of a subregional economy that extends north (to Fife), west (to West Lothian and Falkirk), east (to East Lothian) and south (to Midlothian and the Scottish Borders), and the Council recognise Edinburgh's Park & Ride services as key to tackling the environmental and economic impacts of significant levels of in-commuting (ECC, 2020b). The publicly owned company Lothian Buses offer five Park & Ride sites spread across the edges of the city, and ECC (2013) have identified the potential for future Park & Ride extensions and the creation of new sites, including the provision of EV charging and other services such as click and collect.

5.8.4. Tram

Edinburgh's Tram service opened in 2014 to provide a mass rapid transit system which enhanced public transport connectivity between the city centre and Edinburgh airport (ECC, 2020b). With a capacity of 250 people per tram, patronage surpassed expectations with 7.4 million journeys made in 2018, with a tram extension to Newhaven operational by 2023 to provide better access to employment, the airport, the rail network and to support regeneration (ECC, 2020b). ECC additionally recognise the potential to further develop or extend mass rapid transit routes into Fife, West, Mid and East Lothian (ECC, 2020b).

5.8.5. Road

Despite the city's widely used public transport network, pre Covid-19 statistics show that Edinburgh was the most congested city in the UK and the fourth most congested city in the world in relation to its size, with weekday rush-hour journeys taking some 80 to 85% longer compared to times of free-flow (Thompson, 2020). Covid-19 disruption resulted in a

temporary reduction in traffic, however daily traffic in Edinburgh was reported as 7% higher in February 2021 in comparison to February 2020 (Waugh, 2021). Transport Scotland is responsible for strategic trunk roads such as the city bypass and motorways, and ECC support the widening of trunk roads and/or motorways only where that additional capacity is reserved for public transport, high occupancy vehicles, and active travel (ECC, 2020b). ECC (2020b) is considering a future city operations centre to proactively monitor and manage roads and public spaces to improve transport network performance, reduce congestion and increase public safety, including reduced waiting time at junctions and crossings for pedestrians, cyclists, and public transport in addition to low emission zones and parking management plans.

5.8.5.1. Low Emission Zone & Evs

As of 2022, ECC was developing a city centre Low Emission Zone (LEZ) following Committee approval in January 2022 (ECC, 2022b). The LEZ will operate 24 hours a day, seven days a week, all year round, with cameras to detect vehicles which do not comply with minimum emission standards. Penalty charges will start in June 2024, applying to both residents and non-residents for all types of vehicles (ECC, 2022b). The LEZ will help Edinburgh to comply with legal air quality standards in addition to accelerating the move to lower emission vehicles and encourage earlier renewals of vehicle fleets. In addition, ECC is continuing to add to existing EV infrastructure including the creation of electric charging hubs to accommodate a range of modes including cycles, cars, motorbikes, buses and goods vehicles including cargo bikes (ECC, 2020b).

5.8.5.2. Parking

Edinburgh currently has 19 Controlled Parking Zones (CPZs) and 10 Priority Parking Areas to reduce commuter parking, with generated revenues used to fund mobility improvements (ECC, 2020b). The Council plans to extend the geographical limits of CPZs and Priority Parking Areas to ensure priority for residents and protection against vehicle dominance, with the expansion of CPZs strategically delivered to manage impacts from in-commuting and intra-city commuting across the city. Considering resident parking, permit levels are restricted to a maximum of two permits per household (ECC, 2020b). Local parking standards set maximum parking levels for new developments, requiring EV charging infrastructure and car club provision where appropriate (ECC, 2020b).

As of 2023, a policy being considered for implementation within Edinburgh is a Workplace Parking Levy (WPL). A WPL is a tool to reduce congestion and car commuting by applying a charge on workplaces that provide free car parking spaces for their employees (ECC, 2020b). A WPL ensures businesses contribute towards the costs of congestion while helping

to encourage employers and employees to consider other forms of transport for daily work journeys. ECC's CMP states the Council's intention to develop proposals for the introduction of a WPL, though the reality of implementing a WLP is unknown with the discussion of WPLs generating local controversy and media attention.

5.8.6. Walking

Edinburgh is a compact, walkable city with a comprehensive network of pavements and paths connecting residents to services and amenities, with walking the most common method of making short journeys within the city (ECC, 2020b). Extensive infrastructure has been put in place to aid safe pedestrian movement across the city's roads, ensuring continuous networks where possible. ECC recognise that there is scope for further enhancement and expansion of the walking/wheeling network, and the Council's Active Travel Action Plan 2016 (ATAP) set out a package of measures to support local walking and wheeling. A citywide travel survey undertaken in 2019 identified that the most useful actions that would encourage more people to walk are improved conditions of pavements and paths, more direct paths, and better street lighting (ECC, 2020b). ECC have been progressing with de-cluttering streets, enhancing accessibility, and giving pedestrians priority, and the CMP sets out specific policy requirements to ensure that new paths and pavements link to the wider walking/wheeling network where possible (ECC, 2020b).

5.8.7. Cycling

A survey of Edinburgh residents undertaken by Sustrans (2019) showed that most people do not cycle, with 24% of residents cycling at least once a week and 8% of commuters cycling to and from work. The survey found that the most effective way to encourage more people to cycle within Edinburgh is to provide more and better cycle lanes/paths and improve the condition of existing cycle lanes/paths (ECC, 2020b). With 10% of the Council's transport budget dedicated to cycling, ECC aim to enhance and expand the cycling network with a focus on increasing provision of segregated routes on some main roads and creating a joined-up network, in addition to helping increase cycling confidence and engagement (ECC, 2020b). Transport for Edinburgh have introduced a cycle share scheme, acknowledging the importance of integrating cycle share schemes (including e-cycles) within the wider transport network (ECC, 2020b).

5.9. Summary

This chapter has outlined the rationale and context behind the study's case study cities and selected employer cases. Bath and Edinburgh are two cities committed to achieving net zero 2030 targets in addition to reducing air pollution and improving residents' quality of life.

Promising progress has been made within both cities with increased levels of walking, cycling and public transport use, in addition to policies such as clean air zones. However, car use remains high in both cities, with challenges of congested roads and a need to improve public transport accessibility (particularly outside of city centres) and to build more segregated cycle lanes.

B&NES Council and NatWest are two large employers with targets to reduce the environmental impact of private car commuting. Both organisations have introduced a range of initiatives to encourage environmentally sustainable commuting, for example by restricting free car parking, the provision of free shuttle bus/Park & Ride services, and cycle to work schemes. Commuter travel was significantly disrupted for both organisations as a result of the Covid-19 pandemic, with a shift to majority home working. A detailed exploration into the behavioural impacts of Covid-19 disruption on commuter travel and work practices to both organisation cases is provided in Chapter Six (Employee Surveys) and Chapter Seven (Longitudinal Interview Study).

Chapter Six – Employee Surveys

6.1 Introduction

This chapter reports findings from the employee cross-sectional surveys, considering the short- and medium-term behavioural impacts of Covid-19 disruption on commuter travel to selected large employer cases (addressing RQ1). The chapter discusses findings from the surveys completed by B&NES Council employees first, followed by findings from the surveys completed by NatWest bank employees, with a final cross-case comparison between the two case organisations.

6.2. B&NES Council

The first B&NES Council employee survey launched in January 2021 and closed in March 2021. The survey was conducted during the second UK wide Covid-19 lockdown, in which citizens were instructed to stay at home aside from exercise and essential trips. The survey took approximately 5 to 7 minutes to complete via Online Surveys and asked respondents' questions about their travel to work and/or working from home behaviour and attitudes before and during the second national lockdown. The survey was advertised to all B&NES Council employees and a total of 79 survey responses were returned.

The second employee survey launched in March 2022 and closed in May 2022, where minimal Covid-19 disease control measures were in place. The survey took approximately 5 minutes to complete and asked respondents' questions about their current travel to work and/or working from home behaviour and attitudes. The survey was advertised to all B&NES employees using the same approach as the 2021 survey; however, the survey received a lower response rate of 33 responses. The B&NES Council gatekeeper attempted to re-promote the survey on several occasions, with the low response rate partially explained by survey fatigue as it was advertised after an internal B&NES Council travel survey.

Descriptor											**Survey observations**	
Gender	Male		Female									
	30.4%	48.5%	68.4%	51.5%							78	33
Age Group	18-24		25-34		35-49		50+					
	3.8%	3.0%	10.1%	12.1%	36.7%	36.4%	49.3%	48.5%			79	33
Employment	Full time		Part time									
	73.4%	84.8%	19%	15.2%							64	33
Commute Mode	Car (including carshare and electric car)		Public Transport		Active Travel		Mixed Mode		No commute			
	38.4%	40.6%	23.3%	15.7%	12.3%	18.8%	24.7%	9.4%	0.0%	15.6%	73	32
Household Composition	Pre-school age children		School age children		Persons aged 70 or above		N/A					
	7.6%	6.3%	21.5%	28.1%	2.5%	0%	72.2%	65.6%			82	32
Car Availability	Yes		No									
	79.5%	75.8%	20.5%	24.2%							79	33

Table 20. B&NES sample (green=2021, red=2022)

The 2021 sample has a higher proportion of females to males whereas the 2022 sample is more balanced between the two genders. Both survey samples have a similar spread of ages, with the highest proportion of both samples made up of those aged over 35. Car is the most popular commute mode with most of both samples having access to a car. Both samples report a similar household composition, with the majority of respondents not having school age children or elderly people present within the household. It is possible that there are individuals who participated in both the 2021 and 2022 surveys, but the number of repeat participants is unknown due to anonymisation procedures put in place in both surveys.

6.2.1. Commute behaviour

Before the first national Covid-19 lockdown (i.e., before March 2020), 52.1% of surveyed B&NES Council employees reported travelling to work five or more times a week, with 98.6% of the sample travelling into the office once a week or more. Figure 21 shows that 52.7% of surveyed staff reported commute satisfaction, compared to 26.4% who reported dissatisfaction and 20.8% who felt neutral (neither satisfied nor dissatisfied). Many respondents (66.7%) had no intention or desire to change their commute travel behaviour. From employees surveyed in 2022 (Figure 22), most of the sample (66.6%) reported typically travelling to work once a week or less. There was lower reported commute satisfaction (46.7%) and most 2022 respondents reported no intention to change their commute travel behaviour (70.4%).

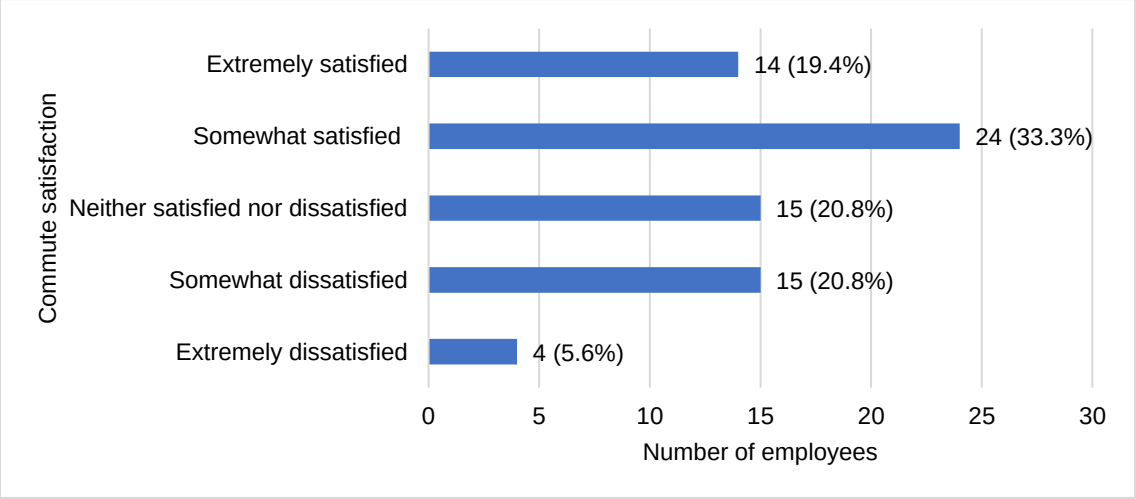


Figure 21. B&NES pre Covid-19 commute satisfaction

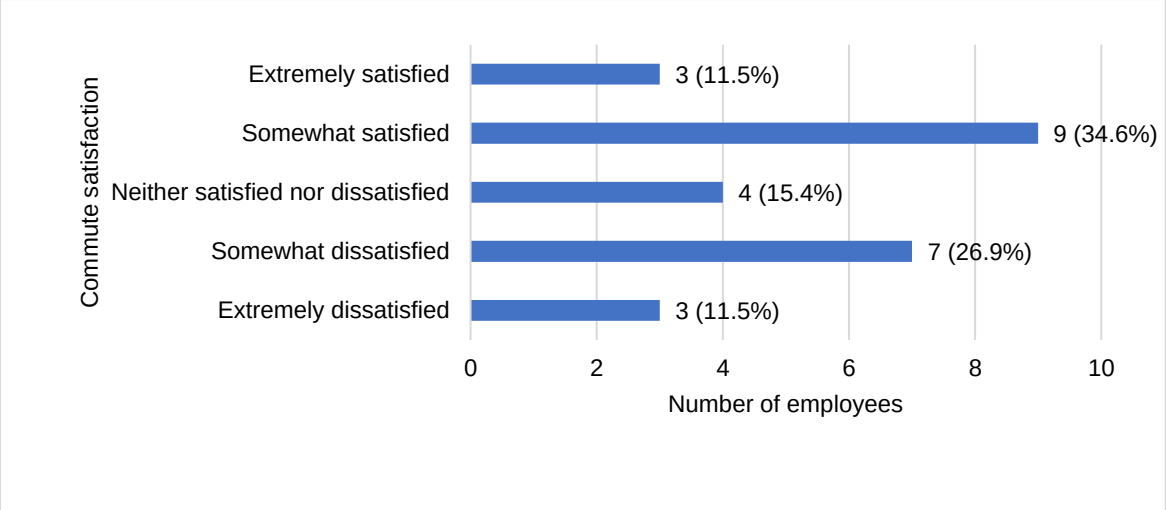


Figure 22. B&NES 2022 commute satisfaction

A breakdown of surveyed employees' commute mode prior to the Covid-19 outbreak is shown in Figure 23 below, with users asked to select the main mode used for the duration of the journey. Travelling to work by car was the most popular reported pre Covid-19 commute mode (38.4% including electric car), followed by mixed mode (24.7%), public transport (23.3%) and active travel (12.3%). Mixed mode commuting is defined as different modes of transport used to travel into work on different days, for example if an employee travelled to work by bus three days a week, and by bicycle two days a week.

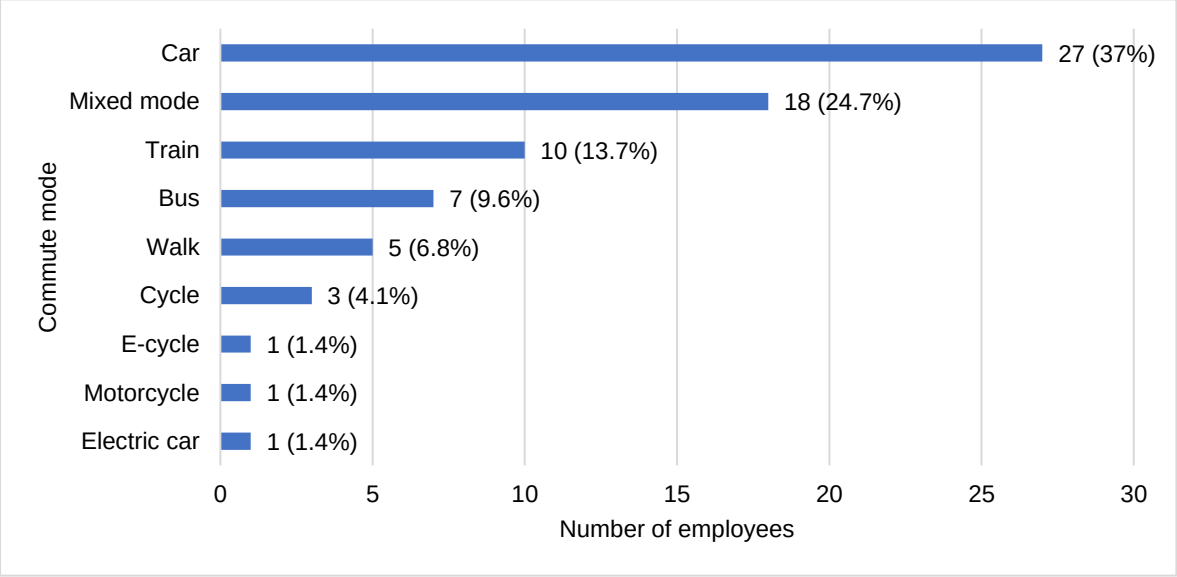


Figure 23. B&NES pre Covid-19 commute mode

During the first Covid-19 national lockdown (beginning March 2020), 91.1% of surveyed employees were instructed by B&NES Council to work from home. The remaining surveyed employees continued to travel into work as their work could only be performed on site. During the second Covid-19 national lockdown (beginning January 2021, the period the first survey data were collected), the same number of surveyed employees (91.1%) were

instructed to work from home, with 8.9% of surveyed employees continuing to travel to work. From the limited number of employees who continued to travel into work throughout the lockdowns (n=7), there was one reported modal shift compared to pre Covid-19, with a switch from the bus to car share/pool, and no reported changes in commute satisfaction.

From the 2022 survey (conducted at a time of minimal Covid-19 preventative measures), the most popular reported commute mode was the car (40.6%), followed by active travel (18.8%), public transport (12.6%), and mixed mode (9.4%) (Figure 24). It is notable that 15.6% of the sample reported having no commute as they worked entirely from home, compared to zero respondents from the 2021 sample.

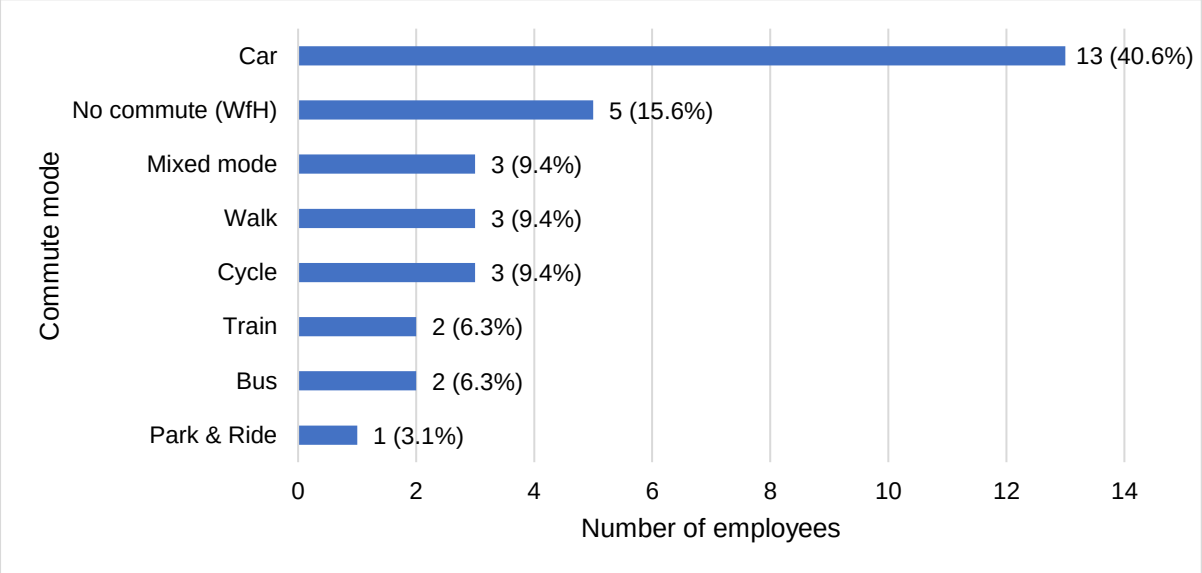


Figure 24. B&NES 2022 commute mode

Tables 21 and 22 below outline the relationship between reported commute mode and commute satisfaction among surveyed employees. Pre Covid-19, public transport users reported the highest level of commute dissatisfaction (47.1%). Active travel (walking and cycling), car, and mixed mode commuters were generally more satisfied than dissatisfied with their commutes, with active travel users reporting 100% commute satisfaction. Among the 2022 survey sample, car users reported the highest level of dissatisfaction (58.3%), and public transport, active travel, and mixed mode commuters were generally more satisfied than dissatisfied with their commute.

		Commute Mode			
		Car	Public Transport	Active Travel	Mixed Mode
Commute Satisfaction	Satisfied	48.1%	35.3%	100.0%	50.0%
	Neutral	25.9%	17.6%	0.0%	27.8%
	Dissatisfied	25.9%	47.1%	0.0%	22.2%
Total		100%	100%	100%	100%

Table 21. B&NES pre Covid-19 commute mode and satisfaction

		Commute Mode			
		Car	Public Transport	Active Travel	Mixed Mode
Commute Satisfaction	Satisfied	16.7%	75.0%	66.7%	66.7%
	Neutral	25.0%	0.0%	0.0%	33.3%
	Dissatisfied	58.3%	25.0%	33.3%	0.0%
Total		100%	100%	100%	100%

Table 22. B&NES 2022 commute mode and satisfaction

In addition to reporting commute satisfaction on a Likert scale, free text comment boxes were provided for questions related to commute satisfaction. Table 23 provides a summary of themes related to commute satisfaction identified from respondents' comments. The majority of the 2021 survey comments describe a frustration with local public transport services, with issues of overcrowding, irregular services, and lengthy journeys (although some public transport benefits were identified). Several car commuters noted issues of congestion and difficulty parking. Active travel commuters reported mixed feelings; the exercise benefits derived from active travel commuting were recognised by several respondents, but issues of air pollution and insufficient cycling infrastructure limited the enjoyment of an active travel commute for some. Flexible working benefits were reported by two participants with evidence of employees travelling outside of peak hours to improve commute satisfaction. Similar themes were identified from the 2022 sample; active travel commuters enjoyed the exercise benefits gained from their commute but described poor cycling infrastructure, public transport commuters noted poor public transport provision (especially in rural locations), and car commuters described a frustration with congested commutes.

Pre Covid-19 Commute (2021 survey sample)	
Themes	Example quotes
Insufficient public transport	“Trains were not particularly frequent, often late and too full in the evening” “Dissatisfied due to train overcrowding and unreliability of the service” “Bus never on time, very crowded trains” “Rail journeys were cramped and busy as had to travel during the rush hour” “Long delays, cancellations or breakdowns meant a 40-minute journey could take 2-3 hours” “The train on my return journey was always extremely crowded and on most occasions, I would have to stand for some or all of the journey” “The trains stopping were few and far between and irregular”
Public transport benefits	“I had noticed a steady improvement in the rail service in the 18 months prior to Covid” “Train was quicker than driving and more convenient” “The fact that I could bulk buy e-tickets on my phone was a plus”
Active travel benefits	“Ideal to get exercise as part of my normal commute and lovely walk” “I liked having the exercise that the walk to work gave me” “Nice bit of exercise”
Active travel disbenefits	“I walk along a busy main road, the air is very smoggy and in summer it’s hard to breath” “I wanted to be able to give up my car but it was a long commute I didn’t feel I could cycle 5 days a week” “Used to bike then got knocked off” “Could have done with less mud on one part of the route”
Traffic congestion / difficulty parking	“It was often exhausting and I wasted time sat in queues of traffic” “Disliked paying for parking, wasting time trying to find parking, etc.” “Parking was an issue at my workplace”
Flexible working benefits	“As I can work flexibly, I miss the worse of the rush hour traffic” “A flexible working pattern allowed me to avoid busy times of the day”
2022 Commute (2022 survey sample)	
Active travel benefits	“A nice bike ride along Bristol to Bath cycle path” “Exercise and no fuel costs” “I am really enjoying walking in to the nearest town because I can walk through countryside and by a river which I really enjoy”
Cycling safety	“Would like better cycle infrastructure. I’m also increasingly bothered by speeding cars in residential areas and the fact that cars are getting higher (SUVs) which means you can’t see over the top of them in the way you can with older cars, making it more dangerous for pedestrians and cyclists” “Poor public transport provision and safe cycle routes prevent sustainable ways to travel”
Limited public transport	“I live in a very rural location with limited bus services, no cross-boundary ticketing and poor connections” “I use 2 buses from different operators to get to work so have to pay two fares. We don’t have multi operator ticketing currently in the area” “Train fares have risen – again” “Poor public transport provision and safe cycle routes prevent sustainable ways to travel”
Congestion	“To go approximately 9 miles can take anywhere between 20 mins to an hour. This is just life” “Traffic is bad”

Table 23. B&NES commute themes

Considering commute journey time, the most common pre Covid-19 commute lasted between 15-29 minutes (30.6%), followed by 45-59 minutes (26.4%), with most respondents reporting to leave their home between 7.30am-8am (31.9%), followed by 7am-7.30am (23.6%). Among the 2022 sample, most commute journeys similarly took between 15-29 minutes (34.6%), followed by 30-44 minutes (26.9%), with most respondents reporting to leave their home between 7am-7.30am (30.8%).

Daily commuting can be considered a habitual behaviour, yet self-reporting habit is problematic due to different interpretations of the word ‘habit’ (Gardner, 2012). As introduced

in Chapter Three, Gardner et al. (2012) developed a four-item automaticity subscale called the SRBAI as a valid measure of habit. Using the SRBAI scale, Table 24 shows that most survey respondents agreed that their pre Covid-19 commute was a habitual behaviour. As discussed in Chapter Two, the HDH posits that disruptive events can weaken or break habitual behaviours, with a higher likelihood of habitual behaviours such as commuting being reconsidered (Verplanken et al., 2008). The 2022 sample was also asked to rate the habitual nature of their current commute travel via completing the SRBAI scale (Table 25). Findings show slightly lower levels of agreement that respondents' commute behaviour is a habitual behaviour across each SRBAI item. However, overall respondents continued to rate their commute a habitual behaviour, suggesting that the Covid-19 disruption did not 'break' the habit of commuter travel for surveyed B&NES Council employees. Yet it is also possible that some participants might have established a new habit of travelling to work since the Covid-19 outbreak, representing a break from prior habits.

Before the Covid-19 outbreak, the way I usually travelled to work was something...				
	I did automatically	*I did without having to consciously remember*	*I did without thinking*	*I started doing before I realised I was doing it*
Agree	81.7%	80.9%	69.5%	35.8%
Neutral	4.2%	2.9%	7.2%	31.3%
Disagree	14.0%	16.2%	23.1%	32.8%
Total	100%	100%	100%	100%
SRBAI scale mean: 5.6				

Table 24. B&NES pre Covid-19 commute habit

The way I usually travel to work is something…				
	I do automatically	*I do without having to consciously remember*	*I do without thinking*	*I start doing before I realise I am doing it*
Agree	76.9%	68.0%	56.0%	28.0%
Neutral	0.0%	8.0%	16.0%	20.0%
Disagree	23.0%	24.0%	28.0%	52.0%
Total	100%	100%	100%	100%
SRBAI scale mean: 5.4				

Table 25. B&NES 2022 commute habit

6.2.2. Working from home behaviour

Considering pre Covid-19 home working, 79.2% of 2021 B&NES Council survey respondents were able to work from home. However, from those who were able to work from home, the majority never or rarely worked from home (53.4%) or worked from home once a week (27.6%) (Figure 25). By contrast, 78.2% of the 2022 sample reported working from home four or more times a week, with zero percent working from home once a week or less (Figure 26). Nearly all of the 2022 sample (96.9%) reported working from home more compared to their pre Covid-19 home working.

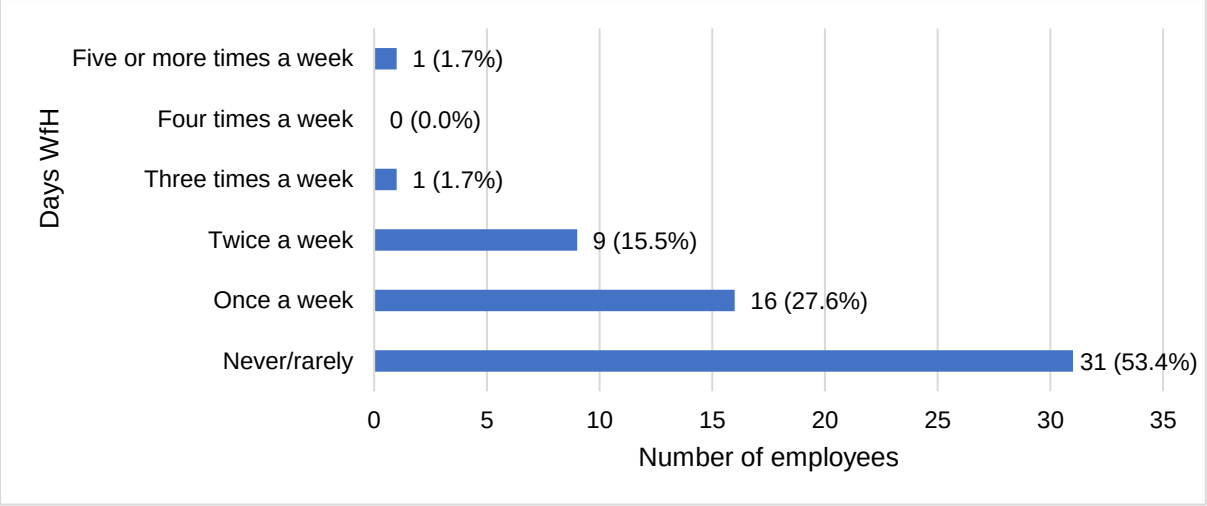


Figure 25. B&NES pre Covid-19 work from home

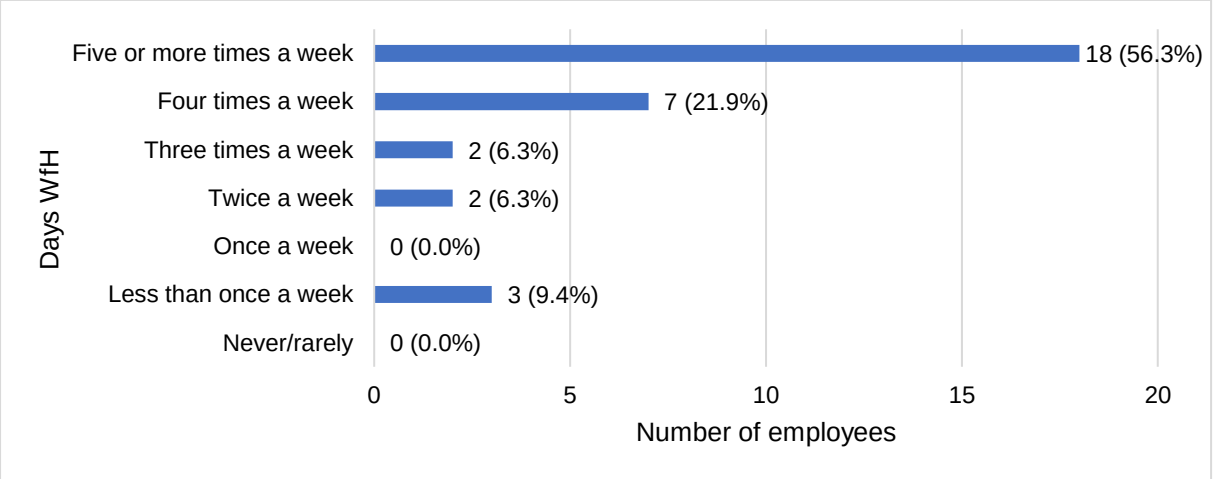


Figure 26. B&NES 2022 work from home

B&NES Council employees surveyed in 2021 reported a high level of satisfaction with their pre Covid-19 home working (85.2%) (Figure 27). The 2022 survey sample reported higher levels of home working dissatisfaction (28.13%), although the majority reported feeling satisfied with working from home (59.5%) (Figure 28).

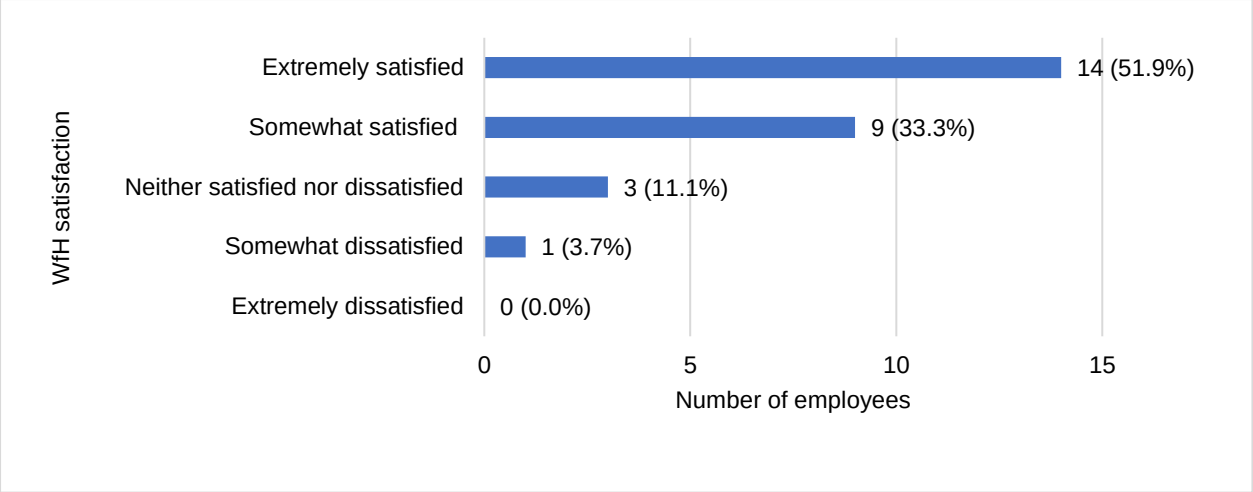


Figure 27. B&NES Pre Covid-19 work from home satisfaction

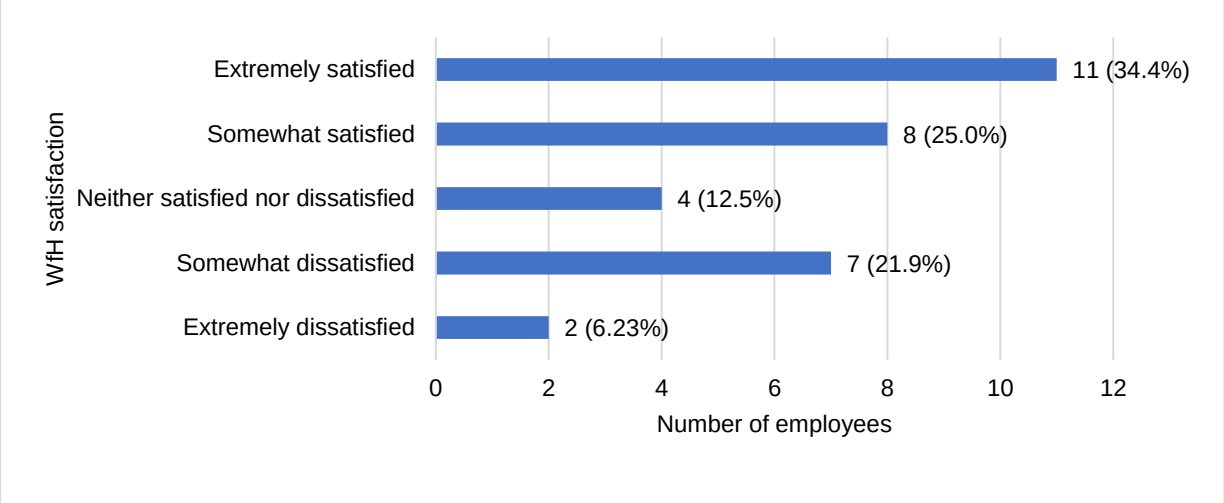


Figure 28. B&NES 2022 work from home satisfaction

A free text comment box was provided for participants to comment on questions related to working from home satisfaction in both surveys. The main themes from the free text responses are summarised in Table 26. In 2021, several employees reported enjoying compulsory home working, citing improvements in work-life balance and relief from the commute. However, many employees reported difficulties associated with compulsory home working, with numerous respondents describing feelings of loneliness and isolation. The importance of providing employees with suitable equipment and technology was evident, with comments suggesting a direct link between poor technology/equipment and decreased work satisfaction (and vice versa). From 2022, there were no reported issues of suitable equipment/technology, yet mixed emotions relating to home working were prevalent, with comments referring to feelings of isolation and reduced productivity in contrast to others reporting enhanced productivity and enjoyment.

2021 Survey Sample	
Themes	Example quotes
Working from home dissatisfaction	“Some aspects of my job are more difficult and less satisfying from home” “Missing interaction with colleagues, flow of ideas, ease of communication between teams etc.” “The prolonged period of WfH isolation and not being able to speak informally with colleagues becomes challenging” “I miss the office environment and interaction with colleagues” “I find it hard to collaborate with colleagues and find learning and development difficult”
Equipment / technology	“Still using own equipment and IT issues can be stressful” “Connectivity has been an intermittent issue” “We currently have to use our personal IT equipment and this can be problematic at times” “Once IT support was in, this works pretty well most of the time” “I have the equipment at home now to enable me to work from home”
Loneliness / isolation	“Main concern - social isolation” “Isolation of working from home for a whole year is becoming a little tedious and soul-destroying” “Dull, isolated, difficult to connect with wider group of colleagues”
Improved work / life balance	“It saves me a lot of time on my commute” “I would now hate to commute” “I like working from home. I am far more productive, I am less stressed and anxious and not having to commute is saving me time, money and stress” “Home working has had a positive impacted on my family life with me now having more time with my family. I feel my stress levels have reduced and my mental wellbeing has improved”
Household challenges	“Family life has been quite stressful which has had an impact” “We don't have room for a desk, let alone a home office”
2022 survey sample	
Mixed emotions	“I feel quite isolated and unsupported. There are also more meetings and emails as a result which is hard to manage. The big benefit however is the lack of a commute there are pros and cons. I miss the incidental conversations with colleagues and cross fertilisation of ideas that happens when you work in a shared space. Sometimes it is nice to be able to concentrate on work when at home” “I do appreciate being able to work from home, but I am finding myself becoming more and more isolated from my work colleagues. This is making me less and less efficient and effective at work” “There are disadvantages but at the moment they do not outweigh the advantages”
WfH enjoyment	“It depends on what I am doing. Some tasks are better done at home with less distractions” “Working from home 3 days / week suits me” “Working from home works well for me. I spend the time saved by going for walks on rural footpaths near my home, two or three times a day, alone and also with my wife, who also works from home. We have lunch together and go for a short lunchtime walk and again in the evening after work (now that it's lighter in the evening)” “There is very little I need to go to the office for to do my role and virtual meetings work well. The only time office work is better than home is for training” “Less commute and much more productive”
WfH concerns	“I do not have the appropriate set up at home to be able to work comfortably and in private” “I miss having an office to go to meet colleagues during the day sometimes”

Table 26. B&NES work from home themes

6.2.3. Wider travel behaviour and attitudes

The 2022 survey asked about the impact of Covid-19 on participants’ wider travel behaviour, including whether participants’ use of several transport modes had increased, decreased, or remained the same. The results shown in Table 27 show an overall trend of reduced travel for every transport mode, suggesting respondents were generally travelling less for both work and leisure compared to their pre Covid-19 travel.

Transport Mode	Use more	Use less	Use the same amount	Don't use
Walking	27.3%	**45.5%**	27.3%	0.0%
Cycling	9.1%	**39.4%**	12.1%	39.4%
Train	6.1%	**36.4%**	15.2%	42.4%
Bus	12.1%	**42.4%**	18.2%	27.3%
Car	18.2%	**57.6%**	15.2%	9.1%

Table 27. B&NES changes to transport modes

Both the 2021 and 2022 surveys asked respondents about their attitudes regarding the long-term impact of Covid-19 on their travel behaviour, mirroring the questions asked in the Transport Focus (2021) travel survey. Among surveyed 2021 employees, 44.3% of respondents agreed that they will avoid public transport and use their car or other vehicle more than they did before. Additionally, 31.7% of respondents agreed that they will walk and/or cycle more, and 87.4% expected to work from home more often in the future. From the 2022 survey sample, 48.5% of respondents disagreed that they would avoid public transport and use their car more than they did before Covid-19. 42.4% disagreed that they will be walking or cycling more than before Covid-19, and 93.8% agreed that they expect to be working from home more often than before Covid-19.

6.3. NatWest (Gogarburn HQ, Edinburgh)

Following the same approach as the B&NES Council surveys, the first NatWest employee survey launched in January and closed in March 2021. The survey was conducted during the second UK-wide lockdown, with citizens instructed to stay at home aside from exercise and essential trips. The survey took approximately 5 to 7 minutes to complete via Online Surveys and asked respondents' questions about their travel to work and/or working from home behaviour and attitudes before and during the second national Covid-19 lockdown. The survey was advertised to all NatWest employees based in Edinburgh, with a total of 64 survey respondents.

The second employee survey launched in March 2022 and closed in May 2022, with minimal Covid-19 disease control measures in place. The survey took approximately 5 minutes to complete and asked respondents' questions about their current travel to work and/or working from home behaviour and attitudes. The survey was advertised to all NatWest employees based in Edinburgh using the same approach as the 2021 survey, with a total of 47 survey respondents.

Descriptor											Survey observations	
Gender	Male		Female		Other							
	54.7%	46.8%	45.3%	51.1%	0%	2.1%					64	47
Age Group	18-24		25-34		35-49		50+					
	1.6%	8.5%	15.9%	19.1%	39.7%	42.6%	42.9%	29.8%			63	47
Pre Covid-19 Employment	Full time		Part time									
	95.3%	97.9%	4.7%	2.1%							64	47
Pre Covid-19 Commute Mode	Car (including carshare and electric car)		Public transport		Active travel		Mixed mode		No commute			
	59.5%	61.7%	7.9%	14.9%	15.7%	10.6%	15.6%	4.3%	1.6%	8.5%	64	47
Household Composition	Pre-school age children		School age children		Persons aged 70 or above		N/A					
	7.8%	8.5%	23.4%	21.3%	0%	0%	71.9%	70.2%			66	47
Car Availability	Yes		No									
	87.5%	83%	12.5%	17%							64	47

Table 28. NatWest sample (green=2021, red=2022)

There is a relatively even gender split between both 2021 and 2022 samples. The 2022 survey sample is slightly younger with 27.6% of the sample under the age of 34 compared to 17 .5% of the 2021 sample. Most of both samples reported working full time, with car the dominant commute mode and a high percentage of car availability. The 2022 sample has a higher number of public transport commuters with fewer active travel commuters. Most respondents within both samples report not having children or elderly persons present in the household. It is possible that there may be individuals who participated in both the 2021 and 2022 surveys, but the number of repeat participants is unknown due to anonymisation procedures in both surveys.

6.3.1. Commute behaviour

Before the first national Covid-19 lockdown (i.e., before March 2020), 47.6% of surveyed staff reported commute dissatisfaction, compared to 38.1% who reported commute satisfaction and 14.3% who felt neutral (neither satisfied nor dissatisfied) (Figure 29). Most respondents reported no intention or desire to change their commute travel behaviour (73.0%) and 41.3% of respondents travelled to work five times a week or more (with 30.2% travelling to work four times a week). Respondents from the 2022 survey reported much lower commute dissatisfaction, with only 14.3% reporting commute dissatisfaction compared to 71.5% satisfaction and 14.3% neutral (Figure 30). The majority of 2022 respondents typically travelled to work once a week (53.2%) and reported no intention or desire to change their commute (63.4%). Of the 34.2% who had been thinking about making a change or had recently made a change, the majority reported a positive modal shift from a conventionally fuelled car to electric car, public transport, or active travel. Only one participant reported a negative modal shift from public transport to private car.

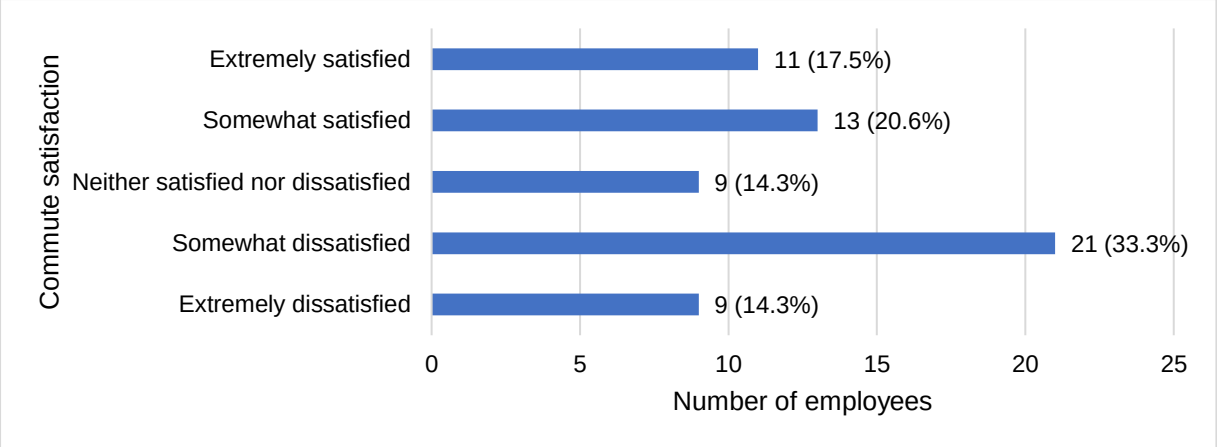


Figure 29. NatWest pre Covid-19 commute satisfaction

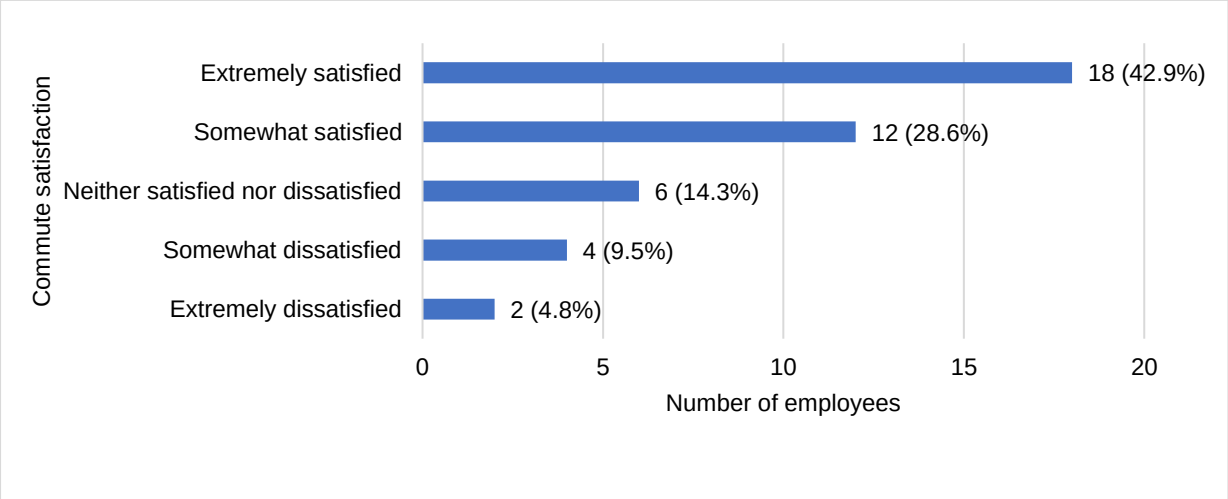


Figure 30. NatWest 2022 commute satisfaction

A breakdown of employees pre Covid-19 commute mode is shown in Figure 31 below, with users asked to report the main mode used for the duration of their journey. Travelling to work by car was the most popular reported commute mode (59.5% including electric car and car share), followed by active travel (15.7%), mixed mode (15.6%) and public transport (9.5%). Mixed mode commuting is defined as different modes of transport used to travel into work on different days, for example if an employee travelled to work by bus two days a week, and by car three days a week.

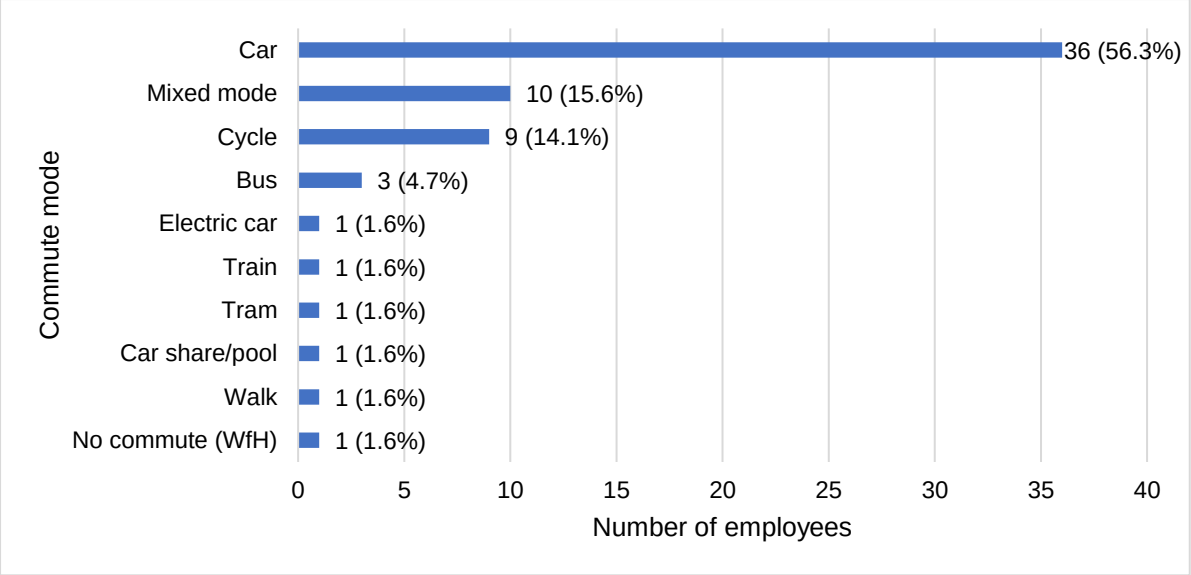


Figure 31. NatWest pre Covid-19 commute mode

During the first Covid-19 national lockdown (March – July 2020), 93.4% of surveyed employees were instructed by NatWest to work from home. The remaining 6.6% of participants continued to travel into work as their work could only be performed on site. During the second Covid-19 national lockdown (January - March 2021, the period the survey data was collected), the same number of employees (93.4%) were instructed to work from home, with 6.6% of employees continuing to travel to work. Reported commute modes from the 2022 survey sample, where most Covid-19 restrictions had been lifted, show that the car was similarly the dominant commute mode among survey participants (61.7% including electric car), with limited public transport (14.9%) and active travel (10.6%) commutes (Figure 32).

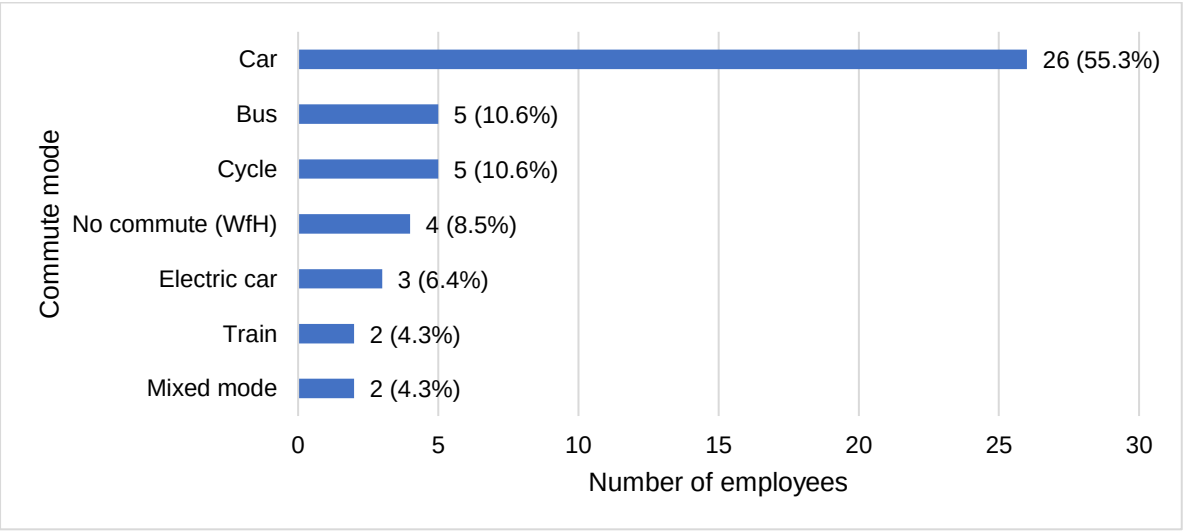


Figure 32. NatWest 2022 commute mode

Tables 29 and 30 outline the relationship between commute mode and commute satisfaction. Pre Covid-19, mixed mode commuters reported the highest level of commute dissatisfaction (60%), followed by car users (57.9%). Both active travel and public transport users were generally more satisfied than dissatisfied with their commutes, with active travel users (walking and cycling) reporting the highest level of satisfaction (90%). Among the 2022 survey sample, there is higher reported commute satisfaction among all commute modes apart from public transport users, with high satisfaction reported among active travellers (100%) and car commuters (70.4%).

		Commute mode			
		Car	Public transport	Active travel	Mixed mode
Commute satisfaction	Satisfied	28.9%	60.0%	90.0%	10.0%
	Neutral	13.2%	0.0%	10.0%	30.0%
	Dissatisfied	57.9%	40.0%	0.0%	60.0%
Total		100%	100%	100%	100%

Table 29. NatWest pre Covid-19 commute mode and satisfaction

		Commute mode			
		Car	Public Transport	Active Travel	Mixed Mode
Commute satisfaction	Satisfied	70.4%	57.1%	100%	50.0%
	Neutral	18.5%	14.3%	0.0%	0.0%
	Dissatisfied	11.1%	28.6%	0.0%	50.0%
Total		100%	100%	100%	100%

Table 30. NatWest 2022 commute mode and satisfaction

In addition to reporting commute satisfaction, free text comment boxes were provided for questions related to commute satisfaction. Table 31 provides a summary of themes related to commute satisfaction identified from the free text comments. The majority of the pre Covid-19 comments describe a frustration with congestion among car users, in addition to those using public transport services such as rail and bus describing issues of overcrowding and irregular services. This contrasts with generally positive comments from those who cycled to work, with cyclists describing benefits such as exercise gained from their active commute. From the 2022 sample, there are mentions of a quieter, less congested commute, potentially explaining the high level of reported commute satisfaction among car users.

Pre Covid-19 Commute (2021 survey sample)	
Themes	Example quotes
Traffic congestion	“Peak travel through Edinburgh City is horrendous” “Traffic was a nightmare” “I felt very frustrated that it took so long to travel so little” “Edinburgh traffic management is poor” “Long traffic jams in morning and evening”
Public transport overcrowding / unreliability	“Scotrail trains have been massively overcrowded for years” “Bus service was not regular enough to be reliable”
Cycling benefits	“I liked commuting by bike – built exercise into day” “Loved cycling. A great way to break up the day”
Cycling facilities	“Good facilities at work end – showers, lockers, secure bike parking” “Need changing facilities and hot showers” “Bicycle route OK – but big sections not very friendly in commute time traffic”
Commute frustration	“Sometimes felt like I was commuting for the sake of being seen to be in the office” “Felt slightly embarrassed that I was sitting by myself in a car like most other commuters. It felt wrong, environmentally, and a waste of precious time”
Commute enjoyment	“It was time alone, in my own space in the car where I was comfortable, temperature controlled and relaxing”
2022 Commute (2022 survey sample)	
Quieter commute	“When actually commuting, the time is less than it used to be” “Travelling off-peak means no traffic” “Quieter due to people working from home” “No hold ups due to traffic as before the pandemic”
Sustainable transport facilities	“I can charge my car for free at work” “Good facilities in work to support active travel”

Table 31. NatWest commute themes

Considering commute journey time, the most common pre Covid-19 commute journey time lasted between 30-44 minutes (33.3%), followed by 45-59 minutes (30.2%), with most respondents leaving before 7am (36.5%), followed by 7am-7.30am (23.8%). Findings from the 2022 sample are similar, with the most common journey times lasting either 30-44 minutes (26.2%) or 45-59 minutes (26.2%). However, the 2022 sample shows a slightly later commute time, with 31% of respondents leaving between 7.30-8am.

The SRBAI scale was used to measure commute habit in both the 2021 and 2021 surveys. Table 32 shows that most 2021 survey respondents agreed their pre Covid-19 commute was a habitual behaviour. Findings from 2022 (Table 33) showed that commuters similarly reported that their post Covid-19 commute was a habitual behaviour (despite slightly lower levels of overall agreement), suggesting that the ‘habit’ of participants’ commuter travel was not broken by Covid-19 disruption despite a significant break in commuter travel where most surveyed employees worked solely from home. However, it is recognised that some participants might have established a new habit of travelling to work since the Covid-19 outbreak.

Before the Covid-19 outbreak, the way I usually travelled to work was something...				
	I did automatically	*I did without having to consciously remember*	*I did without thinking*	*I started doing before I realised I was doing it*
Agree	85.7%	78.6%	78.7%	43.4%
Neither disagree nor agree	3.2%	4.9%	3.3%	20.0%
Disagree	11.1%	16.4%	18.1%	36.7%
Total	100%	100%	100%	100%
SRBAI scale mean: 5.8				

Table 32. NatWest pre Covid-19 commute habit

The way I usually travel to work is something…				
	I do automatically	*I do without having to consciously remember*	*I do without thinking*	*I start doing before I realise I am doing it*
Agree	83%	80%	69.3%	46.1%
Neither disagree nor agree	2.4%	0%	0%	12.8%
Disagree	14.6%	20%	30.8%	41%
Total	100%	100%	100%	100%
SRBAI scale mean: 5.5				

Table 33. NatWest 2022 commute habit

6.3.2. Working from home behaviour

Most 2021 survey respondents reported being able to work from home prior to the Covid-19 outbreak (93.7%). However, the majority either never worked from home (36.7%) or worked from home once a week (36.7%) (Figure 33). As a result of Covid-19 disruption, the reported frequency of working from is notably different for the 2022 sample with 100% reporting being able to work from home, and 83% of the sample reported working from home four times a week or more (Figure 34). Most of those surveyed (95.7%) reported that they currently work from home more compared to their pre Covid-19 home working.

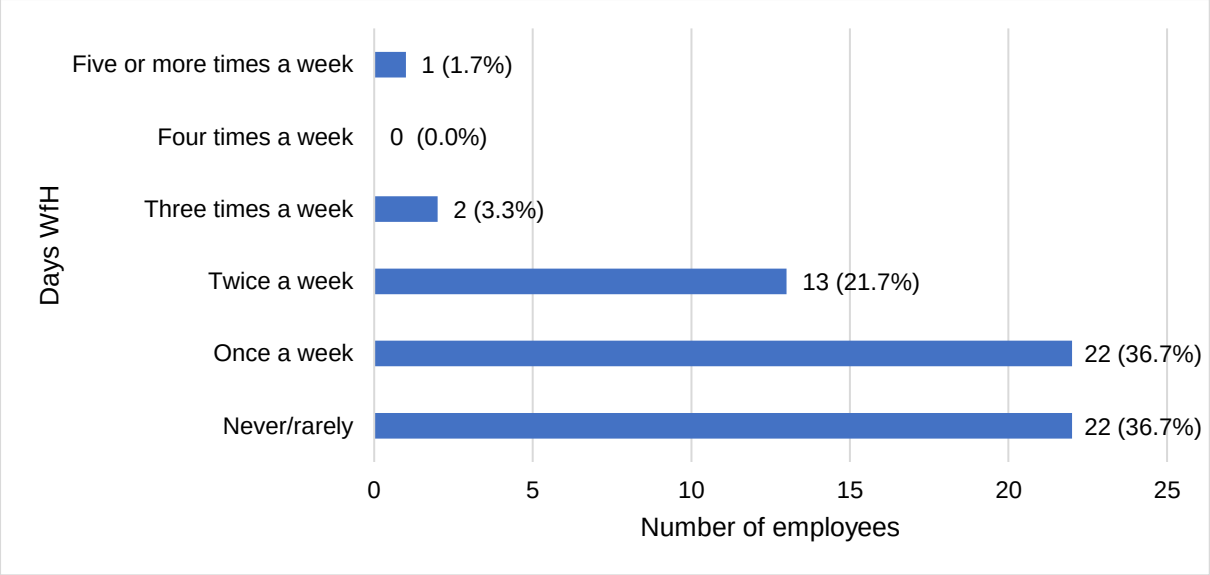


Figure 33. NatWest pre Covid-19 work from home

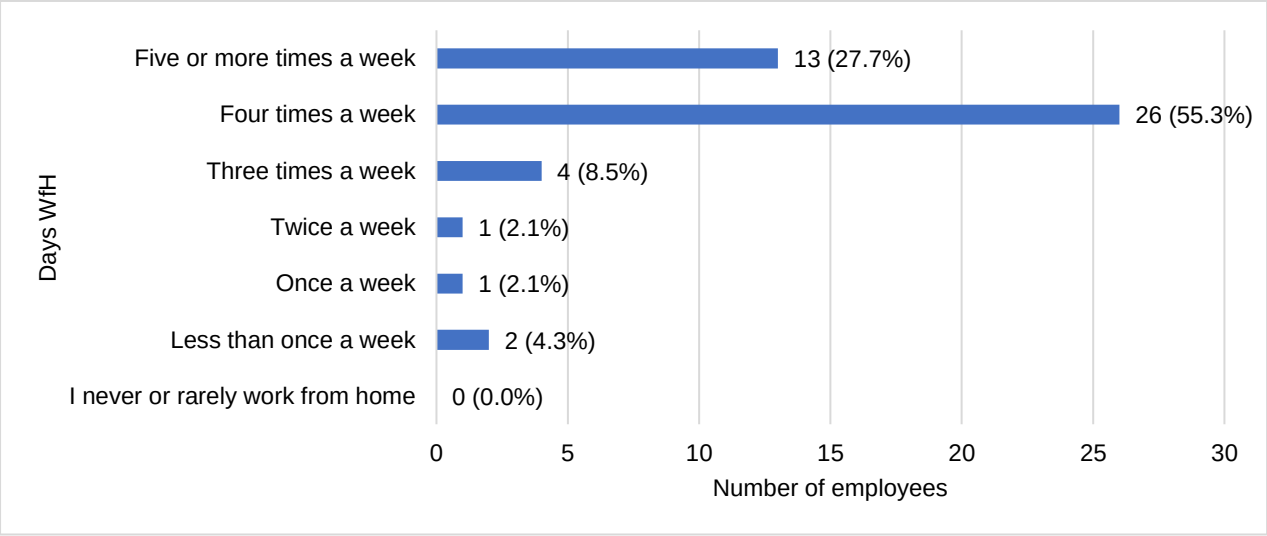


Figure 34. NatWest 2022 work from home

Considering pre Covid-19 home working, there was a high level of reported home working satisfaction (81.6%) (Figure 35). Reported satisfaction was similarly high among the 2022 survey sample, with 85.1% of the sample reporting feeling satisfied with home working (Figure 36).

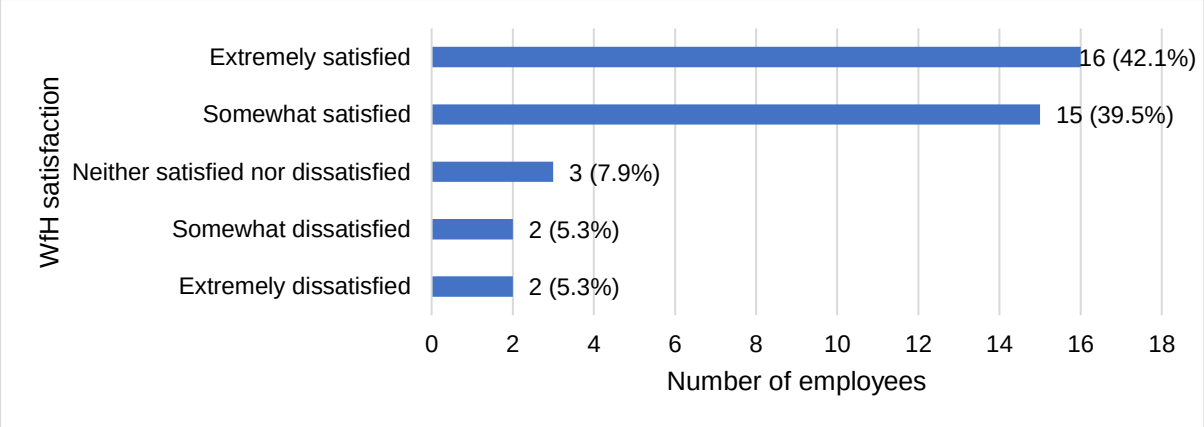


Figure 35. NatWest pre Covid-19 work from home satisfaction

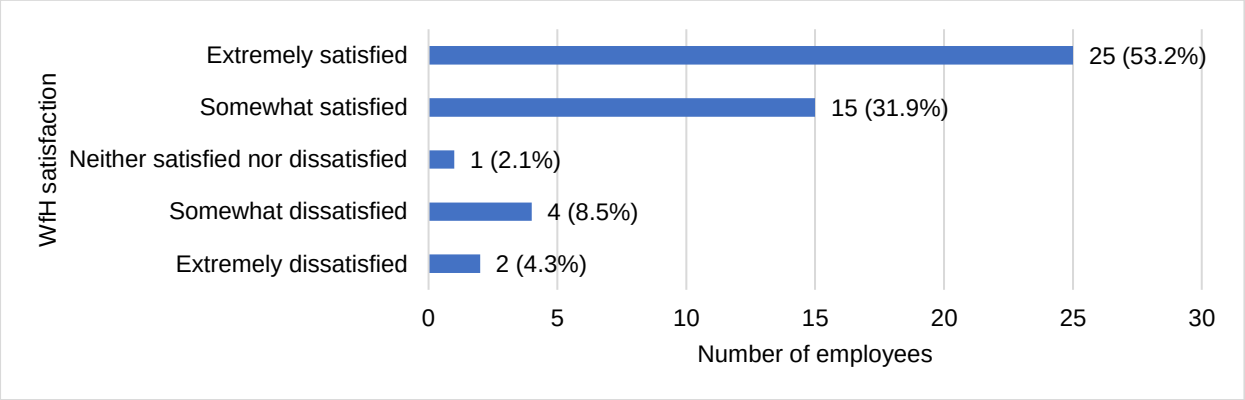


Figure 36. NatWest 2022 work from home satisfaction

A free text comment box was provided for participants to comment on home working satisfaction. The main themes from the free text responses are shown in Table 34. From 2021, several participants described enjoying compulsory home working with reported improvements in work-life balance. However, working from home throughout a national lockdown had a negative impact on numerous surveyed employees' wellbeing, with 38% of comments referring to feelings of loneliness and isolation. The struggle of employees with school aged children having to balance home working with home schooling (with schools shut during the lockdown) was evident as having a negative impact on home working satisfaction. The 2022 sample demonstrated similar themes of mixed emotions in relation to home working; some participants reported struggling to motivate themselves and missing face-to-face colleague interaction, whereas others reported enjoying enhanced flexibility and work-life balance. A new theme arising from 2022 related to energy costs, with an increased awareness of the costs of home working amid energy price increases.

2021 Survey Sample	
Themes	Example quotes
Working from home dissatisfaction	“I do not enjoy working from home every day” “Intrusion of work into my personal space” “It is no substitute for face-to-face interaction and collaboration” “Would much rather work in the office as not glued to a computer screen”
Loneliness / isolation	“Bit lonely” “Felt isolated and lonely” “Dislike lack of social interaction” “Can be a long, lonely day” “I miss collaboration and social side of office”
Home schooling challenges	“Extremely satisfied if it was not for home schooling” “It’s too difficult with my kids at home”
Equipment / technology	“Have been provided with kit and suitable furniture” “I have a work environment set-up provided by employer” “The technology works and I can work very effectively” “My technology drops off about 20+ times per day and my employer has struggled to support me with reliable technology”
Improved work / life balance	“Far better work-life balance” “I love carrying out my role from home. I have balance”
2022 survey sample	
Working from home dissatisfaction	“I hate it, too many distractions at home, no difference between home life and work life. No colleague interaction. Struggle to motivate myself at home” “Lacking direct and easy access to colleagues can complicate some tasks”
Improved work-life balance	“Work life balance is improved, as well as environmental impact. I make it work for me” “I enjoy the flexibility offered by working from home” “Great for work life balance”
Mixed emotions	“I enjoy having my time for personal/family time but it's much harder to learn from others whilst WFH” “It’s ideal but days can get mundane” “Working from home has its benefits however I do enjoy working at office the few times I've been in” “WFH allows flexibility for dog care and to pick up housework - make a cup of tea, stick a washing on etc...But can be lonely and lowers physical exercise”
Energy costs	“Saving money on commuting. although not sure if energy price increase will change this” “Working from a room in the house means I have to pay for heating and lighting and the area I work in isn’t ideal”

Table 34. NatWest work from home themes

The 2022 survey asked about the impact of Covid-19 on participants’ wider travel behaviour (Table 35). For walking, there was a relatively even distribution between those who walked more, less, and the same amount when comparing their pre Covid-19 to current walking levels. For cycling, most respondents who previously cycled reported cycling roughly the same amount. For train users, the majority reported either using the train more or the same amount, whereas with bus users, the majority of bus users reported using the bus less compared to pre Covid-19. A large percentage of car users reported using the car less compared to their pre covid-19 car use (63.8%).

Transport Mode	Use more	Use less	Use the same amount	Don’t use
Walking	29.8%	**36.2%**	34.0%	0.0%
Cycling	10.6%	8.5%	**19.1%**	61.7%
Train	0.0%	**29.8%**	27.7%	42.6%
Bus	2.2%	**41.3%**	21.7%	34.8%
Car	14.9%	**63.8%**	8.5%	12.8%

Table 35. NatWest 2022 changes to transport modes

Both the 2021 and 2022 surveys asked NatWest respondents about their attitudes regarding the long-term impact of Covid-19 on their travel behaviour, mirroring questions asked in the longitudinal Transport Scotland (2021b) Covid-19 public attitudes survey. Among surveyed NatWest employees in 2021, 43.8% of respondents agreed that they plan to avoid public transport and use their car or other vehicle more than they did before, which is slightly lower than the Scottish average of 49%. Additionally, 40.6% of respondents stated that they will walk and/or cycle more, which is lower than the Scottish average of 67%. Most NatWest respondents expected to work from home more often in the future (84.4%), compared to just 39% of the Scottish population. Among the 2022 survey sample, a similar percentage of respondents agreed that they would avoid public transport and use their car or other vehicle more than before (40.5%). Nearly half of respondents stated that they will walk and/or cycle more compared to pre Covid-19 (48.9%), and 93.5% agreed that they expect to work from home more often compared to pre Covid-19. From the 2022 survey sample, it is notable that stated attitudes are incompatible with reported changes to transport modes; survey respondents agreed that they would use their car more and walk and cycle more, but their stated behaviour shows that most used the car less and walked less.

6.4. B&NES Council and NatWest: A cross-case comparison

6.4.1. Commute behaviour

This section will consider the similarities and differences of reported commuter travel behaviour among surveyed B&NES Council and NatWest employees. Considering pre Covid-19 commuter travel, many B&NES Council and NatWest employees from the 2021 survey reported travelling to work five times a week or more (51.2% B&NES, 41.3% NatWest). The most popular commute mode to travel to both employers was the car, although there were more car commuters from the NatWest sample (59.5% NatWest, 38.4% B&NES), with higher levels of reported public transport use among B&NES employees (23.3% B&NES, 9.5% NatWest). B&NES Council employees reported a higher level of commute satisfaction compared to NatWest respondents (52.7% B&NES, 38.1% NatWest), with NatWest employees notably more dissatisfied (46.7% NatWest, 26.4% B&NES).

Public transport users were the most dissatisfied among B&NES Council employees with car commuters more satisfied, in contrast to NatWest employees where car users reported feeling more dissatisfied, with public transport commuters more satisfied. Active travel commuters reported high levels of commute satisfaction among both organisations. Considering the free text comments which provided reasons for commute (dis)satisfaction, car users travelling to both organisations described frustrations over congestion and public transport users in both cities highlighted challenges of overcrowding and irregular services.

Active travel commuters surveyed at both B&NES Council and NatWest described the exercise and wellbeing benefits derived from their active travel commute, although B&NES Council active travel commuters highlighted issues of air pollution and inadequate cycling infrastructure. Commutes were typically shorter for B&NES Council employees, with most respondents also leaving later compared to NatWest employees. Considering the SRBAI scale, both B&NES and NatWest employees reported commuting to be a habitual behaviour.

Considering commuter travel behaviour reported from the 2022 survey samples, NatWest employees reported higher levels of commute satisfaction compared to B&NES employees (75.1% NatWest, 46.7% B&NES). The car was similarly the dominant commute mode for both employers, but with higher levels of car use among NatWest employees (61.7% NatWest, 40.6% B&NES). There was higher reported active travel commuting among B&NES Council employees (18.8% B&NES, 10.6% NatWest), and similar levels of public transport use (14.9% NatWest, 12.6% B&NES). 15.6% of B&NES Council employees reported no commute as they only worked from home, compared to 8.5% of NatWest employees. NatWest car commuters reported much higher satisfaction compared to B&NES Council car commuters (70.4% NatWest, 16.7% B&NES), with higher public transport satisfaction commutes for B&NES Council employees (75.0% B&NES, 57.1% NatWest) and higher active travel commute satisfaction for NatWest (100% NatWest, 66.7% B&NES).

Qualitative comments from free text comments highlight issues of poor public transport provision and cycling infrastructure in addition to congested commutes for B&NES Council employees, compared to more positive comments noting quieter, less congested commutes, and good sustainable transport facilities for NatWest employees. The SRBAI scale demonstrates that, despite significant breaks in commuting for employees at both organisations, commuter travel was rated as a habitual behaviour for both B&NES Council and NatWest employees.

6.4.2. Working from home behaviour

Considering pre Covid-19 working from home, most B&NES Council and NatWest employees were able to work from home, although the majority worked from home either once a week or not at all (B&NES 81.0%, NatWest 73.4%). When employees did work from home, there was high reported satisfaction within both organisations (B&NES 85.2%, NatWest 81.6%). Considering home working as a result of Covid-19 restrictions, both employers instructed the majority of surveyed employees to work from home. Qualitative comments related to home working (dis)satisfaction showed similar themes among both organisations; there were challenges of reported loneliness and isolation and insufficient

home working technology/equipment, but also reports of mixed emotions with some enjoyment of increased home working and improved work-life balance.

Considering home working from the 2022 sample, most surveyed employees reported working from home four or more times a week at both organisations (78.2% B&NES, 83% NatWest), with nearly all reporting to work from home more at the time of survey compared to their pre Covid-19 home working (96.9% B&NES, 95.7% NatWest). Home working satisfaction was higher among surveyed NatWest employees compared to B&NES Council (85.1% NatWest, 59.5% B&NES). Similar to the 2021 sample, qualitative comments demonstrate the mixed emotions related to increased home working within both organisations; some were dissatisfied with increased home working and missed colleague interaction, whereas others noted their improved work-life balance. In NatWest, an additional theme relating to concerns over the energy costs of home working was present.

6.4.3. Wider travel behaviour and attitudes

Considering reported changes in the use of transport modes compared to pre Covid-19 for travel in general, the majority of both B&NES Council and NatWest 2022 survey respondents reported using their car less at the time of survey compared to their pre Covid-19 car use (57.6% B&NES, 63.8% NatWest). There were additionally trends of reported reduced bus use, train use, and walking among both B&NES Council and NatWest employees. There was reported reduced cycling among B&NES Council employees, whereas surveyed NatWest employees reported cycling the same amount.

Considering attitudes related to Covid-19 and travel behaviour, the majority of the 2021 samples at both organisations agreed that long-term, they would avoid public transport and use the car more, in addition to walking and cycling more. From the 2022 sample, the NatWest sample similarly agreed that they would avoid public transport and walk or cycle more, however the B&NES Council sample showed that approximately half of participants felt they would not avoid public transport, and that they would not walk or cycle more.

6.5. Summary

This chapter has provided detailed findings from the employee surveys conducted in 2021 and 2022 among B&NES Council and NatWest staff. The chapter provided findings of the short- and medium-term behavioural impacts of Covid-19 disruption on commuter travel (including commute habit strength), work practices, and general travel behaviour and attitudes for surveyed employees at both B&NES Council and NatWest. Finally, the chapter provided a cross-case comparison to identify similarities and differences between the two case organisations. The next chapter will provide detailed insights into commuter travel and

work practices, describing findings from the longitudinal interview study conducted at B&NES Council and NatWest bank.

Chapter Seven – Longitudinal Interview Study

7.1. Introduction

This chapter reports findings from the qualitative longitudinal interview study, considering the behavioural impacts of a major disruptive event (Covid-19) on commuter travel for selected large employer cases (RQ1) and the role of large employers in encouraging and enabling environmentally sustainable commuting post disruption (RQ2). The chapter first discusses findings from B&NES Council, followed by NatWest bank, with a final cross-case comparison between the two organisations. Table 36 below provides a description of the themes from the study's theoretical framework (the ISM disruption framework, Figure 9), which was used to aid thematic analysis.

Individual level		
The individual context includes the factors held by the individual that affect the choices and the behaviours undertaken.		
Theme	**Discipline**	**Description**
Emotions	Psychology and behavioural economics	How people feel about something is an aspect of behavioural decision-making. Some psychological theories contrast 'hot' evaluations, based on emotions, with 'cold' evaluations, based on attitudes and rational choice, with the rationale that practitioners can focus on emotional and empathetic messaging when appealing to people to change their behaviour.
Costs and benefits	Behavioural economics	The cost/benefit calculation is a basic method of decision making, in which the perceived benefits (utility) of acting are weighed against the perceived costs, including non-monetary costs such as time. Behavioural economics has explored the ways in which human decision making is not perfectly rational, but instead often based on mental shortcuts and biases resulting in 'suboptimal' decision making.
Values, beliefs and attitudes	Psychology	Values make up one of the basic elements of an individual's motivation system; psychology describes values as 'guiding principles' that individuals use to judge situations and are the root of other motivations including beliefs and attitudes. Beliefs are defined as a person's view of a particular aspect of life and sit between values (the most abstract) and attitudes (the most specific) in the hierarchy of psychological motivational constructs. Attitudes are defined as a person's view or evaluation of objects, activities, or other people.
Skills	Psychology and sociology	Skills are defined as the things a person needs to know to carry out a behaviour, including both procedural knowledge (know how) and factual knowledge (know what). Skills are defined psychologically as a 'facilitating condition', i.e., the resources a person needs to enact their intentions alongside social capital and agency. Theories of social practice identify skills (or 'competences') as one of the key elements which come together in the performance of a practice.
Habit	Psychology and sociology	Habits are behaviours undertaken automatically and frequently with little conscious thought. Psychology understands habit as a factor driving behaviour, moderating the influence of behavioural intentions, and is a combination of frequency, automaticity (occurring without deliberate thought) and a stable context in which the behaviour keeps happening. Within social practice theory, the habit is viewed as the whole practice, not a factor in it. All practices are routine and habitual, and intervening in practices involves addressing the elements that sustain them, which lie beyond the individual and their motivations.
Social level		
The social context includes the factors that exist beyond the individual in the social realm yet shape individual behaviour.		
Roles and identity	Psychology	Within psychology, roles relate to a person's repertoire of different behaviours and attitudes based on the 'role' they are fulfilling at the time, whereas the concept of identity is a person's innate sense of who they are.

		Roles are considered to be socially constructed, and psychologists believe that appealing to different roles can influence who takes up a particular behaviour and how.
Institutions	Sociology	Institutions can be formal (such as the workplace) or informal (such as family life) and can influence how groups of individuals behave when engaging activities or interacting with people. Within sociology, institutions emerge from collective human action over time and, once in place, operate to prescribe roles and responsibilities, with expectations about how members should behave.
Networks and relationships	Psychology and sociology	Networks and relationships refer to connections between individuals, which people draw upon in identifying and carrying out possible courses of action. Social capital can be defined as the social resources available through networks and social norms. In aggregate, social networks can help to explain how ideas and behaviours spread.
Material level		
The material context includes the factors that are 'out there' in the environment and wider world, which both constrain and shape behaviour.		
Rules and regulations	Sociology, psychology, behavioural economics	Rules and regulations are set out by formal institutions to prescribe or prohibit certain kinds of behaviour, in addition to more implicit rules and regulations, for example to determine appropriate conduct for individuals in informal institutions.
Objects	Sociology, psychology, behavioural economics	Objects play an important role in shaping the things that people do and the ways in which they change their behaviour. Many behaviours involve the use of objects, and the lack of necessary objects can stop a practice from being undertaken.
Technologies	Psychology, sociology, behavioural economics	Rather than being seen as alternatives to changes in individuals' behaviour, technological improvements can be viewed as central to efforts that aim to reduce the environmental impacts of things people do; it is important to recognise the ways in which people interact with technologies as interactions can influence the effectiveness of a technology in terms of its desired practice.
Infrastructure	Sociology, psychology, behavioural economics	Hard infrastructure refers to the firm boundaries to people's behavioural choices presented by the environments in which they live, with such boundaries often preventing even motivated people from undertaking the behaviour in question.
Time and schedules	Sociology	Time is a finite resource used while carrying out everyday activities; how people allocate the scarce resource of time can be understood as a result of the ways in which they are required or able to co-ordinate with other people or activities. Changes in the demands on people's time or the scheduling arrangements that are in place have the potential to affect the ways in which practices are carried out and, in turn, influence the carbon intensity of different behaviours.
Habit discontinuity hypothesis		
Disruptive events	Psychology	The HDH is a social psychological theory which posits that disruptive events such as Covid-19 can result in habitual behaviours being reconsidered, with a 'window of opportunity' for behaviour change information to become more salient.

Table 36. ISM disruption framework themes (Darnton and Horne, 2013; Verplanken et al., 2008)

7.2. B&NES Council participants

A total of nine B&NES Council employees participated in the first wave of the longitudinal interview study. One interview participant dropped out of the study between wave one and wave two (B-SUS-1), with the remaining eight interviewees participating in all three waves of the study. The eight interviewees are summarised in Table 37, referred to by their job type. As discussed in Chapter Four, the participants were selected via purposive maximum variation sampling with a range of gender, age, commute mode, salaries, and household composition, with a distinction between two interviewee types: practitioner and subjects.

Job Department	Interviewee Type	Ref Number
Human Resources	Practitioner	B-HR-1
Organisational Development	Subject	B-OD-1
Environmental Services	Subject	B-ENV-1
Sustainability Services	Subject	B-SUS-1
Library	Subject	B-LIB-1
Library	Subject	B-LIB-2
Accounting	Subject	B-ACC-1
Accounting	Subject	B-ACC-2
Psychology	Subject	B-PSYCH-1

Table 37. B&NES interviewees

Change matrices in Table 38 and Table 39 show subject interviewees' commute mode and working from home patterns, illustrating changes to commuter travel and working from home behaviours throughout the duration of the longitudinal interview study. When comparing commute modes reported in the final wave to pre Covid-19, there were four positive modal shifts in terms of B&NES Council participants reporting swapping to a more sustainable commute mode (with 'no commute' defined as a positive modal shift), in addition to one partial negative modal shift and no modal shift for three participants. Considering reported future intentions compared to reported commute mode at the time of wave three, one participant reported anticipating a partial positive modal shift (increased walking), two reported negative modal shifts (from public transport and walking to private car), and six participants reported no anticipated changes to their commute mode.

Table 39 demonstrates the significant change to most interviewees' working from home frequency. At the time of the final interview wave (February 2022), eight out of the nine participants reported working from home more compared to their pre Covid-19 home working. One participant continued to never work from home due to their work only being possible on site. Reported future intentions show a similar trend, with eight of the nine participants anticipating that they will continue to work from home more compared to their pre Covid-19 home working.

Following the change matrices, an in-depth exploration of themes is provided with the recurrent cross-sectional analysis approach (described in Chapter Four) used to identify differences in themes between interview time points for all interviewees.

Participant ID	Working pattern	Pre Covid-19	Wave 1 (April/May 2021)	Wave 2 (October/ November 2021)	Wave 3 (February 2022)	Future Intentions
B-OD-1	Full time	Private car	No commute	No commute	**No commute**	Private Car
B-ENV-1	Full time	Train	No commute	Private car	Train	Train
B-LIB-1	Part time	Train	Train	Train	Train	Train
B-LIB-2	Part time	Walk	Private car & walk	Walk & private car	Walk & *private car*	Walk & *private car*
B-ACC-1	Full time	Park & Ride	No commute	No commute	**No commute**	*Private car*
B-ACC-2	Full time	Private car	No commute	No commute	**No commute**	**Walk** & private car
B-PSYCH-1	Part time	Train	No commute	Private car	**No commute**	Train
B-SUS-1	Full time	Bicycle	**No commute**	N/A	N/A	N/A

Table 38. B&NES commute mode change matrix

Positive change compared to pre Covid-19
Negative change compared to pre Covid-19
No change compared to pre Covid-19

Participant ID	Working pattern	Pre Covid-19	Wave 1 (April/May 2021)	Wave 2 (October/ November 2021)	Wave 3 (February 2022)	Future Intentions
B-OD-1	Full time	WfH 1-2 days a week	WfH 5 days a week	WfH 5 days a week	**WfH 5 days a week**	**Trips to office once a month or less**
B-ENV-1	Full time	WfH 2 days a week	WfH 5 days a week	Trips to office once a month or less	**WfH 4 days a week**	**WfH 2-3 days a week**
B-LIB-1	Part time	WfH 0 days a week	WfH 1-2 days a week	WfH 2-3 days a week	**WfH 1-2 days a week**	**WfH 1-2 days a week**
B-LIB-2	Part time	WfH 0 days a week	WfH 0 days a week	WfH 0 days a week	WfH 0 days a week	WfH 0 days a week
B-ACC-1	Full time	WfH 1-2 days a week	WfH 5 days a week	WfH 5 days a week	**WfH 5 days a week**	**WfH 3-4 days a week**
B-ACC-2	Full Time	WfH 1-2 days a week	WfH 5 days a week	WfH 5 days a week	**WfH 5 days a week**	**Trips to office twice a month**
B-PSYCH-1	Part time	WfH 1 day a week	WfH 4 days a week	Trips to office twice a month	**WfH 4 days a week**	**Trips to office twice a month**
B-SUS-1	Full time	WfH 0 days a week	**WfH 5 days a week**	• N/A	• N/A	• N/A

Table 39. B&NES work from home change matrix

Positive change compared to pre Covid-19
Negative change compared to pre Covid-19
No change compared to pre Covid-19

7.3. B&NES Council thematic analysis

7.3.1. Individual themes

Emotions

Wave one interviews identified several emotions related to commuter travel, with those who walked to work expressing joyful emotions when discussing their commute, particularly in low traffic areas. B-LIB-1 described the beauty that they enjoyed when walking through their local park, stating that *"it's beautiful, in the summer it can be lovely with the sun and trees",* adding that the beauty of their walk helped them to get *"mentally ready for work"*. B-LIB-2 expressed their enjoyment of returning to a walking commute after the first Covid-19 lockdown, noting that *"because there was no traffic…it was lovely"*.

Two participants expressed fear when discussing a real or hypothetical cycle commute. B-SUS-1 described feeling unsafe when cycling along the main roads in and out of Bath, and B-LIB-2 explained that they had always been too afraid to use their cycle along a main road required for the commute, as *"I know so many people who've been clipped by buses or taxis and stuff, so it always frightened me too much to do it".*

From wave two, several participants expressed the happiness that they felt with increased home working since the onset of Covid-19; B-PSYCH-1 described a better work-life balance, and B-ACC-2 stated that the ability to go out and walk across some fields on their lunchtime break was *"really nice"*. However, B-HR-1 recognised that some employees were at risk of feeling increasingly isolated from working from home, with the potential for increased negative emotions for some B&NES Council employees:

> *"Some of us have adopted working from home because it really suits us… others really don't like it, they like to go to work because going to work is what you do for status, going to work is what you do to have a bit of a social life, going to work is what you do to get away from home" (B-HR-1)*

Participants had begun to make infrequent trips back to the office at the time of wave two interviews. B-ACC-2 described the extreme negative emotions they felt when returning to their commute, stating that they *"hated the whole commuting experience"* as they *"discovered all the horrors of commuting and being stuck in traffic jams for the first time for a year and a half"*. Meanwhile, B-ACC-1, who had not yet travelled back into the office, reported feeling happy with their lack of commute, noting that *"I haven't done that [commuting] at all…I think satisfaction wise, yeah, it's much better"*. Participants continued to describe the positive emotions tied to home working during the final wave three interviews.

Costs and benefits

From wave one interviews, interviewees discussed the perceived costs and benefits of their pre Covid-19 commuter travel behaviour. Key benefits identified as salient to participants' travel decisions were the notions of flexibility and convenience. Car use was typically associated with a high level of convenience and flexibility, as described by B-ACC-1:

> *"I think the flexibility of private transport is, you know, you might be doing one thing one day then another, and I think that's, with kids… you've done something when they've done nursery schools, they've done junior school where you walk them to school and then dash back to the car, then you've got senior schools, and that's always adapted with your car… I think it's that adaptability that the car gives you" (B-ACC-1)*

However, local restrictions on car use can make more sustainable modes of travel become viewed as the more convenient/flexible option, with three participants discussing their use of sustainable transport modes due to car parking restrictions and costs within Bath. B-LIB-2 spoke about how, because B&NES Council did not provide staff parking, *"there isn't an option to bring your car in unless you want to pay, which not a lot of people are gonna do, it's way too expensive"*. When discussing their train use, B-LIB-1 felt that *"in many ways, it's much more flexible than having to pay for parking"*. B-ACC-1 described increasing car parking restrictions in and around Bath, noting that *"as the on-street parking got tighter and further out…the predictability of being able to park your car was reducing so it wasn't as convenient as just jumping on the Park & Ride"*.

Two participants described how the exercise benefits derived from an active commute was a significant factor in their consideration of how to travel to work. B-PSYCH-1 noted that their walk home after their train commute was important because, *"it was an opportunity to have some exercise, so it wasn't just about commuting, it was also about having a bit of fresh air and exercise after work"*. B-OD-1 spoke about how they would consider parking on the outskirts of Keynsham and cycling into the office, *"only purely 'cause I want to get fit, trying to lose weight"*.

From wave two interviews, expensive public transport fares were identified by B-LIB-2 and B-ACC-2 as a cost barrier to a public transport commute, with B-LIB-2 stating that buses are *"so expensive…it's cheaper to actually run the car into town"*. With most interviewees now travelling into work on an infrequent basis, both B-PSYCH-1 and B-ENV1 discussed a difference in their cost/benefit calculations compared to pre Covid-19, with a car commute now viewed as the more attractive option due to less frequent travel. B-PSYCH-1 noted that, on the times they had travelled into work since Covid-19, they drove in which they were not

doing before the pandemic. Expanding on why this was the case, they explained *"because I'm not needing to do it all the time, I don't feel so guilty about driving on the infrequent occasions that I am going in"*. B-ENV-1 similarly described the rationale behind their increased car use, explaining that when they were travelling in three days a week pre Covid-19, driving was too tiring which made the train an attractive option. Yet now, *"when it's, erm, a day here and there, then one can cope with being that tired…the car…it's quicker and cheaper"*. Significant time and cost savings were identified by several interviewees as a key benefit of home working. B-LIB-1 spoke about saving money in addition to *"a bit of extra time in bed"*, and B-OD-1 described how they now weighed up the costs and benefits of travelling to the office; travel time in addition to petrol and parking costs meant that home working was typically viewed as the preferable option.

Cost barriers to EVs were discussed by several participants, considering both e-cycles and electric cars. B-LIB-2 stated that they would *"love an electric car"* but felt that they were out of their price range with an insufficient second-hand market. B-ACC-2 discussed their interest in an e-cycle but noted that, *"when you get one with an electrical charge, it goes up to about two thousand pounds which makes it a major commitment"*. However, the cheaper running cost of an electric car was identified by B-OD-1, as they explained that the reason behind their desired switch to a hybrid car was due to *"the general cost of fuel"*.

From wave three interviews, participants were continuing to re-evaluate their personal cost/benefit calculations regarding their future commuter travel behaviour. B-ENV-1 commuted by train prior to Covid-19, with a switch to travelling by car for infrequent office trips amid ongoing Covid-19 disruption throughout wave two. Considering a more regular future commute, the environmental cost of driving was a factor in their decision making; they said that they would prefer not to drive as *"the train is a more socially responsible way to travel"*. However, they spoke of the financial cost barrier of an infrequent public transport commute, noting that, *"as somebody who is travelling in a day or two a week, there's zero concessions on that"*.

Car parking restrictions continued to be viewed as a barrier to a car commute for central Bath commuters throughout wave three, with B-LIB-2 noting that, *"they've just put all of the parking charges up again, so it's even more ludicrously expensive than it was"*. However, for several participants, car parking restrictions now acted as an incentive for increased home working as opposed to using sustainable transport modes. B-OD-1 explained that *"rather than driving into Bath everyday where I've got to find somewhere to park and the expense as well, I'm far better off here [at home]"*. At the time of wave three, B&NES Council had confirmed plans to relocate most staff to its Keynsham HQ office as opposed to central Bath

offices. Keynsham has a plentiful supply of low-cost public car parking compared to Bath, with the potential to act as a motivator for future car commuting. B-HR-1 recognised that *"the challenge will be…you can park incredibly cheaply at Keynsham"*. The availability of low-cost parking at Keynsham and the likely influence of this on future travel behaviour was discussed by several subject interviewees; B-ACC-2 spoke about how they would have to compare expensive train and bus costs *with "car parking charges, and the car parking charges are very cheap in Keynsham"*. B-ENV-1 similarly spoke about how *"cost will be a factor…because it costs fifteen pounds a day to park in Bath…whereas in Keynsham it's forty pence all day"*.

Values, beliefs and attitudes

The impact of Covid-19 disruption on participants' attitudes towards transport modes was discussed by several interviewees during wave one interviews, demonstrating a mainly negative change in attitudes towards public transport when Covid-19 rates were perceived as high. B-ACC-1 stated that, *"I worked out I wasn't going back on the buses from a Covid point of view"*, and B-LIB-2 described how *"when I initially went back [to work] after the first lockdown… I wasn't going to contemplate taking a bus at that point"*. B-PSYCH-1 described how their travel behaviour was directly influenced by Covid-19 rates, stating that, *"if they [Covid-19 rates] went back up again, I think I'd just resort to using my car…I think the train would just be for like, very low risk periods"*. B-ENV-1 discussed how they originally had no desire to return to a train commute due to a reluctance to *"sit in a sealed container with a load of other people for two hours with zero control"*. However, they reported a shift in attitudes due to low Covid-19 rates at the time of wave one interview, stating *that "now if the rates are so low, the benefit [of train travel] is so overwhelming that I am prepared to consider a certain amount of risk"*.

At the time of the wave two interviews (October/November 2021), there was a new period of disruption due to the highly transmissible Covid-19 omicron variant. With a high number of Covid-19 cases in South West England, wave two interviews continued to identify negative attitudes towards shared transport among several participants. B-LIB-2 described how they had been looking at car share schemes, but felt that *"obviously with Covid still happening, they're kind of a bit out at the moment"*. B-ACC-1 stated that *"I probably would prefer to use private transport than public transport in the light of Covid"*, and B-PSYCH-1 noted that *"I'm aware that flu and Covid are still quite high, so…I'm kind of not fully back on the train"*. However, not every participant reported negative attitudes towards shared transport; B-OD-1 said that they would hypothetically feel happy to travel by bus if wearing a face mask, and B-ACC-2 reported using the bus for leisure travel with limited concern of catching Covid-19.

During wave three interviews, B-ENV-1 and B-PSYCH-1 reported a shift in their attitudes occurring between wave two to wave three; vaccinations, personal infection, and the omicron variant being less severe for many than originally feared meant that both participants had regained more positive attitudes towards public transport:

> *"I'm triple jabbed, I wear a mask, I've had Covid, erm, so I kind of think, whilst the variants are as they are, omicron, you know, getting less and less dangerous…if you have had the three jabs and maybe you've got some immunity from having Covid… why would it be the only thing that we take so many precautions about, because there are so many other transmissible illnesses out there that we don't" (B-ENV-1)*

> *"I feel like during Covid I just wouldn't, I didn't want to take a bus, I got a taxi or, yeah, but I feel like I'm going to get back to normal now, like my attitudes to buses and trains is the same as before Covid now…I guess I've had enough experience of being out and about with the double vaccine and then the booster…and, erm, I guess with it becoming seemingly a bit more benign as a virus, like, it's less of a risk" (B-PSYCH-1)*

Considering other transport related values, beliefs, and attitudes, as part of wave one interviews, interviewees were asked if they thought car use should be reduced in and around the city of Bath. All participants believed that it should, however there were various beliefs as to why car use should be reduced, with beliefs cited including congestion, air quality, the environment, and road safety. B-ACC-1 stated that car use should be reduced *"because of the physical location of Bath with its valley, with it being in the town centre and the collation of pollution"*. B-LIB-2 felt that *"it's not great for the environment…you know, all the pollution in the city…me just driving into work is adding to that problem"*. The discussion of air pollution among several participants is likely partially due to Bath's CAZ which launched two months prior to wave one interviews. Road safety was a priority for B-SUS-1, as they noted that *"I think anything that can cut down the amount of traffic there, could make it safer for cyclists and walkers"*. B-ACC-2 prioritised a reduction in congestion to improve their personal car journeys, stating that *"I don't really like sitting in traffic jams…it'd be great to get some of these people off the road".*

From wave two interviews, B-OD-1 discussed a change in their values towards car ownership. They described how the car was no longer the luxury item it used to be, with their shift in values caused by their reduced need to travel as a result of the Covid-19 pandemic:

> *"We've got nice cars…so at the moment we're looking at downsizing both of those and trying to get a hybrid car… we just decided that actually, although it's nice to have, we've always enjoyed it, we're not going anywhere, we're not doing anything so why*

have all these expensive cars, so the car's no longer that luxury item it used to be… we've now realised that that's no longer important" (B-OD-1)

Skills

From wave one, B-PSYCH-1 described how a lack of confidence in their skills ability acted as a barrier to using B&NES Council's electric pool cars, stating that *"they might be really simple, but it's just something that, because I'm going to have to arrange somebody to show me how they work…it just means I haven't done it yet".* From wave two, a lack of confidence in cycling skills was recognised by B-ACC-2 and B-LIB-2 as a barrier to a cycling commute. B-LIB-2 stated that *"I'm not a particularly good cyclist…just the thought of it terrifies me"*, and B-ACC-2 described how they wanted to practice their cycling on a low traffic route before attempting a cycling commute. The wave three practitioner interview with B-HR-1 demonstrated that B&NES Council recognises the importance of skills training to encourage environmentally sustainable travel, but issues of budgetary constraints were limiting the ability to provide training to encourage cycling commutes. B-HR-1 explained that *"I'll rack up some free training for adults returning to on road cycling…[but] that could be a budget issue, I don't have that budget at the moment"*.

7.3.2. Social themes

Roles and identity

From wave one interviews, the role of a parent was identified as influencing several participants' commuter travel. Quotes from B-LIB-2 and B-ACC-1 demonstrate how caregiving responsibilities resulted in participants feeling locked in to car commuting due to the school or nursery run:

"One day a week I've got to pick my son up at nursery and I have to be back in [nursery location] by one o'clock in the afternoon and I can't walk it in the time I've got…I really have to be there on time, so that's the one day a week I take in the car" (B-LIB-2)

"I did have responsibilities with taking kids to college and things, so if you've got to set out in the car to start off with, it seems a bit perverse to come back home again [to commute via another mode]" (B-ACC-1)

Two participants spoke of a distinct cyclist identity, with negative connotations creating a barrier to a cycling commute for those who do not identify as a cyclist. B-HR-1 described how *"people tend to divide into, they're either cyclists and they cycle…or 'I'll cycle but only for leisure away from cars', and…there's not much porous movement between those two*

really". B-LIB-2 discussed how they felt put off from cycling from their experience along a nearby canal, stating that *"it's full of cyclists and they belt along there…these guys with all Lycra on just crack along there"*.

Institutions

Prior to Covid-19, B&NES Council had several sustainability policies in place which impacted employees' commuter travel, including policies linked to cycling, business travel, parking, climate literacy training, and air quality. Considering cycling, B&NES Council offered the Cycle to Work scheme to incentivise a cycling commute, which was viewed as a popular incentive among participants. B-SUS-1 described how the salary sacrifice scheme was *"really good, because I couldn't have afforded the bike that I bought without using that"*. The Council additionally took the decision to not offer any car parking to most employees to discourage a car commute. As B-LIB-2 noted above, within central Bath office locations, *"there isn't an option to bring your car in unless you want to pay, which not a lot of people are gonna do"*.

In March 2019, B&NES Council (2019) declared a climate emergency, recognising the need for *"a major shift to mass transport, walking and cycling to reduce transport emissions"*. As part of the climate emergency, B&NES Council were rolling out climate literacy training to educate its staff on issues surrounding climate change. The climate literacy training was in its early stages at the time of wave one interviews, but there was evidence of increased interest and engagement of learning about more sustainable behaviours as a direct result of the training. B-OD-1 described how, since going through the training himself, he had reduced his red meat consumption as he *"suddenly realised how bad it is"*, noting that participating in the workshops *"make you think"*. The climate literacy training was ongoing throughout the longitudinal study period; at the time of wave three interviews, B-HR-1 explained how the Council were using climate literacy training as an opportunity to encourage an overall reduction in staff travel as opposed to modal shift:

> *"The climate literacy training… I don't have to prove the climate change case any longer… you're required to do it…. and obviously part of that is travel, because that's the thing I now use that as a litmus paper, basically just ask them 'what are you gonna do about travel, do you expect to see your team in front of you?' Well, that's not going to happen… you don't need to be in an office, so you don't need to travel to an office" (B-HR-1)*

Corporate messages from the climate literacy training were recognised by several interviewees; B-ENV-1 noted the *"massive push organisationally for us to become climate*

literate", and that, being mindful of the climate emergency, they personally would not *"compel people to come back to the office to just sit and do everything at a laptop all day"*.

Considering formal working arrangements, B&NES Council had a flexi-work policy in place prior to Covid-19:

> *"You had to be in some kind of work whether at a desk or at a depot, erm… I think it was half seven to half four…basically you worked your thirty-eight hours… it was just done on trust… That allowed you to build up, erm, some time to take off, in, erm, if you wanted that, to supplement any of the annual leave. And also…some members of staff would only work certain hours to facilitate childcare or other caring responsibilities" (B-HR-1)*

From wave one interviews, participants frequently described a supportive work environment in terms of flexible working hours. B-LIB-2 said that the flexible working hours were *"one of the reasons that I've stuck with the job"*, and B-PSYCH-1 stated that *"my manager was very good about giving us the flexibility to work when we wanted, as long as we made up the hours"*. However, the Council appeared to offer less flexibility in relation to pre Covid-19 home working. Interviewees spoke of a certain amount of pre Covid-19 'presenteeism', with a strong face-to-face culture and a preference for meetings to be held in person and increased need to travel despite previous attempts to encourage virtual meetings. B-LIB-2 described B&NES Council as *"a very face to face organisation"* and B-ACC-2 stated that *"I felt that the manager very much wanted to have face to face meetings"*. B-PSYCH-1 spoke about a *"definite ethos to be in the office",* and B-SUS-1 described how *"in terms of home working, I never really saw it as an option I suppose"*.

The Covid-19 pandemic resulted in a significant change to expected work practices within B&NES Council, with a switch to a blended working policy with reduced and redesigned office space and increased home working and virtual meetings. The change occurred in an accelerated manner attributed directly to the pandemic, with formal policy details being finalised at the time of wave one interviews:

> *"What we've done… Covid has accelerated it, erm, we have… basically closed to our staff, erm, two offices…we're opening up Keynsham Civic Centre again as our designated office… we are working on a blended working policy, what in effect that will mean is that you could go into an office maybe one or two days a week if you so choose…you shouldn't expect to be going into an office five days a week and when you go into the building, you shouldn't be expecting to go to the same desk that's set up with your bits and pieces" (B-HR-1)*

The blended working policy resulted in a significant change to the institutional expectations of meetings, with new expectations for team meetings to be held online as opposed to in person and a significantly reduced need to travel. From wave one interviews, there were mixed feelings reported among participants when asked about their new style of working; there was some uncertainty over the long-term implications of the blended working policy and how it would work in practice, however the majority felt they would be content with increased home working and occasional office visits. B-PSYCH-1 stated that going into the office *"once a fortnight would be quite good for me"*, recognising that *"that's still quite a significant reduction compared to what we were doing pre pandemic"*, and B-SUS-1 said that *"I'd still like to have quite a lot of home working"*. B-ACC-1 described the uncertainty towards future ways of working, noting that *"I haven't really worked out how the offices are going to work…there's a lot of unknown on that"*.

As part of the new blended working policy, B&NES Council drastically cut down on business travel with a fifty percent reduction compared to pre Covid-19. B-SUS-1 attributed much of this reduction down to the fact that *"people aren't driving between Bath and Keynsham constantly and realising most of it can be done via videocall"*. Considering the future impact of this reduced business travel, B-HR-1 explained:

> *"As part of the blended working, we'll be removing mileage claims from anybody attending a meeting. You can still choose to travel to that meeting if you really think it is important, but we'll be bearing down on managers to monitor that in terms of why are face to face meetings, officer to officer, still taking place, and if they are, erm, if the officer chooses to do that and travel in their own vehicle, they won't be getting paid mileage for it" (B-HR-1)*

As mentioned previously, there were rising Covid-19 cases within the B&NES district due to the omicron variant at the time of wave two interviews. In an attempt to reduce local Covid-19 cases, B&NES Council implemented a temporary work from home order. When asked about a future return to work during wave two interviews, interviewees spoke of the ambiguity regarding the workplace. B-OD-1 stated that, "*there's still this uncertainty about what working for the future's going to look like and people can't really get their head around it"*. B-ENV-1 described the difficulty of managing a team and balancing different requests, noting that, *"I've got some people who are dying to get back in, some people who never want to come in ever again, and then some people are quite indifferent"*. However, B-HR-1 stated that B&NES Council was trying to send a clear message regarding future work practices, noting that *"full days [in the office] are not acceptable, and that's a strong message"*.

As part of the blended working policy, a decision was made to refurbish the Keynsham Civic Centre to better facilitate blended working:

> *"We're going to spend about £1.6 million on changing it inside structurally to reduce particularly noise issues…so there's more collaborative working areas and…we're also spending a few hundred thousand on IT to go in there to improve the meeting rooms, erm, put Wi-Fi in, and again, increase that collaboration" (B-ACC-2)*

> *"You'll be able to go in and book a hot desk… there'll be training areas, training rooms… we've got acoustic booths where you can have private conversations, we've got a couple of rooms where you can go and have a face to face with a line manager… you've got, so say some touchdown benches almost sort of like café style, you know, where if you're only just coming in you can pull out whatever device you've got and check your emails… they've got these collaborative spaces which are open plan, they're not in rooms, and you can book them to have… if you're coming together as a project team and you just wanted to brainstorm some ideas" (B-HR-1)*

By contrast to the significant investment in office space, B-HR-1 discussed the limited investment in sustainable travel infrastructure, with minimal staff travel resulting in staff travel being viewed potentially as less of a priority. From a Council perspective, B-HR-1 stated that *"the message is very strong, you shouldn't be coming into work and if you are coming into work, they're not really talking about how you're making that journey"*.

Wave three interviews provided updates to the Keynsham Civic Centre refurbishment; ongoing building work meant no staff were able to access the office space until at least June 2022, with staff able to access a limited number of alternative office spaces if required. The culture of permanent home working appeared to be becoming established within the organisation, with a preference for virtual meetings among senior management and a distinction identified between meetings and collaboration. Considering the distinction between collaboration and meetings, B-HR-1 explained:

> *"I think what we're starting to develop is a narrative around collaboration and meetings, and distinguishing them…what I would like to see from our side is, anything that can be done online, is done online, anything that you think will benefit from doing things together in a space, okay, that's a collaborative meeting" (B-HR-1)*

Considering future commuter travel, the wave three interview with B-HR-1 highlighted the challenge of limited budget available for new or expanded policies to encourage a modal shift, in addition to the availability of low-cost parking close to Keynsham Civic Centre:

"We've still got the sustainable or active travel measures in place, so we haven't been able to improve that, we've done some additional infrastructure changes at Keynsham Civic Centre to facilitate more cyclists' bikes, but… if you're a new cyclist, or a potential new cyclist, there'll have to be a bit more put behind that….one of the things I will put in place is, I'll rack up some free training for adults returning to on road cycling… I don't have that budget at the moment… The challenge will be, as it always is, to break the mindset of 'I've got a car on the front drive which I paid for, all I'm paying for is petrol …it's there, I'll use it, it's convenient, you can park incredibly cheaply at Keynsham, therefore, why am I going to change the way I do things'" (B-HR-1)

However, the Council had continued to successfully cut down on business travel at the time of wave three, with reduced business travel likely to become a permanent Council policy:

"In 2011… we were doing 1.2 million miles, 600 odd thousand pounds revenue in claims, last year that's down to 300,000 miles, 400,000 revenue and the indicative metrics are that's not going to go climbing upwards rapidly, so obviously the challenge is to bear down on that even more where we can, we'll continue to do that" (B-HR-1)

Networks and relationships

At the time of wave one interviews, there was little to zero face to face interaction among participants with colleague interaction taking place via virtual technologies instead (discussed under 'Technologies'). From wave two interviews, interviewees were beginning to meet colleagues in person on a sporadic basis with reported mixed feelings. Several participants spoke of the benefits they gained from meeting with colleagues in person, specifically for collaboration type work. B-LIB-1 described how *"I do get benefits from seeing people…when you're talking to people about things that you're doing and updating people, you get ideas"*, and B-PSYCH-1 stated that *"it's definitely nice to touch base, to actually see everybody in person"*.

Yet others expressed minimal interest in wanting to meet up with colleagues in a face-to-face setting. B-HR-1 stated that they had returned to Keynsham once for a team meeting, which left them questioning why their colleague had set up a face-to-face meeting as opposed to online. B-ACC-2 noted that *"it felt slightly awkward in that we hadn't actually seen each other physically for so long"*, and B-ACC-1 stated that *"I find it just as easy to meet one to one online, erm, than in face to face with my direct reports"*. B-ENV-1 discussed a change in their views regarding meeting their team members in person after they personally contracted Covid-19:

"I contracted Covid, and that has changed my outlook a little bit actually, erm, because, previously I had told people that I expected to see them in that day in person, erm, having contracted Covid and being doubly vaccinated and taking all the usual precautions and still caught it, then erm I am now going to say do whatever is comfortable for you in terms of team meetings" (B-ENV-1)

From wave three interviews, participants were considering their longer-term plans in terms of meeting with colleagues, with most planning to schedule their office trips specifically to meet up with their team. B-ENV-1 stated that *"there's little point to go in for the day if you end up in a room different to all of your team"*, and B-PSYCH-1 noted that *"I'd only go in if I knew colleagues were there, that would be the only good reason to go in"*.

7.3.3. Material themes

Rules and regulations

B&NES Council went live with its CAZ in March 2021. The CAZ made a strong impact on several participants during wave one interviews, with two participants discussing their consideration of the type of vehicle they drive as a direct result of the CAZ, in addition to increased pressure for B&NES Council to electrify their fleet. B-ACC-2 noted that the CAZ *"did help to influence me in my choice of car, future proofing the car, that was a big influence in my decision"*, and B-ACC-1 stated that, when they bought their last car, they made sure they bought the right sort of vehicle *"to be compliant with the clean air zones"*.

From wave two, similar proposed regulations in neighbouring cities such as Bristol were also seen to have an impact on some participants' consideration of their travel choices:

"Bristol are bringing in congestion charges… with these sorts of things that might happen in the future, as my car becomes more expensive to run I will be needing to think about getting an electric car…but… they're very expensive at the moment … ideally, I know you can do these club cars… if I stopped using my car 'cause it's too expensive or no longer functions, I might look into these car club things" (B-PSYCH-1)

At the time of wave three, B-HR-1 discussed the possibility of extending Bath's CAZ to personal vehicles in addition to additional future sustainable transport policies affecting the B&NES district, noting the need for bold, visionary policies:

"We've got a new strategy, it's out for consultation at the moment… the communications that are coming from the Council speak in terms of transport, erm, as bold, visionary, serious… so in effect, the narrative to the general public is, we aren't going on the way we are, we want to do more in active travel" (B-HR-1)

"We recently had a very significant financial settlement from WECA of government funding… the resources that may make some of our plans, so low traffic neighbourhoods, there are plans for an enhanced corridor between Bristol and Bath which would include a rapid transit and a cycle lane, improved cycle lanes within the district" (B-HR-1)

Objects

Wave one interviews identified objects including showers and lockers as essential to a cycling commute; B-ACC-1 discussed how B&NES Council incentivise people to travel with *"new shower facilities"* and *"massive areas to park your bike"*, and B-SUS-1 spoke about how B&NES *"are putting in showers…to encourage those who want to run to work, and the cyclists"*. E-cycles were recognised as an object with promising potential to encourage a cycling commute, specifically to tackle Bath's hilly terrain. B-HR-1 discussed how B&NES Council invested in some pool e-cycles and said *that "for those who took it up, it was game changing"*.

B-SUS-1 stated that *"an option to rent an electric bike would be good"*, and when discussing a personal purchase of an e-cycle, B-OD-1 noted that *"it helps you with some of the hills, and it's obviously very hilly around there [Bath]"*. E-cycles continued to be identified by several participants as a promising object to encourage a cycling commute during wave three interviews. B-OD-1 discussed the benefit of reducing the fitness barrier, noting that *"the electric side of it was brilliant because it meant that you could travel further and know that you could get back with some assistance"*.

However, concerns over cycle theft were discussed by B-ACC-2 and B-OD-1. B-ACC-2 stated that, if they use their bicycle, they *"have the paranoia that it's going to be stolen…and for me, that is the big thing that stops me from using the bike so much"*. B-OD-1 spoke about how, with e-cycles, *"they're so expensive, and they're getting nicked…you'd be reluctant to take it anywhere and leave it"*. The issue of carrying a work laptop was recognised as an additional barrier to a cycling commute by B-ACC-2 during wave two interviews; B-ACC-2 stated that they would like to try cycling to work but felt that *"it would be awkward because we're supposed to take our laptops backwards and forwards with us, and I wouldn't really want to risk a laptop on the bicycle"*.

Electric cars were discussed by several participants throughout all three interview waves. B&NES Council provide a fleet of electric cars for use of employees which were viewed positively, but no participant felt ready to purchase a personal electric car during wave one interviews despite viewing them favourably. B-OD-1 said that *"I don't want to go the full way yet because I don't think the technology's caught up and we're out in the sticks"*, and B-LIB-2

stated that *"I would love an electric car…they're just out of our price range"*, adding that they were not convinced that *"the data stands up to being as economical and as green as the manufacturers claim"* for hybrid cars. Attitudes towards electric cars remained the same for all participants throughout the interview period, and concerns over cost and limited infrastructure/battery power meant that participants viewed electric cars as a potential option for the long-term future as opposed to the nearby future.

A reduction in personal car use was discussed by several participants during wave three interviews when comparing their current to pre Covid-19 car use. B-ACC-1 stated that *"I've almost stopped using my car apart from long journeys"*, and both B-OD-1 and B-LIB-2 reduced their household car ownership. B-OD-1 reported that *"we managed to get rid of one car"* and B-LIB-2 stated that *"we had two cars, and we sold one because…it was just sitting on the drive"*. Both participants viewed the reduction in household car ownership as a permanent decision, with B-LIB-2 stating that *"I can't see us going back to two cars"*.

In addition to transport related objects, objects used to facilitate home working were discussed. From wave one, participants discussed how B&NES Council provided a range of home working equipment to employees within the early stages of the Covid-19 pandemic, but identified delays in getting new laptops sent out to staff:

> *"We all had to carry out an individual risk assessment, erm, which was basically around your workstation… that then allowed access to, erm, what IT kit did we need… we moved pretty quickly" (B-HR-1)*

> *"They did send out a desktop computer to me within the first two months, erm, and it's been great having that there 'cause it's a massive, big screen and proper PC to work from so that's been good. I guess it has been a bit frustrating that it's taken so long to get us laptops, erm, but I think, yeah, that's just been because of procurement issues" (B-SUS-1)*

From wave two, the ongoing laptop rollout was discussed by several participants, demonstrating the importance of providing sufficient home working objects to enable satisfactory home working. B-ACC-2 stated that, *"until you get a Council laptop, a lot of people are really struggling to use their own older out of date models that don't use Teams or Zoom"*. B-HR-1 identified that the ongoing rollout of laptops was *"the major plank in our hybrid working"*. Thinking to the future, several participants recognised how work laptops would facilitate a more flexible way of working on a long-term basis:

> *"When we do return to the office, I can see that you unplug it, shove it in your bag, and it means that you've got your connectivity as well… so I can kind of see the office*

being a much more flexible environment and less banks of chairs… it's a much more sort of portable arrangement that I think the laptop provides me" (B-ACC-1)

From wave three, the laptop rollout had made good progress with B-OD-1 stating that the Council were *"definitely geared up now so that people can work remotely"*. Permanent changes to office objects were happening as a direct result of the laptop rollout:

"Our IT rollout continues, we've had 1000 laptops rolled out so that people would have the ability to work at home but also to pick up that laptop and move to any hot desk and drop onto the council systems, so obviously we're stripping out a lot of the terminal chairs, desks, type of set ups" (B-HR-1)

Technologies

Of relevance to sustainable commuter travel is the increased use of virtual technologies in the workplace to enable an environmentally sustainable telecommute and reduced need to travel. From wave one, participants spoke about changes to home working technologies since the beginning of the Covid-19 pandemic. The use of virtual technologies continually evolved and improved throughout the early stages of Covid-19 disruption, with participants discussing moving from Skype to Zoom, and eventually to Microsoft Teams, with gradual improvements in ease of use and connectivity.

From wave two interviews, there were mixed feelings regarding the increased use of virtual technologies to communicate with colleagues. B-ACC-2 described preferring virtual meetings, as *"I can talk without interruption, without being listened in"*, whereas B-LIB-1 spoke about difficulties in concentrating from days of online meetings, noting how they spent a lot more time in front of a screen compared to their pre Covid-19 work. Wave two interviews highlighted the possibility of future hybrid meetings, with B&NES Council providing new IT enabled meeting rooms to enable a mixture of people dialling in virtually and attending in person.

From wave three interviews, it was apparent that the use of virtual technologies had become commonplace within the workplace and would continue to be used in the long-term future. B-ENV-1 stated that they would *"now be more minded to have a virtual meeting…because I'm less reliant on face-to-face"*, and B-OD-1 spoke about their request for the best technology in new training suites *"so we can deliver remote as well"*. B-HR-1 summarised the flexible benefits of virtual technologies for large meetings:

"We had a team meeting yesterday with 42 people, you're not going to find a room that will fit 42 people, so your benefits from that is that everybody can join, if they've got to

rush off and do something else, it's not a big deal… and the information is available if they need it afterwards" (B-HR-1)

Infrastructure

Wave one interviews identified insufficient cycling infrastructure as a barrier to VTBC due to a lack of segregated cycle lanes within the B&NES district, with B-LIB-2 stating that *"if we had a cycle lane that was separate from the traffic, I'd use it one hundred percent"*. Insufficient cycling infrastructure continued to be discussed by participants as a barrier to a cycling commute throughout waves two and three, with B-PSYCH-1 stating that although the distance wasn't too far, they didn't cycle to work as *"it's just not a very nice cycle ride"*, adding that the route is *"like a fast road, and it's not the kind of road that you'd want to cycle on"*. However, B&NES Council's new main office location (Keynsham Civic Centre) has the benefit of a segregated cycle route running from Bath, with B-HR-1 identifying an opportunity to promote a cycling commute among employees:

"Some may be tempted to move onto cycling, because you can travel to Keynsham from Bath on a Sustrans cycle route, erm, and as even a novice cyclist, most of it is off road, and you could probably do it in an hour, so you'd be committing yourself to two hours. Now, obviously that will be one of our target areas, I want to do some work on that and getting people to make that transition, because now there's an additional, erm, impetus and motivation for them to do that, because they're only doing it once a week, twice a week maybe" (B-HR-1)

Wave one interviews additionally identified insufficient public transport infrastructure as a barrier to VTBC, with several participants describing how they felt dependent on their car due to a lack of public transport alternatives. B-OD-1 stated that *"because I live out in the sticks, there is no possibility for me to get a bus"*, and B-PSYCH-1 said that *"I only drive my car because I have to"*. Wave two interviews demonstrated the disparity between inner city and outer city public transport infrastructure; B-ACC-2 reported an increase in their public transport use since moving to the city of Bath due to better availability of buses, whereas B-LIB-2 described a frustration of feeling *"penalised"* from living outside of the city centre with limited public transport options. Wave three interviews continued to identify limitations in public transport infrastructure, with B-LIB-2 specifically mentioning a lack of Park & Ride sites to the east of Bath.

Time and schedules

Congestion was a prominent theme during wave one interviews when participants discussed their pre Covid-19 schedules, with heavy traffic resulting in a dissatisfactory, carbon

intensive commute for several interviewees. B-OD-1 stated that *"Bath is always difficult with traffic"*, and B-ACC-2 spoke about how, with their journey to work, *"on a Sunday, I can do it in half an hour, on a weekday it could take an hour and a half depending on the traffic, Bath is a nightmare"*.

Infrequent and irregular services were identified as barriers to a public transport commute by several participants. B-LIB-2 discussed local bus cuts, noting that *"the buses used to run about every fifteen minutes, and now it's every hour"*, with the new timetable incompatible with their work schedule. Similarly, B-ACC-1 spoke about how they looked at the bus timetable and found that *"there were no suitable buses, there was a bus but it took a very long time, did all these diversions and didn't fit in with work"*. Dissatisfaction with public transport schedules and reliability continued to be discussed throughout waves two and three. During wave three interviews, B-PSYCH-1 stated that *"trains really do need to be more frequent and reliable"*, and B-ACC-1 described a frustration with local bus delays, noting that *"a bus was supposed to be every eight or fifteen minutes…and I could be stood there for half an hour"*.

From wave two interviews, most participants reported travelling into the office much less frequently compared to their pre Covid-19 schedules. B-ENV-1 reported having only travelled into the office once, *"for a series of team meetings I'd scheduled for the same day"*. B-ACC-1 stated that *"I'm not going in at all"* and B-PSYCH-1 said that they were *"still working mostly from home, although I do now go into the office for team meetings which are once a month"*.

When participants were travelling into the office, there was evidence of a shift to off-peak travel and reduced hours spent in the office. B-ACC-1 noted that, *"both times I drove in were outside of commuter time…because I went in for events"*, and B-ENV-1 stated that they would *"now choose the most appropriate way to travel according to what my diary holds for that day"*, including travelling back home after meetings to finish the day working from home. B-ACC-1 said that *"I'm anticipating sort of going into the office for a reason and then once that reason is finished perhaps not lingering"*, and B-ACC-2 stated that *"I think there's certainly going to be a switch to travelling in at quieter times…I'll just do the journeys when I need to"*.

However, this increased flexibility in office hours has potential ramifications for certain sustainable transport options such as carsharing, as identified by B-PSYCH-1:

> *"I'd be open to carsharing… it's just difficult because I don't go for full days, I go in for meetings now, so…. finding someone who lives near me that's got a meeting at exactly the same time as me is probably fairly unlikely" (B-PSYCH-1)*

From wave three, B-HR-1 spoke about how they anticipated that there would likely be a wide variation in B&NES Council employees' future travel to work schedules:

> *"You'll see some colleagues going into the office regularly, two days a week, you'll see some dropping in and out, and you'll have other colleagues who have relocated, we have people who have moved well away from the district and their jobs will now be one hundred percent virtual" (B-HR-1)*

When asked about future intentions during wave three interviews, most participants planned to continue to work from home much more frequently compared to their pre Covid-19 home working. B-OD-1 stated that *"I intend to start going back into the office a day or two a week"*, B-ACC-1 felt that their *"split might be twenty five percent office, seventy five percent at home"*, and B-PSYCH-1 felt that it would be *"definitely once a month"* with a preference for *"once a fortnight"*.

7.3.4. Habit discontinuity hypothesis

At the time of wave one interviews, there was little to no commuting taking place for most participants, except for B-LIB-2 whose work could only take place in the workplace. With commutes beginning to return for other participants at the time of wave two interviews, there was evidence of commuting being a broken habit for several interviewees. B-ACC-1 stated that *"I wouldn't know how to commute anymore, it would be a shock to the system to actually leave the house"*, and B-ACC-2 described their first commute back to the office as *"very painful"*. When considering a possible return to their train commute, B-PSYCH-1 identified their broken habit of commuting by train, explaining that *"I think it is just like breaking the habit really…I'd quite like to go back to the train…I just need to make that change"*.

From wave three interviews, participants were beginning to commute into the office on a more frequent basis, yet B-ACC-2 continued to report commuting as a broken habit, stating that *"I'm so un-used to commuting"*. B-ENV-1 specifically discussed the broken habit of using their bicycle as part of their commute due to the associated preparations and materials required for a cycling commute:

> *"I catch a local train… in the summer I would cycle it instead…but that's a routine kind of thing, now that I'm only going in once or twice, then the bike may be at the back of the garage, of the tyres need pumping up, or…so I'm probably cycling less" (B-ENV-1)*

7.4. NatWest participants

A total of eight NatWest employees participated in all three waves of the interview study, with zero dropouts throughout the longitudinal study. As discussed in Chapter Three, participants were selected via purposive maximum variation sampling with a range of gender, age, commute modes, salaries, and household composition, with a distinction between the two types of interviewees: practitioners and subjects.

Job Department	Interviewee Type	Ref Number
Facilities	Practitioner	N-FAC-1
Business Strategy	Subject	N-BUS-1
Cyber Security	Subject	N-CYB-1
Catering	Subject	N-CAT-1
Human Resources	Subject	N-HR-1
Human Resources	Subject	N-HR-2
Analysis	Practitioner	N-ANA-1
Analysis	Subject	N-ANA-2

Table 40. NatWest interviewees

Change matrices in Table 41 and Table 42 provide an overview of NatWest subject interviewees' commute mode and working from home patterns, illustrating how commuter travel and working from home behaviours changed throughout the duration of the study. Table 41 shows that, when comparing reported commute mode from the final wave to pre Covid-19, there was one partial negative modal shift (from only walking to walking with occasional car use), and one partial positive modal shift (from sole private car to private car with occasional carshare); there was no modal shift for the four remaining participants. Considering reported future intentions, the only reported difference from wave three was one partial positive modal shift, with N-HR-2 reporting an intention to use the train in addition to the private car.

Table 42 demonstrates the significant change to all interviewees' working from home frequency. At the time of the third interview wave, all six participants reported working from home more compared to their pre Covid-19 home working. Reported future intentions show that all six participants anticipated that they would continue to work from home more compared to their pre Covid-19 home working, although this did represent a slight decrease in the amount of home working compared to wave three for five out of the six participants.

Following the change matrices, an in-depth exploration of themes is provided, with the recurrent cross-sectional analysis approach (as described in Chapter Four) used to identify differences in themes between interview time points for all interviewees.

Participant ID	Working pattern	Pre Covid-19	Wave 1 (April/May 2021)	Wave 2 October/ (November 2021)	Wave 3 (February 2022)	Future Intentions
N-BUS-1	Full time	Walk	No commute	Walk or private car	Walk or *private car*	Walk or *private car*
N-CYB-1	Full time	Private car and Park & Ride	No commute	Private car	Private car	Private car
N-CAT-1	Full time	Private car	No commute	Private car or carshare	Private car or **carshare**	Private car or **carshare**
N-HR-1	Full time	Bicycle or bus	No commute	Bicycle or bus	Cycle or bus	Cycle or bus
N-HR-2	Full time	Private car	No commute	Private car	Private car	Private car or **train**
N-ANA-2	Full time	Private car	No commute	Private car	Private car	Private car

Table 41. NatWest commute mode change matrix

Positive change compared to pre Covid-19
Negative change compared to pre Covid-19
No change compared to pre Covid-19

Participant ID	Pre Covid-19	Wave 1 (April/May 2021)	Wave 2 (October/ November 2021)	Wave 3 (February 2022)	Future Intentions
N-BUS-1 Full time	WfH 0 days a week	WfH 5 days a week	WfH 5 days a week	**WfH 3-4 days a week**	**WfH 3 days a week**
N-CYB-1 Full time	WfH 1 day a week	WfH 5 days a week	Trips to office once a month or less	**WfH 4 days a week**	**WfH 2 days a week**
N-CAT-1 Full time	WfH 0 days a week	WfH 5 days a week	WfH 2 days a week	**WfH 2 days a week**	**WfH 2 days a week**
N-HR-1 Full time	WfH 0 days a week	WfH 5 days a week	WfH 4 days a week	**Trips to office twice a month**	**WfH 3 days a week**
N-HR-2 Full time	WfH 0 days a week	WfH 5 days a week	WfH 5 days a week	**WfH 5 days a week**	**Trips to office twice a month**
N-ANA-2 Full time	WfH 1-2 days a week	WfH 5 days a week	WfH 5 days a week	**WfH 5 days a week**	**Trips to office twice a month**

Table 42. NatWest work from home change matrix

Positive change compared to pre Covid-19
Negative change compared to pre Covid-19
No change compared to pre Covid-19

7.5. NatWest thematic analysis

7.5.1. Individual themes

Emotions

From wave one interviews, participants who travelled to work via active travel expressed generally positive emotions when describing their pre Covid-19 commute, with N-BUS-1 stating that they felt they were *"coming into work with a much better frame of mind"* when they walked in. N-BUS-1 described finding taking the car to work as *"quite stressful"*, with N-ANA-2 describing how they *"hated"* their car commute. However, N-CYB-1 discussed their enjoyment of their car commute, noting its relaxing qualities. From wave two, N-BUS-1 and N-CYB-1 discussed their feelings regarding their return to commuting. Both participants experienced emotions similar to their pre Covid-19 commute; N-BUS-1 described the positive mental health effects they continued to enjoy from walking to work and N-CYB-1 described their continued enjoyment of a relaxing car commute. No changes in emotions were reported during wave three interviews.

Costs and benefits

From wave one interviews, the main benefits related to participants' pre Covid-19 commuter travel were the benefits of flexibility, reliability, and convenience, with several interviewees identifying active travel as the most flexible and reliable option. N-HR-1 stated that their preference for cycling to work was due to *"reliability, because it might take me slightly longer to cycle from home to work and vice versa but I would know that it would be very predictable"*. N-ANA-1 felt that cycling to work was popular as *"you get the flexibility"*, and N-ANA-2 thought that a cycling commute would *"be so much easier to be honest [compared to the car], you wouldn't have to worry about parking, you wouldn't have to worry about remembering to grab petrol"*.

The notion of travel time was factored into several participants' cost/benefit calculation, with N-CYB-1 and N-HR-2 noting the importance of travel time savings when choosing their commute mode. N-CYB-1 noted how they travelled by car *"every time without fail because it would take me about four times longer if I did public transport"*, whereas N-HR-2 discussed how they chose not to take the bus as *"it's not direct enough"*, adding that, *"although it would be cheaper, it would be a lot more time"*. N-ANA-1 specifically spoke about the time saving benefits of using an e-cycle compared to a normal cycle as a commute mode, as it *"gets around the problem of having to shower and change when you get there [to work]"*. However, saving as much travel time as possible was not a priority for all participants. Instead, N-HR-2 spoke about a willingness to use public transport due to the ability to 'free up' their travel time to enjoy leisurely activities during the commute, noting that, *"I could sit*

on the train and read something or, you know, do something else with my time rather than having to be focussed on driving".

The cost of transport was a prominent factor in several participants' decision making, with high perceived public transport costs acting as a barrier to a train commute. N-CAT-1 described how, for them, *"it comes down to money…'cause it's cheaper in the car than it is on the train"*, and N-HR-2 discussed how the daily train ticket fare was *"quite expensive"* without any season ticket discounts.

From wave two interviews, several participants discussed the time and cost saving benefits of working from home, with most interviewees continuing to primarily work from home. N-CAT-1 said that the increased home working was *"great"* as it *"definitely saves the travel and definitely saves the long hours"*, and N-BUS-1 noted that *"a lot of people…will make lots of [financial] savings by not having to travel every day, and they'll make lots of time savings as well"*. As participants were beginning to return to the office on an infrequent basis, there was a sense of wasted time spent commuting; N-ANA-2 described how they *"resented going into the office"* as they *"didn't like that feeling that I was wasting time"*, and N-FAC-1 described employees' frustration at travelling in to participate in video calls:

> *"I think people are finding, they come in to collaborate and someone doesn't come in and then they end up in a Zoom room anyway…then you're probably going 'well, why did I bother sitting on the bypass on the motorway for an hour in traffic when I could have been at home'" (N-FAC-1)*

The cost barrier to electric vehicles was discussed by several participants during wave two interviews, with N-ANA-1 noting that talk of e-cycles is often focussed around *"the astronomical cost in comparison to an ordinary bike"*. N-BUS-1 described how an electric car would not be considered an economical choice for them due to high purchasing costs. However, N-CYB-1 discussed NatWest's company car scheme, which resulted in their purchase of an electric car due to the strong financial incentive:

> *"[The company car scheme] is quite beneficial at the moment because the company car tax is so low on electric cars, so I have ordered a second car which is an electric one, erm, mainly, or overwhelmingly, because it's so cost effective erm, yes, as a by-product, it's better for the environment… but, you know, the reason is it saves me money" (N-CYB-1)*

In addition to Gogarburn HQ, NatWest has central Edinburgh offices available for use by employees (as discussed under 'Institutions'). From wave three interviews, both N-CAT-1

and N-ANA-2 described how, if travelling to an Edinburgh city centre office, they would opt to use the train instead of the car due to the difficulty and cost of parking in central Edinburgh.

Values, beliefs and attitudes

Attitudes towards transport in relation to Covid-19 were discussed by several participants during wave one interviews, with an increase in negative attitudes towards public transport as a direct result of Covid-19 anxiety. N-CAT-1 described how they felt *"a bit anxious about getting on public transport with Covid still about"*, and N-FAC-1 noted how, when people did start to return to work, they were unlikely to *"jump straight into public transport"*, and that employees travelling in *"will probably decide to come in by car"*.

The impact of ongoing Covid-19 disruption on participants' attitudes towards public transport was similarly discussed during wave two. N-FAC-1 stated that *"people don't want to go on the tram and trains to get into work until they feel comfortable"*. N-CAT-1 described a nervousness when travelling by train as *"people are moving about, everyone's touching the same door handles"* and N-ANA-2 stated that they were *"slightly concerned about the stories you hear of people not wearing masks…so I would only use it at the moment if it was by far the more practical option"*. N-BUS-1 described about hearing *"lots of different stories about bus drivers getting Covid a lot more"*, and feeling that *"being on a bus, your chances of being on the bus of someone else with Covid is actually quite high in a confined space, and it's the same on trains"*. Yet not all participants felt nervous about public transport from a Covid-19 perspective, with N-CYB-1 stating that they'd feel *"quite comfortable"* using public transport.

From wave three, there continued to be mixed attitudes reported among participants when discussing transport from a Covid-19 perspective. N-ANA-2 noted how their train use had *"decreased massively with Covid"*, describing how *"you hear a lot of negative stories and see a lot of pictures of people on trains not wearing their masks"*. By contrast, N-BUS-1 described how their attitude had shifted from wave two; they described reading news studies which found that *"people who use public transport aren't necessarily catching Covid from being on public transport"*, resulting in them feeling more confident to use public transport. N-HR-2 noted that they were not *"put off travelling because of Covid"* and had *"happily used the train to get places"*.

Considering other transport related beliefs, participants were asked if they thought car use should be reduced in and around the city of Edinburgh during wave one interviews. All participants believed that it should, but several beliefs as to why car use should be reduced were mentioned, including beliefs around congestion, air quality, and the environment/climate change. N-ANA-2 stated that, *"the world is coming to an end if we don't cut down …the amount of emissions that we're using"*, adding that *"Edinburgh is chock-a-*

block with cars". N-HR-2 said how *"it probably feels, you know…better for the environment if you can use a train"*. N-HR-1 similarly discussed the *"environmental aspect of it"*, adding that *"I live close to one of the most polluted roads in Scotland and I am absolutely opposed to making short urban journeys by car"*. N-CYB-1 stated that *"traffic is a massive issue"*, adding that this belief was *"not particularly from an environmental standpoint…it's more from a standpoint that…it's just a waste of time, sitting in traffic"*.

From wave two, N-HR-1 described how they believed that they had a *"responsibility to my fellow inhabitants of the planet to use a car less"*, noting that electric cars *"still cause congestion…they still occupy the same space that cause my local area to be less pleasant than it would do if they weren't there"*. From wave three, N-CAT-1 described how their attitude towards their personal car use had changed, citing an increased awareness of perhaps unnecessary car use: *"I think I'm more aware of how much I'm actually using the car to go short journeys when actually I could walk…I think I'm more aware of my car usage than I was before"*.

Interviews conducted during wave two additionally found that attitudes towards the weather influenced several participants' travel behaviour. N-CYB-1 stated that *"I live in Scotland where the weather is not known for being very good, so that's a big thing that detracts from commuting by bike"*. N-HR-1 discussed how they travelled either by cycle or by bus, with the *"default to cycling unless the weather was poor"*, and N-BUS-1 described how they either walked in to work or took the car, adding that their choice of mode *"would really just depend on the weather"*.

7.6. Social themes

Roles and identity

From wave one interviews, a role which influenced commuter travel was the role of a parent or caregiver with fixed nursery/school hours resulting in a car dependent commute. N-HR-2 described how there was the option of a train to work but *"the train left sort of five minutes after the nursery opened…and then at the end of the day it got back into the station ten minutes after the nursery closed"*. N-ANA-1 described findings from an internal BUG survey looking into the barriers of a cycling commute, which showed that *"fifteen percent of people stopped riding their bike every day because of childcare commitments"*.

From wave two interviews, the increased flexibility of working as a result of Covid-19 disruption was recognised as a benefit for those with childcaring responsibilities. N-ANA-2 spoke about how the increased flexibility in working hours has *"really been a Covid benefit… we were all able to leave [the office] and get home nice and early, which for the people with*

kids was really handy". This increased flexibility has the potential to enable caregivers to switch to more sustainable forms of transport:

> *"I think a train is an option…it wasn't practical when we were having to be in at certain times because it didn't get there in time, it left too late for childcare pick up, but if I had flexibility of when I arrived at the office…that might be a good option" (N-HR-2)*

In addition to childcaring responsibilities, a role identified as impacting people's travel decisions within wave two was the role of a pet owner, with increased flexible working practices viewed as a benefit. N-CAT-1 described how they had *"the flexibility to manage my own time…I can work around my personal time, around [pet] horses, so it's good"*. N-FAC-1 spoke about an increase in pet ownership since the Covid-19 pandemic, noting that *"I think there's a lot of people that have…probably bought a puppy…I've heard that so many times since we got back, 'oh I can't come in today because nobody can look after the puppy'"*.

Wave two interviews identified several participants with caregiving roles for elderly parents. Specifically, this was associated with a hesitancy towards using public transport due to perceived increased risk of Covid-19 infection. N-BUS-1 explained that *"I do look after elderly parents…so I am being very careful about what I do, like trying to avoid public transport"*. N-CAT-1 similarly explained their hesitancy towards public transport due to their caregiving responsibilities:

> *"I'm just conscious, my dad is quite elderly, and I have to go up there every day and I don't want to give him something… I think everybody's got to be sensible and that's the challenge around public transport is you can be as safe as possible but if somebody else isn't then you can't control that" (N-CAT-1)*

From wave three interviews, there was a continued recognition of the benefits of increased home working with regards to the role of a parent/caregiver with benefits becoming well-established. N-HR-2 spoke about how *"it is easier working from home…now there's a bit more time in the morning, it's a bit more relaxed"*, noting that in theory, it would be possible to now walk to nursery instead of taking the car, although they still chose to take the car.

Institutions

Despite the provision of car parking for Gogarburn based employees, NatWest had several pre Covid-19 sustainability policies in place to encourage environmentally sustainable commuter travel, including the Cycle to Work scheme and subsidised public transport routes:

> *"We do have subsidised bus routes so although, we do have a deal with Lothian transport on one of the routes that comes from the centre of Edinburgh out to*

Gogarburn, which, we give money to Lothian transport so that they can provide a dedicated route form the centre of Edinburgh to the campus" (N-FAC-1)

These policies were well known and viewed favourably by interviewees during wave one interviews. N-CAT-1 said that they thought the bank were doing lots of great things, citing their *"shuttle buses that operate from the bus stops and from the Park & Ride"* and *"a dedicated tram stop at Gogarburn"*. N-HR-1 stated that the Cycle to Work scheme was *"something that I have used and championed because it's an absolutely knock out deal"*.

N-FAC-1 spoke of future NatWest policies to promote an environmentally sustainable post Covid-19 commute, including free access to cycle rentals, dedicated public transport routes and new car parking restrictions. The bank was organising the use of shared cycles to be available for free use for staff from train stations and Gogarburn campus, in addition to working with bus operators to investigate dedicated bus routes on heavily congested routes. Finally, the bank was planning changes to the car parking system so that those who were not expected to be in the office most of the time would have limited access to parking spaces. The bank was additionally planning to put in 250 EV charging points at Gogarburn HQ to incentivise employees to switch to electric cars, as N-FAC-1 explained that *"we've had feedback that the biggest problem with electric vehicles is finding places to charge it...if you're able to charge your vehicle no problem then that's a big benefit"*.

Considering institutional rules around the need to travel to work, participants spoke about NatWest's progressive flexi-work policy in place prior to Covid-19, with participants able to work from home once or twice a week in addition to working at local offices spread across Edinburgh. N-FAC-1 described how *"pre pandemic, it was very much encouraged to work from home if you could"*, with N-HR-2 noting a general expectation of working 60% of time in the office with the remaining 40% at home.

Despite the previously progressive flexi-work policy, Covid-19 disruption resulted in a significant change to NatWest work practices with a substantial increase in home working for most employees:

"If you're a knowledge worker, which is probably the vast majority of staff at Gogarburn, we're talking about being in the office twenty or thirty percent of the time…and actually, because we've put that investment in equipment to work from home, we're actually saying to people…if you're coming into work to do emails then don't, just work from home, if you're coming in to collaborate, or work on a project, or having meetings then come in…even though it was quite advanced…it'll be even more encouraged" (N-FAC-1)

The changes to flexi-work policy resulted in physical changes to the Gogarburn office space, as described during wave one interviews:

> *"We've taken away quite a lot of fixed desk positions, putting in more collaboration positions, making the building much more open and welcoming… when people do go back in it'll be a much more open collaborative experience for them" (N-BUS-1)*

Most participants felt content with their increased home working, noting the benefits of working from home including reduced commuter travel and improved work-life balance. N-BUS-1 noted how *"the pandemic has been quite a positive thing in terms of, you know, people having a much better work-life balance"* and N-CAT-1 described how they enjoyed the ability to *"work on projects at home without the distractions of being in an office"*. However, two participants expressed a desire to continue to travel into the office on a more regular basis; N-HR-2 stated that they were not *"keen to be working from home, erm, all the time going forward"* and that they would like to interact with their colleagues at least once a week. N-CYB-1 stated the importance of choice, *"I think the key is that we have the choice of how, you know, to work how we prefer and how, you know, we can perform best"*.

An additional change which arose within NatWest due to Covid-19 was a substantial reduction in business travel, which significantly reduced the bank's carbon emissions. N-CAT-1 noted that *"since Covid I haven't been going anywhere…nothing like I used to"* and felt that *"there'll be much less travel than there was before"* regarding future travel. Considering changes to NatWest business travel, N-FAC-1 explained:

> *"Gogarburn has a business school…there's seventy bedrooms there and we used to use them for people travelling…at one point I think there was about three planes a day between Edinburgh and London… so that's been reduced. I'm trying to find out at the moment…what is the ability to travel now …people haven't been able to travel for a year and the business has worked fairly well…are we going to back to people jumping on planes to go to a meeting in London? I don't really think that's a good look." (N-FAC-1)*

At the time of wave two interviews, participants were beginning to return to the office on an irregular basis with a rule that NatWest were not allowing any more than 50% of a floor to be used at any time as a Covid-19 preventative measure. N-ANA-2 described NatWest's message that employees should not *"commute to compute"*, with N-HR-1 and N-FAC-1 describing the new philosophy around encouraging people to travel into the office specifically for collaboration purposes. NatWest staff had continued to develop the flexi-work policy, with remote first workers now expected to travel into the office for two days a month. However,

senior management were placing little pressure on employees to return, with N-HR-1 stating that *"the message from my employer has been very much…you're under no pressure to return on a particular frequency"*. Physical changes to the office space had continued to progress by wave two interviews; N-BUS-1 described a significant reduction in fixed desk positions and a range of different types of space, for example spaces for people to drop in temporarily with laptops, tables for people to sit around for group discussions, and cabana-style areas where employees can participate in Zoom calls in a semi-open area.

N-FAC-1 provided an update of NatWest's sustainable travel policies at the time of wave two interviews. They first identified the issue of increased car commuting since the onset of Covid-19, noting a reported 20% increase in car commuting to Gogarburn. N-FAC-1 also discussed the challenge of decreased use of public transport services including very low usage of dedicated shuttle buses from the rail stations to Gogarburn, with an inability to proceed with planned public transport initiatives until there was a larger number of employees travelling into the office.

Considering future potential policies, plans remained the same as those mentioned during wave one; NatWest planned to provide a cycle share scheme so that employees have the option to cycle to Gogarburn from rail or bus stations, in addition to a free shuttle bus service. Regarding business travel, N-FAC-1 spoke about how the bank was likely to continue to reduce business travel, especially as NatWest was sponsoring COP (the Climate Change Conference of the Parties), *"so they're really putting their environmental credentials out there and it's not a good look if we're still filling loads of planes with people travelling up for the day from London or vice versa"*. Finally, an institutional change related to workwear was identified during wave two interviews, with N-ANA-2 identifying a shift from business wear to smart casual as people began to return to the office.

From wave three interviews, participants spoke about how the office was a very quiet environment with much lower rates of attendance compared to pre Covid-19 resulting from the new hybrid working policy discussed in waves one and two. N-HR-1 noted that *"the bank has been surprised at how unenthusiastic people are about coming back to the office"* with recorded trips to the office showing *"astonishingly low"* capacity. N-FAC-1 described the struggle of trying to achieve higher office capacity in NatWest offices from a facilities perspective, identifying the limited use of collaborative ways of working:

> *"We're really struggling to get people to come back now, in all locations, in Edinburgh a busy day is probably about seven hundred people in Gogarburn out of a population of eight and a half thousand, so there's been a little bit of push from the executive to get people, maybe to, so if you're home first they were talking about two days a month,*

and they tried to push that up a little bit maybe to six days a month and there was a bit of backlash because people had already made lifestyle choices around those two days in the office… From a facilities perspective, what we're looking at around the collaboration piece, where more collaborative settings in the office rather than desks, but actually if people are still working traditionally and only need to collaborate once a quarter or twice a quarter, then we're going to struggle to get people back in the office" (N-FAC-1)

N-FAC-1 questioned if this could be *"the death of the office"*, noting that although NatWest already had a progressive flexi-work policy in place, Covid-19 had *"pushed it to a different level which makes us as an organisation wonder what our future office portfolio needs to be"*. Considering the implications from a commuter travel perspective, N-FAC-1 stated that NatWest was committed to continuing to invest in and work with bus companies to promote a bus commute but noted that numbers of shuttle bus services are *"still very low…most people are driving in if they can"*. The bank was continuing with plans to add in a local cycle hire service in addition to installing electric vehicle charging points. However, N-FAC-1 noted that *"there's probably not a lot from a commuting aspect at the moment"*. Business travel remained similarly low to wave two, with an ongoing reluctance for NatWest to return to the high number of pre Covid-19 domestic business flights.

Networks and relationships

Wave one interviews identified the BUG as a network that successfully influenced commuter travel within NatWest, with a summary of the BUG provided by N-ANA-1:

"We had nearly nine hundred members of the Bicycle User Group who were getting a weekly email…with news and announcements for cyclists at Gogarburn…we worked closely with [facilities staff member] and colleagues on improving facilities for cyclists, so putting in more changing rooms, putting in more lockers, putting more bike storage, making it suitable for equipment and bringing it up the list of priorities… and we organised events like…bicycle maintenance sessions to engage people in cycling, and we saw that the number of bikes on campus rose steadily over the years until it was…about two hundred a day by the end of… when Covid happened" (N-ANA-1)

The BUG aimed to encourage a modal shift to cycling among NatWest employees using multiple methods including information provision on practicalities such as where to store a cycle, where to get changed, weekly emails, guided tours of facilities, a buddy system for cycle rides into work, and a Google Maps document showing the best cycling routes. The BUG was well known among participants; N-ANA-2 described how the BUG were *"very active"* with stalls to raise awareness and handing out *"goodies"* and said that they felt the

offer of a buddy cycle ride seemed *"quite comforting"*. N-FAC-1 described the BUG as *"really progressive"*, citing how they have been *"very committed in getting cycling lanes and routes to the campus approved by the council"*.

N-ANA-1 accredited the BUG's success to their employee-led, evidence-based approach:

> *"I think a lot of the strength of the BUG here comes because it's been employee led… What we had in Gogarburn before…was stuff that had been imposed from high above people who didn't really know what cyclists needed, and they thought it was okay, and they were doing their best in some ways, erm…and, what we've got now is a, a robust relationship between, between both parties… I think that's what's made it so powerful here is it's a completely collaborative thing driven from both sides" (N-ANA-1)*

Considering the impact of Covid-19 on the BUG, N-ANA-1 described the challenges with continuing to be impactful and supporting a cycling to work culture in the context of increased home working and limited commuter travel:

> *"It's increasingly difficult to engage people with riding a bike to work, particularly in offices very empty…it's a face to face thing… that's practically impossible at the moment in that the building is so empty that there's no point going to the effort of organising something, and even in the future, if people are only in two days a month and there's just much lower activity in the building, it becomes more challenging to organise these kind of spontaneous events and get people to engage with them… There's another question just in general with cycling to work and the cycling culture in the business, it's very different when you have people there much more intermittently than they used to be" (N-ANA-1)*

Considering network effects between colleagues, at the time of wave one interviews, there was minimal face to face interaction occurring between colleagues with interaction taking place via virtual technologies instead (discussed under 'Technologies'). From wave two interviews most colleague interaction still took place via virtual technologies, but several participants were beginning to meet up with colleagues in person. N-HR-1, N-HR-2, N-CYB-1 and N-CAT-1 all felt that trips to the office were best reserved for meeting up with colleagues. N-HR-1 described the value they felt from their post Covid-19 office conversations, and N-CAT-1 noted that *"you feel like you've achieved something more by doing that [talking to colleagues] than you do sat in my house"*. Yet not all participants shared the same sentiment; N-ANA-2 described how they *"resented going into the office"*, as *"while it was lovely to see people, I think if I'm going back in the future, it must have a purpose…not just to go to lunch with people"*.

From wave three interviews, several employees discussed a preference for face-to-face interactions with colleagues. N-CYB-1 stated that *"I'd prefer face-to-face meetings, I think they just work better than virtual"*, and N-CAT-1 described how they prefer to meet in person as *"I think it's probably more of a personal connection and you can generate ideas more by being together than sitting on a screen"*. N-BUS-1 similarly felt that *"it's much better to meet in person…particularly for people you've never met before"*. Yet some interviewees remained content with virtual communication, noting that many NatWest colleagues were not based in Edinburgh. N-HR-1 said how, *"on a day-to-day basis… we are content with remote, bearing in mind that a couple of our team are Manchester based anyway"* and N-ANA-2 similarly stated that *"the people that I actually work with…are all based around the UK, India and Poland, so even if I did go back into the office…I wouldn't see them in person anyway"*.

Norms

From wave one interviews, N-HR-1 and N-ANA-1 spoke about social norms surrounding car use within NatWest, identifying a need to make more sustainable transport modes viewed as the norm as opposed to the private car. N-HR-1 said how, *"the fact that there's extensive parking at head office…just fuels the assumption amongst a lot of people that driving to work…it's not only an option, but…it's also seen as something of a right"*. N-ANA-1 described how they had *"nagged"* their colleagues in the facilities team to *"recognise that the private motor car is not the default route to come into the office"*, noting that, whenever there are corporate communications about changes to the office, *"the first thing they always lead on is the impact on car parking"*.

7.7. Material themes

Rules and regulations

During wave one interviews, participants spoke of several potential policies from Edinburgh City Council which, if implemented, would likely impact commuter travel behaviour. N-BUS-1 described several initiatives such as tram extensions, new hubs to connect different modes of public transport, and new cycle routes, but spoke of an additional need to improve the surfacing of Edinburgh's cycle routes. N-HR-1 discussed the potential of a workplace parking levy with potential ramifications for NatWest, noting that *"the bank would be without any question the biggest deal for any employer in Edinburgh because there can't be any other place within the city that has the number of car parking spaces being used on a regular basis"*.

During wave two interviews, several participants discussed the Scottish government's Covid-19 regulations. N-FAC-1 described how, within Scotland *"it's mandatory to wear a mask when you're moving around the office" and "if you're sitting within a metre of someone you*

should still wear a mask". N-ANA-1 discussed differences in Scottish and English guidance in terms of returning to work, noting how, as NatWest were based in Edinburgh, their *"guidance has now moved towards encouraging a slow and steady return to the office"*, as opposed to a faster return in England. N-CAT-1 similarly spoke of differences between English and Scottish rules, stating that *"in Scotland, we're all wearing masks… as soon as you cross the border, no one's wearing a mask anywhere"*.

The ongoing Scottish Covid-19 disease control measures continued to be discussed by several participants in wave three interviews. N-CAT-1 described how *"in Scotland we still have to wear a mask in the workplace…when we go into shops, on public transport"*, with N-HR-1 noting that, *"if you're moving around the office, you're expected to wear a mask, big signs up"*. Yet there were signs that restrictions were beginning to ease; N-BUS-1 spoke about a recent announcement that school children were no longer required to wear masks, with a belief that Scotland would soon end requirements to wear face masks within the workplace.

The politics of sustainable transport policies was discussed by practitioner N-ANA-1 during wave two interviews. N-ANA-1 described how *"Edinburgh has been suffering an awful lot of anti-traffic control backlash"*, citing *"really challenging, unjustifiable objections to road narrowing and temporary bike lines"*. However, they spoke of the new coalition government in Scotland, stating that *"the Greens are now embedded in the Scottish government, and part of the cost to the SNP [Scottish National Party] for that happening is that the active travel budget is being increased",* with Scottish active travel funding now reported to be *"well above most countries in Europe in terms of investment"*.

Considering future transport rules and regulations, N-FAC-1 discussed the increasing likelihood of a workplace parking levy during their wave three interview:

> *"The workplace parking levy… that's now been passed by the Scottish Government erm, I think it's something Edinburgh is very interested in doing. In fact they were auditing the car park before the pandemic, so I can see that potentially coming in quite soon… I suppose then it's a dilemma to the bank, if they pay that as almost a tax, almost a rates tax to be on the site for all employees, which is technically five hundred pounds a space, or do we charge the staff who are driving which would be my preferred because there's no point the bank paying it when you're trying to get people out of their cars" (N-FAC-1)*

Objects

From wave one, NatWest recognised the importance of objects related to cycling to enable a cycle commute, with the availability of lockers and changing areas widely known to participants. N-FAC-1 noted how NatWest have *"two male and two female changing areas, we've got two dry rooms, we've got about six hundred cycle lockers"* in addition to new charging points for e-cycles. N-HR-1 described Gogarburn's basement cycle parking as the *"gold standard"* that *"couldn't be better"*, with good facilities also available in the smaller city centre locations. Facilities were viewed positively by non-cyclists, as N-ANA-2 explained that one of the things they *"really liked"* about NatWest is their changing facilities for cyclists, *"'cause my presumption is if cycled, I'd be a bit of a sweaty mess and would need a shower or else I wouldn't feel comfortable being in the office"*.

N-ANA-1 discussed the potential of e-cycles to encourage a cycling commute among employees who do not currently cycle, as e-cycles can reduce many of the barriers associated with a cycle commute including the requirement for a shower/change of clothes and fitness:

> *"In 2013, you were expected to be in the office five days a week and you were expected to work nine to five and you were expected to wear formal clothes. In 2022, when and if we go back to the office, the expectation is that you won't be there five days a week, you might not even be there one day or for a whole day at a time, you'll be coming and going, erm, there's no expectation you'll wear formal clothes, and the, the reasons you would go to the office change quite a lot…there's not only the fitness thing but there's the, erm, it's just a different way of commuting which is you don't get all sweaty, you just take your time, but the bike still throws you along at fifteen miles per hour and you arrive in the office and just go straight to work" (N-ANA-1)*

In a wave two interview, N-FAC-1 confirmed that all facilities were open for cycling commuters to return to. During wave three, N-ANA-1 discussed cargo cycles, specifically their potential to transform commutes by facilitating a multi-stop commute (e.g., including shopping or the school run):

> *"I think the modern cargo bikes… are transformational in terms of access to cycling …with a cargo bike with a powerful battery, it means anybody can take two primary school children anywhere whatever the weather and at high speed, fifteen miles an hour, it can cut across town quicker than the car. So that opens up the possibility of doing the school run, you can drop them off at the school gate without having to park anywhere and then you can take the bike to work, and you can do all that in your now causally work clothes" (N-ANA-1)*

Considering work objects, participants discussed how NatWest successfully provided equipment to enable increased home working and thus decrease the need for commuter travel since the outbreak of Covid-19. From wave one, N-FAC-1 stated that employees were *"able to order like small foldable desks, chairs, IT equipment, screens, monitors, keyboards"*, with N-HR-2 describing how they got *"a new desk and computer chair sent to me so that I could have that flexibility… create a bit more of a barrier between work and home"*.

N-BUS-1 described how they ordered office furniture from NatWest to ensure that they had a *"reasonably good working environment"* at home. From wave three, N-FAC-1 described NatWest's ongoing investment in work objects to enable flexible working, stating that *"we've invested in quite a lot of Chromebooks…most offices, there's Chromebook cabinets on the floor so you can just go and take one of those"*, meaning that employees do not have to travel to the office carrying their own laptops.

Technologies

From wave one interviews, participants spoke about the use of home working technologies since the beginning of Covid-19 disruption, with a rapid shift to virtual ways of working. N-BUS-1 stated how *"the biggest thing for working from home was, you know, the ability to be comfortable on Zoom"*, adding that *"the biggest barrier for me was the technology and…getting used to working on Zoom, which was quite a big culture change from the way I was working before"*. N-CAT-1 similarly described how *"we didn't really use Teams or Zoom or anything pre Covid, and it's just been a completely different culture change for us"*.

The ongoing importance of virtual technologies was discussed during wave two interviews. Several participants noted the frequent use of Zoom meetings; N-BUS-1 explained that around *"seventy to eighty percent of meetings are now still on Zoom",* adding that *"we're gradually transitioning for more face to face, but I don't ever see it getting much more than twenty to thirty percent"*. Updates to office technologies were also discussed, with N-HR-1 stating that *"the [office] technology has been specifically enhanced because there's now, where previously we ran audio meetings…I think now the vast majority [of meeting rooms] are equipped with Zoom"*.

From wave three, Zoom continued to be the predominant technology used to communicate with colleagues. N-BUS-1 stated that, *"because there's so few people in the office just now, I'd say about ninety to ninety-five percent [of meetings] are through Zoom or Teams and I don't see that changing any time soon"*. NatWest employees had adapted to new virtual ways of working, as described by N-HR-2: *"we've got a sort of weekly team meeting that'll take place via Zoom… and then there's a few catch ups during the week…and we've got a Teams page where if you wanna ask questions"*. N-BUS-1 spoke about the ongoing work to

transform Gogarburn into a hybrid office, noting that *"we put in Zoom into pretty much the majority of every meeting room"*.

Infrastructure

In the city of Edinburgh and its surrounding areas, insufficient cycling infrastructure was identified as prominent barrier to VTBC during wave one interviews. N-HR-1 stated that they disliked cycling in Edinburgh city centre due to the *"traffic and quality of the road surfaces… a lack of segregated alternative to mixing with cars and buses"*. Similarly, N-HR-2 stated that *"what would put me off cycling…it's the shared road space, I don't think I'd feel comfortable sharing with vehicles"*. N-ANA-1 described the issue of disjointed cycle networks within Edinburgh. They stated that *"you find yourself in a segregated lane beside the traffic, you come to a busy roundabout, and it just stops"*, and added that *"if they [cycle lanes] were all properly joined up, people could actually use them"*.

From wave two interviews, cycling infrastructure continued to be discussed. N-ANA-2 said how they felt that *"the uptick in cycling in the first lockdown made clear that…[the] barrier is vehicle traffic"*, with N-CYB-1 stating that *"I don't like cycling on roads because I don't think that's safe"*. N-CAT-1 highlighted discrepancies between inner and outer Edinburgh, explaining that *"[in the] city centre, I'd be more inclined to use a bike because…there's routes…here [in outer Edinburgh]…single roads, it's potholes, it's no lights, it's a bit more dangerous"*. N-BUS-1 noted that *"my street is just extremely bad for potholes…I think there's an awful lot to be done in terms of improving the surfaces"*.

In addition to cycling infrastructure, insufficient public transport infrastructure was recognised as a barrier to VTBC, with several participants describing feeling dependent on their car due to a perceived lack of viable public transport alternatives. N-CAT-1 stated that *"the public transport routes are shocking"*, as they would have to *"change multiple times to get to Gogarburn"*. N-HR-2 described how, because they did not live in the city centre, there were no direct public transport routes to Gogarburn, adding that *"the infrastructure's not, not there in terms of public transport to get where I'd like to get to"*. From wave two, N-CYB-1 described a similar challenge, stating that *"the problem is that all public transport goes into the city centre and out…to go from the south of the city to the west…there's no way of going around the city on public transport"*.

Car parking infrastructure was additionally discussed during wave two interviews. N-ANA-1 spoke about how, due to low Gogarburn office occupancy rates, car parking was readily available for those who wish to drive in, with N-CYB-1 acknowledging that *"at the moment we can park as many days as we want in the car park because the office isn't currently at capacity"*. This potentially resulted in an increase in car commuting, with a 20% reported

increase in driving to work (from 59% in early 2020 to 80% in 2021 reported in internal NatWest travel surveys). Yet during a wave three interviews N-CYB-1 spoke about how freely available car parking was unlikely to be a permanent feature, noting that *"once things to get back to what you might class as a normal state, then there will be a limitation*".

Time and schedules

From wave one interviews, congestion was a prominent theme when participants discussed their pre Covid-19 schedules. N-HR-2 described how *"it would probably take the best part of an hour to get to work…bumper to bumper, it was a very slow commute"*, and N-ANA-2 stated that they *"hated commuting"* because *"it can take up to three hours a day of your life, sitting in traffic"*. NatWest's flexi-work policy was identified as a barrier to a carshare commute with flexible schedules making options such as carsharing viewed as too difficult. N-FAC-1 noted how NatWest had previously tried carsharing initiatives but explained that *"what we found…with a much more flexible workforce, people don't really want to get themselves involved in that kind of carshare where they're restricted in when they can come and leave"*. N-HR-2 described the perceived barrier to a carsharing commute as they said, *"there's no one that kind of lives near me…or, you know, they would have to fit in my timescale so that wasn't a feasible option"*.

From wave two, most participants were travelling in much less frequently compared to their pre Covid-19 commute, with N-HR-1 noting that *"there's just no need for it being more than two days a week"*. N-HR-2 stated that their work was taking place mainly at home but added that *"it's been proposed…that we would be in the office one or two days a month"*. There was evidence of a shift to off-peak travelling to enjoy quieter travel times when interviewees were travelling in; N-HR-2 stated that *"I was going in slightly later than I would've normally"*, and N-CAT-1 said that *"I think the change, post pandemic, is people are leaving earlier to beat the traffic"*. N-ANA-2 described how they *"went in off peak"* to miss rush hour and additionally *"left reasonably early, before four"*, adding that their future plans would involve *"going in later, finish and then go home and work, and leave the office early so you don't get caught in traffic"*. N-FAC-1 described how, considering a shift to off-peak travelling, *"I think there was a bit of a swing to that before the pandemic, but I see it even more"*. Considering congestion during wave two, N-CYB-1 described how their commute had *"probably slightly reduced congestion…but it's quite congested"*. N-HR-1 and N-CAT-1 both similarly felt that the volume of traffic and travel time taken to commute was creeping back to pre Covid-19 levels.

During wave three interviews, participants discussed their current and future commute schedules. N-CYB-1 said that their prediction for the future *"would be probably two or three days a week in the office and two or three at home"*, with N-CAT-1 stating that the new weekly norm for them included *"a couple of days at home, a couple of days in the office"*. N-HR-1 similarly described that their expectation was that *"I'll be back maybe a couple of days a week"*, and N-BUS-1 stated that they planned to *"work one or two days a week in the office"*. However, N-ANA-2 described anticipating returning to the office for *"two days a month"*, adding that, *"I don't see much changing because the bank would have to do something very forceful to get people to come back in more often"*.

There was evidence of a continued preference for off-peak travel for several participants during wave three interviews. N-ANA-2 stated that there was *"no point in going in for nine AM anymore"*, adding that the last time they travelled into the office, *"we all said we'd be in for ten or half ten, and then everyone left at like two"*. Similarly, N-HR-2 noted how travelling into the office *"isn't quite as it used to be"*, adding that they would now *"do a little bit of work at home and then I would do the commute when it was quieter and then I would maybe leave a bit before the end and do some work again when I got home"*. N-FAC-1 explained how *"because people have gotten used to being in your home…people…either come in late and leave maybe a wee bit later or come in early and leave a bit earlier as well, rather than that kind of nine to five"*. Yet not all participants reported a shift to off-peak travelling, with N-HR-1 stating that *"I have been travelling in at what you would previously have recognised as peak times, so like eight thirty and five thirty".*

7.8. Habit discontinuity hypothesis

There was minimal commuter travel taking place during wave one interviews. Thinking to the future, N-FAC-1 anticipated a reduction in the number of employees travelling to work by public transport with switches to car commutes in addition to a significant reduction in commuter travel overall. From wave two interviews, the likely long-term impact of Covid-19 disruption was discussed, with N-FAC-1 stating that *"I think it'll be spring next year before we're back to any kind of normality"*, adding that, *"if you ask people to come in and they're not very keen to come in…if they do get Covid or long Covid…it could be an issue"*.

From wave three, the ongoing impact of Covid-19 disruption was discussed, with N-FAC-1 noting that *"we had omicron… we were all told to stay at home permanently, again… we've now been asked to go back…so commuting is kind of restarting"*. N-FAC-1 described the ongoing nervousness of Covid-19, stating that *"I think it's difficult for the bank to push people to come back into the office when they're still a bit nervous because of Covid"*, adding that *"I*

can see the office being quiet up until potentially after next winter". Thus, Covid-19 represented a substantial disruption to NatWest employees' commuter habits with an anticipated long-term reduction in commuter travel.

7.9. Cross-case comparison

7.9.1. Commute mode

At the time of the final interview wave (February 2022), B&NES Council participants reported four positive modal shifts (to a telecommute) and one partial negative modal shift (from walking to occasional private car), with no modal shift for three participants. NatWest participants reported less change, with one partial negative shift (from only walking to walking with occasional car use), one partial positive shift (from sole private car to private car with occasional carshare), and no modal shift for the four remaining participants. Considering reported future intentions, most B&NES Council subject interviewees reported no anticipated changes from their pre Covid-19 commute mode (n=4), with one partial positive modal shift (increased walking) and two negative modal shifts (from public transport and walking to private car). There was similar minimal change among NatWest participants, with three participants reporting no anticipated change from their pre Covid-19 commute mode, two partial positive shifts (increased occasional train and carshare), and one partial negative shift (occasional increased private car use).

7.9.2. Working from home frequency change

Participants at both organisations reported increased working from home frequency compared to before Covid-19. Within B&NES Council, eight out of the nine participants reported working from home more compared to their pre Covid-19 home working. One participant continued to never work from home due to their work only being possible on site. Similarly for NatWest, all six participants reported working from home more compared to their pre Covid-19 home working. Reported future intentions show an expectation among both organisations for increased home working to remain a permanent change, although with an anticipated increase in the number of future office trips for several participants at both cases.

7.10. ISM disruption framework: a cross-case comparison

7.10.1. Individual themes

<u>Emotions</u>

Participants who commuted by active travel at both organisations described positive emotions when discussing their commute, with participants at both B&NES Council and

NatWest recognising the wellbeing benefits gained from active travel. Fearful emotions were identified when discussing a cycle commute by two B&NES Council participants, which was not mentioned by NatWest interviewees. Conversely, several NatWest participants discussed stressful emotions linked to a car commute, which was less prevalent among B&NES Council participants.

Costs and benefits

Notions of flexibility, reliability and convenience were important considerations related to commute mode choice for several participants in both B&NES Council and NatWest. Car use was typically associated with meeting these criteria, although interviews at both organisations showed how city centre car restrictions can make more sustainable modes of transport become viewed as the more convenient/flexible option. Yet as both organisations have company HQs located on the outskirts of cities with good parking availability, a car commute was viewed more favourably among several participants when commuting to company HQs compared to city centre offices.

The importance of commute travel time savings was discussed by several NatWest participants but not by B&NES Council participants, perhaps due to typically longer commutes for NatWest employees as shown in Chapter Six. However, participants at both organisations spoke about the significant time and cost saving benefits of home working, with a sense of wasted time when returning to commuting felt by several interviewees.

Cost barriers were recognised by many participants within both organisations; expensive public transport fares and the prohibitive cost of e-cycles and electric cars were discussed, including no public transport season ticket discounts as a result of fewer days in the office. However, the cost benefit of purchasing an electric car through a company car scheme was identified by one NatWest participant.

Values, beliefs and attitudes

Interviews conducted during wave one at both organisations showed a negative change in attitudes towards public transport/shared transport because of Covid-19 at both organisations. However, waves two and three provided some evidence of shifting attitudes; participants at both B&NES Council and NatWest discussed how they had begun to feel more positive and confident in using public transport due to a combination of factors including vaccinations, prior infection, and less fear of the virus.

When asked about car use in cities, there was widespread consensus that car use should be reduced in both Bath and Edinburgh. Reported reasons as to why car use should be

reduced were similar across both organisations, with participants citing issues of congestion, air quality, and climate change.

7.10.2. Social themes

Roles and identity

The role of a parent was found to influence commute mode decisions in both organisations, with participants reporting feeling locked in to car commuting as a direct result of inflexible nursey/school drop off times. However, increased flexibility regarding work hours and location as a result of Covid-19 disruption was identified as a benefit by one NatWest participant, with increased flexibility enabling the ability to switch to a more sustainable commute mode. An additional role identified as influencing commute mode choice by two NatWest participants was the role of a caregiver for elderly parents, with participants discussing their hesitancy towards using public transport due to a desire to minimise risk when visiting elderly relatives (due to perceived increased risk of Covid-19 infection from travelling on public transport).

Institutions

B&NES Council and NatWest had both implemented several policies to encourage a sustainable commute. B&NES Council offered schemes such as Cycle to Work, cycling facilities, climate literacy training, and no car parking provision. NatWest provided Cycle to Work, cycling facilities, subsidised public transport routes, shuttle buses, and EV charging points. These policies were widely known and generally viewed as positive by participants at both organisations.

Both organisations had flexi-work policies in place prior to Covid-19, although with a stronger culture of presenteeism evident at B&NES Council. Yet the pandemic directly resulted in significant changes to flexi-work policies; practitioner interviews revealed how both organisations changed to predominantly home working, with virtual meetings recognized as the new norm. Physical changes to office spaces were made at both organisations to facilitate hybrid working/collaboration, with a strong expectation set by senior management that employees should not travel in for days of online calls or emails. Both cases reported a significant reduction in business travel, with reduced travel established as a new norm with in-person business meetings typically replaced by online videocalls.

Significant changes to flexi-work meant that commuter travel had received limited attention in both organisations. Practitioner interviews at B&NES Council revealed the limited investment available for sustainable travel initiatives, with an organisational preference to promote home working to save commuting emissions as opposed to modal shift. NatWest

practitioner interviews identified a 20% reported increase in car commuting with very low use of public transport services, with concerns over the viability of continuing sustainable transport initiatives such as shuttle bus services given low office occupancy rates.

Networks and relationships

Interviews at both organisations reported the significant increase in meeting colleagues virtually with mixed feelings regarding meeting colleagues in person during waves one and two. However, by wave three, there was consensus among participants in both cases that trips to the office to meet with colleagues in person was time well spent, with a preference for planning specific face-to-face meetings in addition to regular online meetings.

7.10.3. Material themes

Rules and regulations

There was widespread knowledge of local rules and regulations in relation to commuter travel in both organisations. Within B&NES Council, policies such as clean air zones were discussed with Bath's CAZ evidently influencing two participants' choice of car. Within NatWest, there was knowledge of cycling infrastructure improvements among several participants, in addition to a potential future workplace parking levy. Considering Covid-19, stricter regulation in Scotland compared to England was discussed by several NatWest participants throughout interview waves two and three. The Scottish Government implemented generally stricter rules compared to the English Government during waves two and three, considering rules around mask wearing and instructing employees to work from home where possible.

Objects

Objects to facilitate a cycling commute were provided by both organisations, although NatWest facilities (such as lockers, basement cycle parking, dry rooms) were typically viewed as gold standard, whereas some B&NES Council participants thought facilities could be improved. E-cycles were recognised as a promising object to increase cycle commuting in both organisations, with participants recognising the ability of e-cycles to reduce barriers such as fitness and the need to shower or change clothes.

Considering objects associated with home working, both organisations acted at the start of Covid-19 disruption to provide employees with objects such as laptops and desk chairs to facilitate home working. The importance of having appropriate objects to enable satisfactory home working was evident across both cases, with objects to be used on a long-term basis to facilitate flexi-work. NatWest additionally provided Chromebooks in the office so that employees could avoid travelling with their personal laptop.

Technologies

There was a significant increase in the use of virtual technologies in both organisations as a direct result of Covid-19; participants within both cases discussed the increase in Zoom and Teams meetings throughout all three interview waves with participants becoming more comfortable and confident in using the technology throughout the study period. All participants agreed that technologies such as Zoom and Teams would remain a permanent way of working and communicating with colleagues.

Infrastructure

Insufficient cycling and bus infrastructure was discussed by participants in both organisations, with interviewees citing a lack of segregated cycle lanes, poor cycle lane surfaces, and a lack of direct bus routes (particularly outside of city centres) as reasons to avoid a cycle or bus commute. The challenge of car parking availability was discussed in both NatWest and B&NES Council practitioner interviews; plentiful car parking at both companies' HQ locations represented a challenge in terms of trying to avoid a car-led Covid-19 recovery, with both organisations reporting an estimated 20% increase in car commuting since the onset of the pandemic.

Time and schedules

Congested commutes were discussed by participants at both organisations during wave one interviews, with interviewees citing frustration over their pre Covid-19 car commutes. Changes to participants' schedules were identified throughout waves two and three; interviewees at both cases discussed maximising the benefits of new flexi-work policies introduced as a result of Covid-19, with evidence of participants travelling in less and at off-peak times to enjoy a quieter commute. Off-peak commuter travel was viewed favourably by interviewees, yet practitioner interviews identified challenges associated with increasingly flexible work schedules, with flexible schedules limiting the ability to promote sustainable initiatives such as carsharing.

Habit discontinuity hypothesis: commuting habits & Covid-19

Covid-19 disruption was maintained throughout the entire interview study period; both B&NES and NatWest practitioner interviews highlighted the challenges associated with the long-term disruption, with organisations not back to a sense of 'normality' by final wave three interviews. The final NatWest practitioner interview revealed challenges to get employees to return to the office even on a limited basis, with the long-term implications of Covid-19 disruption for commuter travel viewed as somewhat of an unknown for both organisations.

Several B&NES Council interviewees spoke about how they felt their habit of commuting had been broken from a prolonged period of home working, with initial trips back to the office in wave two described as a ‘shock to the system’. There was additional evidence of a broken habit of travelling by public transport reported by two participants during waves one and two, but participants had appeared to generally revert to their pre Covid-19 travel habits by the time of wave three. Overall, the evidence from both organisations shows that HDH applied more strongly to breaking commute habits in favour of working from home, as opposed to changing habits of commute mode.

7.11. Summary

This chapter has provided a detailed description of the longitudinal interview study, conducted via three separate interview waves with employees from B&NES Council and NatWest bank. Findings demonstrate limited changes to commute mode contrasted with notable increases in home working at both organisations. Notions of flexibility, convenience, reliability and cost are key to understanding people’s commute travel behaviour decisions. Car parking restrictions are effective in encouraging environmentally sustainable commutes, by making more sustainable modes perceived as better value for money and more convenient. However, the availability of plentiful, low-cost parking at both organisations’ HQs raises concerns over future commutes, with both cases reporting increases in car commuting since the onset of Covid-19. The next chapter presents findings from the messaging survey, including whether the Covid-19 disruption has altered the perceived persuasiveness of previously validated messages promoting walking, cycling, and bus use.

Chapter Eight – Messaging Survey

8.1. Introduction

This chapter reports findings from the messaging survey, considering whether the Covid-19 disruption has altered the perceived persuasiveness of previously validated messages promoting walking, cycling, and bus use (RQ2). The chapter discusses the findings from the survey followed by a comparison of findings with the ADAPT study, which investigated message persuasiveness for messages promoting walking, cycling and bus use in a pre Covid-19 setting.

8.2. Survey sample socio-demographics

As discussed in Chapter Three, a nationally representative sample was recruited using Prolific. The messaging survey sample (n=405) was broadly representative of the UK by gender, age, and ethnicity (Table 43). The survey was live for two weeks in September 2021.

Descriptor							**Survey observations**
Gender	Male	Female					
	48.64%	51.36%					405
Age group	18-29	30-39	40-49	50-59	60-69	70+	
	21.48%	16.79%	17.78%	18.27%	22.96%	2.72%	405
Ethnicity	Asian	Black	Mixed	Other	White		
	8.82%	4.79%	4.28%	3.02%	79.09%		397

Table 43. Messaging survey socio-demographics

8.3. Survey findings

8.3.1. Travel behaviour

Survey respondents were asked to report the transport mode that they most frequently used for journeys made under two miles within the past two weeks. The car was the most popular mode (47.4%), followed by walking (39%) (Table 44). Respondents were additionally asked what their preferred mode would be for journeys made under five miles. Table 45 shows that the most popular preferred mode is the car (38.8%), followed by cycling (23.7%), and walking (16.1%), with bus the most popular public transport option (10.1%).

Primary Mode	**Responses**
Car (including carshare)	47.4%
Walking	39.0%
Bus	5.2%
Rail	4.0%
Bike (including e-bike)	2.2%
Taxi	1.2%
Other	1.0%

Table 44. Primary transport mode for journeys under 2 miles

Preferred Mode	Responses
Car (including carshare)	38.8%
Bike (including e-bike)	23.7%
Walking	16.1%
Bus	10.1%
Underground / Metro / Light Rail	4.2%
Rail	2.5%
Motorbike	1.7%
Tram	1.5%
Other	1.5%

Table 45. Preferred transport mode for journeys under 5 miles

8.3.2. Covid-19 and travel behaviour

Survey respondents were asked how their travel behaviour might have changed since the onset of Covid-19, comparing their travel behaviour at the time of survey to their pre Covid-19 behaviour in terms of walking, cycling, and bus use. Figure 37 shows that most respondents reported that they now walk more compared to their pre Covid-19 walking (52.1%), with 35.6% reporting that they walk the same amount, and 7.4% reporting that they now walk less. Considering cycling (Figure 38), the majority of the sample did not cycle before Covid-19, and they still did not cycle (60.7%). From those who do cycle, 19% report cycling the same amount, 12.8% report cycling more, and 5.9% report cycling less. With bus use (Figure 39), 41% of the sample reported that they did not use the bus before Covid-19 and they do not use the bus now. Among bus users, 35.1% reported using the bus less compared to their pre Covid-19 bus use, 20.3% reported using the bus the same amount, and 2% reported using the bus more. Thus, overall reported travel behaviour among survey respondents suggests a trend of increased walking, similar cycle use, and reduced bus use compared to pre Covid-19 travel.

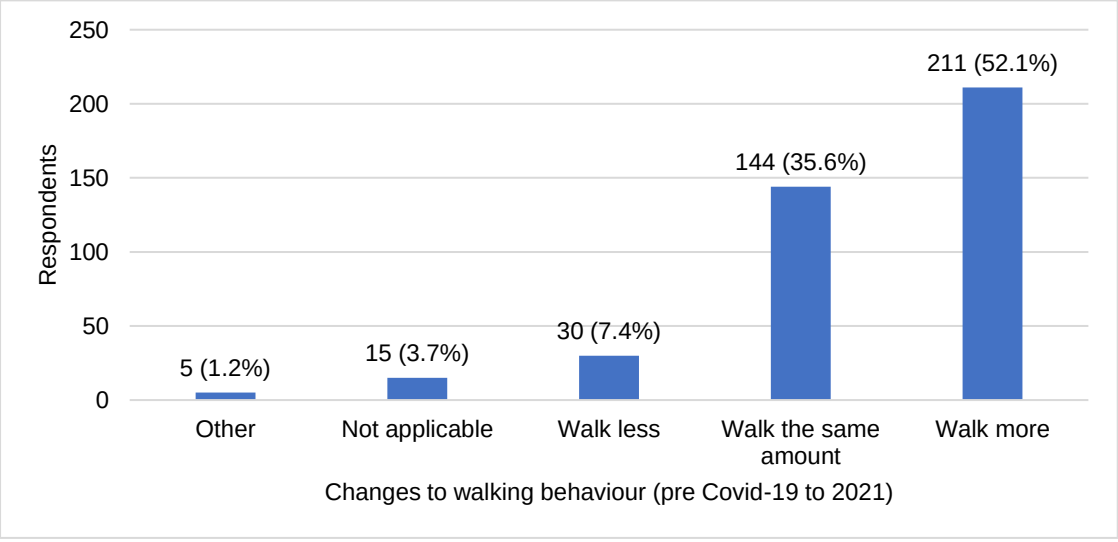


Figure 37. Changes to walking behaviour, pre Covid-19 to September 2021

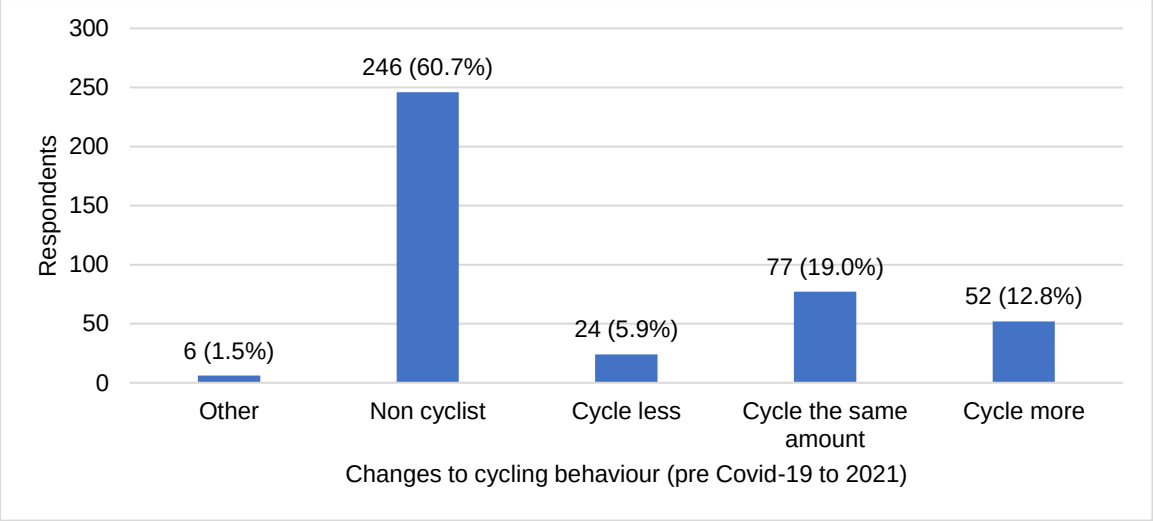


Figure 38. Changes to cycling behaviour, pre Covid-19 to September 2021

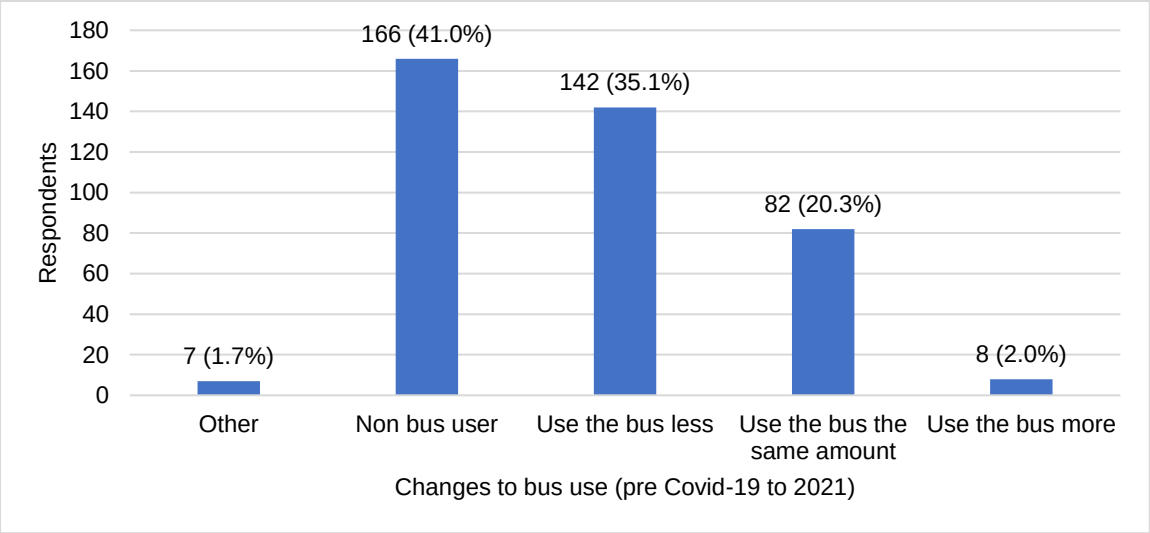


Figure 39. Changes to bus use, pre Covid-19 to September 2021

8.4. Message persuasiveness

The survey's dependent variable was the persuasiveness of each message. To assess the dependent variable, participants rated eight questions on a Likert scale from 1 to 5 and the mean of these scores was calculated to create an overall persuasiveness rating score, with a maximum score of 40 indicating very high perceived persuasiveness. The persuasiveness message was selected as the only dependent variable as the study replicated the approach undertaken in the ADAPT study (as described in Chapter Four).

A linear mixed effects model was used to account for variation between participants, which is outlined in Chapter Four. The model assessed the effects of message mode, message type, message value, gender, age, primary mode of transport, preferred mode of transport, changes to travel behaviour since Covid-19, and the five personality factors (Openness,

Conscientiousness, Extraversion, Agreeableness, and Neuroticism) on the persuasiveness ratings of messages. All interactions between message features and predictor variables were also assessed. Random effects were specified in the model, which consisted of adjusting errors for clustering within-participants using a random intercept model. All other variables were included as fixed in the model. All significance values were 2 tailed with $\alpha = 0.05$. The Holm-Bonferroni method was carried out as a post-hoc test to reduce the possibility of type I error. Interactions that did not reach significance were removed from the final model. Findings from the model are discussed throughout the remainder of this chapter, including interpreting findings in relation to RQ2.

8.4.1. Predictor variables

Of the predictor variables, message mode ($p<0.001$), message value ($p<0.001$), age ($p=0.01$), and cycling behaviour ($p=0.04$) were found to have a significant impact on the persuasiveness ratings of messages. None of the big-five personality traits were found to have a significant impact on the persuasiveness ratings of messages. Gender, primary transport mode, and changes to walking and bus use since Covid-19 also had no significant impact. A description of the significant predictor variables and their relationship with message persuasiveness is provided below.

8.4.2. Message mode and persuasiveness

Message mode (i.e., whether messages promoted the use of walking, cycling, or bus) had a significant impact on the persuasiveness ratings of messages in general ($p<0.001$). Post-hoc analysis identified that messages promoting walking were rated as the most persuasive and were rated as significantly more persuasive than messages promoting bus ($p<0.001$). Messages promoting cycling were additionally rated as significantly more persuasive than messages promoting bus ($p<0.001$). Messages promoting walking were rated as more persuasive than messages promoting cycling, but the difference was not significant ($p=0.145$).

Message Mode	Mean	Std. Error
Walk (n=403)	**31.977**	0.916
Cycle (n=403)	30.665	0.924
Bus (n=402)	23.235	0.927

Table 46. Message mode and persuasiveness scores

8.4.3. Age and persuasiveness

Post-hoc analysis showed that participants in the youngest age bracket (18-29) rated messages as significantly more persuasive than all other age groups, including 30–39 year-olds ($p=0.044$), 40-49 year-olds ($p<0.001$), 50-59 year-olds ($p<0.001$) and participants aged

60+ ($p<0.001$). No significant interactions were found between the rest of the age brackets, with participants in the 60+ age bracket rating messages as the least persuasive.

Age	Mean	Std. Error
18-29 (n=87)	**30.215**	0.846
30-39 (n=68)	28.943	0.900
40-49 (n=72)	28.001	0.860
50-59 (n=74)	28.051	0.862
60+ (n=104)	27.918	0.865

Table 47. Age and persuasiveness scores

8.4.4. Message value and persuasiveness

Considering the impact of message value on message persuasiveness (i.e., whether messages incorporated a health or finance value), post-hoc analysis showed that messages promoting a finance value were rated as significantly more persuasive than messages promoting a health value overall ($p=0.001$).

Message Value	Mean	Std. Error
Health (n=405)	27.730	0.814
Finance (n=403)	**29.522**	0.826

Table 48. Message value and persuasiveness scores

8.4.5. Cycling behaviour and persuasiveness

Cycling behaviour (and how it has changed compared to pre Covid-19) was found to have a significant impact on the persuasiveness ratings of messages in general. Post-hoc analysis identified that those who cycled more (when compared to their pre Covid-19 cycling) rated messages as significantly more persuasive than those who cycled less since Covid-19 ($p=0.019$). Those who reported cycling more since Covid-19 also rated messages as significantly more persuasive than non-cyclists ($p<0.001$), with non-cyclists rating messages as the least persuasive.

Cycling behaviour change since Covid-19	Mean	Std. Error
Cycle more (n=52)	**29.995**	0.906
Cycle the same amount (n=77)	28.869	0.856
Cycle less (n=24)	27.697	1.097
Non-cyclist (n=246)	27.628	0.765

Table 49. Cycling behaviour and persuasiveness scores

8.5. Interaction effects

Of the significant interaction effects, message mode had five significant interactions, message value had three significant interactions, and message type had one significant interaction, suggesting that the mode and value that a message contains is more influential

than the message type (i.e., authority or ad populum argument) on perceived persuasiveness. A description of the significant interaction effects is provided below.

8.5.1. Interactions between message value and message mode

Post-hoc analysis identified a significant interaction between message value and message mode ($p<0.001$). Messages promoting walking were rated as significantly more persuasive when promoting a health value compared to a finance value ($p<0.001$). Conversely, bus messages were rated as significantly more persuasive when promoting with a finance value compared to a health value ($p<0.001$). Cycling messages were rated as marginally more persuasive when promoting a finance value, but the difference was not significant. Messages promoting walking/health were rated as the most persuasive combination overall, followed by walking/finance, and cycling/finance. Bus/health messages were rated as the least persuasive combination.

	Walk		Cycle		Bus	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
Health	**33.114**	0.961	30.651	0.971	19.425	0.966
Finance	30.840	0.972	**30.780**	0.975	**27.046**	0.989

Table 50. Persuasiveness ratings across message mode and value

8.5.2. Interactions between message mode and preferred transport mode

A significant interaction between message mode and participants' preferred transport mode was identified ($p<0.001$). For messages promoting cycling, those who preferred to cycle rated cycling messages as significantly more persuasive than those who preferred to use the car ($p<0.001$) and public transport ($p<0.001$). Similarly, those who preferred to walk rated cycling messages as more persuasive than those who preferred to use the car ($p=0.44$) and public transport ($p=0.17$). For messages promoting bus use, respondents who preferred to use public transport rated messages as significantly more persuasive than those who preferred to use the car ($p=0.002$), cycle ($p=0.001$), or walk ($p=0.001$). For messages promoting walking, those who preferred to cycle rated walking messages as the most persuasive followed closely by those who preferred to walk. However, there were no significant interactions with walking messages rated as highly persuasive across all preferred transport modes.

	Walk		Cycle		Bus	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
Car	31.836	0.977	29.992	0.985	22.517	0.982
Cycle	**32.631**	0.914	**32.522**	0.927	22.345	0.926
Walking	32.558	1.113	31.523	1.123	22.040	0.926
Public Transport	31.327	1.051	29.436	1.059	**24.877**	1.053
Other	32.273	2.050	30.140	2.006	22.188	2.051

Table 51. Persuasiveness ratings across message mode and preferred transport

8.5.3. Interactions between message mode and cycling behaviour

Post-hoc analysis additionally found a significant interaction between message mode and cycling behaviour ($p<0.001$). For messages promoting cycling, those who reported cycling more since Covid-19 rated messages as more persuasive than those who cycled less ($p<0.001$), those who were not cyclists ($p<0.001$) and those who cycled the same amount ($p=0.06$). There were no significant interactions between reported cycling behaviour and messages promoting walking or the bus.

	Walking		Cycling		Bus	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
Cycle more	**33.340**	1.119	**33.748**	1.125	22.899	1.123
Cycle same amount	32.002	1.056	31.267	1.065	**23.336**	1.066
Cycle less	31.020	1.404	29.508	1.399	22.562	1.408
Non-Cyclist	32.139	0.939	28.367	0.947	22.377	0.952

Table 52. Persuasiveness ratings across message mode and cycling behaviour

8.5.4. Interactions between message value and age

There was a reported significant interaction between message value and age ($p<0.001$). For messages incorporating a finance value, 18-29 year-olds rated messages as significantly more persuasive than 30-39 year-olds ($p=0.012$), 40-49 year-olds ($p<0.001$), 50-59 year-olds ($p<0.001$), and 60+ ($p<0.001$). For messages incorporating a health value, 18-29 year-olds rated messages as significantly more persuasive than 40-49 year-olds ($p=0.022$). Those aged 18-29 additionally rated health messages as more persuasive than all other age groups, but the difference was not significant.

	Health		Finance	
	Mean	Std. Error	Mean	Std. Error
18-29	**28.638**	0.923	**31.748**	0.934
30-39	27.848	0.978	29.923	0.947
40-49	26.980	0.937	28.833	0.947
50-59	27.477	0.938	28.458	0.951
60+	27.662	0.935	27.905	0.946

Table 53. Persuasiveness ratings across age group and message value

8.5.5. Interactions between message mode and message type

A significant interaction was found between message mode and message type (p=0.001). Across all message modes, authority type messages were rated as significantly more persuasive than ad populum messages. Authority type messages were similarly rated as more persuasive than consequence type messages, but reported differences were not significant.

	Walk		Cycle		Bus	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
Authority	**32.714**	1.092	**32.377**	1.049	**24.424**	1.121
Consequence	32.315	1.075	30.352	1.138	24.210	1.188
Ad Populum	30.902	1.136	29.267	1.137	21.072	1.019

Table 54. Persuasiveness ratings across message mode and message type

8.5.6. Interactions between message mode and conscientiousness

Post-hoc analysis found a significant interaction between message mode and the conscientiousness personality trait (p=0.04). For messages promoting walking, those who were high (p=0.006) or mid (p=0.022) in conscientiousness rated messages as significantly more persuasive than those low in conscientiousness. For messages promoting cycling and bus use, there were no significant interactions reported between conscientiousness and message persuasiveness. However, those with high to mid conscientiousness rated cycling messages as more persuasive than those low in conscientiousness, suggesting that those with mid to high conscientiousness are more likely to rate walking and cycling messages as more persuasive compared to those with low conscientiousness.

	Walking		Cycling		Bus	
	Mean	Std. Error	Mean	Std. Error	Mean	Std. Error
High Conscientiousness	**32.869**	1.074	31.056	1.082	22.923	1.079
Mid Conscientiousness	32.437	1.009	**31.082**	1.018	22.345	1.022
Low Conscientiousness	31.070	0.970	30.030	0.977	**23.113**	0.982

Table 55. Persuasiveness ratings across conscientiousness and message mode

8.6. Summary of findings

The messaging survey found that car was the most popular and preferred transport mode for short journeys (under two and five miles). When asked about changes to travel behaviour since the onset of Covid-19, respondents reported typically walking more, cycling the same amount (with low rates of reported cycling), and using the bus less.

Considering the impact of predictor variables on message persuasiveness, message mode had a significant impact on the persuasiveness ratings of messages; messages promoting

walking and cycling were rated as more persuasive than messages promoting bus, with walking messages rated as the most persuasive. Respondents in the youngest age bracket (18-29) rated messages as significantly more persuasive than all other age brackets, with participants in the 60+ age bracket rating messages as the least persuasive. Messages incorporating a finance value were rated as significantly more persuasive than messages incorporating a health value overall, and those who cycled more since the onset of Covid-19 rated messages as significantly more persuasive than non-cyclists and those who cycled less.

Considering message persuasiveness and interaction effects, messages promoting walking were rated as significantly more persuasive when incorporating a health value, whereas cycling and bus messages were more persuasive when incorporating a finance value. Messages promoting walking/health were rated as the most persuasive combination, with bus/health messages the least persuasive. Respondents who preferred active travel modes (walking and cycling) rated messages promoting cycling as more persuasive compared to those who preferred to use the car or public transport, with public transport users rating bus messages as more persuasive than those who preferred active travel or the car. Similarly, those who reported cycling more since Covid-19 rated messages promoting cycling as significantly more persuasive than non-cyclists and those who cycled less. Walking messages were rated as highly persuasive independent of preferred transport mode. Considering message type, authority type messages were rated as significantly more persuasive than ad populum type messages across all message modes (walking, cycling, bus). Finally, there were interaction effects between message mode and the conscientiousness personality trait; those who had high or mid conscientiousness rated both walking and cycling messages as more persuasive than those low in conscientiousness.

8.7. Comparison of findings to the ADAPT Study

RQ2 asked whether the Covid-19 disruption has altered the perceived persuasiveness of previously validated messages promoting walking, cycling, and bus use. As part of RQ2, the following hypotheses were developed to test in the messaging survey:

- H1. Post Covid-19 disruption, users perceive previously validated walking messages as more persuasive compared to pre Covid-19
- H2. Post Covid-19 disruption, users perceive previously validated cycling messages as more persuasive compared to pre Covid-19
- H3. Post Covid-19, users perceive previously validated bus messages as less persuasive compared to pre Covid-19

To answer RQ2 (and the study's hypotheses), the overall persuasiveness ratings of messages from both this study's messaging survey and the ADAPT surveys are compared to identify similarities and differences. Overall persuasiveness scores vary; this study has a maximum persuasiveness rating of 40, whereas the ADAPT surveys had a maximum persuasiveness rating of 25. This is due to the ADAPT surveys' persuasiveness ratings being normalised using a square transformation to correct for a left skewed distribution, whereas this was not required for this messaging survey's sample. This difference means it has not been possible to conduct statistical tests to identify whether the persuasiveness ratings are significantly different from one another. Instead, the overall ranking of messages will be considered. It should also be noted that the ADAPT persuasiveness ratings are comprised of three different samples (from three different surveys), whereas persuasiveness ratings from this study's messaging survey are all from the same sample. Following a comparison of persuasiveness ratings, findings from the messaging survey's predictor variables and interaction effects will be compared to the three ADAPT surveys (walking, cycling, and bus).

8.7.1. Message persuasiveness comparison

Ranking	Messaging survey	ADAPT surveys
1	Walking/Health/Authority	Cycling/Finance/Ad Populum
2	Walking/Health/Consequence	Cycling/Health/Authority
3	Walking/Health/Ad Populum	Cycling/Health/Consequence
4	Walking/Finance/Consequence	Cycling/Finance/Consequence
5	Cycle/Health/Authority	Cycling/Finance/Authority
6	Cycle/Finance/Consequence	Walking/Health/Authority
7	Cycle/Health/Consequence	Cycling/Health/Ad Populum
8	Walking/Finance/Authority	Bus/Finance/Consequence
9	Cycle/Finance/Authority	Walking/Health/Consequence
10	Cycle/Health/Ad Populum	Bus/Finance/Authority
11	Bus/Finance/Consequence	Bus/Finance/Ad Populum
12	Walking/Finance/Ad Populum	Walking/Finance/Consequence
13	Cycle/Finance/Ad Populum	Walking/Finance/Authority
14	Bus/Finance/Authority	Walking/Health/Ad Populum
15	Bus/Finance/Ad Populum	Walking/Finance/Ad Populum
16	Bus/Health/Consequence	Bus/Health/Consequence
17	Bus/Health/Authority	Bus/Health/Authority
18	Bus/Health/Ad Populum	Bus/Health/Ad Populum

Table 56. Comparison of message persuasiveness ranking

Comparing the persuasiveness ranking of messages, there are notable differences from this study's messaging survey compared to the ADAPT surveys. The first difference relates to walking and cycling; 5 out of 6 cycling messages received the highest persuasiveness scores from the ADAPT surveys, with cycling/finance and cycling/health messages the most persuasive combinations. Walking/health and bus/finance messages typically ranked in the middle, with bus/health the least persuasive combination. For this study's messaging survey, bus/health messages were similarly rated as the least persuasive messages. However,

bus/finance messages were also ranked low on the persuasive scale, with bus messages typically rated as less persuasive compared to the ADAPT survey. Another difference is identified between walking and cycling messages; this study found walking messages to be the highest rated, with walking/health the most persuasive combination, with cycling messages typically ranked in the mid-range.

Overall, it can be said that this study's messaging survey differed from ADAPT findings. The results of the study gave support to H1 as the evidence suggests that post Covid-19 disruption, users perceive walking messages as more persuasive compared to pre Covid-19. The results of the study additionally gave support to H3, with users of this study's messaging survey perceiving bus messages as less persuasive compared to the pre Covid-19 ADAPT sample. The evidence did not support H2; post Covid-19 cycling messages were typically perceived as less persuasive compared to pre Covid-19, with cycling message persuasiveness strongly related to cycling behaviour (described in the following section).

A full list of messages and their persuasiveness scores is provided in Appendix 4.

The remainder of this chapter will compare findings from the messaging survey's predictor variables and interaction effects with the three ADAPT surveys (walking, cycling, and bus).

8.7.2. ADAPT walking survey

Pangbourne, Bennett and Baker (2020) report findings from their walking messaging survey conducted as part of the ADAPT study. The survey had a sample of 402 participants residing in the UK aged over 18 recruited through Amazon Mechanical Turk. The sample closely matched the ethnic distribution of the UK but was gender biased with more males than females (274 males, 120 females, 8 unknown), and skewed towards younger participants with 46.4% aged 18–29, 34.6 aged 30–39, 15% aged 40–49, 2.7% aged 50–59 and 1.1% aged 60 and over.

Considering predictor variables, the ADAPT walking survey found that 30-39 year olds rated all walking messages as significantly more persuasive than participants 29 and under and 40+ year olds. This finding contrasts with this study's messaging survey which found that 18-29 year olds rated messages as significantly more persuasive than all other age groups. This difference may in part be explained by different sampling procedures as the ADAPT survey had a sample skewed towards younger participants with a limited age range compared to the messaging survey which was nationally representative in terms of age distribution.

The ADAPT walking survey observed that the conscientiousness personality trait had a significant impact on the persuasiveness ratings of messages, with those high in

conscientiousness rating message as significantly more persuasive than those low in conscientiousness. Within this study's messaging survey, an interaction effect similarly observed that those who were high in conscientiousness rated walking messages as significantly more persuasive than those low in conscientiousness. Both this study and the ADAPT walking survey also found that walking messages containing a health value were rated as significantly more persuasive than walking messages containing a finance value.

Pangbourne, Bennett and Baker (2020) additionally report that authority arguments were rated as significantly more persuasive than arguments ad populum and consequence, with arguments ad populum shown to be the least persuasive. This study's messaging survey interaction effects similarly identified that walking messages with an authority type argument were rated as the most persuasive, with ad populum the least persuasive.

Considering interaction effects, post-hoc tests conducted as part of the ADAPT walking survey revealed key differences between age groups for health and finance values of walking messages. Messages incorporating a health value were rated as significantly less persuasive than 18-29 year olds compared to 30-39 year olds. By contrast, this messaging survey identified that health values were rated as the most persuasive by 18-29 year olds, followed by 30-39 year olds. However, both ADAPT and this study's messaging survey found that messages incorporating a finance value were reported as significantly more persuasive by 18-29 year olds than those aged 40+.

Overall, there are both similarities and differences when comparing the ADAPT walking survey with this study's messaging survey. Regarding similarities, the conscientiousness personality trait appears to be a promising characteristic on which to personalise walking messages, with high conscientiousness associated with high persuasiveness in both surveys. Both surveys additionally found that walking messages promoting a health value were rated as significantly more persuasive than walking messages promoting a finance value, with health the most effective value to which pro-walking messages should appeal. Considering message type, both surveys observed that walking messages featuring an authority type argument were rated as the most persuasive, with ad populum type messages the least persuasive (although findings were non-significant in this messaging survey).

Finally, both sets of surveys found that messages promoting a finance value were rated as significantly more persuasive by 18-29 year olds than those aged 40+. However, one key observed difference was age. Both surveys found that age is a variable relevant to constructing persuasion profiles, yet ADAPT observed 30-39 year olds to rate walking messages as significantly more persuasive than other age groups, whereas the messaging

survey found that 18-29 year olds rated messages as significantly more persuasive than all other age groups. Furthermore, Pangbourne, Bennett and Baker (2020) report that messages incorporating a health value were rated as significantly less persuasive than 18-29 year olds compared to 30-39 year olds, whereas this messaging survey found that health values were rated as the most persuasive by 18-29 year olds.

8.7.3. ADAPT cycling survey

Considering whether Covid-19 disruption altered the perceived persuasiveness of previously validated messages promoting cycling, this section will compare relevant findings from this study's messaging survey to key findings from the ADAPT cycling survey (unpublished at the time of writing). The cycling survey used a non-representative sample of 408 participants residing in the UK aged over 18, recruited through Amazon Mechanical Turk. The sample was biased in terms of gender and age; with 290 males, 114 females and 4 unknown, and skewed towards younger participants compared to the general population (47.8% aged 18-29, 30.6% aged 30-39, 18.9% aged 40-49, 2.2% aged 50-59 and 0.2% aged 60+). However, the sample did closely match the ethnic distribution of the UK.

Considering predictor variables, from the big-five personality traits the ADAPT survey found that those high in conscientiousness rated all cycling messages as significantly more persuasive than those low in conscientiousness. Although findings were not significant, this study similarly found that those with high to mid conscientiousness rated cycling messages as more persuasive than those low in conscientiousness. The ADAPT survey additionally found that those high in extraversion rated messages as significantly more persuasive than those low in extraversion, whereas no relationship between extraversion and cycling message persuasiveness was identified in this messaging survey. Both surveys found that openness to experience, neuroticism and agreeableness had no significant impact on persuasiveness ratings of cycling arguments.

The ADAPT cycling survey identified primary mode of transport as having a significant impact on the perceived persuasiveness ratings of cycling arguments, with those who used a cycle as their primary mode of transport rating messages as significantly more persuasive than those who used other forms of transport as their main mode. This messaging survey identified a similar result; cycling behaviour (and how it has changed compared to pre Covid-19) was found to have a significant impact on the persuasiveness ratings of messages with those who cycled more compared to pre Covid-19 rating messages as significantly more persuasive than those who cycled less, and non-cyclists overall, for both messages in general and cycling messages specifically.

The ADAPT survey found that cycling messages incorporating a health or finance value were rated as similarly persuasive, mirroring findings in this study's messaging survey where cycling messages were rated as marginally more persuasive when promoting a finance value as opposed to health, but with no significant difference. Furthermore, both surveys found that ad populum type messages were rated as less persuasive than authority and consequence type messages. Considering interaction effects, the ADAPT cycling survey found that walkers rated health arguments for cycling as significantly less persuasive than cyclists and drivers, whereas no such interaction effect was identified in this study's messaging survey.

Overall, a comparison of findings from the ADAPT cycling survey to this study's messaging survey indicates that both health and finance values can be used to promote cycling messages. Both studies additionally show that those who cycle rate cycling messages as more persuasive, and authority and consequence cycling messages are more persuasive than ad populum cycling messages. Participants high in conscientiousness rated cycling messages as more persuasive than those low in conscientiousness in both studies. However, ADAPT additionally found that those high in extraversion reported cycling messages as more persuasive, whereas no association between extraversion and cycling message persuasiveness was found in this study's messaging survey.

8.7.4. ADAPT bus survey

Analysis of the ADAPT bus survey findings was at an early stage at the time of writing with findings unpublished. The bus survey used a non-representative sample of 346 participants residing in the UK aged 18 or over, recruited through Amazon Mechanical Turk. The sample was biased in terms of gender, with 206 males, 137 females, and 2 unknowns, and skewed towards younger participants compared to the general population (with 85.6% of the sample aged 39 or under).

Preliminary analysis of the ADAPT bus survey showed that messages promoting a finance value were rated as significantly more persuasive than messages incorporating a health value. This mirrors findings in this messaging survey, where bus messages with a finance value were rated as significantly more persuasive compared to bus messages promoting a health value. Furthermore, the ADAPT bus survey found that argument types authority and consequence were rated as more persuasive than arguments ad populum (although the difference was not significant). A similar finding was reported in the messaging survey, where authority and consequence bus messages were rated as more persuasive than ad populum bus messages. Analysis of the ADAPT bus survey found that regular bus users were more persuaded by bus messages than car users or cyclists (but not walkers).

Similarly, this messaging survey reported that respondents who preferred to use public transport rated bus messages as significantly more persuasive than those who preferred to use the car, cycle, or walk. Considering personality traits, the ADAPT survey found those low in openness were more persuaded by bus messages than those mid to high in openness. Openness was not found to be a notable interaction for bus messages in this study's survey. However, this messaging survey found that those low in conscientiousness rated bus messages as more persuasive than those with high or mid conscientiousness (although differences were not significant).

8.8. Summary

This chapter has reported findings from the messaging survey, with a comparison of findings to the ADAPT study. This study's messaging survey found that the car was the primary and preferred transport mode for journeys under two and five miles. Reported changes to travel behaviour since the onset of Covid-19 demonstrates trends of increased walking, low levels of cycling, and reduced bus use. Considering message persuasiveness, findings show that message mode (i.e., walking, cycling or bus) and message value (i.e., message value) are more influential on perceived persuasiveness than message type (i.e., authority, consequence or ad populum). Interaction effects are of importance, with the following conclusions:

- Walking/health is the most persuasive combination overall, with bus/health the least persuasive;
- Messages promoting walking should incorporate a health value, with either authority or consequence message type;
- Messages promoting cycling can incorporate either a health or finance value, with either authority or consequence message type;
- Messages promoting bus should incorporate a finance value, with either authority or consequence message type;
- User mode preference is associated with message persuasiveness:
    - Those who prefer to cycle rate walking and cycling messages as more persuasive than those who prefer to use the car or public transport.
    - Those who prefer to use public transport rate bus messages as more persuasive compared to those who prefer to use the car or active travel.
    - The exception is walking messages – there was no significant interaction between preferred transport mode and walking messages suggesting walking messages are typically appreciated by a wide range of people;

- Younger age groups (18-29) rate messages as more persuasive than older age groups (30+); and
- Those high or mid in the conscientiousness personality trait rate messages promoting walking and cycling as more persuasive than those low in conscientiousness.

There were both similarities and differences when comparing findings to the ADAPT study. Overall persuasive rankings varied; this study found that walking messages were typically rated as more persuasive compared to ADAPT, with cycling and bus messages typically rated as less persuasive. Yet both studies found that health values are more persuasive than finance for walking messages, health and finance values are similarly persuasive for cycling messages, and finance values are more persuasive than health for bus messages. Both studies also found that authority and consequence type messages are more persuasive than ad populum type messages across all modes. Considering personality traits, both studies found that being mid or high in conscientiousness was linked to rating active travel messages as more persuasive. Considering travel behaviour, both studies found that those who cycle rate cycling messages as more persuasive, and those who use public transport rate bus messages as more persuasive compared to those who use other modes. There were differences in relation to age and message persuasiveness, but both found that finance values were rated as more persuasive among younger age groups. A discussion of what findings mean in relation to RQ2 and RQ4 is provided in Chapter Nine.

Chapter Nine – Discussion

9.1. Introduction

The combined data collection methods including employee surveys, a longitudinal interview study and a messaging survey, have produced a comprehensive dataset with detailed insights into the impact of Covid-19 on commuter travel to the two case study organisations (B&NES Council and NatWest Bank), in addition to the role of employers and messaging interventions to encourage environmentally sustainable travel. This discussion chapter will bring together the key findings from the analyses outlined so far to demonstrate how the RQs have been addressed. This chapter will show how findings relate to the existing academic research, with implications discussed.

9.2. RQ1. What are the behavioural impacts of a major disruption event (Covid-19) on commuter travel for selected large employer cases?

The ongoing Covid-19 disruption and restrictions in place during the data collection period had the potential to enable various adaptive behaviours including remoding, retiming, rescheduling, reducing, and renorming (Marsden et al., 2020). The extent to which adaptive behaviours in relation to commuter travel took place was explored via the case study employee surveys (Chapter Six) and longitudinal interview study (Chapter Seven).

Findings from the case study employee surveys show that, pre Covid-19, most of the B&NES Council and NatWest surveyed employees reported travelling to work four to five times a week. Commute behaviour was rated as a habitual behaviour with car the most popular commute mode. Employees typically reported low to medium commute satisfaction, citing frustrations over congested car commutes and overcrowded/irregular public transport services. By contrast, active travel commuters at both organisations reported feeling the most satisfied. From the 2022 sample, which was conducted in the spring with minimal Covid-19 measures in place, the car remained the most popular commute mode with a higher reported modal share in both case studies compared to the 2021 samples. The ability to meaningfully compare the 2022 and 2021 survey samples is limited due to the repeated convenience sampling approach. However, findings are supported by internal case study surveys, with internal employee surveys undertaken at both B&NES Council and NatWest reporting increased rates of car commuting since the onset of Covid-19. Commuting was rated as a habitual behaviour for both B&NES Council and NatWest employees surveyed in 2022, despite the ongoing disruption to commuter travel due to Covid-19.

The longitudinal interview study (Chapter Seven) found there was minimal change to participants' commute mode at both B&NES Council and NatWest. However, several participants discussed their decision to actively avoid public transport during interview waves one and two due to a perceived increased risk of catching Covid-19 on public transport. While not focussed solely on commuter travel, the messaging survey described in Chapter Eight asked about changes to bus travel, comparing pre Covid-19 to September 2021. Findings from the nationally representative sample indicate decreased bus use with 35% reporting using the bus less compared to 20% using the bus the same amount and 2% using the bus more. These findings are in line with national transport statistics and studies monitoring changes in travel trends in response to Covid-19; DfT (2022), Transport Scotland (2021a) and Anable et al. (2022) identified decreased bus usage since the onset of Covid-19. Harrington and Hadjiconstantinou's (2022) survey, which asked about commute modes before and during Covid-19 across the UK, found that anticipated changes were more prevalent among public transport commuters with 49% of public transport commuters reporting potentially switching modes, and Angell and Potoglou's (2022) study of Cardiff workers additionally found a reported 11.4% decrease in public transport when asked about future mode choice. Findings are in line with the international literature, with both Shibamaya et al. (2021) and Paul, Chakraborty and Anwari (2022) identifying public transport as the least preferred transport mode across almost all regions in response to Covid-19.

However, this study's third interview wave found that a move away from public transport commuting is not necessarily a permanent change, with several pre Covid-19 public transport users interviewed reporting a switch back to public transport. This mirrors findings in Marshall, Bizgan and Gottfried (2021), who found a softening of attitudes towards public transport over time. National statistics additionally demonstrate an increase in the use of public transport as Covid-19 restrictions softened, albeit not yet reaching pre Covid-19 levels of use (DfT, 2022; Transport Scotland, 2021a). Similar findings are evident when examining international epidemics; Wang's (2014) study of SARS in Taiwan identified a 'perception of risk' period with no new reported SARS cases resulting in the normal use of the underground in terms of daily passengers one-year post-peak. Considering Covid-19, this study found that the perception of risk period varied from person to person, but most participants typically felt their perception of risk was low by the time of wave three due to vaccination, prior infection, lower Covid-19 case rates, and less fear of Covid-19. In sum, findings demonstrate that remoding away from public transport is an expected behavioural impact following a major public health event such as Covid-19, but this is unlikely to be a permanent change for many.

While evidence of long-term remoding is limited, this study's employee surveys and longitudinal interview study described in Chapter Six and Chapter Seven respectively, found that reducing travel was a key adaptive behaviour at both case study organisations. Pre Covid-19, most surveyed employees worked from home either once a week or not at all. By contrast, the majority of the 2022 sample reported working from home four or more times a week, with nearly all reporting to work from home more at the time of survey compared to their pre Covid-19 home working. Interviewees at both organisations reported substantial increases in their working from home frequency compared to pre Covid-19, apart from one participant whose role required being in the office. When asked about future intentions, interviewees anticipated to continue their increased home working, suggesting a re-norming of home working with reduced commuter travel as a permanent change. Practitioner interviews at both organisations provided further evidence of this re-norming with changes to flexi-work policies, substantial investment in home working equipment, acceptance among senior management, and phrases such as 'don't commute to compute' becoming widely known.

Increased working from home and reduced commuter travel for certain sectors of the workforce is similarly evident in the wider Covid-19 literature; the TRANSAS panel survey reports that 41% of worked days were spent working from home in June 2021 compared to 11.6% pre Covid-19, and the All Change? study found that the proportion of respondents who worked from home 5 days a week in November 2021 was more than double the equivalent proportion in the period before the pandemic (Anable et al., 2022; Marshall, Bizgan and Gottfried, 2021). Harrington and Hadjiconstantinou (2022) and Angell and Potoglou (2022) similarly report increased home working among surveyed workers as a direct result of the pandemic. However, not all sectors of the workforce were able to work from home in response to the pandemic. Survey data reported in Anable and Marsden (2021) identify job sectors including financial services, IT and telecoms, media and marketing, accountancy, legal and real estate as accounting for the most working from home. As described in Chapter Seven, both B&NES Council and NatWest classified their workers into categories, with it widely recognised among both organisations that the majority of desk-based workers would spend a substantial proportion of their time working from home post Covid-19.

In addition to reduced commuter travel, the interview study demonstrated some evidence of retiming; several interviewees at both organisations discussed changing their work travel schedules since Covid-19, with participants maximising the benefits of increased flexi-work policies to travel less and at off-peak times for a quieter commute. This mirrors findings reported in Anable et al. (2022), where peak hour travel congestion levels in 2021 were

down 6% compared to 2019. Evidence from the disruption literature similarly demonstrates how retiming and reducing journeys are the two most likely travel adaptations made in response to disruptive events (Parkes, Jopson and Marsden, 2016; Marsden et al., 2020). Anable et al. (2022) note the significant impact of long-term reduced commuter travel on the transport network with likely carbon and congestion benefits, as commuting responds to around 20% of all UK car mileage with notable impacts on the peak period. The international literature suggests that reduced commuter travel in response to Covid-19 is most prevalent in Europe, with the UK and Italy reporting the highest rates of home working (Shibamaya et al., 2021). By contrast, East Asian countries have reported typically lower rates of home working (Paul, Chakraborty and Anwari, 2022). Across all 14 countries surveyed in Shibamaya et al. (2021), likelihood of working from home, and hence, reduced commuter travel, was associated with being young, highly educated, and living in an urban area.

In sum, this study's employee surveys and longitudinal interview study show the main behavioural impact of a major disruptive event (Covid-19) on commuter travel to B&NES Council and NatWest has been reducing, i.e., a reduction in the amount of travel. Reduced commuter travel is anticipated to be a long-term change with evidence of institutional re-norming around increased home working. The pre Covid-19 literature suggests this has reinforced a prior trend, with ICTs playing a key role in supporting and fostering the implementation of flexible work practices (Faulconbridge et al., 2020). Burkinshaw (2016) notes the trend of increasing flexible work and enhanced use of ICTs prior to Covid-19, with a steady decline in the number of commute trips made per person per year over the past 20 years (LeVine et al., 2017). Both surveys and interviews demonstrate the important role of ICTs to enable reduced commuter travel, with evidence of growing confidence and satisfaction in working virtually throughout the study period. The severity of the Covid-19 disruption has enabled previous barriers to increased home working to be dismantled; prior norms of office-based working which were found to directly contribute to peak-time transport congestion, such as presenteeism, are no longer influencing commute travel behaviour in this study's selected cases (Munch, 2020).

Despite some evidence of early remoding with an initial move away from public transport and increased car usage, interviews showed participants regaining confidence in using public transport towards the end of the study period with minimal change in commute mode at the time of the final interview wave compared to pre Covid-19. This is likely due to factors independent of Covid-19 having greater salience on commute mode choice; the employee surveys identified that commuter travel continued to be viewed as a habitual behaviour (albeit less frequent) and interviewees described notions of flexibility, reliability, convenience, cost, and travel time as important to commute mode choice. Similar findings were identified

in Marshall, Bizgan and Gottfried (2021), whereby Covid-19 had minimal influence on commute mode choice compared to considerations of habit, convenience, comfort and cost. Furthermore, several interviewees discussed feeling locked-in to a car commute due to perceived inadequate public transport and cycling infrastructure, with car remaining the most popular commute mode at both organisations throughout the study period. The notion of feeling locked-in to a car commute has been previously identified in the commuting literature, with Barr and Prillwitz (2014) describing how many English commuters interviewed felt as though their car commute was inevitable, particularly for those with a multi-stop commute (Cass and Faulconbridge, 2016; Burkinshaw, 2018).

9.3. RQ2. Has the Covid-19 disruption altered the perceived persuasiveness of previously validated messages promoting walking, cycling and bus use?

To understand whether Covid-19 disruption altered the perceived persuasiveness of previously validated messages promoting walking, cycling and bus, findings from a nationally representative messaging survey were compared to the ADAPT study's series of surveys (Chapter Eight). There are notable differences between the pre Covid-19 ADAPT surveys and this study's post Covid-19 messaging survey in terms of overall perceived persuasiveness, suggesting that Covid-19 disruption may have altered the perceived persuasiveness of both walking and bus messages.

A comparison of overall persuasiveness scores shows that, post Covid-19, messages promoting walking were rated as more persuasive compared to the pre Covid-19 ADAPT walking survey (Pangbourne, Bennett and Baker, 2020). This could be linked to the reported increase in walking among the survey respondents since the onset of Covid-19, with 52.1% of respondents reporting to walk more compared to their pre Covid-19 walking. This mirrors findings in the wider literature, with Marsden and Anable (2021) identifying significantly increased rates of walking among their panel survey participants, alongside a boost in UK government funding to invest in improved pedestrian infrastructure in response to Covid-19. Yet despite the difference in overall persuasiveness ratings, interaction effects show many elements of perceived persuasiveness remained the same and can be considered as valid to communicate pro-walking messages in a post Covid-19 context. Both this messaging survey and the ADAPT survey found that walking messages promoting a health value were rated as significantly more persuasive than messages promoting a finance value, with health the most persuasive value to which pro-walking messages should appeal. Both surveys additionally observed that walking messages featuring an authority type argument were rated as the most persuasive, with ad populum type messages the least persuasive. The conscientiousness personality trait is evidently a promising characteristic on which to

personalise walking messages, with high conscientiousness significantly associated with high perceived persuasiveness in both sets of surveys.

Cycling messages were rated as less persuasive in the post Covid-19 messaging survey compared to the ADAPT cycling survey, however both studies found a strong association between being a cyclist and rating cycling messages as persuasive. ADAPT post-hoc tests identified that those who used a bicycle as their primary mode of transport in the past two weeks rated messages as significantly more persuasive than those who used other forms of transport as their main mode. Within this study's messaging survey, cycling behaviour (and how it has changed compared to pre Covid-19) was similarly found to have a significant impact on the persuasiveness ratings of messages, with those who cycled more compared to pre Covid-19 rating cycling messages as significantly more persuasive than both non-cyclists and those who cycled less. National statistics show an increase in cycling post Covid-19, however cycling levels remain low with 60.7% of the messaging survey's sample reporting to be a non-cyclist (DfT, 2022; Transport Scotland, 2021a). Thus, it can be said that, for cycling messages, perceived persuasiveness is dependent on cycling behaviour as opposed to being affected by Covid-19 disruption. The barriers to taking up cycling as a mode of transport were discussed in the longitudinal interview study (Chapter Seven), with interviewees describing the notion of a specific cyclist identity, and how this can be a barrier if one does not view themselves this way. Future research should consider how to create persuasive cycling messages which can successfully appeal to a non-cyclist audience, including identifying and targeting messages to those with minimal barriers to cycling.

Finally, the evidence shows that post Covid-19, bus messages are perceived as less persuasive compared to pre Covid-19. Bus messages incorporating a health value were rated as the least persuasive in both ADAPT and this messaging survey, whereas bus messages incorporating a finance value within ADAPT were rated as more persuasive compared to the post Covid-19 messaging survey. The lower persuasiveness ratings of bus messages in the post Covid-19 survey could be partially due to negative perceptions of public transport arising since the onset of Covid-19. The survey found bus message persuasiveness was associated with personal bus use, with 35.1% of the survey sample reporting using the bus less since the onset of Covid-19. The early phases of the pandemic promoted a clear 'avoid public transport' message, and both findings from the longitudinal interview study and the wider literature demonstrate increased negative perceptions of public transport in the short-medium term (Harrington and Hadjiconstantinou, 2022; Angell and Potoglou, 2022). However, as described above, the evidence suggests that attitudes towards public transport have softened over time, with national statistics showing bus use at around 90% pre Covid-19 use (Marshall, Bizgan and Gottfried, 2021; Urban Transport

Group, 2022). Thus, it would be helpful to re-test bus/finance messages to see if perceived persuasiveness has improved, noting ongoing initiatives to encourage bus use such as the DfT's £2 bus fare cap (DfT, 2023c). Comparing interaction effects other than value, both ADAPT and this study's messaging survey found bus messages incorporating the argument types authority and consequence to be rated as the most persuasive.

In summary, it appears that changes to people's attitudes and travel behaviour since the onset of Covid-19 has likely altered the perceived persuasiveness of messages, resulting in walking messages viewed as more persuasive, and bus messages viewed as less persuasive. The perceived persuasiveness of cycling messages continues to be most related to whether an individual perceives themselves to be a cyclist or not. Several interaction effects remain true in both the ADAPT surveys and the messaging survey, which can be used to guide the design of messaging interventions as described in section 9.5.

9.4. RQ3. What is the role of large employers in encouraging and enabling environmentally sustainable commuting post disruption?

Both B&NES Council and NatWest had pre Covid-19 sustainability travel targets with measures in place to encourage employees to travel to work in modes other than the private car, despite the provision of extensive parking facilities at NatWest's Gogarburn HQ. For example, both organisations offered the Cycle to Work scheme alongside the provision of objects such as secure cycle storage and showers to facilitate a cycling commute. B&NES Council purposefully did not provide car parking to employees, whilst NatWest provided subsidised public transport routes, shuttle buses from major rail stations, and electric vehicle charging points for both e-cycles and electric cars. Both organisations intended to continue with the existing measures to promote sustainable commuter travel, but practitioner interviews recognised the challenge of achieving modal shift.

Post Covid-19, practitioners interviewed at both B&NES Council and NatWest were considering whether reduced trips to the office should be a new priority to achieve sustainability targets instead of modal shift. There has been ongoing research as to whether working from home is less carbon intensive than commuting to work. It is a complex topic, with factors such as heating, energy efficiency, and commute mode/distance all important to consider (Schupak, 2021). However, some organisations choose to take a simplistic approach and define a telecommute, i.e., working from home, as contributing towards a zero-carbon commute due to a lack of commuting emissions. Practitioner interviews show that, at least in the short to medium term, reducing work-related travel had become a greater priority than modal shift, with minimal attention placed on sustainable travel initiatives throughout the longitudinal interview study period. Both organisations invested in the procurement of permanent home working equipment for employees in response to Covid-19

with significant changes to flexi-work policy. Changes included increased home working, virtual meetings established as the new norm and physical changes to office space to facilitate hybrid working, with expectations from senior management that employees should not travel in for days of online calls and emails. Both organisations additionally reported a significant reduction in business travel, with in-person business meetings typically replaced by video calls.

Interviews demonstrated how increased home working and decreased commuter and business travel, which occurred as a direct result of Covid-19, have been established as a new norm. Both B&NES Council and NatWest participants discussed the significant increase in Zoom and Teams meetings throughout all three interview waves, with participants becoming more comfortable and confident using videocall technology throughout the study period. This contrasts with findings from the pre Covid-19 disruption literature, which found that concepts of stability and habit typically dominate transport policy, with society seeking a return to pre-event conditions as quickly as possible when faced with disruptive events (Marsden and Docherty, 2013; Williams, Chatterton and Parkhurst, 2012).

Yet despite decreased commuter travel, evidence from the employee case study surveys and internal organisational surveys demonstrate an increase in the modal share of car commuting at both organisations, with the wider Covid-19 commuting literature similarly finding evidence of increased car commutes (Harrington and Hadjiconstantinou, 2022; Angell and Potoglou, 2022). As described in section 9.2., it is unclear whether reported increases in car commuting will remain a long-term change with evidence of attitudes softening towards public transport over time. However, it remains important for both B&NES Council and NatWest, in addition to other large organisations, to continue to understand and identify how they can encourage and enable environmentally sustainable commuting in a post Covid-19 context. As discussed in Chapter Three, large organisations are a source of authority with significant influence over their employees' work-related travel behaviour. The remainder of this section will discuss potential areas to focus on, based on the evidence from the longitudinal interview study, employee surveys and the wider literature. However, whilst the triangulation of methods and the use of comparative cases was selected to help improve the credibility and validity of findings, the external validity of the study is limited, with findings not necessarily applicable to other large organisations.

9.4.1. Encouraging and enabling active travel commutes

Active travel received much attention in the early stages of Covid-19 disruption, with reported uptakes in walking and cycling for leisure trips alongside government funded schemes such as Streetspace to improve walking and cycling infrastructure (Marsden and

Docherty, 2021). Case study surveys show that those who commuted by active travel reported the highest levels of commute satisfaction, and interviewees from both B&NES Council and NatWest spoke of the important health and wellbeing benefits gained from an active commute. As noted by Guell et al. (2012), the emotional aspect of commuting can be overlooked by practical concerns but recognising the emotional aspects of commuting, such as enjoyment of exercise or 'me time', is important to fully understand and influence commute travel behaviour. Organisations should seek to understand and promote the positive emotional aspects of active travel commuting and address the fearful emotions, as several participants described fearful emotions when discussing a potential cycling commute. Several participants described a specific cyclist identity which appeared both unrelatable and undesirable, echoing findings reported by Guell et al. (2012) where many Cambridge commuters could not subscribe to identities such as cyclists. In addition to highlighting the positive emotions tied to an active travel commute, communication campaigns with the aim of reducing the notion of a specific cyclist identity may be important to encourage a wider uptake of cycling as a commute mode.

Practitioner interviews recognised the importance of skills training to encourage a cycling commute, although B&NES Council identified how budgetary constraints were limiting the ability to provide cycle training. In addition to training, the BUG in NatWest demonstrated the importance of cycling communities to encourage a cycling commute, with the BUG successfully increasing the number of cycling commuters to NatWest using methods such as providing information about practicalities such as cycle storage, where to get changed, weekly emails, guided tours of facilities, talking to colleagues about cycling to work, a buddy system for cycle rides into work, and a Google Maps document showing the best routes for cycling into work. This is echoed in Cass and Faulconbridge (2016), who found that materials tied to cycle commuting are more complex than just a cycle and suitable pathway, with additional materials required. Insufficient cycling infrastructure was discussed by participants in both organisations among both cyclists and non-cyclists, with interviewees citing a lack of segregated cycle lanes and poor cycle surfaces. While improving cycling infrastructure is beyond the control of organisations, organisations can lobby for improvements and promote the availability of high-quality infrastructure where appropriate, with Chapter Five identifying committed government funding in both Bath and Edinburgh to improve active travel infrastructure.

Distance is a key barrier to taking up an active travel commute for many people. To this end, e-cycles were recognised within both case study organisations as having promising potential to increase rates of cycle commuting. Both subject and practitioner interviewees recognised the ability for e-cycles to reduce barriers associated with a typical cycling commute such as

fitness, travel time and the need to shower or change. E-cycles were identified as particularly helpful in Bath, which is known for its hilly terrain. However, the prohibitive cost of e-cycles was identified by several participants, with e-cycles typically viewed as above an acceptable price range, in addition to concerns over theft. This suggests that company initiatives to enable e-cycle commutes through reduced cost, for example via a company hire scheme or increased Cycle to Work budget, could encourage employees to start an e-cycle commute. Organisations should also seek to promote the benefits of an e-cycle commute in relation to factors salient to commute mode choice. Findings from the longitudinal interview study and the wider literature suggest that campaigns which promote the time saving, flexibility, convenience and health benefits (including mental health) benefits of e-cycles would prove effective (Marshall, Bizgan and Gottfried, 2021). The potential benefits of e-cargo cycles were also highlighted in the longitudinal interview study, for example to enable a multi-stop commute including dropping children off at school. This could help to overcome the notion of feeling locked into a car commute as identified by caregiver interviewees (Chapter Seven) and Barr and Prillwitz (2014). E-cargo cycle commutes could be encouraged by organisations through the provision of suitable, secure on-site cycle parking and extending the maximum cycle to work scheme offer. The use of e-cargo cycles is becoming increasingly common across Western Europe countries such as Germany but would likely require communication campaigns to help shift social norms in a UK context (Narayanan and Antoniou, 2022).

9.4.2. Encouraging and enabling public transport commutes

Private car was favoured as a transport mode for several interviewees due to the car's perceived ability to be flexible, reliable and convenient. However, interviews at both organisations showed how car parking restrictions, particularly in city centres, made public transport viewed as the more convenient/flexible option. Yet as both B&NES Council and NatWest have HQs located on the outskirts of Bath and Edinburgh with ample car parking space, a car commute was viewed favourably among several participants when commuting to company HQs. The challenge of car parking availability was discussed in both NatWest and B&NES Council practitioner interviews; plentiful car parking at both companies' HQ locations represented a challenge in terms of trying to avoid a car-led Covid-19 recovery. Therefore, the use of car parking restrictions may be necessary to make a public transport commute viewed as the more flexible, convenient option. Restrictions can be both spatial, i.e., restricting the availability of car parking spaces, and financial, i.e., making it expensive for employees to park their car. There are limitations to this approach, namely in the case of B&NES Council where plentiful low-cost parking was provided locally, and not specifically for B&NES Council employees.

Alongside car parking restrictions, there is a need to improve public transport infrastructure with insufficient public transport recognised as a barrier to a public transport commute by several participants in both case studies. While infrastructure improvements are outside the remit of the organisations' control, employers can promote any local or national initiatives to improve public transport, such as the £2 bus fare cap policy introduced across England in December 2022 and still in place at the time of writing, or improvements to local services for example through Bus Service Improvement Plans (DfT, 2023c).

Considering the impact of Covid-19, the NatWest practitioner interview highlighted the challenge encouraging a public transport commute in the context of decreased use of public transport services and fewer commuter trips. The final, wave three interview showed mixed attitudes among participants when discussing public transport from a Covid-19 perspective. Some users noted how their public transport use had decreased because of Covid-19, although several participants spoke about their shifting attitudes, with vaccines and more information about the virus instilling confidence to return to public transport. However, cost implications of a public transport commute were identified; with fewer trips to the office, several participants spoke about how they would no longer benefit from any season ticket discount with a cost barrier to a future public transport commute. Organisations should seek to provide information about the level of risk associated with Covid-19 and other viruses and public transport use for vulnerable or concerned employees (particularly in the winter months), in addition to exploring options to provide discounted deals for employees travelling in less frequently.

9.4.3. Encouraging and enabling electric vehicle commutes

Electric cars were discussed positively by several participants at both case studies throughout all three interview waves. B&NES Council provide a fleet of electric cars for use by employees which were viewed positively, but no participant felt ready to purchase a personal electric car throughout the study period. One participant discussed feeling intimidated by the prospect of using an electric car for the first time, suggesting skills training sessions might help to overcome barriers for some. Concerns over purchasing costs and limited infrastructure/battery power meant that participants viewed electric cars as an option for the long-term future as opposed to the nearby future. NatWest had committed to putting in 250 electric vehicle charging points at Gogarburn HQ to incentivise employees to switch to electric cars from conventionally fuelled cars. One participant discussed their purchase of an electric car due to NatWest's company car scheme, demonstrating the ability of large private

sector organisations to utilise company car scheme deals to promote the uptake of electric vehicle commuting.

9.4.5. Encouraging and enabling carsharing/car clubs

City-wide restrictions on car use in both Bath and Edinburgh were already causing some participants to reconsider future car use, citing potential policies such as congestion charges, clean air zones, and workplace parking levies. Two case study interviewees noted how they would be more open to initiatives such as car clubs if the convenience and cost of private car use were to change. This mirrors findings reported in Marshall, Bizgan and Gottfried (2021), where participants flagged policies such as clean air zones as potentially contributing to changes in car ownership. Encouraging the use of carsharing is more complicated since increased flexi-work post Covid-19, with both subject and practitioner participants at B&NES Council and NatWest describing how flexible schedules have made options such as lift sharing seem too complex. Therefore, organisations should focus on promoting car club initiatives, promoting the benefits such as enabling access to newer, more environmentally friendly vehicles and removing the cost and hassle of vehicle ownership.

9.5.6. Shifting norms

Throughout the study period, B&NES Council was rolling out climate literacy training to staff in a response to its declared climate emergency. There was evidence of increased interest and engagement of learning about more sustainable behaviours as a direct result of the training, with one participant noting a change in their own behaviour as the workshop caused them to reflect on their own actions. Training similar to the climate literacy course could be utilised by organisations to help shift norms, by raising awareness and making employees consider their travel behaviours and viable alternatives. Organisations can additionally help to foster new norms around sustainable transport when considering their communications. For example, a NatWest interviewee discussed how, whenever there are corporate communications about changes to the office, any impact on car parking was always mentioned first. Organisations should consider and embed the sustainable transport hierarchy into future communications, as shown in Figure 40.

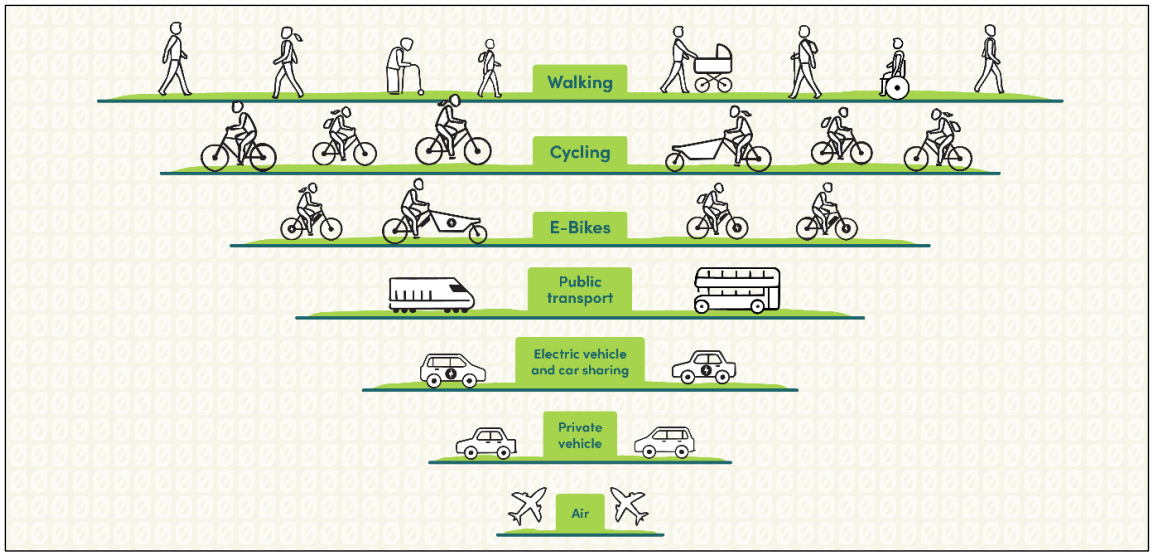


Figure 40. Sustainable transport hierarchy (Action Net Zero, 2023)

An additional norm which organisations can seek to encourage relates to off-peak travel. Barr and Prillwitz (2014) note that many individuals reported feeling 'locked in' to their car use practices, with the structure of everyday life requiring a shift to enable more sustainable mobility. The increase in flexi-work because of Covid-19 at both B&NES Council and NatWest has unarguably created this shift, with interviews demonstrating that several participants were travelling to work at quieter, off-peak times. Anable et al. (2022) discuss the positive impact of decreased peak hour travel, with important carbon and congestion benefits. Furthermore, encouraging off-peak travel would help to encourage VTBC by generating time-space contingencies conducive to sustainable commuting, considering for example the school run or healthcare trips (Cass and Faulconbridge, 2016). Organisations should promote their flexi-work policies with clear institutional guidelines on the ability to travel in at off-peak times to aid a reduction in local congestion.

9.5. RQ4. How should messaging interventions be designed to help meet transport decarbonisation targets?

As described in Chapter Two, much of the existing persuasive technology to encourage VTBC fails to use tailored messaging as a persuasive strategy with persuasive systems typically employing self-monitoring, gamification and rewards and social comparison (Sunio and Schmocker, 2017; Anagnostopoulou et al., 2018). However, persuasive message interventions delivered via mobile technology have demonstrated a large degree of success in promoting health behaviour change, with messages tailored to individual factors such as psychographic variables reported as significantly more persuasive than those designed for a general audience (Fjeldsoe, Marshall and Miller, 2009; Head et al., 2013; Muench et al., 2017).

A pilot study described in Anagnostopoulou et al. (2020) tested whether tailored messages could translate into actual behavioural change. The pilot demonstrated promising initial results; findings suggest that the personalised approach had some impact on motivating users to change their travel behaviour to more sustainable choices, with users reporting favourable views of tailored persuasive messages. Companies such as BetterPoints Ltd are increasingly embedding tailored in-app messages to encourage modal shift, with bespoke packages available for organisations to encourage environmentally sustainable commuter travel among staff (BetterPoints, 2023). In addition to the workplace interventions described above, messaging interventions are a tool to help organisations meet their transport decarbonisation targets. Findings from the employee surveys and longitudinal interview study demonstrate the ingrained habit of commuter travel, with Covid-19 disruption unable to break many participants' travel habits. However, the wider disruption literature does demonstrate VTBC occurring in the context of life change events such as moving house or starting a new job (Verplanken and Roy; 2016; Fuji, Garling and Kitamura, 2001; Verplanken et al., 2008). Thus, the timing of messaging interventions should be considered within this context, for example perhaps targeting new starters joining an organisation, or alongside any relocations.

Considering the findings from the messaging survey described in Chapter Eight and the PSD model introduced in Chapter Two, some recommendations for designing messages to promote VTBC are provided below. The PSD model demonstrates the need to identify the intent (who is the persuader, what type of change does the persuader target), the event (use, user, and technology contexts), and the strategy (message and route) (Sunio and Schmocker, 2017). Considering the persuader, findings from the messaging survey identified that authority type messages were frequently rated as more persuasive than other message types. This research identified that the large organisations selected for study had considerable influence over employees' travel decisions, with employees typically acknowledging and accepting travel-related policies implemented by their employer. Thus, large organisations can be considered a trusted authority source to deliver persuasive messaging campaigns. The event would be determined by the organisation but could be, for example, a campaign run by a company with the ability to incorporate in-app tailored messaging. However, alternatives such as messaging via company intranets and general communication campaigns could also be considered to reduce user burden, with the persuasive systems literature identifying challenges of high abandonment and attrition rates related to app interventions (Cellina et al., 2019).

The remainder of this chapter will consider best practice for message design to encourage an environmentally sustainable commute.

9.5.1. Messages to promote active travel

Considering findings from RQ2, messaging interventions in the post Covid-19 era should include a promotion of active travel modes including e-cycles. As outlined in Chapter Eight, messages promoting walking should incorporate a health value, using either authority or consequence message type. Messages promoting cycling can incorporate both health and financial values, with either authority or consequence message type. Considering audiences, walking messages are typically viewed as persuasive by a wide range of people, despite their preferred transport mode. Conversely, those with a preference for cycling or walking are likely to view messages promoting cycling as more persuasive than those who prefer to use the car or public transport. This means messages promoting cycling could achieve better results via focusing on those with an interest in active travel, perhaps considering those who do already undertake some active travel but could increase the amount or distance, or to target those who walk or cycle for leisure but not utility trips. Additionally, those high or mid in conscientiousness rated messages promoting walking and cycling as more persuasive than those low in conscientiousness; organisations could ask questions to employees specifically to measure conscientiousness and use this to focus efforts. The research found that younger ages (18-29) rated messages as more persuasive than all older age groups, although the practicality of implementing a targeted approach to younger age groups in a workplace intervention is unclear.

Considering findings from the longitudinal interview study and wider literature, messages or communication campaigns should focus on the positive emotional aspects tied to active travel commuting (such as the wellbeing benefits), and address the fearful emotions tied to a cycling commute, for example by providing information on the availability of segregated cycle lanes where appropriate. Additionally, notions of flexibility, reliability, convenience, costs, travel time, and roles and identity are all important to commute mode choice. Taking this into account, active travel should be promoted in terms of its excellent flexibility, reliability, and cost compared to other modes, with organisations to promote any cost saving schemes such as Cycle to Work. Messages to promote an e-cycle commute should specifically consider advertising the time-saving benefits. As discussed previously, communication campaigns should also consider how to broaden the perceived identity of who is a cyclist, for example via testimonials or images demonstrating a diverse range of people cycling.

9.5.2. Messages to promote public transport

Considering the messaging survey results discussed in Chapter Eight, messages to promote public transport should focus on promoting a financial value and avoid the inclusion of health values. Messages should incorporate either authority or consequence message types, with

those who prefer to use public transport rating messages as more persuasive. Given that public transport usage has still not recovered to pre pandemic levels, messaging could be focussed on targeting pre Covid-19 public transport users who have not yet returned. This could include, for example, information on the relative exposure of Covid-19 and similar viruses when travelling by public transport compared with other public spaces to reassure and restore confidence on public transport use.

Considering the notions tied to commute mode choice, public transport is perhaps more difficult to promote via message as a public transport commute is typically viewed as less flexible, reliable, convenient or faster than corresponding car journeys. However, as outlined in Chapter Seven, public transport commutes can become viewed the more flexible, convenient option where car parking restrictions are present. Thus, messages to promote public transport could be linked to local car parking restrictions, for example comparing the cost of a public transport journey to the cost of city centre car parking or with messages such as ‘car-free equals carefree’. Furthermore, organisations such as B&NES Council and NatWest could demonstrate the benefits of an off-peak public transport commute via quieter, less congested journeys. Any cost saving initiatives related to public transport should additionally be clearly communicated, particularly to younger audiences with those aged 18-29 rating financial values as more persuasive.

9.5.3. Additional messages

Considering the sustainable transport hierarchy (Figure 40), messaging interventions should primarily seek to encourage uptake of active travel and public transport. However, organisations may wish to promote initiatives such as car clubs and electric vehicles. The messaging survey did not examine the perceived persuasiveness of messages for these modes, making this an area for future research. However, findings from the longitudinal interview study and the wider literature show that messages should seek to consider and promote the benefits of these modes in relation to flexibility, reliability, convenience, comfort and cost.

9.6. Summary

This chapter has brought together the key findings from the analyses in addition to the wider literature, to demonstrate how the RQs have been addressed. The chapter has specifically considered the behavioural impacts of a major disruptive event (Covid-19) on commuter travel to selected large employer cases, whether the Covid-19 disruption has altered the perceived persuasiveness of previously validated messages promoting walking, cycling, and bus use, in addition to the role of large employers and messaging interventions in encouraging and enabling environmentally sustainable commuting post disruption.

The subsequent, final chapter contains the study's conclusions, including a summary of key findings, limitations of the research, and considerations for future research.

Chapter Ten – Conclusion

10.1. Introduction

The research presented in this thesis has provided an intensive examination of the impact of Covid-19 disruption on commuter travel and implications for organisations to promote environmentally sustainable commuting post disruption based on two case studies. Findings were conceptualised through the ISM disruption framework (Figure 9), an interdisciplinary model incorporating practice theory, social psychology and behavioural economics perspectives. The four RQs which were conceptualised at the beginning of this thesis have been answered in Chapter Nine. This final chapter will synthesise the findings, including a discussion of the implications of research to demonstrate the original contributions made to the literature. Finally, the limitations of the research are addressed, with recommendations for future work.

10.2. Summary of key findings

The findings presented in this thesis raise several implications relevant to policy. A summary of the key findings and implications relevant to policy are discussed, considering primarily the context of large organisations.

10.2.1. Reduced commuter travel is the main behavioural impact from Covid-19 disruption

Findings from the case study surveys and longitudinal interview study show that reduced travel was the main behavioural impact on commuter travel within the two case organisations as a result of Covid-19 disruption. Prior to Covid-19, most participants included in the research reported travelling to work four times a week or more; employees seldom used virtual meeting technologies with high levels of business travel for in-person meetings, and a culture of presenteeism within B&NES Council. The introduction of measures to slow the spread of Covid-19 resulted in immediate full-time home working for the majority of desk-based B&NES Council and NatWest employees. Employees began a slow return to the office throughout the study period as disruption measures eased, but on a much less frequent basis.

In response to the Covid-19 disruption, both B&NES Council and NatWest introduced new flexi-work policies with increased working from home established as a new norm for most desk-based employees. Case study surveys demonstrate that most employees reported working from home more compared to their pre Covid-19 home working. Interviews suggest that the increased flexibility in home working would have likely occurred in the medium to long term future, yet the Covid-19 disruption rapidly accelerated trends by helping to

establish new norms and overcome pre-conceived notions of home working among both employees and employers. Both organisations invested substantially in home working equipment with offices redesigned to facilitate hybrid working, with increased home working anticipated to be a permanent change. Practitioner interviews demonstrated how new flexi-work policies were the main priority in both organisations throughout the study period compared to employee commuter travel initiatives. Identifying suitable measures to successfully encourage and enable VTBC in the context of reduced commuter trips was identified as a challenge, with B&NES Council citing the issue of limited budget to implement sustainable travel measures given its reduced priority.

10.2.2. Commute mode has remained relatively stable, with a softening of attitudes towards public transport over time

The longitudinal interview study showed that, when employees did travel into the office, their commute mode remained relatively stable. Reported future intentions show that most B&NES Council and NatWest interviewees anticipated no changes from their pre Covid-19 commute mode. Several participants discussed their decision to actively avoid public transport during waves one and two due to a perceived increased risk of catching Covid-19 on public transport, and internal employee surveys found evidence of reduced public transport as a commute mode with an estimated 20% increase in car commuting reported at both organisations. However, the third interview wave suggests that a move away from public transport commuting is likely not a permanent change for all, with several pre Covid-19 public transport users interviewed describing a switch back to public transport. Interviewees described how factors such as Covid-19 vaccination, prior infection, lower Covid-19 case rates and a perceived reduced risk of Covid-19 had contributed to feeling comfortable returning to public transport.

10.2.3. Notions of habit, flexibility, reliability, convenience, travel time and cost are typically more important to commute mode choice than Covid-19

As described in 10.2.2., other than short to medium reductions in the use of public transport, commute mode choice remained relatively stable for most employees throughout the study period. This is likely due to factors other than Covid-19 having more salience on individual commute mode choice. Case study surveys identified that employees continued to view their commute travel as a habitual behaviour despite the ongoing disruption, with deeply ingrained habitual behaviours challenging to change. Aside from habit, in-depth interviews identified considerations of flexibility, reliability, convenience, travel time and cost as having influence on travel behaviour decisions. Primarily, employees expressed their desire to travel to work

via a mode which is flexible, reliable, and convenient. For some, this meant using the car, particularly for those with multi-stop commutes, for example including a school-run. However, the evidence showed that car parking restrictions in city centre locations can result in more sustainable modes, such as the bus, being viewed as a more flexible, reliable and convenient option.

The importance of travel time varied among participants; many wished to travel to work as quickly as possible, however others spoke of the value of ‘me time’ and were happy to use modes which took longer but meant their travel time was not spent focussed on driving. The travel time savings of working from home were widely appreciated among the interviewees and viewed as a key benefit of home working. The importance of cost was recognised, particularly in relation to a public transport commute. Despite interviewees travelling in less frequently towards the end of the study period, the cost of a public transport commute continued to be viewed negatively with less frequent travel reducing the ability to benefit from discounted fares, such as through season tickets. Cost also had influence over other transport modes; one participant discussed getting a new electric car through the NatWest company car scheme due to the financial benefits, whereas others discussed not being willing to commute by car if the car parking costs were too high. The availability of cheap or free car parking available near both B&NES Council and NatWest HQ sites was identified as a barrier to promoting environmentally sustainable commuting post Covid-19.

10.2.4. There is some evidence of retiming commutes with increased off-peak travel

In-depth discussions from the longitudinal interview study demonstrated some evidence of retimed commuter travel. As discussed in section 10.2.1., both case study organisations implemented new flexi-work policies with institutional expectations that employees should travel in for collaboration purposes and avoid commuting to undertake calls or emails all day long. Several participants spoke of making the most of the new flexi-work policies by travelling in for specific events or meetings and returning to work from home when finished, resulting in a quieter off-peak commute. It is unclear to what extent this is a wider trend among B&NES Council and NatWest employees, with the second employee survey participants reporting to typically leave their home for work during the morning peak (7am-8am). However, the wider literature identifies significant benefits associated with reduced peak hour travel in terms of carbon and congestion impacts, with measures to promote off-peak travel to be encouraged (Anable et al., 2022).

10.2.5. Best practice to inform measures for organisations to promote environmentally sustainable commuter travel

Findings from the research identified best practice lessons for organisations to encourage and enable environmentally sustainable commuter travel. Despite the reported reduction in commuter travel at both case organisations, employers should continue to encourage and enable VTBC to help improve local GHG emissions, congestion, air quality and quality of life for residents.

Considering active travel commutes, organisations should seek to understand and promote the positive emotional aspects of active travel commuting including the wellbeing benefits and to address the fearful emotions, particularly fear of a cycling commute. Efforts should be made to widen the perceived identity of a cyclist. Practical measures are additionally important; organisations should provide clear information on objects required to facilitate a cycling commute including information on lockers, showers, cycle storage, and provide events such as guided tours and buddy rides. E-cycles have promising potential due to their ability to overcome key barriers such as fitness and distance. Organisations should consider how they can help reduce the cost barrier of e-cycles, for example via a company hire scheme or increased Cycle to Work scheme budgets. The benefits of e-cycles (including time saving, flexibility and convenience) should be clearly communicated alongside training sessions to try out an e-cycle.

A public transport commute is somewhat more challenging to promote, considering how the car is typically perceived as more flexible, reliable, convenient, and better value for money, in addition to some remaining hesitancy from a Covid-19 risk perspective. However, interviews demonstrated that public transport modes can become viewed as the more flexible and convenient option used instead of the car where sufficient car restrictions are in place. Where possible, organisations should implement car parking restrictions such as not providing car parking spaces to employees. Organisations should seek to provide information about the level of risk associated with Covid-19 and other viruses and public transport use (particularly in the winter months) for vulnerable or concerned employees, in addition to promoting awareness of any local or national public transport initiatives to encourage the use of public transport, such as bus fare cap schemes or improvements to local services through bus service improvement plans.

Considering electric vehicles, private sector organisations can utilise company car scheme deals to promote the uptake of electric vehicle commuting. Carsharing was not considered to be a worthwhile initiative to promote among the case organisations due to the varied schedules of employees. However, car clubs are identified as being of interest with some

participants reconsidering their future car ownership due to real or planned local policies such as congestion charges, clean air zones and workplace parking levies. Organisations should focus on promoting car club initiatives, particularly considering schemes where car club vehicles can be hired as a pool car fleet and opened to employees to rent out of hours. Benefits to advertise include access to newer, more environmentally friendly vehicles and removing the cost and hassle of vehicle ownership.

Finally, organisations should seek to shift the norms of commuter travel with consideration of the sustainable transport hierarchy (Figure 40). Policies such as staff training on climate literacy can be helpful to aid awareness of the impact of individual actions and alternative options available. The research additionally identified off-peak commuter travel as a post Covid-19 behaviour among several participants. Organisations should ensure that off-peak travel becomes an embedded norm given the congestion and carbon benefits associated with reduced peak travel.

10.2.6. Best practice to inform messages to promote environmentally sustainable commuter travel

The thesis compared findings from this study's messaging survey to the ADAPT study's surveys, resulting in the identification of best practice to inform messages to promote environmentally sustainable commuter travel. Persuasive messages are an underutilised tool to encourage VTBC, with demonstrable success in promoting health behaviour change. Considering the design of messaging interventions, the persuader should be a trusted authority source such as an organisation attempting to promote voluntary commuter travel behaviour change. Exact interventions can be determined by the organisation but could include a campaign hosted by a sustainable mobility app, messaging via company intranets, or internal communication campaigns. The timing of interventions is important to consider; existing evidence demonstrates successful VTBC in the context of life change events such as moving house or starting a new job, suggesting interventions could be targeted to new starters, office or home relocation, or a return to the office following a disruptive event.

From comparing this study's messaging survey to the ADAPT surveys, some general conclusions on best practice to inform message design can be made. Post Covid-19 walking messages are perceived as more persuasive compared to pre Covid-19, with walking messages rated as persuasive by a wide range of people regardless of their preferred transport mode. Messages promoting walking should incorporate a health value, using either authority or consequence message type. By contrast to walking, cycling messages typically only appeal to those who cycle, with preconceived notions of a cyclist identity limiting the broader appeal of cycling as a commute mode. This means messages promoting cycling

could achieve better results via focusing efforts on those with an existing interest in active travel, perhaps employees who already undertake some active travel but could increase the amount or distance, or employees who walk or cycle for leisure but not utility trips. Additionally, those high or mid in conscientiousness perceived messages promoting walking and cycling as more persuasive than those low in conscientiousness; organisations could ask questions to employees specifically to measure conscientiousness and use the results to focus efforts.

Considering public transport, bus messages are perceived as less persuasive compared to pre Covid-19, likely given the increased hesitancy towards public transport as a direct result of the pandemic. Bus messages are perceived as more persuasive by those who prefer to use public transport, and messages should incorporate either authority or consequence message types. Bus messages were rated as significantly more persuasive when incorporating a financial value compared to a health value, meaning messages should seek to promote any cost saving initiatives where relevant.

10.3. Reflections on Theory

This research utilised the ISM disruption framework, incorporating elements from the ISM model, HDH, and PSD. Considering the HDH, the research sought to identify whether the Covid-19 disruption had the potential to act as a large-scale trigger resulting in changes to commuter travel habits (Verplanken and Roy, 2016). The research found limited evidence of changes in commuter travel habits; when employees did travel into work, they continued to rate their commute travel as a habitual behaviour (although it is possible that some participants might have established new travel behaviours throughout the study period which were subsequently rated as habitual). The evidence from both organisations shows that HDH applied more strongly to establishing new habits of working from home, with home working established as a new norm for the majority of participants. It can therefore be said that the Covid-19 disruption did not act as a large-scale trigger to change habits of commute mode, but instead to change habits of commute frequency.

However, the appropriateness of the HDH can be questioned noting the unprecedented nature of the Covid-19 disruption. The existing HDH literature typically focusses on short-term disruptive events such as moving house (Verplanken and Roy; 2016; Fuji, Garling and Kitamura, 2001; Verplanken et al., 2008). The ongoing, and constantly changing, nature of the Covid-19 disruption (and subsequent ongoing changes to restrictions on travel behaviour) meant that it was not possible to identify window of opportunity periods where users had a higher likelihood of habitual behaviour being (re)considered (Verplanken et al., 2008). It is perhaps more appropriate to understand the observed changes in behaviour as

an outcome of the ongoing elements of flux throughout the study period, as opposed to specific changes in participants' habits as a result of the disruption. Furthermore, while the ISM disruption framework lists habit as a factor within the individual context, this study identified the importance of multiple factors influencing commuter travel within the broader social and material contexts. For example, rules and regulations set by the UK government in an attempt to reduce rates of Covid-19, and changes to flexi-work policies implemented by employers, significantly influenced participants' behaviour reported throughout the study period. As such, the role of individual agency (including habit) is somewhat limited in the context of this study. Organisational decision-making played a key role in determining participant behaviour, for example with changes to off-peak commuter travel occurring as a direct result of newly established flexi-work policies. Yet it should be noted that the importance of achieving consensus/buy-in from employees is recognised as an important consideration in organisational decision-making, particularly within public sector organisations (Nutt, 2005). Finally, reflecting on findings from the messaging survey in relation to the study's theoretical framework, the survey's results found some evidence to support the hypotheses developed based upon the HDH and pandemic disruption literature. As predicted, walking messages were perceived as more persuasive and bus messages were perceived as less persuasive following the Covid-19 disruption. Findings from the qualitative research and prior studies suggest this is likely partially due to changes in attitudes towards shared transport and personal health occurring as a result of the pandemic (noting frequently reported desires to avoid public transport in response to a pandemic event) (Sadique et al., 2007; Goodwin et al., 2011). However, the messaging survey did not support the hypothesis that cycling messages would be perceived as more persuasive post disruption, with the majority of the survey sample being non-cyclists and cycling message persuasiveness related to reported cycling behaviour.

Message values were found to play an important role in users' perceptions to message persuasiveness. The study found that values tied to health and finance were rated as persuasive, with health values particularly persuasive for walking messages. The study additionally found that users who were mid or high in the conscientiousness personality trait rated active travel messages as more persuasive compared to those who were low in conscientiousness. This is perhaps unsurprising, noting that those high in conscientiousness tend to be goal orientated and show self-discipline (Oyibo, Orji and Vassileva, 2017). Yet while these individual level factors are important, the research has demonstrated the importance of considering these within the broader social and material contexts. Initiatives targeted at the individual to promote VTBC (particularly considering their values/personality traits) will be most successful when targeted to users where the wider environment is

conducive to behaviour change, for example through employers providing flexible time and schedules, and where suitable public transport and active travel infrastructure is available.

10.4. Limitations of the research

The research successfully produced in-depth research on commuter travel and work practices at the two selected UK case studies. However, there are limitations with the research design and individual data collection methods, which are summarised below.

Considering the overall research design, some opportunities were missed due to the sequencing of the data collection. The study opted for an employee survey first, followed by the first qualitative interview wave. This sequencing helped to structure the interviews and recruit participants to the interview study. However, noting the CR preference to prioritise qualitative data (with quantitative data a suitable supplementary method), it is recognised that it would have been optimal to begin with the interviews, using surveys used to validate the qualitative findings. Furthermore, it would have been beneficial to factor in time to explore the topic of persuasive messaging within the interviews, to triangulate the messaging survey's findings and strengthen the recommendations discussed in Chapter Nine.

The study's messaging survey included a nationally representative survey via a stratified quota sample. Although the nationally representative sample is a strength, quota stratified sampling is a non-probability sampling method resulting in sampling bias, meaning it is not possible to make statistical inferences from the messaging survey findings from the sample to the population. It should also be noted that the messaging survey is measuring perceived persuasiveness; the fact that behavioural intention was not measured is a limitation, noting stated persuasiveness and actual/intended persuasiveness will differ. The actual persuasiveness of the messages to encourage modal shift is unknown and should be explored in future research.

One significant limitation from the employee surveys relates to the sampling procedure and hence limited external validity. A non-probability convenience sampling approach was used due to the limited resources available, meaning that findings are not representative of the study's selected case organisations and cannot be generalised to all employees. Furthermore, despite the careful survey design, the samples likely contain self-selection bias (where people with specific characteristics are more likely to agree to take part in a study than others), social desirability bias (where people have the tendency to underreport socially undesirable attitudes and behaviours and overreport more desirable attributes) and recall bias (where participants do not remember previous events or experiences accurately). Finally, small sample sizes within the surveys are recognised as a limitation. The small

samples meant it was not possible to test whether the relationships identified in the crosstabulations have a statistically significant association or not. Care should be taken when interpreting results with findings not generalisable to all B&NES Council and NatWest employees.

A limitation of the longitudinal interview study concerns sample size. The longitudinal approach enabled the qualitative research to achieve credibility in terms of confidence in the truth of the findings, with maximum variation sampling to understand a range of behaviours and attitudes towards commuter travel. However, recruiting additional participants would have enabled a wider range of views to be considered with increased transferability of findings. Given the mixed methods approach, lack of capacity limited the sample size for this element of the study. Furthermore, it is recognised that findings from the interviews likely contain a certain amount of social desirability and recall bias. A final limitation is the reliance on one researcher; the ability to employ additional researchers to examine the qualitative process and provide input into themes developed would have helped to increase the dependability and confirmability of the findings (discussed further in section 3.6.2.). Triangulation was used to help improve the validity of the research, with the cases' interview and survey findings considered together in Chapter Nine to help overcome the limitations associated with each method.

Considering the case studies, two case organisations in two different cities were selected to help better understand causality via establishing the circumstances in which a theory does or does not hold. Both B&NES Council and NatWest represent large organisations with HQs outside of city centre locations and sustainable travel measures in place with a significant number of desk-based employees. Both case study cities (Bath and Edinburgh) share broadly similar features in terms of economy, socio-demographics and geography. However, a notable difference between the two relates to private versus public sector; B&NES Council operates as a public sector organisation on the principle to serve residents living within the Bath and North East Somerset area, whereas NatWest operates as a major retail and commercial bank on the principle of driving profits. The two organisations have distinct workplace structures and decision-making processes, including on decisions related to workplace travel initiatives. The transferability of findings to (1) organisations which are smaller in scale with a lower number of desk-based workers and (2) locations with distinct economies, demographics, and geographies, is limited.

Finally, the context of the study is recognised as a potential limitation of the research. The research was conducted in the short to medium term period following the outbreak of the Covid-19 pandemic. While there were minimal Covid-19 restrictions in place by the end of

the study period, behaviours and attitudes remained likely more affected by concern over perceived risk of the Coronavirus compared to the long-term. It is also recognised that international responses to the pandemic varied significantly, and this study's relevance is limited to the UK context. Thus, findings are limited in their transferability to international countries in addition to periods of "normality" with minimal concern over Covid-19, though there are important lessons to be learnt for swift adaptive responses to any future epidemics or pandemics.

10.5. Recommendations for future work

This research has provided detailed insight into the behavioural impacts of Covid-19 disruption on commuter travel and work practices, with an understanding of the role of large employers and messaging to promote environmentally sustainable commuting in the context of major disruption. Several recommendations have been produced, considering best practice in terms of designing and disseminating persuasive messaging campaigns. The next step should be to empirically test these messages in a real-life setting. Future research should test whether the messages summarised in section 10.2.6. can enable actual travel behaviour change, for example by developing a messaging campaign delivered via a randomised controlled trial approach. Studies should seek to include a wider range of sustainable transport modes, such as electric vehicles, car clubs and e-cycles. Considering this study's theoretical framework, future research should also aim to understand the impact of delivering messaging interventions in the context of disruptive events, such as a house move, office relocation, or a new job.

Furthermore, it would be beneficial to understand the long-term behavioural impacts of Covid-19 disruption on commuter travel and work practices. Research should seek to understand whether identified trends of reduced and increased off-peak commuter travel found in this study and in the wider literature remain a long-term behavioural impact, and if so, to understand whether such shifts in behaviour result in meaningful impact on the transport system at the local and national level in terms of carbon emissions, air pollution, and congestion.

This study has identified that the factors which theoretically influence message persuasiveness have remained relatively stable throughout Covid-19 disruption (albeit with evidence of changes to overall perceived persuasiveness for walking and bus messages). Future research could advance theory regarding VTBC, HDH and the use of persuasive messages (as depicted in this study's ISM disruption framework) by conducting experiments that seek to understand if mode intentions can be predictably influenced by the messages that have been found to be more theoretically persuasive in terms of values, existing

behaviours, and personality traits. Experiments could be deployed both under business-as-usual conditions and during disruptive events, to further advance understanding of persuasive messaging, HDH and associated windows of opportunity to encourage VTBC.

Large organisations represent useful units of study when examining commuter travel behaviour, with organisations able to influence travel behaviour and work practices. Taking this into account, employer-based sampling frames are recommended as suitable to conduct experiments and advance theory related to VTBC, HDH and persuasive messaging. Appropriate disruptive events to study could take the form of confined, pre-determined events related to workplace travel, such as relocation or graduate schemes. Future research should also seek to explore what messages might persuade people not to travel, rather than to use a different mode, as this is a remaining knowledge gap.10.6. Final conclusions

This thesis aimed to examine the behavioural impacts of Covid-19 disruption on commuter travel, and to understand the role of large employers and messaging to promote environmentally sustainable commuting (including telecommuting) in the context of major disruption. Throughout this thesis, four RQs have been addressed which have contributed to meeting the study's aim. Findings identified that, within the selected large employer cases, reduced commuter travel was the main behavioural impact resulting from Covid-19 disruption. The evidence suggests that increased home working has been established as a new norm, with both case organisations anticipating much lower levels of commuter travel in the long-term, in addition to increased off-peak commuter travel. Both reduced commuter travel and increased off-peak commuter travel have potentially significant benefits in terms of improving local air quality, congestion, and reducing carbon emissions. The actual impact of such reported changes should be explored in future research.

Aside from a short-term aversion to public transport, commute mode remained relatively stable throughout the study period, with a softening of attitudes towards public transport over time. Notions of habit, flexibility, reliability, convenience, travel time and cost are typically more important to commute mode choice than attitudes to Covid-19. The evidence has demonstrated that car parking restrictions are an effective way to make sustainable transport modes such as active travel and public transport become viewed as a preferable option to the private car. E-cycles were identified as a promising mode to encourage VTBC given their ability to enable a flexible, reliable, and often quick commute. Measures to reduce the cost burden of e-cycles should be prioritised, for example via loans or increased Cycle to Work scheme budgets. Measures to reduce the cost burden of public transport commutes are also key, with less frequent commuter travel reducing prior benefits such as season ticket discounts.

In sum, findings have provided an original contribution to the travel disruption, persuasive messaging, commute travel, and work practices literature. This work will help to inform the development of sustainable travel workplace initiatives, including detailed guidance on how to encourage and enable environmentally sustainable commuting via messaging interventions.

References

ACAS. 2014. *The right to request flexible working: an ACAS Guide*. [Online]. [Accessed 10/10/2022]. Available from: https://webarchive.nationalarchives.gov.uk/ukgwa/20181204192815mp_/http:/www.acas.org.uk/media/pdf/1/7/The-right-to-request-flexible-working-the-Acas-guide.pdf

Ackroyd, S. 2009. *Research Designs for Realist Research*. [Online]. [Accessed 14/12/2020]. Available from: https://www.researchgate.net/profile/Stephen-Ackroyd-2/publication/285330593_Research_designs_for_realist_research/links/63f49104574950594531b195/Research-designs-for-realist-research.pdf

Action Net Zero. *What are my sustainable transport options?* [Online]. [Accessed 10/10/2022]. Available from: https://www.actionnetzero.org/guides-and-tools/sustainable-travel-options-transport-hierarchy/

Adams, R. and Hampton, S. 2018. Behavioural economics vs social practice theory: perspectives from inside the United Kingdom government. *Energy Research & Social Science*. **46**, pp.214-224.

Adler, P. and Adler, P. 2012. 'Expert voice'. In S. E. Baker and R. Edwards. *How many qualitative interviews are enough? National Centre for Research Methods Review Discussion Paper*, pp. 8-11.

Ajzen, I. 1991. The theory of planned behavior. *Organizational Behavior and Human Decision Processes*. **50**(2), pp.179-211.

Anable, J. 2005. 'Complacent Car Addicts' or 'Aspiring Environmentalists'? Identifying travel behaviour segments using attitude theory. *Transport Policy*. **12**(1), pp.65-78

Anable, J. and Wright, S, D. 2013. *Golden Questions and Social Marketing Guidance Report. SEGMENT.* [Online]. [Accessed 20/04/2020]. Available from: https://aura.abdn.ac.uk/bitstream/handle/2164/3226/Deliverable_7.8.4_GOLDEN_QUESTIONS_REPORT_Final_Corrected_27oct13.pdf?sequence=1

Anable, J., Brown, L., Docherty, I. and Marsden, G. 2022. *Less is more: Changing travel in a post-pandemic society.* [Online]. [Accessed 09/12/2023]. Available from: Less is more: Changing travel in a post-pandemic society (creds.ac.uk)

Anagnostopoulou, E., Bothos, E., Magoutas, B., Schrammel, J. and Mentzas, G. 2018. Persuasive Technologies for Sustainable Mobility: State of the Art and Emerging Trends. *Sustainability*. **10**(2128), pp.1-22.

Anagnostopoulou, E., Urbančič, J., Bothos, E., Magoutas, B., Bradesko, L., Schrammel, J. and Mentzas, G. 2020. From mobility patterns to behavioural change: leveraging travel behaviour and personality profiles to nudge for sustainable transportation. *Journal of Intelligent Information Systems*. **20**, pp.157-178.

Andersson, A., Winslott Hiselius, L. and Adell, E. 2018. Promoting sustainable travel behaviour through the use of smartphone applications: A review and development of a conceptual model. *Travel Behaviour and Society*. **11**, pp.52-61

Angell, C. and Potoglou, D. 2022. An insight into the impacts of COVID-19 on work-related travel behaviours in the Cardiff Capital Region and following the UK's first national lockdown. *Cities*. **124**, pp.1-13.

AQR. 2020. *Iterative Approach*. [Online]. [Accessed 29/04/2020]. Available from: https://www.aqr.org.uk/glossary/iterative-approach

Azad, A., Sernbo, E., Svard, V., Holmlund, L. and Bjork Bramberg, E. 2021. Conducting In-Depth Interviews via Mobile Phone with Persons with Common Mental Disorders and Multimorbidity: The Challenges and Advantages as Experienced by Participants and Researchers. *International Journal of Environmental Research and Public Health*. **18(**22), pp.1-13.

B&NES Council. 2014a. *Economy Strategy Review, 2014-2030*. [Online]. [Accessed 07/04/2022]. Available from: https://www.bathnes.gov.uk/sites/default/files/siteimages/Planning-and-Building-Control/Major-Projects/ba192_economic_strategy_05.pdf

B&NES Council. 2014b. *Getting Around Bath: A Transport Strategy for Bath*. [Online]. [Accessed 0704/2022]. Available from: https://www.bathnes.gov.uk/sites/default/files/sitedocuments/getting_around_bath_transport_strategy_-_final_issue_web_version.pdf [was also mott macdonald]

B&NES Council. 2016. *Active Travel*. [Online]. [Accessed 07/04/2022]. Available from: https://www.bathnes.gov.uk/services/your-council-and-democracy/local-research-and-statistics/wiki/active-travel

B&NES Council. 2019*. Climate Emergency*. [Online]. [Accessed 08/04/2022]. Available from: https://beta.bathnes.gov.uk/climate-emergency

B&NES Council. 2020a. *B&NES Council Constitution*. [Online]. [Accessed 07/04/2022]. Available from: https://democracy.bathnes.gov.uk/ieListDocuments.aspx?CId=652&MId=5469&Ver=4&info=1

B&NES Council. 2020b. *B&NES Council Corporate Strategy 2020 to 2024*. [Online]. [Accessed 07/04/2022]. Available from: https://beta.bathnes.gov.uk/bnes-council-corporate-strategy-2020-2024/context-and-challenges

B&NES Council. 2020c. *Transport Delivery Action Plan for Bath, 2020 Onward*. [Online]. [Accessed 07/04/2022]. Available from: https://beta.bathnes.gov.uk/sites/default/files/Bath%20Report%20Aug%202020%20-%20Final%20edited.pdf [was BUS 2020]

B&NES Council. 2020d. *Population*. [Online]. [Accessed 07/04/2022]. Available from: https://www.bathnes.gov.uk/services/your-council-and-democracy/local-research-and-statistics/wiki/population

B&NES Council. 2020e. *Internal Staff Survey.* Unpublished.

B&NES Council. 2021a. *Bath with NES: Ambitious together for a fair, green, creative and connected city region. One Shared Vision*. [Online]. [Accessed 07/04/2022]. Available from: https://beta.bathnes.gov.uk/sites/default/files/Ambitious%20Together_Digital%20Report_Update%2021.06_7_Accessibility%20checked_Compressed_1.pdf

B&NES Council. 2021b. *Internal Staff Survey*. Unpublished.

B&NES Council. 2022. *Bath and North East Somerset Local Plan*. [Online]. [Accessed 16/12/2023]. Available from: https://beta.bathnes.gov.uk/bath-and-north-east-somerset-local-plan-2022-2042-launch-document/scope-and-content-local-plan

Bailey, J. 2008. First steps in qualitative data analysis: transcribing. *Family Practice*. **25**(2), pp.127-131.

Bamberg, S. 2013. *Changing environmentally harmful behaviors: A stage model of self-regulated behavioral change*. Journal of Environmental Psychology. **34**, pp.151-159.

Barr, S. and Prillwitz, J. 2014. *A Smarter Choice? Exploring the Behaviour Change Agenda for Environmentally Sustainable Mobility*. Environment and Planning C: Politics and Space. **32**(1), pp.1-19.

Bartle, C., and Chatterjee, K. 2019. Employer perceptions of the business benefits of sustainable transport: A case study of peri-urban employment areas in south west England. *Transportation Research Part A: Policy and Practice*, 126, 297–313. https://doi.org/10.1016/j.tra.2019.04.012

Behrens, R. and Mistro, R.D. 2010. Shocking habits: Methodological issues in analyzing changing personal travel behavior over time*. International Journal of Sustainable Transportation*, **4**(5), pp.253-271.

BetterPoints. 2023. *The behaviour change company for transport, health and climate.* [Accessed 10/12/2023]. Available from: https://www.betterpoints.ltd/

Bhandari, P. 2020. *Sampling Bias and How to Avoid It*. [Online]. [Accessed 29/04/2022]. Available from: https://www.scribbr.com/methodology/sampling-bias/

Bhandari, P. 2022. *Triangulation in Research*. [Online]. [Accessed 15/05/2023]. Available from: https://www.scribbr.co.uk/research-methods/triangulation-in-research/

Bhaskar, R. 1989. *Reclaiming Reality: A Critical Introduction to Contemporary Philosophy*. Routledge

Blom, B. and Morén, S. 2011. Analysis of Generative Mechanisms. *Journal of Critical Realism.* **1**, pp.60-79.

Braun, V. and Clarke, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology.* **3**, pp.77-101.

Burkinshaw, J. 2016. Employment Structures and Working Practices - What's Next for Travel Demand and Energy in Transport? In: Wadud, Z. and Marsden, G. (eds.) *Mobility and Energy Futures Series.* Leeds: Energy Leeds, University of Leeds.

Burkinshaw, J. 2018. *Commuting and the role of flexible working practices*. PhD thesis, University of Leeds.

Cass, N. and Faulconbridge, J. 2016. Commuting practices: New insights into modal shift from theories of social practice. *Transport Policy*. **45**, pp.1-14.

Caulfield, B. 2015. Does it pay to work from home? Examining the factors influencing working from home in the Greater Dublin Area. *Case Studies on Transport Policy*. **3**(2), pp.206–214.

Cavaye, A.L.M. 1996. Case study research: a multi-faceted research approach for IS. *Information Systems Journal*. **6**(3), pp.227-242.

Cellina, F., Bucher, D., Mangili, F., Veiga Simao, J., Rudel, R. and Raubal, M. 2019. A Large Scale, App-Based Behaviour Change Experiment Persuading Sustainable Mobility Patterns: Methods, Results and Lessons Learnt. *Sustainability*. **11**(2674), pp.1-23.

Chao Fong, L. 2022. *UK Covid: Boris Johnson announces end to restrictions in England*. [Online]. [Accessed 09/12/2023]. Available from: UK Covid: Boris Johnson announces end to restrictions in England – as it happened | Coronavirus | The Guardian

Chatterjee, K. 2016. *Life Events as Opportunities for Behavioural Change*. [Online]. [Accessed 20/04/2020]. Available from: https://travelbehaviour.files.wordpress.com/2016/05/life-events-presentation-at-ucl.pdf

Clark, T., Foster, L., Sloan, L. and Bryman, A. 2022. *Bryman's Social Research Methods*. 6th ed. Oxford: Oxford University Press

Cohen, D. and Crabtree, B. 2006a. *The Interpretivist Paradigm*. [Online]. [Accessed 29/04/2022]. Available from: http://www.qualres.org/HomeInte-3516.html

Cohen, D. and Crabtree, B. 2006b. *Lincoln and Guba's Evaluative Criteria*. [Online]. [Accessed 29/04/2022]. Available from: http://www.qualres.org/HomeLinc-3684.html

Coolen, H.C.C.H. 2012. Qualitative Methods in Housing Research. [Online]. [Accessed 29/04/2022]. Available from: https://www.sciencedirect.com/topics/social-sciences/positivism

Danermark, B. Ekstrom, M. Jakobsen and J. Ch Karlsson. 2002. *Explaining Society: Critical Realism in the Social Sciences*. London: Routlege

Daniel, E., Bardi, A., Fischer, R., Benish-Weisman, M. and Lee, J.A. 2022. Changes in Personal Values in Pandemic Times. *Social Psychological and Personality Science*. **13**(2), pp.572-582.

Darke, P., Shanks, G. and Broadbent, M. 1998. Successfully Completing Case Study Research: Combining Rigour, Relevance and Pragmatism. *Information Systems Journal*. **8**, pp.273-289.

Darnton, A. 2008. *Reference Report: An overview of behaviour change models and their uses*. [Online]. [Accessed 20/04/2020]. Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/498065/Behaviour_change_reference_report_tcm6-9697.pdf

Darnton, A. and Horne, J. 2013. *Influencing behaviours: a user guide to the ISM tool*. [Online]. [Accessed 20/04/2020]. Available from: https://www.gov.scot/publications/influencing-behaviours-moving-beyond-individual-user-guide-ism-tool/

Darnton, A., Verplanken, B., White, P. and Whitmarsh, L. 2011. *Habits, Routines and Sustainable Lifestyles: A summary report to the Department for Environment, Food and Rural Affairs*. [Online]. [Accessed 20/04/2020]. Available from: http://randd.defra.gov.uk/Document.aspx?Document=HabitsRoutinesSustainableLifestylesEVO502FinalSummaryReportNov2011(2).pdf

De Vos, J. 2020. The effect of COVID-19 and subsequent social distancing on travel behavior. *Transportation Research Interdisciplinary Perspectives*. **5**, pp.1-3.

Department for Transport. 2021. *Decarbonising Transport: A Better, Greener Britain*. [Online]. [Accessed 10/10/2022]. Available from: https://assets.publishing.service.gov.uk/media/610d63ffe90e0706d92fa282/decarbonising-transport-a-better-greener-britain.pdf

Department for Transport. 2022. *Transport Statistics Great Britain 2022*. [Online]. [Accessed 09/12/2023]. Available from: Transport Statistics Great Britain: 2022 Summary - GOV.UK (www.gov.uk)

Department for Transport. 2023a. *Transport and environment statistics*. [Online]. [Accessed 09/12/2023]. Available from: Transport and environment statistics: 2023 - GOV.UK (www.gov.uk)

Department for Transport. 2023b. *Walking and cycling statistics, England*. [Online]. [Accessed 09/12/2023]. Available from: Walking and cycling statistics, England: Introduction and main findings - GOV.UK (www.gov.uk)

Dobson, P. J. 2001. Longitudinal case research: A critical realist perspective. *Systemic practice and action research*, **14**(3), pp.283-296.

Donnellan, M.B., Oswald, F.L., Baird, B.M. and Lucas, R.E. 2006. The mini-IPIP scales: tiny-yet-effective measures of the Big Five factors of personality. *Psychological Assessment*. **18**(2), pp.192-203.

Dudovskiy, J. 2022. *Quantitative data analysis.* [Accessed 10/12/2022]. Available from: https://research-methodology.net/research-methods/data-analysis/quantitative-data-analysis/

Easton, G. 2010. Critical realism in case study research. *Industrial Marketing Management.* **39**(1), pp.118-128.

Edie. 2019. *Edinburgh commits to become 'net-zero' carbon city by 2030*. [Online]. [Accessed 07/04/2022]. Available from: https://www.edie.net/edinburgh-commits-to-become-net-zero-carbon-city-by-2030/

Edinburgh City Council. 2013. *Public and Accessible Transport Action Plan 2013 – 2020*. [Online]. [Accessed 07/04/2022]. Available from: https://www.edinburgh.gov.uk/downloads/file/26156/public-and-accessible-transport-action-plan

Edinburgh City Council. 2016. *2011 Census Travel to Work: Commuting into, out of and within the City of Edinburgh*. [Online]. [Accessed 07/04/2022]. Available from: https://www.edinburgh.gov.uk/downloads/file/24280/travel-to-work-flows-topic-report-for-edinburgh

Edinburgh City Council. 2020a. *City of Edinburgh Council Travel Behaviour Survey 2019*. [Online]. [Accessed 07/04/2022]. Available from: https://www.edinburgh.gov.uk/downloads/file/30187/edinburgh-travel-behaviour-survey-2019

Edinburgh City Council. 2020b. *City Mobility Plan, 2021-2030*. [Online]. [Accessed 07/04/2022]. Available from: https://democracy.edinburgh.gov.uk/documents/s31421/City%20Mobility%20Plan%20-%20Combined%20v2.pdf

Edinburgh City Council. 2022a. *Invest Edinburgh, Economy*. [Online]. [Accessed 07/04/2022] Available from: https://www.investinedinburgh.com/edinburgh/economy?documentId=40&categoryId=1

Edinburgh City Council. 2022b*. Low Emission Zone.* [Online]. [Accessed 07/04/2022]. Available from: https://www.edinburgh.gov.uk/lowemissionzone

Faulconbridge, J., Jones, I., Marsden, G. and Anable, J. 2020. Work, ICT and travel in multinational corporations: the synthetic work mobility situation. *New Technology, Work and Employment.* **35**(2), pp.1-20.

Felstead, A. 2012. Rapid Change or Slow Evolution? Changing Places of Work and Their Consequences in the UK. *Journal of Transport Geography.* **21**, pp.31–38.

Fitzgerald, P. 2009. *Edinburgh districts map.* [Online]. [Accessed 15/12/2021]. Available from: https://commons.wikimedia.org/wiki/File:Edinburgh_districts_map_OSM.png

Fjeldsoe, B.S., Marshall, A.L. and Miller, Y.D. 2009. Behaviour change interventions delivered by mobile telephone short-message service. *American Journal of Preventive Medicine.* **36**(2), pp.165-173.

Fletcher, A.J. 2017. Applying critical realism in qualitative research: methodology meets method. *International Journal of Social Research Methodology.* **20**(2), pp.181-194.

Fogg, B. J. 1997. Captology: the study of computers as persuasive technologies. *Human factors in computing systems: looking to the future.* New York: ACM New York.

Fogg, B.J. 2002. Persuasive technology: using computers to change what we think and do. *Ubiquity*. **2**, https://doi.org/10.1145/764008.763957

Fogg, B.J. 2009. *A Behavior Model for Persuasive Design*. [Online]. [Accessed 10/12/2-23]. Available from: https://www.demenzemedicinagenerale.net/images/mens-sana/Captology_Fogg_Behavior_Model.pdf

Fujii, S., Garling, T. and Kitamura, R. 2011. Changes in drivers' perception and use of public transportation: Effects of temporary structural change on cooperation in a real-life social dilemma. *Environment and Behavior*. **33**(6), pp.796-808.

Gardner, B. 2012. *How should we measure habit?* [Online]. [Accessed 15/12/2022]. Available from: https://www.slideshare.net/thereflectuk/bgs-newcastle-habit-measurement-talk-23-04-12

Gardner, B., Abraham, C., Lally, P. and de Bruijn. 2012. Towards parsimony in habit measurement: Testing the convergent and predictive validity of an automaticity subscale of the Self-Report Habit Index. *International Journal of Behavioral Nutrition and Physical Activity*. **9**(102), pp.1-12

George, T. 2022. *Semi-Structured Interview*. [Online]. [Accessed 14/12/2023]. Available from: https://www.scribbr.co.uk/research-methods/semi-structured-interviews/

Goldberg, L.R. 1999. A broad-bandwidth, public-domain, personality inventory measuring the lower-level facets of several five-factor models. In: In: Mervielde, I.D. (Ed*.), Personality psychology in Europe* Vol 7. Tilburg University Press, Tilburg, The Netherlands, pp. 7–28.

Goodwin, C. 2020. *What are the pros and cons of online survey research?* [Online]. [Accessed 10/12/2022]. Available from: https://meetingst.com/what-are-the-pros-and-cons-of-online-survey-research/

Goodwin, R., Gaines, S.O., Myers, L. and Neto, F. 2011. Initial Psychological Responses to Swine Flu. *International Journal of Behavioural Medicine*. **18**, pp.88-92.

Goscé, L. and Johansson, A. 2018. Analysing the link between public transport use and airborne transmission: mobility and contagion in the London underground. *Environmental Health*. **17**(84), pp.1-11.

Graham, S. and Thrift, N. 2007. Out of order. *Theory, Culture and Society*. **23**, pp.1-25.

Grant, A. 2019. *Doing Excellent Social Research with Documents: Practical Examples and Guidance for Qualitative Researchers*. London: Routledge.

Grossoehme, D. and Lipstein, E. 2016. Analyzing longitudinal qualitative data: the application of trajectory and recurrent cross-sectional approaches. *BMC Research Notes.* **9**(136), pp.1-5

Guell, C., Panter, J., Jones, N.R. and Ogilive, D. 2012. Towards a differentiated understanding of active travel behaviour: Using social theory to explore everyday commuting. *Social Science and Medicine*. **75**(1), pp.233-239.

Guiver, J. 2011. *Travel adjustments after road closure: Workington.* [Online]. [Accessed 20/04/2020]. Available from: http://clok.uclan.ac.uk/5254/1/Guiver-Workington2_5254.pdf

Halpern, D., Bates, C., Mulgan, G. and Aldridge, S. 2004. *Personal Responsibility and Changing Behaviour: the state of knowledge and its implications for public policy*. [Online]. [Accessed 19/07/2019]. Available from: https://webarchive.nationalarchives.gov.uk/+/http:/www.cabinetoffice.gov.uk/media/cabinetoffice/strategy/assets/pr2.pdf

Hardisty Jones Associates. 2020. *Bath & North East Somerset Employment Growth and Employment Land Review*. [Online]. [Accessed 07/04/2022]. Available from: https://beta.bathnes.gov.uk/sites/default/files/2020-11/BNES%20Employment%20Growth%20and%20Employment%20Land%20Review%20-%20Final%20Report%20v4.0.pdf

Harrington, D. and Hadjiconstantinou, M. 2022. Changes in commuting behaviours in response to the COVID-19 pandemic in the UK. *Journal of Transport & Health*. **24**, pp.1-10.

Harvey, L. 2022. *Researching the Real World*. [Online]. [Accessed 29/04/2022]. Available from: https://www.qualityresearchinternational.com/methodology/RRW8pt2pt2Positivismandsurveys.php

Head, K.J., Noar, S.M., Iannarino, N.T., Grant Harrington, N. 2013. Efficacy of text messaging-based interventions for health promotion: a meta-analysis. *Social Science and Medicine*. **97**, pp.41-48.

Hermanowicz, J.C. 2013. The Longitudinal Qualitative Interview. *Qualitative Sociology*. **36**, pp.189-208.

Hitchcock, G., Conlan, B., Kay, D., Brannigan, C. and Newman, D. 2014. *Air Quality and Road Transport: Impacts and solutions.* [Online]. [Accessed 20/07/2020]. Available from: https://www.racfoundation.org/assets/rac_foundation/content/downloadables/racf_ricardo_aea_air_quality_report_hitchcock_et_al_june_2014.pdf

IJsselsteijn W., de Kort Y., Midden C., Eggen B. and van den Hoven E. 2006. Persuasive Technology for Human Well-Being: Setting the Scene. In: IJsselsteijn W.A., de Kort Y.A.W., Midden C., Eggen B., van den Hoven E. (eds) *Persuasive Technology. PERSUASIVE 2006. Lecture Notes in Computer Science*. Springer, Berlin, Heidelberg

Institute for Government. 2022. *Timeline of UK government coronavirus lockdowns and restrictions.* [Online]. [Accessed 09/12/2023]. Available from: Timeline of UK government coronavirus lockdowns and restrictions | Institute for Government

Jariyasunant, J., Abou-Zeid, M., Carrel, A., Ekambaram, V., Gaker, D., Sengupta, R. and Walker, J.L. 2015. Quantified Traveller: Travel Feedback Meets the Cloud to Change Behaviour. *Journal of Intelligent Transportation Systems*. **19**(2), pp.109-124.

Jüttner, W. 2017. *An Introduction of Social Practice Theory in Environmental Policy: The Social Practice of Driving in The Netherlands.* Utrecht University, Student Thesis

Kang, H. 2021. Sample size determination and power analysis using the G*Power software. *Journal of educational evaluation for health professions*. doi: 10.3352/jeehp.2021.18.17.

Kaptein, M., Markopoulos, P., de Ruyter, B. and Aarts, E. 2015. Personalizing persuasive technologies: Explicit and implicit personalization using persuasion profiles. *International Journal of Human-Computer Studies.* **77,** pp.38-51.

Kim, C., Cheon, S.H., Choi, C.H. and Lee, H.J. 2017. Exposure to fear: changes in travel behavior during MERS outbreak in Seoul. *KSCE Journal of Civil Engineering*. **21**, pp.2888-2895.

King, L.M., Booth, C.A. and Lamond, J.E. 2014. *Benefits and limitations of social practice theory to evaluate practices in sustainable office buildings.* [Online]. [Accessed 10/12/2023]. Available from: https://www.arcom.ac.uk/-docs/proceedings/ar2014-0013-0022_King_Booth_Lamond.pdf

Konsult. 2016. *Konsult Policy Guidebook*. [Online]. [Accessed 17/08/2020]. Available from: http://www.konsult.leeds.ac.uk/pg/

Koziol-Nadolna, K. and Beyer, K. 2021. Determinants of the decision-making process in organizations. Procedia Computer Science. 192, pp.2375-2384.

Krouwel, M., Jolly, K. and Greenfield, S. 2019. Comparing Skype (video calling) and in-person qualitative interview modes - an exploratory comparative analysis. *BMC Med Res Methodol*. **19**(219), pp.1-9.

LaMorte, W.W. 2018. *The Transtheoretical Model (Stages of Change).* [Online]. [Accessed 25/07/2019]. Available from: http://sphweb.bumc.bu.edu/otlt/MPH-Modules/SB/BehavioralChangeTheories/BehavioralChangeTheories6.html

Latkin, C.A., Edwards, C., Davey-Rothwell, M.A. and Tobin, K.E. 2018. The relationship between social desirability bias and self-reports of health, substance use, and social network factors among urban substance users in Baltimore, Maryland. *Addictive Behaviour*, **73**, pp.133-136.

Lavrakas, P. 2008. *Repeated Cross-Sectional Design. Encyclopaedia of Survey Research Methods*. [Online]. [Accessed 29/04/2022]. Available from: https://methods.sagepub.com/reference/encyclopedia-of-survey-research-methods/n465.xml

Lawley, J. 2013. *Fogg Model of Behavioural Change*. [Online]. [Accessed 09/07/2021]. Available from: https://www.clean language.co.uk/articles/attachments/2013-08-17_Fogg_Model_of_ Behavior_Change.pdf

Le Vine, S., Polak, J. and Humphrey, A. 2017. *Commuting Trends in England: 1988-2015*. Department for Transport: London

Lincoln, Y, S. and Guba, E, G. 1985. *Naturalistic Inquiry*. Newbury Park, CA: Sage Publications.

Lingard, L. 2019. Beyond the default colon: Effective use of quotes in qualitative research. Perspect Med Educ. 8(6), pp.360-364.Line, T., Jain, J. and Lyons, G. 2011. *The role of ICTs in everyday mobile lives*. [Online]. [Accessed 16/12/2021]. Available from: https://core.ac.uk/reader/323897170

Longhurst, R. 2009. Interviews: In-Depth, Semi-Structured. *International Encylopedia of Human Geography,* pp.580-584

Lumivero. 2023. *Nvivo Software*. [Online]. [Accessed 16/12/2023]. Available from: https://lumivero.com/products/nvivo/

Lund Research. 2012. *Quota Sampling*. [Online]. [Accessed 29/04/2022]. Available from: https://dissertation.laerd.com/quota-sampling.php#:~:text=Disadvantages%20of%20quota%20sampling&text=It%20also%20means%20that%20it,only%20belong%20to%20one%20stratum.

Magezi, D.A. 2015. Linear mixed-effects models for within-participant psychology experiments. *Frontiers in Psychology*. **6**, pp.1-7

Malterud, K. 2001. Qualitative research: Standards, challenges and guidelines. *The Lancet*. **358**, pp.483-488.

Marsden, G. and Docherty, I. 2013. Insights on disruptions as opportunities for transport policy change. *Transportation Research Part A: Policy and Practice*. **51**, pp.46-55.

Marsden, G. and Docherty, I. 2021. Mega-disruptions and policy change: Lessons from the mobility sector in response to the Covid-19 pandemic in the UK. *Transport Policy*. **110**, pp.86-97.

Marsden, G., Anable, J., Chatterton, T., Docherty, I., Faulconbridge, J., Murrary, L., Roby, H. and Shires, J. 2020. Studying disruptive events: Innovations in behaviour, opportunities for lower carbon transport policy. *Transport Policy*. **94**, pp.89-101.

Marshall, B., Bizgan, L. and Gottfried, G. 2021. *All Change? Longitudinal travel tracker.* [Online]. [Accessed 09/12/2023]. Available from: All Change? longitudinal travel tracker (publishing.service.gov.uk)

Mason, J. 2002. *Qualitative Researching*. 2nd Edition, Sage Publications: London.

McCombes, S. 2019a. *Survey Research*. [Online]. [Accessed 29/04/2022]. Available from: https://www.scribbr.com/methodology/survey-research/

McCombes, S. 2019b. *Sampling Methods*. [Online]. [Accessed 29/04/2022]. Available from: https://www.scribbr.com/methodology/sampling-methods/

McSherry, M. 2020*. Edinburgh 4th In Europe In New Financial Centres Index*. [Online]. [Accessed 07/04/2022]. Available from: https://scottishfinancialreview.com/2020/09/25/edinburgh-4th-in-europe-in-new-financial-centres-index/ [previously Scottish financial review]

Merriam-Webster. 2020. *Disruption*. [Online]. [Accessed 05/08/2020]. Available from: https://www.merriam-webster.com/dictionary/disruption

Moher, D., Liberati, A., Tetzlaff, J. and Altman, D.G. 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Medicine*. **21**(6), 1000097.

Mohr, D.C., Schueller, S.M., Montague, E., Burns, M.N. and Rashidi, P. 2014. The Behavioral Intervention Technology Model: An Integrated Conceptual and Technological Framework for eHealth and mHealth Interventions. *Journal of Medical Internet Research*. **16**(6), pp.1-15.

Moon, K. and Blackman, D. 2014. A Guide to Understanding Social Science Research for Natural Scientists. *Conservation Biology*. **28**(5), pp.1167-1177.

Muench, F., van Stolk-Cooke, K., Kuerbis, A., Stadler, G., Baumel, A., Shao, S., McKay, J.R. and Morgenstern, J. 2017. A randomized controlled pilot trial of different mobile messaging interventions for problem drinking compared to weekly drink tracking. *PloS one.* **12**(2), pp.1-36.

Munch, E. 2020. Social norms on working hours and peak times in public transport. *Time & Society*. **29**(3), pp.836-865.

Narayanan, S. and Antoniou, C. 2022. Electric cargo cycles – A comprehensive review. *Transport Policy*. **116**, pp.278-303

National Records of Scotland. 2020. *City of Edinburgh Council Area Profile.* [Online]. [Accessed 07/04/2022]. Available from: https://www.nrscotland.gov.uk/files/statistics/council-area-data-sheets/city-of-edinburgh-council-profile.html

NatWest. 2022. *Edinburgh*. [Online]. [Accessed 07/04/2022]. Available from: https://jobs.natwestgroup.com/pages/edinburgh

NCH Software. 2023. *Express Scribe Transcription Software*. [Accessed 16/12/2023]. Available from: https://www.nch.com.au/scribe/index.html?kw=express%20scribe%20latest%20version&gclid=Cj0KCQiAsvWrBhC0ARIsAO4E6f9qybEY69UZWJsgdd2xJe8B6if7KVaHc2EMChIxvJeVPYi-KyTlZFoaAn0GEALw_wcB

Nel, H. 2016a. *Research Paradigms: Positivism*. [Online]. [Accessed 29/04/2022]. Available from: https://www.intgrty.co.za/2016/07/19/the-research-paradigms-positivism/

Nel, H. 2016b. *Research Paradigms: Interpretivism*. [Online]. [Accessed 29/04/2022]. Available from: https://www.intgrty.co.za/2016/08/15/research-paradigms-interpretivism/#:~:text=The%20interpretivist%20paradigm%20believes%20that,interact%20within%20their%20social%20environment

Nomis. 2011. *Bath and North East Somerset – Method of travel to work.* [Online]. [Accessed 07/04/2022]. Available from: https://www.nomisweb.co.uk/census/2011/QS701EW/view/1946157346?rows=cell&cols=rural_urban

Nutt, P. C. 2005. Comparing public and private sector decision-making practices. Journal of Public Administration Research and Theory. 16(2), pp.289-318.

Nutt, P.C. 1999. Public-Private Differences and the Assessment of Alternatives for Decision Making. Journal of Public Administration Research and Theory. 9(2), pp.305-350.

O'Brien, J. 2009. Sociology as an epistemology of contradictions. *Sociological Perspectives*. **52**, pp.5-22

O'Keefe, P., Caulfield, B., Brazil, W. and White, P. 2016. The impacts of telecommuting in Dublin. *Research in Transportation Economics*. **57**, pp.13-20.

O'Mahoney, J. and Vincent, S. 2014. Critical Realism as an Empirical Project: A Beginner's Guide. In Edwards, P., O'Mahoney, J. and Vincent, S. *Studying Organizations Using Critical Realism: A Practical Guide*. Oxford: Oxford University Press, pp.1-21.

Office for National Statistics. 2018. *Population projections.* [Online]. [Accessed 17/05/2020]. Available from: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections

Office for National Statistics. 2020. *Data and analysis*. [Online]. [Accessed 10/10/2020]. Available from: Home - Office for National Statistics (ons.gov.uk)

Office for National Statistics. 2022. *How industries have changed at a local level between censuses*. [Online]. [Accessed 10/12/2023]. Available from: How industries have changed at a local level between censuses - Office for National Statistics (ons.gov.uk)

Oinas-Kukkonen, H. and Harjumaa, M. 2008. A Systematic Framework for Designing and Evaluating Persuasive Systems. In: Oinas-Kukkonen, H., Hasle, P., Harjumaa, M., Segerståhl, K., Øhrstrøm, P. (eds) *Persuasive Technology. Lecture Notes in Computer Science*, vol 5033. Springer, Berlin, Heidelberg.

Oyibo, K. O., Orji, R. and Vassileva, J. 2017. Investigation of the Influence of Personality Traits on Cialdini's Persuasive Strategies. Proceedings of the Personalization in Persuasive Technology Workshop, *Persuasive Technology*, pp.8-20.

Pangbourne, K. and Masthoff, J. 2016. Personalised messaging for voluntary travel behaviour change: interactions between segmentation and modal messaging. In: *28th Annual Universities' Transport Study Group Conference,* Bristol, 6th–8th January 2016. Bristol, UTSG, pp.1-12.

Pangbourne, K., Bennett, S. and Baker, A. 2019. Attitude or personality? Tailoring messages for active travel. In: *31st Annual Universities' Transport Study Group Conference, Leeds, 8-10 July 2018*. Leeds, UTSG, pp.1-12.

Pangbourne, K., Bennett, S. and Baker, A. 2020. Persuasion profiles to promote pedestrianism: Effective targeting of active travel messages. *Travel Behaviour and Society*. **20**, pp.300-312

Parkes, S.D., Jopson, A. and Marsden, G. 2016. Understanding travel behaviour change during mega-events: Lessons from the London 2012 Games. *Transportation Research Part A: Policy and Practice*. **92**, pp.104-11

Partridge, J. 2020. *Royal Bank of Scotland changes name to NatWest.* [Online]. [Accessed 07/04/2022]. Available from: https://www.theguardian.com/business/2020/jul/22/royal-bank-of-scotland-changes-name-to-natwest

Paul, T., Chakraborty, R. and Anwari, N. 2022. Impact of COVID-19 on daily travel behaviour: a literature review. *Transportation Safety and Environment*. **4**(2), pp.1-17.

Pawson, R. and Tilley N. 1997. *Realistic Evaluation*. London: Sage Publications.

Peer, E., Brandimarte, L., Samat, S. and Acquisti, A. 2017. Beyond the Turk: Alternative platforms for crowdsourcing behavioural research. *Journal of Experimental Social Psychology*. **70**, pp.153-163.

Perloff, R. M. 2003. *The Dynamics of Persuasion: Communication and Attitudes in the 21st century*. 2nd ed. Mahwah, NJ: Erlbaum.

Prochaska, J. O. and DiClemente, C. C. 1982. Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice*. 19(3), pp.276-288.

Prolific. 2022. *Prolific*. [Online]. [Accessed 29/04/2022]. Available from: https://www.prolific.co/

RAC. 2022. *The Bath Clean Air Zone: What you need to know*. [Online]. [Accessed 07/04/2022]. Available from: https://www.rac.co.uk/drive/advice/emissions/the-bath-clean-air-zone-what-you-need-to-know/

Rainey, H. G., R. W. Backoff, and C. H. Levine. 1976. Comparing public and private organizations. Public Administration Review 36 (March/April): 233–44.

Ragin, C. 1994. The goals of social research. *Constructing social research*, pp.31-53.

Richter, J., Friman, M. and Gärling, T. 2011. Soft transport policy measures: gaps of knowledge and research needs*. International Journal of Sustainable Transportation.* **5**(1), pp.199-215.

Riley, W.T., Rivera, D.E., Atienza, A.A., Nilsen, W., Allison, S.M. and Mermelstein, R. 2011. Health behavior models in the age of mobile interventions: are our theories up to the task? *Translation Behavioral Medicine.* **1**(1), pp.53-71

Ritchie, J., Lewis, J. and Elam, G. 2003. Designing and selecting samples. In: Ritchie J, Lewis J, editors. *Qualitative research practice: a guide for social science students and researchers*. London: Sage, pp. 77–108

Roby, H. 2014. Understanding the development of business travel policies: Reducing business travel, motivations and barriers. *Transportation Research Part A: Policy and Practice,* **69**, pp.20-35.

Rodriguez, S. B., and D. H. Hickson. 1995. Success in decision making: Different organizations, different reasons for success. Journal of Management Studies 32 (5): 655–78.

Ruspini, E. 1999. Longitudinal research and the analysis of social change. *Quality and Quantity*. **33**, pp.219–227.

Saarijärvi, M, and Bratt, E.L. 2021. When face-to-face interviews are not possible: tips and tricks for video, telephone, online chat and email interviews in qualitative research. *European Journal of Cardiovascular Nursing*. **20**(4), pp.392-396.

Sadique, M.Z., Edmunds, W.J., Smith, R.D., Meerding, W.J., de Zwart, O., Brug, J. and Beutels, P. 2007. *Precautionary Behavior in Response to Perceived Threat of Pandemic Influenza. Emerging Infectious Diseases*. **13**(9), pp.1307-1313.

Sandelowski M. 1996. One is the liveliest number: the case orientation of qualitative research. *Res Nurs Health*. **19**(6), pp.525–529.

Saunders, M., Lewis, P. and Thornhill, A. 2009. *Understanding research philosophies and approaches*. [Online]. [Accessed 10/12/2021]. Available from: https://www.researchgate.net/publication/309102603_Understanding_research_philosophies_and_approaches

Sayer, A. 1992. *Method in Social Science: A Realist Approach.* London: Routledge.

Sayer, A. 2000. *Realism and social science*. London: Sage Publications.

Schatzki, T. R. 1996. *Social Practices: A Wittgensteinian Approach to Human Activity and the Social*. Cambridge: Cambridge University Press.

Scotland Census. 2011. *Scotland's Census*. https://www.scotlandscensus.gov.uk/webapi/jsf/tableView/tableView.xhtml

Scottish Parliament. 2023. *Timeline of Coronavirus (COVID-19) in Scotland*. [Online]. [Accessed 09/12/2023]. Available from: Timeline of Coronavirus (COVID-19) in Scotland – SPICe Spotlight | Solas air SPICe (spice-spotlight.scot)

Schwenk, G. 1990. Conflict in organizational decision making: An exploratory study of its effects in for-profit and not-for-profit organizations. Management Science 26 (4): 436–48

Shibayama, T., Sandholzer, F., Laa, B. and Brezina, T. 2021. Impact of COVID-19 lockdown on commuting: a multi-country perspective. *ETJIR*. **21**(1), pp.70-93.

Shove, E. 2003. *Comfort, Cleanliness and Convenience: the Social Organization of Normality*. Berg: Oxford.

Shove, E., Pantzar, M. ans Watson, M. 2012. *The dynamics of social practice: Everyday life and how it changes*. SAGE Publications Ltd.

Smith, C. and Elger, T. 2014. Critical Realism and Interviewing Subjects. In Edwards, P., O'Mahoney, J. and Vincent, S. *Studying Organizations Using Critical Realism: A Practical Guide.* Oxford: Oxford University Press, pp.148-168

Spencer, E.A., Brassey, J. and Mahtani, K. 2017. *Catalogue of Bias: Recall Bias.* [Online]. [Accessed 29/04/2022]. Available from: https://catalogofbias.org/biases/recall-bias/

SPSS Statistics. 2023. *IBM SPSS Statistics*. [Accessed 16/12/2023]. Available from: https://www.ibm.com/products/spss-

statistics?utm_content=SRCWW&p1=Search&p4=43700077577384501&p5=e&gclid=Cj0KCQiAsvWrBhC0ARIsAO4E6f9EQP-B2Nc2CMWn_veVpDARw4w8uIF0RaCiRlrX9A_uMdG8OR8gnfQaAhhHEALw_wcB&gclsrc=aw.ds

Stake, R. E. 1995. *The art of case study research.* Sage Publications, Inc.

Statistics, 2022. *Holm-Bonferroni Method*. [Online]. [Accessed 10/12/2021]. Available from: https://www.statisticshowto.com/holm-bonferroni-method/

Stopher, R. 2004. Reducing road congestion: a reality check. *Transport Policy*. **11**(2), pp.117-131.

Sturcke, J. 2008. *Manchester says no to congestion charging*. [Online]. [Accessed 18/07/2020]. Available from: https://www.theguardian.com/politics/2008/dec/12/congestioncharging-transport

Sunio, V. and Schmöcker, J.D. 2017. Can we promote sustainable travel behavior through mobile apps? Evaluation and review of evidence. *International journal of sustainable transportation*. **11**(8), pp.553-566.

Thompson, R. 2020. *Covid-19 and traffic volumes in Edinburgh*. [Online]. [Accessed 07/04/2022]. Available from: https://blogs.ed.ac.uk/roythompson/2020/08/04/covid-19-and-traffic-volumes-in-edinburgh/

Tolbert, P.S. and Hall, R.H. 2008. Organizations: Structures, Processes and Outcomes. 10th ed. Routledge

Tommasetti, A., Singer, P., Troisi, O. and Maione, G. 2018. Extended Theory of Planned Behaviour (ETPB). *Sustainability*, **10**(7), 2580.

TomTom. 2022. *TomTom traffic index.* Amsterdam: TomTom.

Transport Focus. 2021. *Covid-19*. [Online]. [Accessed 14/12/2023]. Available from: https://www.transportfocus.org.uk/topics/covid-19/

Transport for London. 2013. *Olympic Legacy Monitoring: Personal Travel Behaviour During the Games.* [Online]. [Accessed 10/12/2023]. Available from: https://content.tfl.gov.uk/olympic-legacy-personal-travel-report.pdf

Transport Scotland. 2021a. *COVID-19 Transport Trend Data*. [Online]. [Accessed 09/12/2023]. Available from: COVID-19 Transport Trend Data - 30 August - 5 September 2021 | Transport Scotland

Transport Scotland. 2021b. *COVID-19 Public Attitudes Survey Data*. [Online]. [Accessed 14/12/2023]. Available from: https://www.transport.gov.scot/publications/?topic=4f6d00b5-fccf-4e32-8023-21db9f7bddd1&q=attitudes

Travelwest. 2020. *Joint Local Transport Plan 4 2020-2036*. [Online]. [Accessed 08/04/2022]. Available from: https://travelwest.info/app/uploads/2020/05/JLTP4-Adopted-Joint-Local-Transport-Plan-4.pdf

UC Berkeley Statistics. 2023. *Type I and Type II errors.* [Online]. [Accessed 10/10/2023]. Available from: https://www.stat.berkeley.edu/~hhuang/STAT141/Lecture-FDR.pdf

UCLA. 2021. *Introduction to Linear Mixed Models*. [Online]. [Accessed 16/12/2023]. Available from: Introduction to Linear Mixed Models (ucla.edu)

University of Bath. 2020. *Working with partners for the renewal of the region's economy.* [Online]. [Accessed 07/04/2022]. Available from: https://www.bath.ac.uk/announcements/working-with-partners-for-the-renewal-of-the-regions-economy/

University of Leeds. 2016. *ADAPT – Sustainable Behaviour Change*. [Online]. [Accessed 14/12/2020]. Available from: https://environment.leeds.ac.uk/transport-research/dir-record/research-projects/726/adapt-sustainable-behaviour-change

Urban Transport Group. 2022. *What's happening on travel trends.* [Online]. [Accessed 09/12/2023]. Available from: What's happening on travel trends 0710 (urbantransportgroup.org)

Vasileiou, K. Barnett, J., Thorpe, S. and Young, T. 2018. Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC Medical Research Methodology.* **18**(148), pp.1-18.

Verplanken, B. and Holland, R. W. 2002. Motivated decision making: Effects of activation and self-centrality of values on choices and behavior. *Journal of Personality and Social Psychology*, **82**(3), pp. 434–447.

Verplanken, B. and Roy, D. 2016. Empowering interventions to promote sustainable lifestyles: Testing the habit discontinuity hypothesis in a field experiment. *Journal of Environmental Psychology*. **45**, pp.127-134.

Verplanken, B. and Wood, W. 2006. Interventions to break and create consumer habits. *Journal of Public Policy and Marketing*. **25**(1), pp.90-103.

Verplanken, B., Walker, I., Davis, A. and Jurasek, M. 2008. Context change and travel mode choice: Combining the habit discontinuity and self-action hypotheses. *Journal of Environmental Psychology*. **28**(2), pp.121-127.

Vogl, S. 2013. Telephone Versus Face-to-Face Interviews: Mode Effect on Semistructured Interviews with Children. *Sociological Methodology*. **43**(1), pp.133-177.

Wang, K.Y. 2014. How change of public transportation usage reveals fear of the SARS virus in a city. *PLoS One.* **9**(3), pp.1-26

Waugh, L. 2021. *Traffic surpasses pre-pandemic levels in Scotland.* [Online]. [Accessed 07/04/2022] Available from: https://news.siemens.co.uk/news/traffic-surpasses-pre-pandemic-levels-in-scotland

Webb, T., Joseph, J., Yardley, L. and Michie, S. 2010. Using the Internet to Promote Health Behaviour Change: A Systematic Review and Meta-Analysis of the Impact of Theoretical Basis, Use of Behaviour Change Techniques, and Mode of Delivery on Efficacy. *Journal of Medical Internet Research*. **12**(1), pp.1-18.

Wiafe, I. 2012. *A framework for designing persuasive technology*. University of Ghana, PhD Thesis.

Williams, D., Chatterton, T. and Parkhurst, G. 2012. Using disruption as an opportunity to change travel practices. In: *1st International Conference on Urban Sustainability and Resilience*, 5-6 November 2012, London, UK. London: UCL, pp.1-14.

Yamamoto, M. 1997. Strategic decisions and corporate governance in Japan. In Strategic decisions, ed. V. Papadakis and P. Barwise. Boston: Kluwer

Yin, R. 2009. *Case Study Research: Design and Methods*. 4th Edition, Sage: Thousand Oaks

Yu, K. and Li, H. 2016. Mechanism of Persuasive Experience-A New Design and Evaluation Framework of Persuasive Systems. In: Marcus A. (eds) *Design, User Experience, and Usability: Novel User Experiences.* DUXU 2016. Lecture Notes in Computer Science, vol 9747. Springer, Cham

Zhao, X., Strasser, A., Cappella, J.N., Lerman, C. and Fishbein, M. 2011. A measure of perceived argument strength: reliability and validity. *Commun. Methods Meas.* **5**(1), pp.48–75.

Appendices

Appendix 1. Employee survey questions

Participant Information

Do you live in the United Kingdom?

- ○ Yes
- ○ No

Are you aged 18 or over?

- ○ Yes
- ○ No

Current behaviour

First, we would like to ask you some questions about your **current** work and travel behaviour (i.e. during a recent typical week)

Work pattern

Are you working full-time or part-time at your current employer?

- ○ Full-time
- ○ Part-time
- ○ Other

If you selected "Other", please specify:

Home working

Does your employer allow you to **work from home**?

- ○ Yes
- ○ No

Do you know why you are not allowed to work from home?

- ○ My work can only be performed on site
- ○ My employer does not support home working
- ○ Don't know
- ○ Other

If you selected Other, please specify:

In a typical week, how many days do you currently **work from home**?

- ○ Once a week
- ○ Twice a week
- ○ Three times a week
- ○ Four times a week
- ○ Five or more times a week
- ○ Less than once a week (e.g. once or twice a month)
- ○ I never or very rarely work from home

How **satisfied** are you with **working from home**?

- ○ Extremely dissatisfied
- ○ Somewhat dissatisfied
- ○ Neither satisfied nor dissatisfied
- ○ Somewhat satisfied
- ○ Extremely satisfied

If you have any comments, please leave them below.

Has your amount of home working changed compared to your pre Covid-19 home working?

- ○ I now work from home more compared to my pre Covid-19 home working
- ○ I now work from home less compared to my pre Covid-19 home working
- ○ I now work from home roughly the same amount compared to my pre Covid-19 home working
- ○ I did not work from home before Covid-19 and I do not work from home now

Travel to work

Which means of transport do you typically use **to travel to and from work**? Please select the MAIN mode used for the duration of your journey. If you use different modes of transport on different days, please select "Other" and specify the modes used and frequency of each mode in a typical week (e.g. Car x3, Bus x2)

- ○ Car
- ○ Electric car
- ○ Bus
- ○ Train
- ○ Tram
- ○ Park & Ride
- ○ Car share/pool
- ○ Bicycle (including bike sharing)
- ○ E-bicycle
- ○ Walk all the way
- ○ Motorcycle
- ○ Not applicable - I work entirely from home
- ○ Other

How many days in a **typical week** do you usually **travel to work**?

- ○ Once a week
- ○ Twice a week
- ○ Three times a week
- ○ Four times a week
- ○ Five or more times a week
- ○ Less than once a week (e.g. once or twice a month)
- ○ I never or very rarely travel to work

How **satisfied** are you with **your current commute**?

- ○ Extremely dissatisfied
- ○ Somewhat dissatisfied
- ○ Neither satisfied nor dissatisfied
- ○ Somewhat satisfied
- ○ Extremely satisfied

If you have any comments, please leave them below.

The way I **travel to work** is something...

Please don't select more than 1 answer(s) per row.

	Strongly disagree	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree	Strongly agree
I do automatically	▢	▢	▢	▢	▢	▢	▢
I do without having to consciously remember	▢	▢	▢	▢	▢	▢	▢
I do without thinking	▢	▢	▢	▢	▢	▢	▢
I start doing before I realise I am doing it	▢	▢	▢	▢	▢	▢	▢

Are you thinking about changing the way you typically travel to work?

- ○ No plans to change
- ○ Have been thinking about making a change
- ○ Want to change, but not able to
- ○ Have recently made a change

If you have recently made a change or would like to make a change, please specify the change below.

How long does it take you on average to travel to your MAIN place of work by the means of transport that you most often use?

Please don't select more than 1 answer(s) per row.

	0-14min	15-29min	30-44min	45-59min	60-89min	90-119min	120min+
Journey time	▢	▢	▢	▢	▢	▢	▢

When do you normally depart from your home?

Please don't select more than 1 answer(s) per row.

	Before 7am	7am-7.30am	7.30am - 8am	8am-8.30am	8.30am-9am	9am-10am	After 10am	Time varies e.g. shift work
Departure time	▢	▢	▢	▢	▢	▢	▢	▢

Attitudes

Next, we would like to ask a few questions about your attitudes.

Thinking about a year from now, to what extent do you agree or disagree with the following regarding the long-term impact on your travel behaviour?

I will be avoiding public transport and using my car or other vehicle more than I did before Covid-19.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree
- ○ Don't know
- ○ Not applicable

I will be doing all of the things I did before Covid-19 including vacations and travel.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree
- ○ Don't know
- ○ Not applicable

I expect to be working from home more often than before Covid-19.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree
- ○ Don't know
- ○ Not applicable

I will be walking or cycling more than before Covid-19.

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree
- ○ Don't know
- ○ Not applicable

Personal details

Finally, we would like to ask just a few more questions about yourself.

How would you describe your gender?

- ○ Female
- ○ Male
- ○ Other
- ○ Prefer not to say

In which of these age groups are you?

- ○ 18-24
- ○ 25-34
- ○ 35-49
- ○ 50-64
- ○ 65+

Do you have any of the following in your household? Please select **ALL** that apply.

- ☐ Children aged 4 or under (pre-school age)
- ☐ Children aged 4 - 16 (school age)
- ☐ Persons aged 70 or above
- ☐ None of the above

What is the highest level of educational qualification you hold (or are currently studying towards)?

- ○ GCSE / N5 / O-level or BTEC / NVQ
- ○ A-level, Higher, Advanced Higher or equivalent
- ○ Professional qualification
- ○ Bachelor's degree or equivalent
- ○ Master's degree / postgraduate
- ○ Doctoral degree
- ○ Prefer not to answer

How would you broadly classify your job?

- ○ Manager
- ○ Professional
- ○ Technician and/or Associate Professional
- ○ Clerical Support
- ○ Services and/or Sales
- ○ Cleaner and/or Helper

What was your individual annual income pre tax in 2021?

- ○ Up to £9,999
- ○ £10,000 to £19,999
- ○ £20,000 to £29,999
- ○ £30,000 to £39,999
- ○ £40,000 to £49,999
- ○ £50,000 to £59,999
- ○ £60,000 to £69,999
- ○ £70,000 to £79,999
- ○ £80,000 to £89,999
- ○ £90,000 to £99,999
- ○ £100,000 or above
- ○ Prefer not to answer

Do you have any of the following? Please select **ALL** that apply.

- [ ] A full driving licence
- [ ] A car available to you most of the time
- [ ] A bicycle (including electric bicycle)
- [ ] Other private vehicle
- [ ] A public transport route which can take you to work
- [ ] None of the above

What is the postcode of the place where you lived PRIOR to the COVID-19 outbreak? *If you prefer not to say, please leave this question blank.

What is the postcode of the place where you CURRENTLY live? *If you prefer not to say, please leave this question blank.

Appendix 2. Interview topic guides

Example practitioner topic guide (wave one)

Introductions	• No right and wrong answers, interested in learning about your own experience and opinions in relation to your job role.

Theme 1: Pre pandemic	• To start off with, could you please describe your role at x organisation?
	• How long have you worked at x organisation?
	• Thinking back to before Covid, can you please describe the office space, including where your offices were located, and where employees worked?
	  ○ Policies around flexible/home working?
	  ○ Hotdesking?
	• Again, thinking back to before the Covid outbreak, what sort of work did your organisation undertake in relation to staff travel planning for employees?
	  ○ What were your responsibilities relating to this?
	• Did x organisation have any specific staff travel planning commitments prior to Covid?
	  ○ What were your responsibilities relating to this?
	• Can you please describe any of the pre Covid employer initiatives/ support available to employees to encourage environmentally friendly commuting to offices?
	  ○ Uptake of initiatives?
	• Any recognised barriers to encouraging environmentally sustainable commuting (i.e. reducing the number of private cars driving to work) to offices?
	• Parking arrangements for staff?

Theme 2: Post pandemic	Next, I would like to talk about staff travel from the first national lockdown in March 2020, up until now. • How was your role affected by the lockdowns? • Key changes to staff travel as a result of Covid-19? • From the first lockdown up until now, any challenges regarding staff travel to work? ○ Parking arrangements or locations affected? • Similarly, could you please describe any challenges you or colleagues have had to deal with regarding supporting the increase in home working?

Theme 4: Future	Finally, I'd like to talk about future plans regarding employees' travel.
	• Any decisions made by regarding employees returning to the office, or continuing to work from home?
	  ○ What decisions have been made?
	  ○ Will staff have a choice in where they can work?
	• We've already discussed pre-Covid plans regarding staff travel. I'm wondering if there have been any changes to these plans since the outbreak of Covid?
	  ○ What are the changes?
	  ○ Is Covid the cause of any changes?
	• Could you please talk about the planned future initiatives to promote environmentally sustainable commuting?

Example subject topic guide (wave one)

Introductions	• Could you please describe your work at your employer? • How long have you worked at your employer?

Theme 1: Pre pandemic	I am interested in understanding about your typical work and travel behaviour prior to the Covid-19 pandemic.
	<u>1a. Work</u>
	• Before the Covid outbreak, access to flexible working arrangements, for example in terms of the hours you worked, and where you worked?
	  ○ Hours worked
	  ○ Where you worked
	• How often did you work with your fellow colleagues? Interaction mainly face to face, online, or a mix?
	• When you worked at home, what was your working from home set up like?
	  ○ Office set up e.g. desk, monitor, computer chair
	  ○ ICTs e.g. cloud computing, video conferencing, email, internet access
	• How did you feel about your pre Covid working arrangements?
	
	<u>1b. Travel</u>
	• Thinking back to before the Covid-19 outbreak, could you please describe your typical journeys to and from work, for example how you travelled and how long journeys took?

	○ Distance from home to workplace ○ Any variance in the way travelled to work? ○ Travel alone or with others? • What do you think where the main reasons for why you used that mode(s) of transport? • Ever considered choosing a different mode of transport to travel to work? ○ What change were you considering? ○ What stopped you from making a change? • Aware of any employer initiatives or support available to encourage environmentally sustainable commuting (e.g. not using a private car)? ○ Did you ever consider using these initiatives? <u>1c. Household</u> • Could you please describe your household before the Covid outbreak, including the type of dwelling you lived in and who you lived with? • Did you have any dependents you cared for (e.g. children or elderly relatives)? ○ Did caring responsibilities have an impact on the way you chose to travel to and from work (e.g. school run)? What was this impact? • Did you partake in any recreational activities, such as exercise, hobbies or shopping, which had an impact on the way you chose to travel to and from work?
Theme 2: Lockdowns and in between	Next, I would like us to talk about your work and travel behaviour from the first national lockdown in March 2020, up until the most recent lockdown. <u>2a. Work</u> • Please describe what happened to working arrangements from the first lockdown up until the most recent lockdown, for example where you worked, and how you worked with colleagues? ○ Work location ○ Work with colleagues ○ Technologies • Working from home set up, and did this change at all throughout the lockdowns? ○ Equipment purchase • Did you go back to your workplace at any point? ○ How had the workplace changed? How did you feel about going back to the workplace? • Overall, how did you feel about your lockdown working arrangements? <u>2b. Travel</u> • (If travelled into work): any differences in travelling to work compared to your pre Covid travel? What was different? <u>2c. Household</u> • Did you move house or did your household or living arrangements change at all since the first lockdown? ○ Describe any changes in household/living arrangements ○ Changes impacted travel to work options? • Did you have any dependents you cared for during the lockdowns? ○ Did these responsibilities affect your working arrangements? How?
Theme 3: Current behaviour e.g. within the past week	<u>3a. Work</u> • Current working arrangements in terms of where and how you work? ○ Work hours ○ Work location ○ Work with colleagues ○ Technologies • How do you feel about your current working arrangements? <u>3b. Travel</u> • Are you currently travelling into the office? ○ Mode(s) of transport ○ How often are you travelling into the office? ○ Are you content with your travel to and from work? ○ What do you think are the main reasons for why you use your current mode(s) of transport? <u>3c. Household</u> • Any changes to household or living arrangements since the most recent lockdown? ○ Describe any changes in household/living arrangements ○ Have changes impacted travel to work options? • Do any of your current household responsibilities impact the way you choose to travel to and from work (if travelling to work)?

Theme 4: Future	<u>4a. Work</u>
	• What would you like to see in the future regarding your working arrangements?
	  ○ Work location
	  ○ Work hours
	  ○ Work with colleagues
	
	<u>4b. Travel</u>
	• If you could choose from any transport mode, what would be your preferred way to travel to and from work?
	  ○ How would you feel about using public transport (e.g. bus or train) to get to work?
	  ○ How would you feel about walking or cycling, including using an electric bike, to get to work?
	  ○ How would you feel about car sharing to get to work?
	• Do you think it is important to reduce the amount of private vehicles driving to your workplace?
	  ○ Why do you think this is important? / Why don't you think this is important?
	• How do you think your workplace could help to support you and other colleagues in travelling to work in an environmentally sustainable way?

Appendix 3. Ethics documents

Ethical approval

AREA 20-025 Amd August 2021 - Approval

ResearchEthics <researchethics@leeds.ac.uk>
Fri 03/09/2021 10:16
To:Rosie Samuel <ts17rss@leeds.ac.uk>
Cc:Kate Pangbourne <K.J.Pangbourne@leeds.ac.uk>;ResearchEthics <researchethics@leeds.ac.uk>

Dear Rosie

AREA 20-025 Amd August 2021 - Messaging for environmentally sustainable commuting post disruption

NB: All approvals/comments are subject to compliance with current University of Leeds and UK Government advice regarding the Covid-19 pandemic.

Many thanks for confirming. I am pleased to inform you that the above research ethics application has been reviewed by the School of Business, Environment and Social Services (AREA) Committee and on behalf of the Chair, I can confirm a favourable ethical opinion based on the documentation received at date of this email.

Please retain this email as evidence of approval in your study file.

Please notify the committee if you intend to make any amendments to the original research as submitted and approved to date. This includes recruitment methodology; all changes must receive ethical approval prior to implementation. Please see https://ris.leeds.ac.uk/research-ethics-and-integrity/applying-for-an-amendment/ or contact the Research Ethics Administrator for further information researchethics@leeds.ac.uk if required.

Ethics approval does not infer you have the right of access to any member of staff or student or documents and the premises of the University of Leeds. Nor does it imply any right of access to the premises of any other organisation, including clinical areas. The committee takes no responsibility for you gaining access to staff, students and/or premises prior to, during or following your research activities.

Please note: You are expected to keep a record of all your approved documentation, as well as documents such as sample consent forms, risk assessments and other documents relating to the study. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited.

It is our policy to remind everyone that it is your responsibility to comply with Health and Safety, Data Protection and any other legal and/or professional guidelines there may be.

I hope the study goes well.

Best wishes
Georgina Hough
On behalf of Dr Matthew Davis, CHAIR, AREA

Employee survey participant information sheet and consent form

University of Leeds Commuting Survey 2022

Participant Information

Participant Information Sheet

1. Research title

Messaging for environmentally sustainable commuting post disruption

2. What is the purpose of this research?

You are being invited to participate in a study developed by researchers at the Institute for Transport Studies of the University of Leeds. This research aims to understand the behavioural impacts of Covid-19 disruption on commuter travel (including walking, cycling, and working from home) in the United Kingdom.

3. What will the research involve for me?

- In this survey, we will ask you some questions about you as well as your travel to work and/or working from home behaviour and attitudes in relation to Covid-19 disruption.
- This survey will take approximately 5-10 minutes to complete. The survey is best completed on a computer or tablet but can also be completed via your smartphone.

4. What are the possible benefits of taking part?

- Any insights we can gain from your participation will be extremely useful in explaining any change of behaviour and attitudes amid Covid-19 disruption. We will be working with employers and policy makers to better understand how organisations can respond to major disruptive events and support employees, both now and in the future.
- We will conduct a raffle game when the survey is finished to show our gratitude for your participation and two winners will be selected, each winning a voucher worth £50. You will be entitled the right to join this draw if you complete this survey.

5. Am I eligible to participate in this survey?

This survey is only for UK-based individuals who are aged 18 or over.

6. Do I have to take part and can I withdraw my response from the research?

Participating in this study is entirely voluntary. You are free to not participate in this research at all. If you have already started the survey but later on do not want to continue anymore regardless of the reason, you have the right to exit at any point of the survey and we will delete your response from the

dataset. There will be no consequences for failing to complete the survey. Once you have submitted your completed survey responses, you will be able to withdraw your data until 01/04/2022. After this date, it is not possible to withdraw your data. If you wish to withdraw your data, please contact Rosie Samuel: ts17rss@leeds.ac.uk.

7. Will my taking part in the research be kept confidential and how will the data be processed?

Please bear in mind that no personally identifiable information, apart from your email address, will be required throughout the data collection. You will be asked to leave your email address to be registered for the raffle game. If you are willing to provide your email address, this information will be deleted after the entire data collection is finished. This data collection and research work is for our academic use only. Publication of research outputs will only take place after thorough anonymisation and will not disclose any personally identifiable information. The University of Leeds Research Privacy Notice can be downloaded here.

8. Ethical approval

The research has been reviewed and approved by the University Research Ethics Committee of the University of Leeds, with the ethics reference AREA 20-025 and permission has been obtained to circulate this survey.

9. What if I have any questions?

We very much appreciate your valuable input. If you require more information about this research or have any questions about the survey, please contact Rosie Samuel (leader of this research) at ts17rss@leeds.ac.uk.

Informed Consent I have read the Participation Information Sheet and clearly understand what will be involved in the survey, the risks and benefits of participation, how the data will be protected and used and the voluntary nature of taking part. Hence, I am giving my consent to take part in this survey.

- ○ Yes, I would like to participate
- ○ No, I do not wish to participate

Interview participant information sheet

Institute for Transport Studies

UNIVERSITY OF LEEDS

Participant Information Sheet

Messaging for environmentally sustainable commuting post disruption

You are being invited to take part in a research project. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the project?

The overall aim of this study is to understand the behavioural impacts of Covid-19 disruption on commuter travel (including walking, cycling, and working from home) in the United Kingdom. The research will help to inform the development of sustainable transport policy, alongside offering guidance for employers on how to encourage and enable environmentally sustainable commuting post Covid-19 disruption. The duration of this project is from 01/10/2019 – 01/09/2022.

Why have I been chosen?

You have been chosen to participate as you have previously completed the University of Leeds Covid-19 Travel Survey as part of this study.

Do I have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw prior to 31/05/2021 without it affecting any benefits that you are entitled to in any way. You do not have to give a reason.

What do I have to do?

Taking part in this stage of the research will involve participating in one interview. The interview will be conducted via Microsoft Teams, a secure technology able to conduct and record interviews (or alternatively via telephone). The interview will occur at a time and place which is convenient to you and will involve you responding to questions about your travel to work and/or working from home behaviour and attitudes. The interview will be recorded with your permission and will last around 30-60 minutes.

What are the possible disadvantages and risks of taking part?

No risk or harm to you is anticipated if you participate in this research.

What are the possible benefits of taking part?

You will be entitled to an e-voucher of your choice worth £15 for completing this interview. In addition, it is hoped that this work will generate detailed insight into how the societal and economic disruptions have impacted on employees and how employers can support employees and enable environmentally sustainable commuting (including telecommuting) post disruption.

Use, dissemination, and storage of research data

To ensure a high quality and accurate record of the interview is made, the researcher would like to record the interview. This recording will be used only for analysis and will be transferred after the interview onto the University's secure OneDrive system and the original recording destroyed. No other use will be made of the recording, and no one outside of the University of Leeds research team will be allowed access to the recording.

Will my taking part in this project be kept confidential?

All the information that we collect about you during the course of the research will be kept strictly confidential and will only be accessible to members of the University of Leeds research team. You will not be able to be identified, with all interview transcripts appropriately anonymised.

What will happen to the results of the research project?

The anonymised results of the research will be published as a thesis which will be seen by academic staff members at the University of Leeds. The results will also feature in academic publications and conference presentations. The data collected during the course of the project will not be used for any additional or subsequent research.

Who is organising/ funding the research?

The research is funded by the Engineering and Physical Sciences Research Council (EPSRC) hosted at the University of Leeds.

Contact for further information

If you require any further information please contact the researcher Rosie Samuel (ts17rss@leeds.ac.uk) or the supervisor Dr Kate Pangbourne (K.J.Pangbourne@leeds.ac.uk).

Thank you for reading this information sheet and considering taking part in the Messaging for environmentally sustainable commuting post disruption project at the University of Leeds. You may keep this copy, and if you agree to participate in the interview, you will be asked to sign a consent form.

Interview consent form

Institute for Transport Studies

UNIVERSITY OF LEEDS

Consent to take part in 'Messaging for environmentally sustainable commuting post disruption' research project

	Add your initials next to the statements you agree with
I confirm that I have read and understand the Participant Information Sheet dated 07/09/2020 explaining the research project and I have had the opportunity to ask questions about the project.	
I agree for the data collected from me to be stored on the University of Leeds' secure OneDrive system and deleted once the thesis has been submitted on 30/09/2022.	
I understand that taking part in the project will include being interviewed and video-recorded via Microsoft Teams OR audio-recorded via telephone with my permission.	
I agree to take part in the research project and will inform the lead researcher should my contact details change during the project and, if necessary, afterwards.	

Name of participant	
Participant's signature	
Date	
Name of researcher	
Signature	
Date	

Project title	*Document type*	*Version #*	*Date*
Messaging for environmentally sustainable commuting post disruption	Consent form	1.0	07/09/2020

Appendix 4. Messaging survey

Messaging survey questions

1. Informed Consent

I have read the Participation Information Sheet and clearly understand what will be involved in the survey, the risks and benefits of participation, how the data will be protected and used and the voluntary nature of taking part. Hence, I am giving my consent to take part in this survey. *

- ○ Yes, I would like to participate
- ○ No, I do not wish to participate

2. To begin, please enter your Prolific ID into the box and then click 'Next Page'. It is very important that you enter your correct ID. We can only pay participants whose Prolific IDs entered here match the Prolific IDs submitted through Prolific. Your Prolific ID has 24 alphanumeric characters. It is not your email address.
*

3. Do you live in the United Kingdom? *

- ○ Yes
- ○ No

4. Are you aged 18 or over? *

- ○ Yes
- ○ No

5. What is your gender?

- ○ Male
- ○ Female
- ○ Other
- ○ Prefer not to say

6. In which of these age groups are you?

- ◯ 18-29
- ◯ 29-39
- ◯ 39-49
- ◯ 49-59
- ◯ 59-69
- ◯ 70+

7. Please enter the first section of your UK post code (e.g. L1 / S11 / EX20)

8. Approximately how many journeys under 2 miles (3.2 kilometres) have you done in the past week?

- ◯ Less than 5
- ◯ 5-10
- ◯ 10-15
- ◯ 15-20
- ◯ 20+

9. What types of transport did you use for these journeys (please select all that apply)?

- ☐ Car (including car share)
- ☐ Rail
- ☐ Taxi
- ☐ Bus
- ☐ Bike
- ☐ Walking
- ☐ Other (please specify):

10. Which type of transport did you use ***most*** for these journeys?

- ○ Car (including car share)
- ○ Rail
- ○ Taxi
- ○ Bus
- ○ Bike
- ○ Walking
- ○ Other (please specify):

11. What public transport options do you have within a mile of your home (please select all that apply)?

- ☐ Bus
- ☐ Tram
- ☐ Underground / Metro / Light Rail
- ☐ Rail
- ☐ None of these
- ☐ Other (please specify):

12. Which of these public transport options have you used in the past year (please select all that apply)?

- ☐ Bus
- ☐ Tram
- ☐ Underground / Metro / Light Rail
- ☐ Rail
- ☐ None of these
- ☐ Other (please specify):

13. In the past month, approximately how many times have you used each of these public transport options?

	0	1-5	5-10	10-20	20-30	30+
Bus	○	○	○	○	○	○
Tram	○	○	○	○	○	○
Underground / Metro / Light Rail	○	○	○	○	○	○
Rail	○	○	○	○	○	○
Other	○	○	○	○	○	○

14. In an ideal world, which method of transport would you like to use most for journeys under 5 miles (8 kilometres)?

- ◯ Car
- ◯ Motorbike
- ◯ Bicycle (including e-bike)
- ◯ Walking
- ◯ Bus
- ◯ Tram
- ◯ Underground / Metro / Light Rail
- ◯ Rail
- ◯ Other (please specify):

15. Occasionally participants skip through questions without paying much attention to what they are answering. To show us you are paying attention please answer "True" to the question below so we know you're paying attention. Answering any of the other options may invalidate the results. *

- ◯ Unsure
- ◯ Neither True nor False
- ◯ True
- ◯ False

16. Imagine the statement below was given as a reason to walk journeys under 2 miles (3.2 kilometres):

"Doctors and scientists agree that walking short distances has substantial health benefits"

This statement...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Is a believable reason for walking more	◯	◯	◯	◯	◯
Is a convincing reason to walk more	◯	◯	◯	◯	◯
Gives a reason to walk more that is important to me	◯	◯	◯	◯	◯
Made me feel more confident about walking more	◯	◯	◯	◯	◯
Would help convince my friends to walk more	◯	◯	◯	◯	◯
Made me think about walking more	◯	◯	◯	◯	◯
Made me think about walking less	◯	◯	◯	◯	◯
Overall, how much do you agree or disagree with the statement	◯	◯	◯	◯	◯

17. Imagine the statement below was given as a reason to walk journeys under 2 miles (3.2 kilometres):

"Most people who walk more say that saving money is one of the top five benefits"

This statement...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Is a believable reason for walking more	○	○	○	○	○
Is a convincing reason to walk more	○	○	○	○	○
Gives a reason to walk more that is important to me	○	○	○	○	○
Made me feel confident about walking more	○	○	○	○	○
Would help to convince my friends to walk more	○	○	○	○	○
Made me think about walking more	○	○	○	○	○
Made me think about walking less	○	○	○	○	○
Overall, how much do you agree or disagree with this statement	○	○	○	○	○

18. Imagine the statement below was given as a reason to cycle journeys under 2 miles (3.2 kilometres):

"Travelling short journeys by bicycle every day is enough exercise to bring with it significant health benefits including weight loss and a stronger heart"

This statement...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Is a believable reason for cycling more	○	○	○	○	○
Is a convincing reason to cycle more	○	○	○	○	○
Gives a reason to cycle more that is important to me	○	○	○	○	○
Made me feel confident about cycling more	○	○	○	○	○
Would help to convince my friends to cycle more	○	○	○	○	○
Made me think about cycling more	○	○	○	○	○
Made me think about cycling less	○	○	○	○	○
Overall, how much do you agree with this statement	○	○	○	○	○

19. Imagine the statement below was given as a reason to cycle journeys under 2 miles (3.2 kilometres):

"Most people agree that cycling more could save them money"

This statement...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Is a believable reason for cycling more	○	○	○	○	○
Is a convincing reason to cycle more	○	○	○	○	○
Gives a reason to cycle more that is important to me	○	○	○	○	○
Made me feel confident about cycling more	○	○	○	○	○
Would help to convince my friends to cycle more	○	○	○	○	○
Made me think about cycling more	○	○	○	○	○
Made me think about cycling less	○	○	○	○	○
Overall, how much do you agree or disagree with this statement	○	○	○	○	○

20. Imagine the statement below was given as a reason to take the bus for journeys under 5 miles (8 kilometres):

"Most people of all ages say that frequent bus travel makes them feel fitter and healthier"

This statement...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Is a believable reason for taking the bus more	○	○	○	○	○
Is a convincing reason for taking the bus more	○	○	○	○	○
Gives a reason to take the bus more that is important to me	○	○	○	○	○
Made me feel confident about taking the bus more	○	○	○	○	○
Would help convince my friends to take the bus more	○	○	○	○	○
Made me think about taking the bus more	○	○	○	○	○
Made me think about taking the bus less	○	○	○	○	○
Overall, how much do you agree or disagree with the statement	○	○	○	○	○

21. Imagine the statement below was given as a reason to take the bus for journeys under 5 miles (8 kilometres):

"Commuting by bus instead of by car could save you an average of £1200 a year"

This statement...

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Is a believable reason for taking the bus more	○	○	○	○	○
Is a convincing reason for taking the bus more	○	○	○	○	○
Gives a reason to take the bus more that is important to me	○	○	○	○	○
Made me feel confident about taking the bus more	○	○	○	○	○
Would help convince my friends to take the bus more	○	○	○	○	○
Made me think about taking the bus more	○	○	○	○	○
Made me think about taking the bus less	○	○	○	○	○
Overall, how much do you agree or disagree with this statement	○	○	○	○	○

22. How would you say your current bus use compares to your pre Covid-19 bus use (i.e. before December 2019)?

- ○ I now use the bus less compared to my pre Covid-19 bus use
- ○ I now use the bus roughly the same amount compared to my pre Covid-19 bus use
- ○ I now use the bus more compared to my pre Covid-19 bus use
- ○ I did not use the bus before Covid-19 and I do not use the bus now
- ○ Other (please specify):

23. How would you say your current levels of cycling compares to your pre Covid-19 levels of cycling (i.e. before December 2019)?

- ○ I now cycle less compared to my pre Covid-19 cycling
- ○ I now cycle roughly the same amount compared to my pre Covid-19 cycling
- ○ I now cycle more compared to my pre Covid-19 cycling
- ○ I did not cycle before Covid-19 and I do not cycle now
- ○ Other (please specify):

24. How would you say your current levels of walking compares to your pre Covid-19 levels of walking (i.e. before December 2019)?

- ◯ I now walk less compared to my pre Covid-19 walking
- ◯ I now walk roughly the same amount compared to my pre Covid-19 walking
- ◯ I now walk more compared to my pre Covid-19 walking
- ◯ I did not / rarely walked before Covid-19 and I do not / rarely walk now
- ◯ Other (please specify):

25. Please read the statements below and rate the extent to which you agree these statements describe you.

In general I...

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Talk to a lot of different people at parties	◯	◯	◯	◯	◯
Feel others' emotions	◯	◯	◯	◯	◯
Like order	◯	◯	◯	◯	◯
Get upset easily	◯	◯	◯	◯	◯
Have difficulty understanding abstract ideas	◯	◯	◯	◯	◯
Keep in the background	◯	◯	◯	◯	◯
Am not really interested in others	◯	◯	◯	◯	◯
Make a mess of things	◯	◯	◯	◯	◯
Seldom feel blue	◯	◯	◯	◯	◯
Do not have a good imagination	◯	◯	◯	◯	◯

26. Please read the statements below and rate the extent to which you agree these statements describe you.

In general I...

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
Am the life of the party	◯	◯	◯	◯	◯
Sympathize with others' feelings	◯	◯	◯	◯	◯
Get chores done right away	◯	◯	◯	◯	◯
Have frequent mood swings	◯	◯	◯	◯	◯
Have a vivid imagination	◯	◯	◯	◯	◯
Don't talk a lot	◯	◯	◯	◯	◯
Am not interested in other people's problems	◯	◯	◯	◯	◯
Often forget to put things back in their proper place	◯	◯	◯	◯	◯
Am relaxed most of the time	◯	◯	◯	◯	◯
Am not interested in abstract ideas	◯	◯	◯	◯	◯

Messaging survey code

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Messaging survey overall persuasiveness score

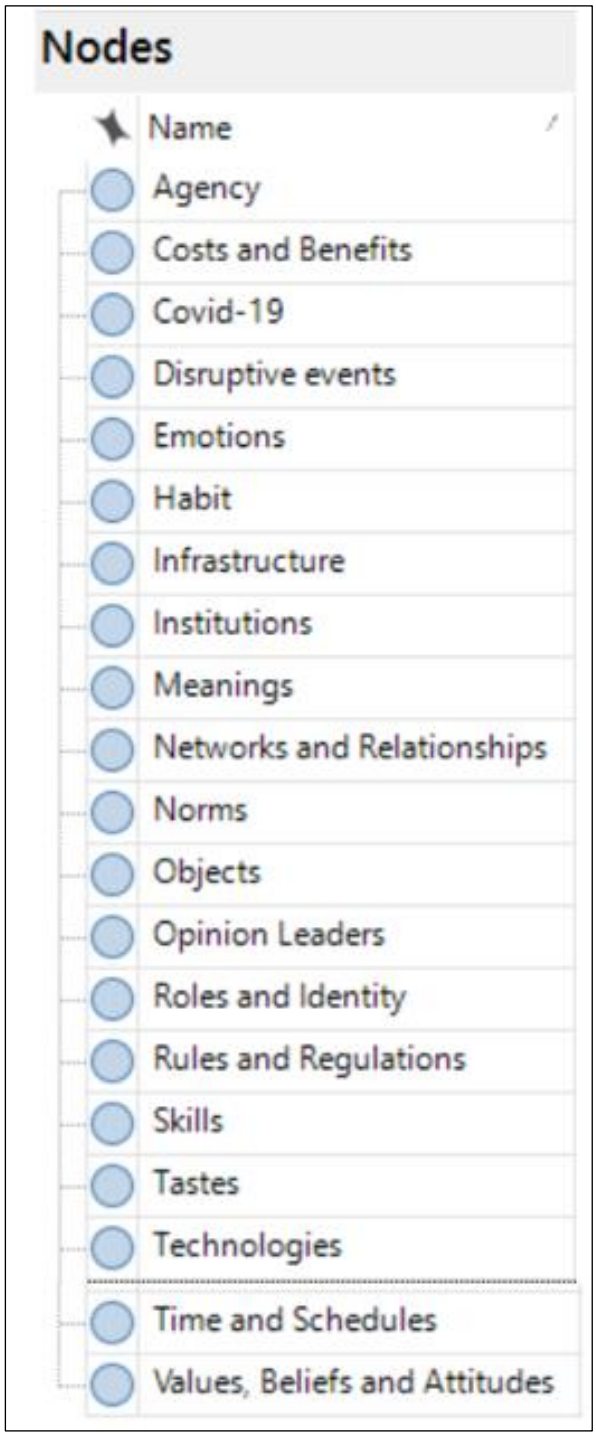
Message	Message value/type	Overall persuasiveness score, max 40
"Regular walking can buy you three to seven additional years of life. It could also improve your mood, exercise your brain and reduce your risk of heart failure"	Walking/Health, Consequence	32.34
"Doctors and scientists agree that walking short distances has substantial health benefits"	Walking/Health, Authority	32.23
“95% of adults agree that walking is a good way to stay healthy”	Walking/Health, Ad Populum	31.63
“Walking could save you a lot of money, costing you less on fuel, car repairs and even insurance”	Walking/Finance, Consequence	31.24
Scientists have shown that cycling is one of the easiest ways to stay healthy and in shape	Cycle/Health, Authority	29.12
"Travelling short journeys by bicycle every day is enough exercise to bring with it significant health benefits including weight loss and a stronger heart	Cycle/Health, Consequence	28.66
Travelling short journeys by bicycle could save you money by reducing the amount you spend on fuel or other travel expenses	Cycle/Finance, Consequence	28.41
The award-winning personal finance blogger Ricky ‘Skint Dad’ Willis saved over £3,400 a year by using alternatives to driving, particularly by walking more	Walking/Finance, Authority	27.60
Most people who walk more say that saving money is one of the top five benefits	Walking/Finance, Ad Populum	27.28
Researchers have shown that cycling short journeys will almost always save you significant amounts of money	Cycle/Finance, Authority	27.22
Over 90% of people agree that cycling is a healthy way to travel	Cycle/Health, Ad Populum	27.21
Commuting by bus instead of by car could save you an average of £1200 a year	Bus/Finance, Consequence	26.76
Most people agree that cycling more could save them money	Cycle/Finance, Ad Populum	26.34
Research commissioned by industry leaders has shown that travelling by bus is extremely cost effective compared to travelling by car	Bus/Finance, Authority	25.63
Most people who regularly take the bus rather than the car can save a significant amount of money by doing so	Bus/Finance, Ad Populum),	23.69
Catching the bus to work instead of driving achieves half your recommended daily exercise	Bus/Health, Consequence	21.14
In the largest ever study on the subject, scientists have shown that catching the bus is an effective way to lose weight and prevent or manage many other long-term health conditions	Bus/Health, Authority	18.06
Most people of all ages say that frequent bus travel makes them feel fitter and healthier	Bus/Health, Ad Populum	17.00

ADAPT surveys overall persuasiveness score

Message	Message mode/value/type	Overall persuasiveness (from squared averages, max 25)
Most people agree that cycling more could save them money	Cycling/Finance/Ad Populum	16.28
Scientists have shown that cycling is one of the easiest ways to stay healthy and in shape	Cycling/Health/Authority	16.17
Travelling short journeys by bicycle every day is enough exercise to bring with it significant health benefits including weight loss and a stronger heart	Cycling/Health/Consequence	16.10
Travelling short journeys by bicycle could save you money by reducing the amount you spend on fuel or other travel expenses.	Cycling/Finance/Consequence	16.10
Researchers have shown that cycling short journeys will almost always save you significant amounts of money	Cycling/Finance/Authority	16.09
Doctors and scientists agree that walking short distances has substantial health benefits	Walking/Health/Authority	14.58
Over 90% of people agree that cycling is a healthy way to travel	Cycling/Health/Ad Populum	14.32
Commuting by bus instead of by car could save you an average of £1,200 a year	Bus/Finance/Consequence	14.09
Regular walking can buy you three to seven additional years of life. It could also improve your mood, exercise your brain and reduce your risk of heart failure	Walking/Health/Consequence	13.97
Research commissioned by industry leaders has shown that travelling by bus is extremely cost effective compared to travelling by car	Bus/Finance/Authority	13.47
Most people who regularly take the bus rather than the car can save a significant amount of money by doing so	Bus/Finance/Ad Populum	13.23
Walking could save you a lot of money, costing you less on fuel, car repairs and even insurance	Walking/Finance/Consequence	12.59
The award-winning personal finance blogger Ricky ‘Skint Dad’ Willis saved over £3,400 a year by using alternatives to driving, particularly by walking more	Walking/Finance/Authority	12.51
95% of adults agree that walking is a good way to stay healthy	Walking/Health/Ad Populum	12.38
Most people who walk more say that saving money is one of the top five benefits	Walking/Finance/Ad Populum	11.87
Catching the bus to work instead of driving achieves half your recommended daily exercise	Bus/Health/Consequence	11.44
In the largest ever study on the subject, scientists have shown that catching the bus is an effective way to lose weight and prevent or manage many other long-term health conditions	Bus/Health/Authority	10.30
Most people of all ages say that frequent bus travel makes them feel fitter and healthier	Bus/Health/Ad Populum	9.93

Appendix 5. Interview Coding Frame

Original coding frame (based on ISM disruption framework)



Final coding frame