Determinants and Consequences of Car Use

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"The answer to global transport challenges is not less transport – it is sustainable transport."

Ban Ki-moon
8th Secretary-General of the United Nations

Abstract

Global demand for road travel is likely to double by 2050, creating serious environmental and human health risks. Forms of transport that are more sustainable should, therefore, be encouraged. This research aimed to generate a better understanding of personal transport decisions to contribute towards improving interventions and policies for reducing car use with four studies.

The first reviewed psychological theories applied to understanding car use. These theories have evolved to become more comprehensive, however, some mechanisms of car use choice remain unaccounted for. Thus, the CAUSE framework was developed with the review's findings to provide an integrated conceptual overview of potentially modifiable antecedents of car use.

The second is a quantitative analysis exploring the relationships between public transport connectivity, commuting and two aspects of wellbeing: life satisfaction and mental distress. Life satisfaction was related to mode choice and mental distress was related to public transport connectivity. The study highlights the role of connectivity when understanding the psychological effects of travel.

The third is a cross-cultural interview study investigating transport decisions and experiences among two culturally different cities. Accessibility, affordability and comfort were common transport decision considerations. However, distinct differences were observed in the attitudes and perceptions of private vehicles due to the different transport policies in both cities.

The fourth is a quantitative analysis exploring the considerations of environmental factors during car purchases. Pro-environmental attitudes and behaviours were found related to environment-related consideration during car purchases in general. However, the extent of the consideration and profile of these individuals differed significantly across sociodemographic and regions, possibly as a result of different policies.

Overall, this research summarises the complexity of car use behaviour both at the theoretical and experiential levels. The implications of these findings for interventions and policies are discussed further in the final chapter of the thesis, alongside future directions for research in this area.

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Author's Declaration

I declare that the work presented in this thesis was planned, undertook and written by me. All four studies presented here have been written as manuscripts for publication and at the time of submission, one paper was published (Chapter 3), one was under review after revision (Chapter 2) and two were in preparation for submission (Chapters 3 and 4). All four publications are co-authored but are all primarily the product of my work.

For the review of psychological theories (Chapter 2), I conducted the search, screened the articles, extracted the data, assessed the quality of included studies and developed the integrative conceptual framework under the supervision of, and in collaboration with, my lead supervisor, Charles Abraham (CA). Mathew White (MW) and Stephen Skippon (SS) commented on the protocol and provided advice during the development of the framework. Christin Hoffmann inter-rated at the screening, data extraction and quality assessment stages of the review. For quantitative study investigating commuting, public transport connectivity and wellbeing (Chapter 3), I prepared the dataset and conducted the statistical analysis and interpretation under the guidance of MW. CA provided detailed advice at all stages and SS provided advice at various stages as required.

For the cross-cultural interview study (Chapter 4), I developed the protocol and interview materials, applied for ethical approval, conducted the interviews, transcribed the audio recordings and undertook the coding and analyses with guidance from CA. MW commented on the protocol and provided advice related to the analysis. SS provided helpful insights that shaped the analysis. For the quantitative study exploring the profiles of individuals who consider environmental factors during car purchases (Chapter 5), I prepared the dataset and conducted the statistical analysis and interpretation under the supervision of MW. CA provided detailed advice at all stages and SS provided advice at various stages as required.

I wrote the manuscripts for all four studies with my supervisors providing feedback and guidance when revising the drafts.

List of Publications

The thesis produced four papers for publication and each is presented here as individual chapters from Chapters 2 to 5. At the time of submission, the publication status for each paper is as follow:

Chapter 2 has been submitted and is currently under review after revisions:

> Chng, S., Abraham, C., White, M. P., Hoffmann, C., & Skippon, S. (under review). Psychological theories of car use: An integrative review and conceptual framework. *Journal of Environmental Psychology.* [Resubmitted after revision]

Chapter 3 has been published as:

> Chng, S., White, M., Abraham, C., & Skippon, S. (2016). Commuting and wellbeing in London: The roles of commute mode and local public transport connectivity. *Preventive Medicine, 88*, 182-188. doi: 10.1016/j.ypmed.2016.04.014.

Chapter 4 is in preparation for submission as:

> Chng, S., Abraham, C., White, M., & Skippon, S. (under review). Driving in London and Singapore; A cross-cultural, qualitative comparison of city transportation experiences. *Travel Behaviour and Society.*

Chapter 5 is in preparation for submission as:

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Chapter 1: Introduction

Transport accounts for approximately 64% of the world's oil consumption, and global transport energy use has doubled in the past 30 years, mainly due to increased car use (International Energy Agency [IEA], 2015). Without new regulatory policies, or changes in public behaviour, the global demand for road travel is likely to double by 2050, especially in countries with rapidly developing economies (IEA, 2015). This growth creates serious risks to the environment and to human health (World Health Organisation, 2016), through air pollution and reduced physical activity, with implications for the prevalence of obesity, diabetes and coronary heart disease (Flint, Cummins, & Sacker, 2014; Wener & Evans, 2007).

In the longer term, affordable low-carbon or carbon-neutral cars are likely to reduce the environmental impact of driving but before these vehicles become commonplace there will be substantial increases in car use (Clark II & Cooke, 2016; Falcocchio & Levinson, 2015). Moreover, carbon-neutral cars will do nothing to increase active travel and so contribute nothing to population-level physical activity (Garcia-Sierra, van den Bergh, & Miralles-Guasch, 2015). There is, therefore, an urgent need to encourage people to travel in more environmentally sustainable and active ways, such as using public transport, walking or cycling to mitigate these predicted trends. Reducing car use for commuting may be particularly important due to its frequency and congestion impact (van Acker, van Wee, & Witlox, 2010). In England and Wales, 57.5% of commuters drove to work (Office of National Statistics, 2013) and this figure is higher in the US at 76% (McKenzie, 2015). Unfortunately, reducing car use is a complex problem. Progress will depend on integrating insights from many scientific disciplines and developing legislative, pricing and engineering solutions (United Nations, 2016; European Commission, 2012).

The four studies presented in this thesis aim to expand our insights into personal transport decisions and consider how these contribute towards optimising car use reduction interventions and policies. The remainder of this introductory chapter describes the background to these studies, preliminary

work undertaken and aims of the research programme, and summarises the studies themselves.

1.1. Evolution of transportation

Transportation demand is intertwined with globalisation requiring efficient movement of people and freight to sustain cohesive economic systems (Rodrigue, Comtois, & Slack, 2017). Technological and economic developments facilitate the movement of goods and people in greater quantities over longer distances, and often, in considerably shorter time than at any previous time (Banister & Berechman, 2001), although it is interesting to note that traffic congestion in some cities means that the many travel more slowly than the few did, on horse-drawn carriage in past generations. This evolution can be summarised as encompassing four time periods, each linked with specific transportation-related technological innovations: the pre-industrial era, the industrial revolution, Fordism and post-Fordism (globalisation). The pre-industrial era, where transport was limited to harnessing animal labour or wind energy is not pertinent to this discussion.

1.1.1. The industrial revolution era

The industrial revolution, which began in Europe from the 1750s, led to significant transformations in transportation that accompanied economic, political and social changes (Aldcroft & Freeman, 1983). The technological innovations included the development of coal-powered steam engines and metallurgy (Deane, 1979). These resulted in the introduction of two new transport systems; the canal systems and the railways. Opportunities to travel greater distances in shorter periods of time were expanded and specialised transportation services developed (Vuchic, 2007).

Advances in engine propulsion technology and shift from coal to oil towards the end of the 19th century improved the speed, capacity and range of cars, trains and ships (Aldcroft & Freeman, 1983). These advances, coupled with greater transport accessibility, increased mobility demands and contributed to migration and urbanisation facilitating the growth and connectedness of cities (Rodrigue et al., 2017). Urban transportation, which had relied on walking and horse-drawn carriages, underwent a technological transformation, starting with the

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introduction of electric trams, notably in Western Europe and the United States (Millward, 2005). In larger cities like London, underground train systems were also constructed (Porter, 1998). This enabled wider separation between the workplaces and residences and expanding cities (Rode et al., 2017). The bicycle was another important innovation that changed travelling by providing a cheaper transportation that continues to be popular today (Horton, Rosen, & Cox, 2016).

1.1.2. Fordism era

The Fordist era was heralded by the invention of the internal combustion engine and pneumatic tire (Vuchic, 2007). These technological advances made road vehicles faster, more comfortable, and inexpensive compared to steam engine-powered ones. However, the proliferation of road vehicles only began with the industrial production of the Model T car by Ford, using assembly lines (Rodrigue et al., 2017). Mass-producing cars and other road vehicles brought economies of scale and made them considerably more affordable (Marchetti, 1994). Cars became popular and ubiquitous, providing fast and inexpensive personal mobility that altered lifestyles and changed the geography of cities (Geels, 2005). Road infrastructure was expanded to cope with the growing vehicle demand, particularly in cities where suburbanisation generated ongoing urban spread (Rode et al., 2017). Consequently, motorised transportation became a powerful symbol of modernity and development (Marchetti, 1994).

1.1.3. Post-Fordism era (globalisation)

Everyday travel further evolved with the advances in telecommunications, globalisation of trade, more efficient distribution systems, development of air transportation from the 1970s (Rodrigue et al., 2017) and expansion of high-speed trains providing fast inter-city connections (Marchetti, 1994). Car production has also developed into a global industry resulting in a bourgeoning desire for car ownership and consequent congestion and environmental degradation (Hickman & Banister, 2014).

Our current era is increasingly characterised by increasing financial constraints, the search for alternatives energy sources to reduce our dependency on fossil fuels, and efforts to mitigate the impact of transportation on our environment

(Mendez, Monje, & White, 2017). Technological innovations have generated cars using alternative sustainable energy sources (e.g., electric cars), but these technologies remain expensive and their uptake is slow (Costa & Fernandes, 2012). Before these vehicles become mainstream, our reliance on fossil fuelled road transport will continue to grow, particularly in countries that are currently undergoing motorisation due to increased affluence (IEA, 2015).

1.1.4. The next transportation revolution

Today, we can foresee next revolution in transportation based on technological breakthroughs in fields such as artificial intelligence, energy storage, robotics and quantum computing (van Audenhove, Korniichuk, Dauby, & Pourbaix, 2014). This has already generated autonomous vehicles that are being tested in cities (nuTonomy, 2017; Waymo, 2017) and radically different forms of transportation are under development, such as the Hyperloop (2017) allowing 1,000 kilometres per hour passenger and freight speeds. Individual and city responses to such changes in transportation will determine their capacity to resolve the transport challenges we face today (Geels, 2011).

1.2. Transport and urban form

Transportation is interrelated with urban form as it facilitates accessibility and creates agglomeration effects and networking advantages (Dimitriou & Gakenheimer, 2009; United Nations Habitat, 2013; Knoflacher, Rode, & Twiari, 2008). Urbanisation dominated the 20th century and is expected to continue well into the second half of the 21st century, especially in developing economies where cities are rapidly expanding (Ang & Marchal, 2013). About two-thirds of the world's population (estimated at 6.4 billion people) are likely to be urbanites by 2050 and their urban travel will constitute more than 60% of global mileage (United Nations, 2015). This will make transport the largest local source of urban air pollution (Rode et al., 2017) and urban transport the largest source of transport-related carbon emissions globally (van Audenhove et al., 2014).

As cities continue to expand, it becomes increasingly complex to manage and plan for sustainable and accessible transportation. Cities have adopted different approaches but they usually employ a combination of transport-related

strategies (i.e., provision of public transport to reduce proliferation of private transport) and urban planning (e.g., development and agglomeration planning; Carmon & Fainstein, 2013). These have resulted in compact, walkable, public transport-based cities as well as sprawling car-based cities struggling to avoid gridlock (Glaeser & Khan, 2004). Whatever the shape of the city, urban dwellers tend to spend about 1.2 hours commuting per day (An, Gordon, & Moore, 2014; Angel & Blei, 2016) but less motorised cities differ from auto-dependent cities (Newman, 1996) because their dominant transport modes have different speeds and capacity (Westrom & Sussman, 2014).

1.2.1. Preliminary work: Transport choices and urban density in the UK

To understand how transport choices and urban form are related in the UK and in preparation for the studies to follow, an exploratory study was undertaken using data from Understanding Society, the UK Household Longitudinal Study. This secondary data analysis investigated the relationships between urban density (one aspect of urban form), public transport accessibility, and the travel mode choice of commuters in England and Wales. Urban commuters were found to be more likely to use the public transport, instead of their cars, if they lived in denser areas with good access to public transport. Nevertheless, those who lived in small to medium sized cities (e.g., Exeter and Bristol) were more likely to drive to work. Interestingly, walking and cycling, environmentally-friendly modes that are also advantageous to our physical health, were most common in both the densest and least dense areas, such as inner London and Durham respectively. A manuscript reporting this work has been written for publication and is included in this thesis as Appendix 1.A. This work led to further questions about the potential trade-offs between living in areas with good public transport access and living in population-dense city neighbourhoods and bout the motivations that determine transportation patterns, beyond physical constraints.

1.3. Urban transport challenges

Providing transportation to support urban mobility increases in complexity as population density and the concentration and connectedness of activities grow (Rodrigue et al., 2017). Transport problems develop when transport infrastructures cannot satisfy demands urban mobility (Rode et al., 2017). Some

of the most common urban transport challenges include (i) traffic congestion and parking difficulties resulting from motorisation and inadequate infrastructures; (ii) longer commutes due to congestion and increasing home-to-workplace distance; (iii) public transport inadequacy and cost because of over- or under-utilisation; (iv) high maintenance or replacement costs of aging transport infrastructures; and (v) difficulties incorporating non-motorised transport due to high traffic density or lack of infrastructure and facilities (European Commission, 2016).

Many of these challenges are interrelated and based on the prevalence of car use. Thus, city authorities have attempted to make car use less attractive and alternatives such as public transport, walking and cycling more appealing (Passenger Transport Executive Group, 2015). Despite substantial investment in improving and expanding public transport and efforts to persuade car drivers to use public transport (e.g., for commuting), there continues to be a strong bias against public transport in some cities, especially in North America and Asia, because of the negative perceptions of public transport (Redman, Friman, Gärling, & Hartig, 2013). Travelling in one's personal vehicle is commonly perceived to be a symbol of status and economic success by drivers in cities where public transport users are viewed as a less successful outgroup (Belgiawan et al., 2014; Delbosc & Currie, 2014; Pojani & Stead, 2017).

1.4. Urban transport alternatives to cars

Urban travels within high density cities with high demands for short distance mobility (e.g., London and Singapore) allows economies that can underpin the creation of cost-effective and efficient public transport (Camagni, Gibelli, & Rigamonti, 2002). Moreover, quality, affordable public transport is increasingly viewed as foundational to the quality of life and social equity in cities (Passenger Transport Executive Carmon & Fainstein, 2013; Group, 2010; Mattioli, 2014).

Reliance on urban public transport varies globally. It is noticeably higher in Asia and lowest in North America, with European cities somewhere between, creating three broad categories of cities (Priester, Kenworthy, & Wulfhorst, 2013; Rodrigue et al., 2017). First, transit-oriented cities, such as Singapore,

Hong Kong, Melbourne and Helsinki, see land use and developments coordinated around public transport infrastructure provision. These cities typically have lower levels of car use and more pedestrian-friendly central areas served by public transport. Second, adaptive transit cities where cars and other private vehicles are the dominant mobility choice and public transport plays a marginal and residual role. This is often the case in decentralised and lower density cities such as Los Angeles and Houston. Third, hybrid cities such as London, New York and Shanghai are characterised by the adequate provision of public transport in central areas while the peripheral regions remain dependent on private vehicle use.

Walking and cycling are accessible and potentially healthier alternatives to vehicle use in cities, particularly in urban centres. They are commonly used for short distance travels and are often contingent on the availability of supporting infrastructures (e.g., pathways and cycle lanes) and fair weather (Jain & Tiwari, 2016; Simons et al., 2014). Better provision for, and integration of, these alternative transport modes could reduce private vehicle use, and consequently, the impact of car use on health and environment (Newman & Kenworthy, 2015). However, adoption of these opportunities depends on being able to change the perception and beliefs to transport users.

1.5. Towards a car-lite society

The future ambition of cities is to transition from 'car-centric' towards 'car-lite' societies built on new urban mobility models that are more environmentally friendly, socially inclusive and economically efficient (Metz, 2013). This represents a paradigm shift in urban mobility toward providing users with numerous affordable and connected mobility options on-demand (e.g., ride-sharing services like Uber) that are complemented by customer-oriented public transport services to make car-free lifestyles feasible (Centre for Liveable Cities, 2016). Technological advancement may also facilitate the enhancement of mobility demand management (e.g., journey optimisation mobile applications) and introduce competition which will ultimately reduce the cost of travel for users (Passenger Transport Executive Group, 2015; Shaw, 2016). The challenge is to ensure that these developments remain person-oriented and effective (Higham, Cohen, Peeters, & Gössling, 2013; Stead, 2017).

1.6. Applying psychology to transportation development

Psychology has been increasingly applied in transportation research because, of course, understanding how we interact with transport systems is crucial to optimising the policies and provision (Bamberg, 2014; Fujii, 2017). The last two decades of research into the determinants of transportation decisions have been guided by the assumption that these decisions are reasoned, rational and of conscious intention (e.g., Bamberg & Schmidt, 1998). However research looking at the habitual nature underlying transportation decisions has also highlighted the role of automatic impulsive processes that are activated by situational cues that reside outside of our conscious awareness (e.g., Verplanken et al, 1998).

This dual system perspective has guided the development of sophisticated models of self-regulatory processes underpinning transport mode choices but greater investment in the behavioural science of transportation is needed (Fujii & Taniguchi, 2014; Gatersleben, 2014) to meet the challenge of shaping transport demand while also minimising damaging environmental and health consequences (van Wee, 2014). In addition, technologies in transportation have been rapidly advancing (e.g., dock less ridesharing services, mass-market electric vehicles and autonomous vehicles) and these hold great potential to disrupt existing transport decision-making, but current models and theorisations may not adequate. Thus further work elucidating the processes underlying perceptions, attitudes, preferences, and habitual action can optimise the effectiveness of interventions that seek to address these challenges (van Acker et al., 2010).

1.7. Aims and overview of this doctoral programme

This thesis takes a multidisciplinary and mixed-method approach to generate a better understanding of personal transport decisions to contribute towards improving the effectiveness of car use reduction interventions and transport policies. Perspectives and methodology from psychology are integrated with insights from geography, economics and systems engineering to form a multidisciplinary approach to conceptualising and designing the research program. These are adjacent fields to psychology in the field of transport research. Personal transport decisions, in this thesis, encompass 1) the use of

different types of transport modes (e.g., public, private and active transport) across different contexts (i.e., work and leisure), and 2) the vehicular purchase decisions. In particular, it aims to address the following four broad questions:

1. What can psychological theory tell us about the determinants of car use?
2. Are there psychological consequences of our travel mode choices?
3. How do car use and other transport choices differ across cultures? Are these differences a function of transport policies?
4. What factors do people consider when buying cars, for example, do they consider environmental consequences?

There are six chapters in this thesis, including this one. The final chapter provides an overview and critique of the work and its potential applications. Chapters Two to Five present four stand-alone studies addressing the above four broad questions. Each is written as a manuscript for publication. Each study adopts a different research focus and methodology, and reflects the progression of thoughts throughout my doctoral programme. This is explained in further details in the next section. At the time of writing, one study is published (Chapter 3) and three are currently under review (Chapters 2, 4 and 5). The manuscript-style presentation of this thesis means that there is some repetition in the introductory sections of these chapters. The remainder of this introductory chapter will provide a more detailed introduction to each study than was possible in the abstract.

1.8. The studies

The aim of the first study (Chapter 2) was to gather an understanding of the current knowledge base regarding car use and the extent that psychology has been applied in this field of research. Thus the focus here was to review psychological theories and models that have been applied to understanding car use. This review found that the theories applied in environmental psychology have evolved to become more comprehensive, however, some mechanisms of car use choice remain unaccounted for. A framework integrating the existing theories and other constructs identified here was developed to provide a conceptual overview of potentially modifiable antecedents of car use. The level of empirical support for each mechanism of behavioural regulation is also

presented with this framework. This framework provides a helpful consolidation of empirically supported self-regulatory mechanisms underlying car use and transport behaviours that will serves as a useful guide when designing behaviour change interventions and when understanding the research gaps that need to be filled in future work. It is also likely that the framework is applicable to other ecologically-relevant behaviour patterns given their close proximity and relatedness of transport behaviours.

One observation from the first study was that current research largely focuses on understanding and theorising the antecedents of transport decisions; not enough is understood about the experiences and consequences of carrying out these transport behaviours. Thus the second study (Chapter 3) set out to address this knowledge gap. It is the first of two quantitative studies in this PhD that uses the Understanding Society panel study, the UK Household Longitudinal Survey. This study focused on the role of public transport connectivity in the relationships between commuting and two aspects of wellbeing: life satisfaction and mental distress. There was little relationship between connectivity and the likelihood of public transport commutes. Nonetheless, those with good public transport connectivity reported lesser mental distress in general. The study highlights the advantages of using a more detailed categorisation of commute modes and discusses the implications on intervention strategies and policies promoting commuting behaviour change.

Another observation from the first study was the limited availability of cross-cultural research and understanding of transport behaviours. Existing research in this area originate largely from Europe and thus the third study (Chapter 4) aimed to contribute towards closing this knowledge gap by understanding transport behaviour and decisions in a culture that has not been studied yet. This study is a cross-cultural qualitative study investigating the transport decision-making, experiences and opinions among residents of London and Singapore. These two cities have adopted different policies to manage their growing car population and usage of road infrastructure. As a result, differences were observed in the perceptions of, and attitudes towards private transport. Cars go beyond serving utilitarian purposes for most Singaporeans and represented social status and achievement while Londoners viewed having a

car as a necessity due to the (perceived) lack of accessible alternatives. However, common themes in transport decisions included the importance of accessibility, affordability and comfort of the transport, be it public or active transport. It was also observed that strict, and expensive, car ownership regulation was acceptable to most interviewees if they understood its rationale. This highlights the importance of public engagement and education to the implementation of effective transport policies.

An interesting observation in the third study that warranted further exploration was the purchase and ownership of cars even when they were relatively expensive and/or were not particularly necessary when traveling within cities with well-connected public transport networks. Thus the fourth study (Chapter 5) explored the underlying nature of considerations during car purchases to better understand these decisions. This is the second quantitative study using the Understanding Society panel study in this PhD. This study explored the profiles of individuals who consider environmental factors during car purchases. There were three categories of considerations during car purchases: utility, image and environment. Individuals who were concerned with climate change and actively engaged with the discourse, and engaged in pro-environmental behaviours regularly were more likely to consider environment-related factors during car purchases. However, the extent of consideration and profile of these individuals significantly differed across sociodemographics and regions.

Collectively, the four studies here integrate conceptualisations and perspectives from multiple disciplines (e.g., psychology, economics, geography) using a mixed-method approach to provide multifaceted insights into personal transportation decisions.

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Chapter 2: Understanding car use: A review of key psychological theories.[1]

2.1. Abstract

Personal car use is increasing globally and is an important contributor to poor air quality and global greenhouse gas emissions. Although individuals have little direct control over some emission sources (e.g. heavy industry), they can modify their car use thereby reducing their own contribution. There have been many attempts to understand the psychology of personal car use and identify ways in which individuals might be encouraged to adopt more environmentally friendly travel modes. The aim of the current paper was to review available psychological theories and models that have been applied to understanding car use and develop an integrated conceptual overview of potentially modifiable antecedents that could inform future intervention design and further theoretical research. Fifteen psychological theories were identified from thirty-two unique studies but most theories were applied only once. Although two theories in particular (the Comprehensive Action Determination Model and Stage Model of Self-Regulated Behaviour Change) are both relatively comprehensive and have empirical support, our review suggests there are mechanisms of behavioural regulation relevant to car use that are not included in either theory. Integrating theories, we developed an integrative conceptual framework, referred to as the CAr USE (or CAUSE) framework of cognitive and emotional antecedents of car use. This framework is likely to be applicable to other ecologically-relevant behaviour patterns. Implications for research and practice are discussed.

2.2. Introduction

Transport accounts for approximately 64% of world oil consumption and global transport energy use has doubled in the past 30 years, mainly because of increased car use (International Energy Agency, 2015). Without new regulatory policies, global demand for road travel is likely to double by 2050 with rising numbers of cars in developing countries (International Energy Agency, 2015).

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[1] A version of this chapter has been submitted for publication and is currently under review in the *Journal of Environmental Psychology* as: Chng, S., Abraham, C., White, M. P., Hoffmann, C., & Skippon, S., Psychological theories of car use: An integrative review and conceptual framework.

This has serious ramifications for human health and environment (World Health Organisation, 2016). Car use reduces physical activity during commuting (Flint, Cummins, & Sacker, 2014; Wener & Evans, 2007) while substantially increasing carbon dioxide and nitrogen oxide emissions compared to public transport use (Shapiro, Hassett, & Arnold, 2002). In the longer term, affordable low-carbon or carbon-neutral cars may reduce the environmental impact of driving but large increases in car use are predicted before they become widely available (Clark II & Cooke, 2016; Falcocchio & Levinson, 2015). Meanwhile, encouraging more sustainable travels is crucial to mitigating these predicted trends (Garcia-Sierra, van den Bergh, & Miralles-Guasch, 2015).

This will depend on persuading the public, including drivers, to use public transport or walk or cycle, especially for commuting (Van Acker, Goodwin, & Witlox, 2016). While many interventions have been tested there are surprisingly few robust interventions that have been found to reduce car use (Graham-Rowe, Skippon, Gardner, & Abraham, 2011). Research that elucidates the processes by which transport modes are chosen and used routinely is crucial for optimising intervention effectiveness. Models developed within a psychology of transportation can identify antecedents of car use and determinants of behaviour change that may be targeted by interventions (van Acker, van Wee, & Witlox, 2010). Understanding theorised mechanisms also allows researchers to describe how and why interventions are or are not effective. For example, was an intervention unsuccessful because it had no effect on the targeted mechanism of action or because the targeted mechanism had no or only weak effects on transport behaviour patterns? Application of such models in intervention evaluations affords tests of those models so allowing theory development (Rothman, 2004).

So how can we best understand the actions of travellers within transport systems? This paper reviews psychological theories that have been applied to understanding car use. Theories are a set of concepts and/or statements that specify how phenomena relate to each other, describe a system for what is known, and explain and predict phenomena (Bem & Looren de Jong, 1997; Chalmer, 1976). We had four aims in the current work: 1) identify psychological theories applied to understanding car use, 2) assess the extent to which the

identified theories had been applied within the transportation literature, 3) assess the quality of theory utilisation and application within identified studies, and 4) assess the comprehensiveness of the extent of theories in terms of their coverage of identified concepts.

2.3. Methods

Psychological theories of car use were identified using four sources: electronic databases, web searching, forward and backward searching of reference lists and hand searching of key transport psychology journals. Empirical application of the theories was identified from electronic databases and the reference lists of retrieved articles.

2.3.1. Literature search

Psychology and transportation databases (EBSCOHost, Web of Science, Ovid, ProQuest, SCOPUS and TRID) were searched in September 2015, using synonyms for: 1) car use; 2) travel mode choice and 3) theory. The search strategy (see Appendix A) was customised for each database. Sensitivity analysis ensured that key articles on theories relevant to explaining car use (identified in the initial scoping search) were included. The volume of literature meant the search was restricted to titles and abstracts for search specificity. 14,316 unique records were generated for further inspection.

2.3.2. Article selection

2.3.2.1. Inclusion criteria for theories

Theories were included if they met our definition of theory and considered individual behaviour as an outcome or part of the process leading to the outcome, which, in our review, is car/non-car use. Theories focusing only on cognition (e.g., intentions and preferences) without application to behaviour were excluded. While such theories may contribute to our understanding of beliefs and intentions, such mechanism may not translate into behaviour (Sheeran, 2002).

2.3.2.2. Inclusion criteria for articles

A two-stage screening of articles was undertaken. First, examining titles and abstracts, articles were retained if they: (i) mentioned theory in relation to

car/non-car use and (ii) were published in full-text format in a peer-reviewed scientific journal. Applying the above criteria, 148 potentially relevant articles were identified.

The second stage (full-text screening) applied tighter inclusion criteria. Articles were included if: (i) the theory used met our study's operational definition adapted from Michie, West, Campbell, Brown, and Gainforth (2014; a descriptive system of a set of concepts and/or statements specifying how phenomena (car use) relate to each other, describes what is known, and explains and predicts phenomena), and (ii) car use was operationalised and measured. Articles applying multiple theories were included.

Articles were excluded if they: did not include a measure (self-reported or objective) of car use behaviour (e.g., measuring only stated intention or preference for car use were excluded); were not empirical; or did not involve human participants (e.g., computational simulations were excluded). Dissertations and doctoral theses, books, book reviews, conference posters and presentations, editorials and commentaries were excluded to limit the volume of material. We did not exclude articles based on research quality as we were also interested in assessing study's quality and theory application.

Applying these criteria identified 17 publications. Forward and backward searching of reference lists was also carried out to further identify papers that did not mention using theories in its title and/or abstract until no new citations emerged. This generated 18 further publications. The resulting 35 publications reported 37 relevant studies. Multiple papers reporting the same dataset were regarded as one study so each theory was only extracted once; this excluded 5 studies, leaving 32 independent studies that utilised 15 relevant psychological theories.

2.3.3. Data extraction

Data was extracted on: (i) theory or theories used, (ii) constructs within the theory or theories that were operationalised and/or tested, (iii) study characteristics (i.e., study's sample, design and origin, and measures of car/non-car use).

2.3.4. Quality assessment criteria

Quality assessment of included articles was conducted in two stages using the tool found in Appendix B. First, the study's quality was assessed using a modified version of the Quality Assessment Tool for Quantitative Studies (QATQS). The original tool, developed by the Effective Public Health Practice Project (Thomas, Ciliska, Dobbins, & Micucci, 2004) for public health research, was expanded to include study designs (prospective, retrospective and cross-sectional) commonly used in transportation research. A study's quality was assessed on its (i) sample selection bias, (ii) study design, (iii) potential confounders, (iv) blinding (for interventions), (v) data collection methods, (vi) withdrawal and dropouts, and given ratings of strong, moderate or weak. The study's overall quality was then appraised based on ratings of the above six indicators. Overall quality ratings were given as strong (no weak ratings in any of the six indicators), moderate (one weak rating) or weak (two or more weak ratings).

Further, following the recommendations of the QATQS's developers we also collected data on two other aspects of study quality: a) Intervention integrity (the degree to which the central intervention could be isolated from other possible co-occurring interventions); and b) Appropriateness of statistical analysis. However the guidelines recommend not including these ratings in the overall final appraisal scores due to potential subjectivity in interpreting these components (Thomas et al., 2004). Hence they are included for background information only.

Next, we developed our own quality appraisal of elements important to the current research but were not in the QATQS, including: a) Theory-informed study design; and b) Theory measurement. Regarding theory-informed design, all studies in the current analysis were informed by theory, by definition. More important here was the extent that the theory was operationalised (e.g., intentions, descriptive norms). We rated those that included 80-100% of constructs as 'strong', those that included 40-79% of constructs as 'moderate', and those that included <40% of constructs as weak, operationalisation of the theory. For theory measurement, rating criteria included the use of reliable and valid construct measures. Studies demonstrating both validity and reliability

were rated 'strong', those demonstrating validity but not reliability as 'moderate', and those demonstrating neither as 'weak', measurements.

2.3.5. Inter-rater reliability

Articles were screened for relevance first by title and abstract and then by full-text by the lead author (SC). A second researcher (CH) independently screened a random selection of 200 (1.5%) articles at the title and abstract stage and 44 (30%) articles at the full-text stage. Data extraction and quality assessment of studies were initially undertaken by SC with 12 (34.3%) studies independently assessed by CH. Inter-rater reliability was assessed. Differences of views about inclusion and inconsistencies were resolved through discussion and consensus with the other authors.

2.4. Results

2.4.1. Study characteristics

An overall of the study characteristics is presented below with more detailed information found in Table A.1. Very high levels of agreement were observed for decisions on inclusion of articles (title and abstract, and full text screening: 100%), data extraction (theory identification: 100%; construct identification: 96% study information: 94%) and quality assessment (overall: 92%; theory application: 94%). Given these very high levels of agreement and consistency in the review process, further statistical assessment of inter-rater reliability was judged to be redundant. Nonetheless, Gwet's AC1 scores ranged from 0.91 to 1.00 at all review stages.

2.4.1.1. Sample

Twenty studies recruited participants from the general population, of which 3 were commuter-only samples (i.e., those who travel from home to work daily), 7 consisted of individuals with car access, 3 with drivers-only samples and 2 samples of individuals who recently relocated. Nine studies sampled students, of which 2 solely included students with driving licence and/or car access. Another 3 studies sampled university employees and one study sampled both university employees and students.

2.4.1.2. Study design

The 32 studies used very different methodologies. Eight car use reduction intervention evaluations were identified. Only six studies, all interventions, used experimental designs (e.g., controlled clinical trial in Eriksson, Garvill, and Nordlund (2008)) where investigators randomly allocated individuals to intervention or control groups and were classified as having strong methodological quality for study design. Three studies used cohort designs where the same group of individuals were tested before and after exposure to the intervention or event of interest (e.g., relocation in Bamberg (2006)) but this exposure was not controlled by the researchers. One study used an interrupted time series design with multiple observations over time to compare car and non-car use for daily commuting trips using both self-reported measures and telemetric data. The remaining 22 studies were observational designs that were cross-sectional ($n = 10$), prospective ($n = 8$) and retrospective ($n = 4$) in nature. These studies were classified as having moderate methodological quality for study design.

2.4.1.3. Measures

Though the initial search included both self-reported or objective measures of car use behaviour, no studies using objective measures were identified. All identified studies used either one or both of the following two types of self-reported car use measures: 1) 'actual' car use behaviour where participants report retrospectively their car use during specified time periods (31 studies); 2) 'typical' car use behaviour where participants are asked to report their usual car patterns (2 studies). Typical methods for collecting 'actual' car use information were travel diary/log (e.g., Bamberg (2007)). Only one study (Anable, 2005) used both measures of typical and actual car use.

2.4.1.4. Country

The studies, published between 1998 and 2015, were mostly conducted in Europe, specifically 13 (41%) in Germany and 7 in the UK (22%). The remaining 6 (19%) studies were conducted in Asia (3), North America (2) and South America (1).

2.4.2. Quality assessment

The quality of studies was assessed on their methodology and theory application. Fourteen (44%) studies were found to have strong, 14 (44%) moderate, and 4 (12%) weak, methodological quality. The overall assessment of the quality of theory application found 17 (53%) studies of strong quality, 11 (34%) studies of moderate quality and 4 (12%) studies of weak quality. These rating were based on the following two aspects of theory application. First, whether the study design was informed by an identified theory and operationalised the theoretical constructs on which 18 (56%) studies had strong ratings while 10 (31%) and 4 (13%) had moderate and weak ratings respectively. Second, whether the measures of the theoretical constructs were reliable and valid on which 28 (88%) studies had strong ratings while 3 (9%) and 1 (3%) studies were given moderate and weak ratings respectively. Of the 32 studies, only 9 (28%) studies were assessed to have both strong methodological and theory application quality. Detailed ratings of each assessed methodological and theory application quality for the studies can be found in Tables 2.A.1 and 2.A.2.

2.4.3. Theories identified

We identified fifteen psychological theories explaining car use and listed them in Table 2.1 alongside the theory's original paper and number of articles here applying it.

Table 2.1.
Theories identified in the review and the number of articles reporting them.

Theory	First author theorist (date)	Articles reporting theory included in review[a]
Theory of Planned Behaviour	Ajzen (1991)	14 (19)[b]
Norm Activation Model	Schwartz (1977)	8
Model of determinants of script-based driving choice	Gärling (2001)	3
Value Belief Norm Theory	Stern (1999)	3
Theory of Interpersonal Behaviour	Triandis (1977)	3
Comprehensive Action Determination Model	Klöckner (2010)	2
Stage Model of Self-regulated Behavioural Change	Bamberg (2013b)	2
Model of Action Phases	Heckhausen (1987)	1
Model of Material Possession	Dittmar (1992)	1
Normative Decision-making Model	Schwartz (1981)	1
Prospect Theory	Kahneman (1979)	1
Selection, Optimism and Compensation Model	Baltes (1990)	1
Theory of Cognitive Dissonance	Festinger (1957)	1
Theory of Cognitive Evaluation	Deci (1975)	1
Value Attitude Behaviour Hierarchical Model	Homer (1988)	1

Note: [a]Articles could have reported one or more theories
[b]Number in brackets represent the unadjusted frequency for articles in which the same first author has published more than one article applying the same theory to the same data set. Detailed information of the studies can be found in Table 2.A.1.

2.4.3.1. Frequency of theory application

By definition, all studies in this review applied at least one theory. In addition, we identified 6 (19%) studies that applied two or more theories in combination and these studies all included the Theory of Planned Behaviour and/or the Norm Activation Model. Fifteen theories were identified across 32 studies. Half (n = 16) the studies applied the Theory of Planned Behaviour (n = 14) and/or the Norm Activation model (n = 8). A further 5 theories were applied in 15 (47%) studies: Model of determinants of script-based driving choice (n = 3), Value Belief Norm Theory (n = 3), Theory of Interpersonal Behaviour (n = 3), Comprehensive Action Determination Model (n = 2) and Stage Model of Self-Regulated Behavioural Change (n = 2). Collectively, these 7 theories were applied in 26 (81%) studies in our review. The remaining 8 theories were applied only once. Appendix C briefly introduces the theories included here.

2.4.3.2. Theory operationalisation and testing

Eighteen (56%) studies operationalised between 80 to 100% of the constructs within the theory it used (the main theory only if more than one was used) in their study. A further ten studies operationalised between 40 to 79% and 4 studies less than 40% of the theoretical constructs. The Theory of Planned Behaviour was the most consistently operationalised as 10 of 13 studies utilising it operationalised between 80 to 100% of its constructs. Most studies (22; 69%) also reported an effort to test the application and fit of the operationalised theory with the data collected.

2.4.3.3. Additional constructs identified

Seventeen (50%) studies had also included additional constructs into the theories that they used. Habit was the most frequently added construct (10; 29%) followed by moral (3; 9%) and descriptive (3; 9%) norms. These constructs were most frequently added to studies using the Theory of Planned Behaviour and Norm Activation Model.

2.4.3.4. Characteristics of theories

Most identified theories had been described prior to 1998 (the year the earliest paper in this review was published). Four theories were more recent, the Value Belief Norm Theory (1999), the Model of determinants of script-based driving

choice (2001), the Comprehensive Action Determination Model (2010) and the Stage Model of Self-Regulated Behavioural Change (2013). The two most recent theories (Comprehensive Action Determination Model and Stage Model of Self-regulated Behavioural Change) provide more comprehensive models by integrating constructs from well-established theories in this field, specifically the Theory of Planned Behaviour, Norm Activation Model and Theory of Interpersonal Behaviour. Since they incorporated many concepts from other theories a more detailed review of these two recent theories was undertaken.

2.4.3.5. Comprehensive Action Determination Model

The Comprehensive Action Determination Model (CADM) was proposed to understand ecological behaviours by integrating the main assumptions from the Theory of Planned Behaviour, the Norm Activation Model, the Ipsative Theory of Behaviour and 'habit' (Klöckner, 2013; Klöckner & Blöbaum, 2010) to incorporate the intentional, normative, situational and habitual influences on ecological behaviours. Figure 2.1 shows the findings from all the studies identified by our review support the CADM. Even after removing findings from studies conducted by the author theorists (see Figure 2.A.1), all the posited relationships continued to be supported by at least one study except for two relationships: 1) person norms to car use habit, and 2) car access to car use behaviour.
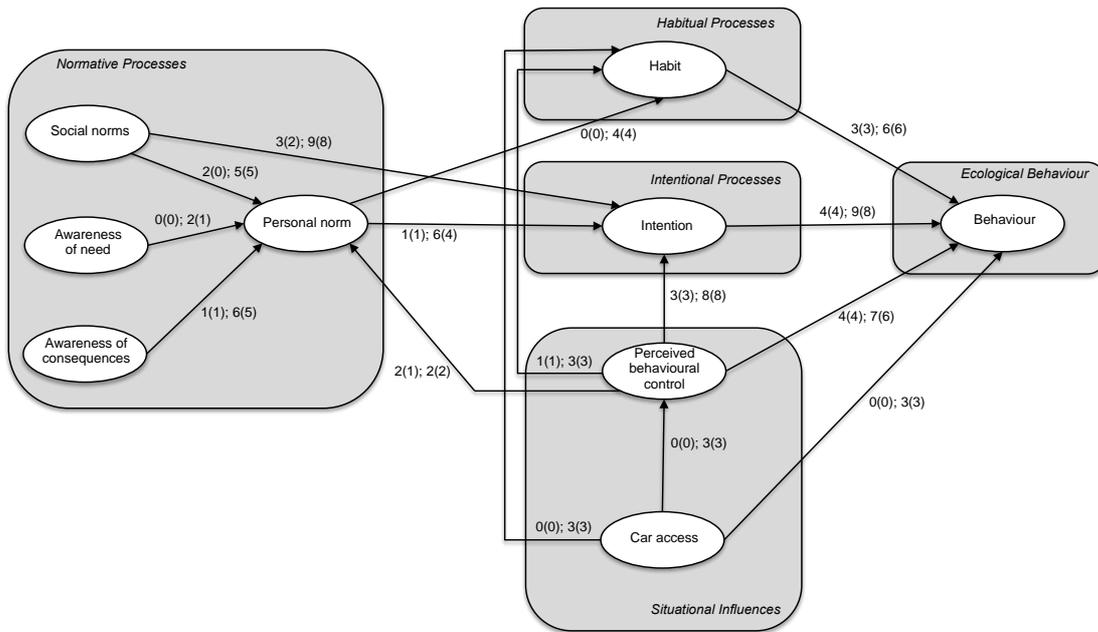
Figure 2.1. Supporting findings for the Comprehensive Action Determination Model

Note: n = 32; The numerical figures associated with each theorised relationship represent the number of studies within our review that reported support in the following sequence: Correlations (Significant correlations); Path coefficients (Significant path coefficients), e.g., for the theorised relationship from personal norm to intention we identified 1 correlational study that reported a significant relationship and 6 studies reporting path coefficients, of which only 4 studies reported significant findings.

2.4.3.6. Stage Model of Self-Regulated Behavioural Change

The Stage Model of Self-Regulated Behavioural Change (SSBC) was developed to guide systematic intervention development. The theory integrates constructs from the Norm Activation Model as predictors of goal-intention and the Theory of Planned Behaviour as predictors of behavioural-intention into the Model of Action Phases that stresses the deliberative, goal-directed nature of behaviour change (Bamberg, 2013b). By doing so, this new model (a) stresses the self-regulatory nature of behaviour change, (b) conceptualises behaviour change as a transition through temporally ordered sequence of qualitatively different stages and (c) further conceptualising the intention preceding behaviour into a time-ordered sequence of goal-, behavioural- and implementation-intention. Figure 2.2 depicts the version of this model from

Bamberg (2013b) and the support our review identified for the specified relationships. Most relationships were supported by at least one study when using the findings from all studies identified by our review. However, after removing findings from studies conducted by the theorist, there was limited support for the newly proposed temporally ordered operationalisation of the intention construct (see Figure 2.A.2).
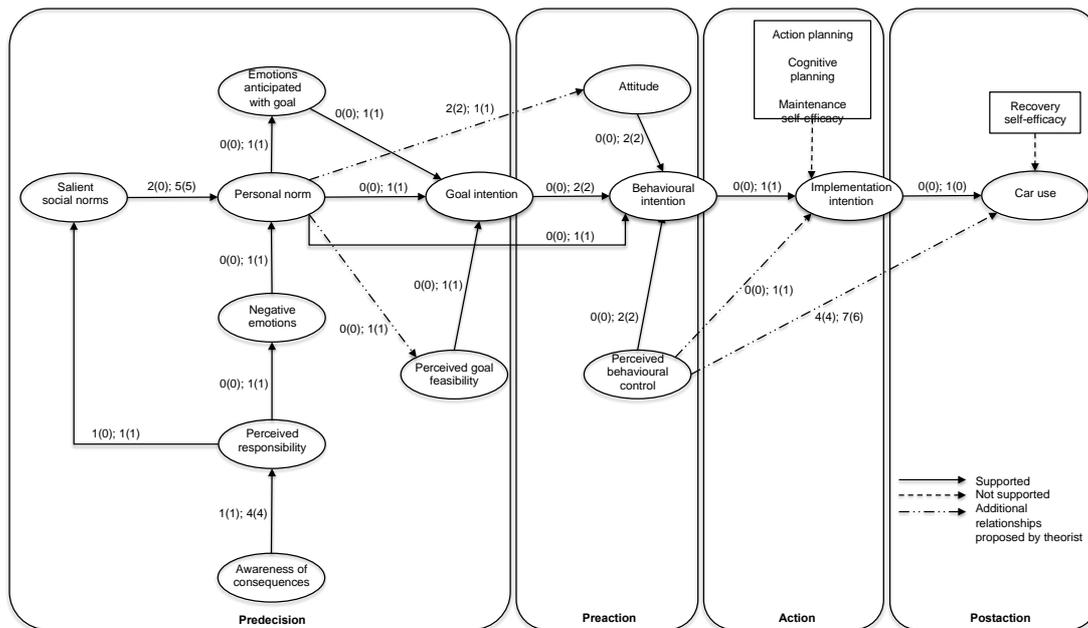
Figure 2.2. Supporting findings for the Stage Model of Self-Regulated Behaviour Change

Note: n = 32; The numerical figures associated with each theorised relationship represent the number of studies within our review that reported support in the following sequence: Correlations (Significant correlations); Path coefficients (Significant path coefficients), e.g., for the theorised relationship from personal norm to goal intention we only identified 1 study reporting significant path coefficients.

2.4.4. An integrative conceptual framework of antecedents of car use (the CAUSE Framework)

The CADM and SSBC offer two distinct integrations of concept from well-established theories such as the Theory of Planned Behaviour and Norm Activation Model. The CADM conceptualised car use as a variant of an ecological behaviour and thus incorporated mainly ecologically related

antecedents. By contrast, the SSBC conceptualised car use as a self-regulated behaviour and focused on explaining its deliberative and goal-directed nature to inform behaviour change. So neither is comprehensive and each could supplement the other. For example, when developing a theory-guided intervention to reduce habitual car use while promoting active and/or public transport use instead, the SSBC would be useful but, because it does not include habitual behaviour, additional constructs and relationships from the CADM could be helpfully added. Nonetheless, these two models overlap and neither comprehensively summarises our knowledge in this area.

Thus, we developed an overview conceptual framework summarising all potential mechanisms of change included in current theories applied to car use. This framework may be useful when designing interventions and tracking the mechanisms through which they are expected to have their effects, for example, when developing a "logic model" (W.K. Kellog Foundation, 2004). Our framework is not a new theory, no new mechanisms are proposed; it is an integration and consolidation of theories already applied to car use. The framework summarises tested mechanisms and highlights those that require further testing. We present this conceptual framework with the strength of evidence supporting each mechanism and proposed relationships between constructs in Figure 2.3. Since the framework was derived from studies theorising the causal psychological mechanisms that explain car use, we refer to it as the CAUSE (CAr USE) framework.

47
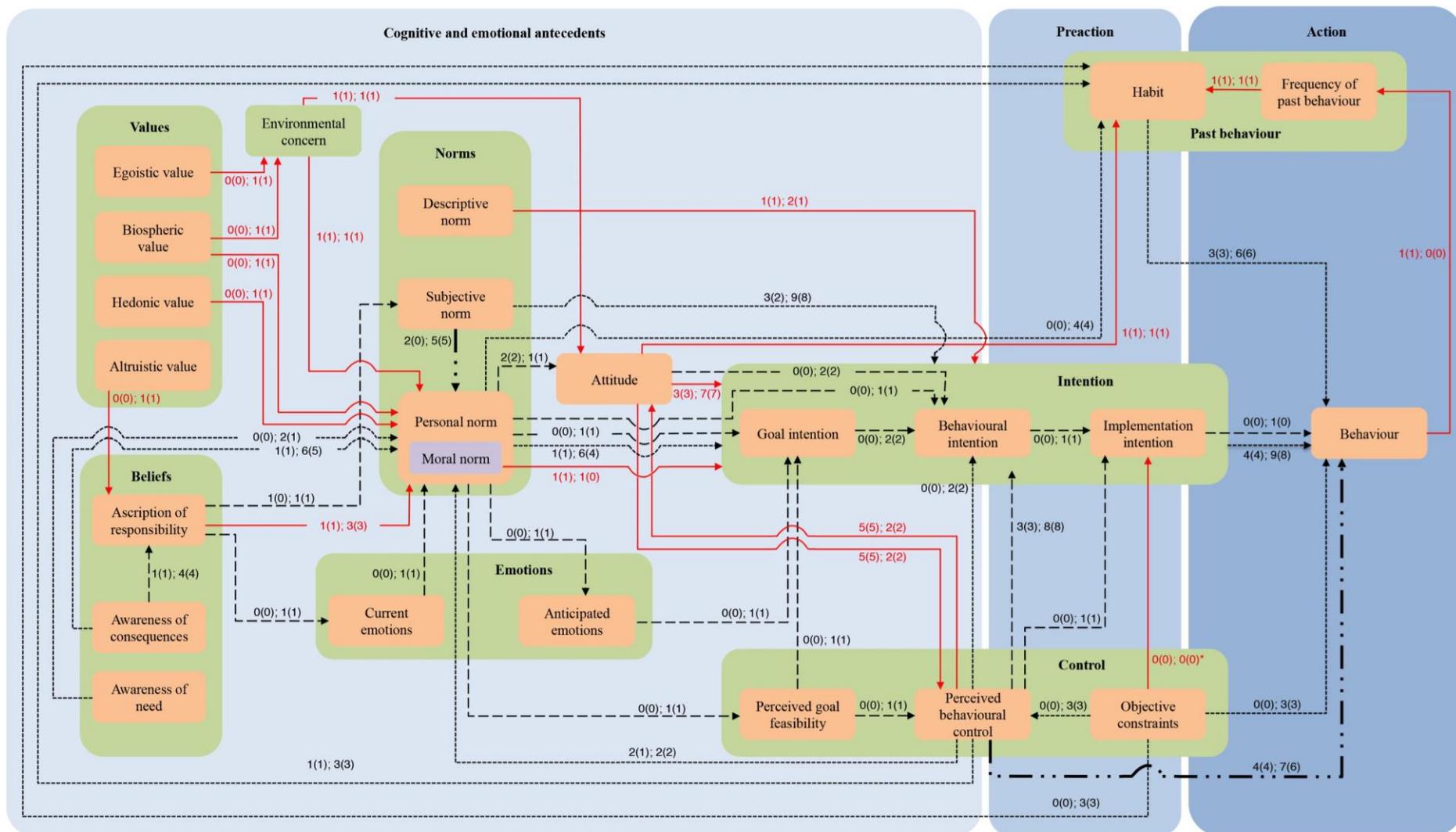
Figure 2.3. Integrative conceptual framework of theoretical constructs of car use (CAUSE Framework)

Note: ------▶ indicates that this relationship was included in the Comprehensive Action Determination Model.

– –▶ indicates that this relationship was included in the Stage Model of Self-Regulated Behaviour Change. –··▶ indicates that this relationship was included in both the Comprehensive Action Determination Model and Stage Model of Self-Regulated Behaviour Change. ───▶ indicates additional relationship proposed. * represents that the relationship is proposed but has not tested within any studies identified in the review. The numerical figures associated with each theorised relationship represent the number of studies within our review that reported support in the following sequence: Correlations (Significant correlations); Path coefficients (Significant path coefficients), e.g., for the theorised relationship from personal norm to intention we identified 1 correlational study that reported a significant relationship and 6 studies reporting path coefficients, of which only 4 studies reported significant findings.

To create this framework, the CADM and the SSBC were first integrated, mapping out all relationships specified in each and removing duplicates. Car use decisions can be conceptualised as a time-ordered sequential process, thus we adopted the SSBC's general structure and clustered the constructs within our framework into three stages (cognitive and emotional antecedents, preaction and action). We included the SSBC's operationalization of 'intention' to reflect the self-regulatory nature of car use decisions within this time-ordered sequence. However, our conceptualisation of motivational transitions differed from the SSBC to account for the additional constructs in our framework. Goal intention was construed as a cognitive antecedent while behavioural intention was recognised to be in transition from being an antecedent of decisions to a preaction construct. Lastly, implementation intention was construed as being in both the preaction and action stages. As the CADM does not operationalise intentions in the same manner as the SSBC, an overall motivational construct was included. This was useful because in some included studies identified motivation as an important construct without specifying between early goal formation and implementation intention formation. We were able to incorporate all constructs from both theories and additional constructs within the framework.

The CAUSE framework presents the constructs and relationships from the CADM within a time-ordered sequential manner proposed by the SSBC and two notable constructs in the framework are 'habit' and 'objective constraints' from the CADM. First, 'habit' was integrated into the category of past behaviour and situated in the preaction stage within the framework to reflect that the car use decision-making process may at times be influenced by past behaviour, an idea supported by the Model of Determinants of Script-Based Driving Choices. Second, 'objective constraints' was also situated within the same preaction stage to reflect its relationship with implementation intentions. This reflects that implementation intention in relation to car use (or other travel modes) are influenced by the presence of access to the means to the behaviour, i.e. having access to a car would strongly influence one's ability to implement an intention to drive. The above manner that 'habit' and 'objective constraints' were included in the framework meant that we were able to acknowledge the automaticity of car use decision-making and how car access limits one's ability to carry out their intentions.

The next step in developing the framework involved incorporating findings from the other 13 theories identified in the review that were not already included. This resulted in the addition or expansion of three groups of constructs. First, the category of 'values' was added to the framework to acknowledge its role of influencing beliefs and norms as postulated by the Value Belief Norm Theory. Four relevant 'values' constructs were identified from Lind, Nordfjærn, Jørgensen, and Rundmo (2015) to be related to the formation and/or maintenance of beliefs and personal norms of car/non-car use and added into the framework: altruistic, biospheric, egoistic and hedonistic values. We also added the related concept of 'environmental concern' was added. This construct, also reported as the New Environmental Paradigm within studies in our review (e.g., Lind et al. (2015)), was frequently measured and has been demonstrated to mediate the relationships between biospheric and egoistic values and personal norm and attitude towards car use. The addition of 'environmental concern' and environment-related values highlights that transportation choices may be directed by concerns about environmental conservation (Anable, 2005; Donald, Cooper, & Conchie, 2014; Gardner & Abraham, 2010).

Three normative mechanisms are included. The perception of whether others are engaging in car use (descriptive norm) and whether they approve of car use (subjective norm) as well as whether car us is viewed personally as "right or wrong" (personal norm) are theorised as determinants of intention (Gardner & Abraham, 2010; Mann & Abraham, 2012). Moral norm has been construed as developing from environmental concern and environmental-related attitudes (Donald et al., 2014), but our analyses did not find empirical support for these hypothesised relationships. Moreover, the definition of "moral" and "personal" norms is substantially overlapping across studies (for example, compare Gardner and Abraham (2010) and Anable (2005)). Consequently, we subsumed moral norms under personal norms.

Including the above into the framework at this stage expands its comprehensiveness by incorporating constructs that have been frequently used

in transportation research but not necessarily formal components of CADM or SSBC.

Finally, we added the construct 'frequency of past behaviour' that we propose to mediate the feedback loop from behaviour to habit. This was informed by the studies that used the Model of Determinants of Script-Based Driving Choices (Fujii & Gärling, 2003; Gärling, Fujii, & Boe, 2001). This feedback loop represents how each time a car is used/not used may reinforce or weaken the driver's habitual car use and possibly their perception of the ease of using or not using a car in future. There is limited evidence for this proposed relationship (see Fujii and Gärling (2003) and Gardner (2009)) but it may warrant further research.

2.5. Discussion

Our review identified thirty-two unique studies that applied fifteen different psychological theories to understanding car use. Some theories were more frequently applied than others with seven theories applied in more than 80% of studies and eight theories only applied once. Thus some theories are more influential than others. This is consistent with reviews of theory utilisation across other areas (e.g., Davies et al., 2015; Glanz & Bishop, 2010; Painter et al., 2008; Prestwich et al., 2013). This is likely due to maturation of psychological theory in understanding ecological behaviour more generally. The Theory of Planned Behaviour (TPB) and Norm Activation Model (NAM) were most widely applied before 2010 but, since then, ecological behaviour-specific theories have been developed, in particular the Comprehensive Action Determination Model (CADM) and the Stage Model of Self-Regulated Behaviour Change (SSBC).

Four of five most frequently applied theories (TPB, NAM, Value Belief Norm theory (VBN) and Theory of Interpersonal Behaviour (TIB)) are well established in behavioural science and it is unsurprising that they can partially explain car use. In addition, these theories share constructs and mechanisms. The TPB and the TIB are general theories of social behaviours and include expectance-value and normative belief constructs to explain behavioural intention and behaviour. A key distinction between the two is the extent to which they highlight conscious monitoring of choices versus automatic enactment. The TIB

proposes that this conscious control decreases when habitual behaviours are formed and strengthened.

The NAM and VBN were developed to explain specific behaviour patterns. The NAM explains prosocial altruistic behaviour while the VBN explains environmental behaviours but both conceptualise personal norms as its only direct determinant instead of behavioural intention as posited by TPB and TIB. Nevertheless, the theorisation of the mechanisms leading to personal norms differs in both theories.

Given that psychological theories have been applied in transport studies for the three decades, it is surprising that there is a dearth of research that systematically evaluates their application. Past reviews and meta-analyses in this area either focused on individual psychological constructs (Gardner & Abraham, 2008) or on a specific theory (Klöckner, 2013), none focusing on reviewing the breadth of theories, implied mechanisms applied or the quality of their application. Further empirical evaluations of the utility of psychological theories and the feasibility of their application in intervention design in needed in relation to car use (and perhaps ecological behaviour, more generally). Nonetheless, this mirrors theory-testing across behavioural science where advances are slow despite numerous calls for greater operationalisation, application, testing and refinement of theory (Abraham & Michie, 2008; Davis, Campbell, Hildon, Hobbs, & Michie, 2015; Glanz & Bishop, 2010; Michie & Johnston, 2012; Noar & Zimmerman, 2005; Rothman, 2004; Weinstein & Rothman, 2005).

The CADM and SSBC integrated empirically-supported relationships included in existing theories (e.g., personal norm to intention) and added related constructs (e.g., habit). This response to the need for ecological behaviour-oriented psychological theories (Stern, 2000) is an exciting development, not only for understanding car use but ecological behaviours in general. Further testing of such integrative frameworks has the potential to inform intervention and policy design (Truelove, Carrico, Weber, Raimi, & Vandenbergh, 2014). Nonetheless, the need for further empirical studies to establish the validity of the proposed

relationships remains, especially the novel time-ordered construal and operationalisation of behavioural intention in the SSBC.

We consolidated findings across identified theories and constructs (e.g., environmental concern) into an integrative conceptual framework of antecedents of car use and we have referred to it as the CAUSE (CAr USE) framework (see Figure 2.3). We are *not* suggesting that this integrative framework should replace existing theories and recognise the challenge of operationalising all the constructs within our framework in any particular study. Its purpose is to provide a map representing how existing theories fit together within our wider understanding of the self-regulation and antecedents of car use and possibly other ecological behaviours, such as recycling or water conversation. This may not be a definitive map of theoretical constructs and may be added to by future research. It does, however, highlight the complexity of mechanisms identified in this area and also the limitations of many of the theories we identified.

The time-ordered sequential self-regulation process in the CAUSE framework provides a useful guide during intervention development to inform designers on which constructs at each specific stage in the car use decision process they should consider targeting. For example, in an environment where car ownership and usage are normative and seen as socially desirable with little awareness of its consequences, goal and behavioural intention to use cars are likely to be strong, so interventionists might consider discouraging action (rather than undermining motivation) by targeting the facilitating conditions of car use such as increasing taxation on car ownership and usage. With a priori knowledge about the mechanisms of behaviour change, targeted interventions could potentially be more financially prudent and effective.

Our integrative conceptual framework is, like all theories and models, a work in progress. The framework was developed from studies theorising causal mechanisms resulting in car use motivation and behaviour. As further tests of CAUSE mechanisms are conducted, some may be highlighted as especially important while others appear less important. Consequently, the framework could be further developed and updated. Some directions for future research

into the role of identification are suggested by the construction of the CAUSE framework. First, the framework does not include 'identity' constructs, such as 'green identity' (Clayton et al., 2015; Whitmarsh & O'Neill, 2010). Research establishing the independence and additive predictive validity of such constructs would warrant their inclusion. Second, the cross-cultural validity of environmental research could be improved by the inclusion of collective and individualistic cultural differences in the perception of car use (Cho, Thyroff, Rapert, Park, & Lee, 2013; Greif, 1994; Nayeem, 2012; Oliver & Lee, 2010; Triandis, 1988)). Third, research has explored how global identification using constructs such as 'cosmopolitan orientation' (Leung, Koh, & Tam, 2015) representing the extent to which individuals see themselves as part of the global human family, facing global challenges can predict pro-environmental behaviours, such as reduced personal car use. Research could clarify at what level identification has most impact on pro-environmental choices, including choosing not to drive.

Such work could expand the framework beyond individual cognition based on the underlying assumption that we operate as *Homo Economicus* (rational decision makers, involved in deliberative, mindful decisions, e.g., Ajzen (1991) and Stern (2000)), or *predictably irrational* individuals (engaging in habitual, automatic behaviours, e.g., Kurz, Gardner, Verplanken, and Abraham (2015) and Verplanken and Orbell (2003)), or a combination of both (Batel, Castro, Devine-Wright, & Howarth, 2016; Clayton et al., 2015) to also clarify how broader cultural and global factors influence the ways in which we think and act.

Most of the studies we identified were European so highlighting the need to raise the profiles of relevant theory to researchers outside of Europe and especially in emerging economies where automotive growth is forecasted to grow rapidly in the coming decades (International Energy Agency, 2015; PricewaterhouseCoopers, 2016). Our integrative conceptual framework will be helpful in these emerging economies for understanding car use antecedents in order to target the appropriate cognitive and emotional antecedents, such as instilling values and cultivating norms, to promote long-term sustainable travel behaviours. Such research could also highlight cross-cultural differences likely

to be more important than those observed between European countries (Hofstede, 2001; Nayeem, 2012; Oliver & Lee, 2010).

More than half the identified studies were rated as having moderate to poor methodological quality, primarily due to potential selection bias from low percentages of participation agreement. Participant recruitment in this area seems particularly challenging, possibly due to the level of burden and disruption to daily life routines that travel studies require (i.e., requiring participants to complete daily travel diaries). Thus, the main challenge for future studies should have lower levels of burden and intrusiveness in daily lives, particularly those using travel diaries and/or travel behaviour modifications. Though the latter suggestion seemingly negates the purpose of behaviour change studies, in reality, commitment and subsequent adherence to behaviour changes is greatly influenced by personal motivation, attitude towards the change and appraisals of its feasibility. Interestingly, studies identified in the review reporting higher percentages of participation agreement (Anable, 2005; Bamberg, 2006; Bamberg & Schmidt, 2003c; Eriksson et al., 2008; Mann & Abraham, 2012) may provide useful illustrations of method. Furthermore, with the proliferation of location-based mobile smart technology, future studies can explore the possibility of mobile application-based travel diaries and interventions to further encourage participation (Çolak, Alexander, Alvim, Mehndiratta, & González, 2015).

It is also important to highlight that whilst the search strategy aimed to identify most of the relevant studies in this area, it is by no means exhaustive. It was not possible to identify every study that applied a theory to car use because not all studies acknowledged the utilization of a theory within their title and/or abstract; only 17 of 35 included publications mentioned their use of a theory within their title and/or abstract. Though the search strategy could have been expanded to a full-text, such a search would not have been practical. This emphasizes the importance of reporting theory testing in the abstract and, if possible, within the title.

2.6. Conclusions

Humans are causing measurable changes to our ecosystem and only changes in our behaviours at population levels can arrest these developments. The current work attempted to integrate an extensive psychological literature exploring the psychological determinants of car use as an exemplar of how psychological constructs can help us better understand what drives and motivates environmentally-relevant behaviours. Combining 15 theories we developed an integrative conceptual framework of antecedents of car use (the CAUSE framework). We believe this has the potential to clarify what specified mechanistic relationships are being tested in studies theorising personal car use behaviours. In addition, the CAUSE framework may be helpful in conceptualizing different approaches to reducing car use and also for researchers investigating other ecologically-relevant behaviours.

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Chapter 3. Commuting and wellbeing in London: The roles of commute mode and local public transport connectivity. [2]

3.1. Abstract

Objective: To explore the relationships between commute mode, neighbourhood public transport connectivity and subjective wellbeing.

Method: The study used data on 3,630 commuters in London from wave two of Understanding Society (2010/11). Multivariate linear regressions were used to investigate how commute mode and neighbourhood public transport connectivity were associated with subjective wellbeing for all London commuters and for public transport commuters only. Subjective wellbeing was operationalized in terms of both a positive expression (life satisfaction measured by a global single-item question) and a more negative expression (mental distress measured by the General Health Questionnaire). Logistic regression was also used to explore the predictors of public transport over non-public transport commutes.

Results: After accounting for potentially-confounding area-level and individual-level socioeconomic and commute-related variables, only walking commutes (but not other modes) were associated with significantly higher life satisfaction than car use but not with lower mental distress, compared to driving. While better public transport connectivity was associated with significantly lower mental distress in general, train users with better connectivity had higher levels of mental distress. Moreover, connectivity was unrelated to likelihood of using public transport for commuting. Instead, public transport commutes were more likely amongst younger commuters who made longer distance commutes and had comparatively fewer children and cars within the household.

Conclusion: The findings highlight the heterogeneity of relationships between commute mode, public transport connectivity and subjective wellbeing and have

implications for intervention strategies and policies designed to promote commuting behaviour change.

3.2. Introduction

A growing literature suggests that the means by which people travel to and from work, that is, their commute mode can significantly affect their health and wellbeing. Active commuting, such as walking and cycling, and even commuting by public transport, as opposed to driving, increases daily physical activity with associated health benefits (NICE, 2012; Flint, Cummins, & Sacker, 2014; Laverty, Mindell, Webb, & Millett, 2013; Pucher, Buehler, Bassett, & Dannenberg, 2010; Stathopoulou, Powers, Berry, Smits, & Otto, 2006; Wanner, Götschi, Martin-Diener, Kahlmeier, & Martin, 2012). It has also been proposed that non-car commuting may be associated with higher self-reported, or subjective, wellbeing (Humphreys, Goodman, & Ogilvie, 2013; Martin, Goryakin, & Suhrcke, 2014; St-Louis, Manaugh, van Lierop, & El-Geneidy, 2014), operationalised as both higher life satisfaction (Stutzer & Frey, 2008) and lower mental distress, e.g., fewer symptoms of depression and anxiety (Roberts, Hodgson, & Dolan, 2011). The benefits of subjective wellbeing are increasingly recognised by governments worldwide (ONS, 2013), not least because psychological ill-health places a large burden on health and social care (Roberts et al., 2011). Thus, improving our understanding of how commuting relates to subjective wellbeing offers important insights into reducing the burden of disease and ill-being among commuters.

Several questions remain unanswered. First, previous studies tended to collapse different transport modes (e.g., bus and train; walking and cycling) into over-arching categories (i.e., public transport and active transport, respectively; Flint et al., 2014; Martin et al., 2014). However, there may be important differences in commuter experiences of these different travel modes. Second, few have investigated the effects of public transport infrastructure quality near one's residence, i.e., the level of 'neighbourhood connectivity' (Chng, White, Abraham, Alcock, & Skippon, 2015). Connectivity may simultaneously affect: a) public transport use; and b) public transport commuter wellbeing. For example, while we might expect people to use public transport more often if available,

some studies suggest that people may be unaware of transport options (Beirão & Cabral, 2007). No previous studies of the relationship between connectivity and wellbeing among public transport users were found.

Finally, the limited studies that considered relationships between commute mode and wellbeing focused on whether certain modes are associated with either: a) positive wellbeing (e.g., life satisfaction; Stutzer & Frey, 2008), or b) (reduced) mental distress (e.g., symptoms of anxiety and depression; Humphreys et al., 2013; Martin et al., 2014; Roberts et al., 2011), and tended to assume that one is the inverse of the other. However, research in positive psychology suggests that, although related, these measures should be considered separately (Kahneman & Krueger, 2006; Seligman, 2002). For example, research examining relationships between wellbeing and urban green space found that controlling for one facet of wellbeing (life satisfaction) did not eliminate the effects of green space on the other (mental distress) or vice versa, suggesting that urban green space may act to improve wellbeing both by decreasing negative symptoms and promoting positive outcomes through different mechanisms (White, Alcock, Wheeler, & Depledge, 2013). A richer understanding of the relationship between commute mode and wellbeing may be gained by considering both aspects, e.g., cycling to work might promote wellbeing by encouraging positive emotions (which are known to be associated with physical activity in general; Stathopoulou et al., 2006) and/or by reducing mental distress, e.g., anxiety associated with traffic jams.

3.2.1. The present study

This study explores these issues using cross-sectional data from the Understanding Society panel survey (also known as the UK Household Longitudinal Study, UKHLS). In particular, we focused on a sub-sample of participants residing within Greater London and commuted to work. This sub-sample was chosen because London's public transport infrastructure, relative to the rest of UK, is well developed and accessible, and neighbourhood-level public transport connectivity data (Transport for London, 2010) could be merged with existing individual-level data. We investigated four key questions: 1) Are subjective wellbeing relationships with commute mode homogenous within mode categories (e.g., are all public transport modes associated with similar

wellbeing results)?; 2) Are commute mode relationships with wellbeing the same for positive and negative wellbeing measures – or independent?; 3) Are individuals living in neighbourhoods with good connectivity more likely to use public transport to get to work?; 4) Is wellbeing higher among public transport users with good connectivity?

Our analyses controlled for a range of sociodemographic factors known to be associated with wellbeing (Dolan, Peasgood, & White, 2008) and relevant observable commute-related factors, such as number of cars in the household and commute distance, which are also important in the present context.

3.3. Methods

3.3.1. Data source and sample

The sample was drawn from wave 2 (2010/11; n = 54,597) of the UKHLS (University of Essex, 2013), a longitudinal panel survey of 40,000 UK households that began in 2009. Participants are surveyed annually on their socioeconomic circumstances, attitudes, and behaviour via a computer-assisted personal interview. Detailed study and sampling methodology information is reported elsewhere (Lynn, 2011). The commuting module in wave 2 explores commute behaviour. Participants were categorised as commuters if they were in employment and worked somewhere other than at home.

The samples used for analyses were commuters in London (n = 3,630) who provided data for one or both of the main dependent measures (life satisfaction, n = 2704; General Health Questionnaire, n = 2,694). The appropriate UKHLS cross-sectional weight was applied to improve the sample's population representativeness, thus sample sizes reported are weighted respondent samples rounded to integer values.

3.3.2. Measures

Positive wellbeing was measured using the single-item global life satisfaction question "How dissatisfied or satisfied are you with your life overall?", with responses ranging from "not satisfied at all" (1) to "completely satisfied" (7). Mental distress was measured using the 12-item General Health Questionnaire (GHQ), a widely used and validated instrument in patient and general

populations (Goldberg et al., 1997; Goldberg & Williams, 1991), on a 36-point Likert scale with increasing levels of distress.

Commute mode was assessed using responses to the question "How do you usually get to your place of work?" Responses were categorised as either a) car/van (the reference category in subsequent analyses); public transportation b) train; c) bus/coach; d) underground; and active transport e) walking, and f) cycling. The remaining travel mode observations (car/van passengers [1.91% of total observations], taxi [0.98%], motorcycle [0.11%] and combination of modes [1.07%]) were excluded due to small sample sizes. A binary public transport variable (reference category [ref] = non-public transport) was also derived for further analysis.

Connectivity was operationalised using the London-based 'Public Transport Accessibility Level' (PTAL) dataset (Transport for London, 2013), which measures public transport network density in small geographical areas, after accounting for walking access time, service availability and reliability (Transport for London, 2010). The PTAL is categorised into 6 levels from 1 (very poor or low accessibility) to 6 (excellent or high accessibility). Further information is available elsewhere (Transport for London, 2010). For current purposes, in part due to relatively small sample sizes, we collapsed the 6-point scale into a binary variable reflecting either i) 'Poor' connectivity (i.e., Level 1 [very poor] to Level 3 [moderate]); or ii) 'Good' connectivity (i.e., Level 4 [good] to Level 6 [excellent]). This data is specified at the geographical unit of a Lower Layer Super Output Area (LSOA). There are 4,835 LSOAs in London with an average population of 1,720 (2012 data). As UKHLS provides individual-level LSOA data (with special licence access), we were able to assign specific LSOA PTAL values to specific individuals to reflect their neighbourhood's connectivity. Subsequent analyses used 'Poor' connectivity as the reference category.

To account for potentially observable confounding variables, covariates included in the fully adjusted models were age, sex (ref = male), presence of work-limiting illness or disability (ref = no illness), monthly household income (quintiles equivalized using the Organisation for Economic Co-operation and Development modified scale indexed to March 2012, ref = lowest quintile),

educational attainment (high school qualifications, degree or above, ref = no qualifications), London congestion zone location (derived by identifying LSOAs that are located within the 2007-2011 boundary that includes the Western extension; ref = outside congestion zone), month of interview, commute distance, number of cars in the household, and the urban density (number of people per km^2), indices of deprivation (income, employment, education, crime rate and environment) and percentage of green space of the LSOA in which they lived.

3.3.3. Statistical analysis

Previous research suggests it makes little difference whether wellbeing variables are treated as linear or ordinal data (Ferrer-i-Carbonell & Frijters, 2004), so the current analyses operationalised life satisfaction and GHQ as continuous variables.

Multivariate linear regressions investigated their relationship with commute mode and connectivity, controlling for potentially confounding variables. In each case several models were tested. The first (unadjusted) model included only commute mode. A second (PTAL-adjusted) model included connectivity. A third (fully-adjusted) model added sociodemographic variables. A fourth (SWB-controlled) model added the negative wellbeing measure to the positive wellbeing model and vice-versa. Any effects remaining significant once the second wellbeing measure was added indicates independent effects on the positive versus negative aspects of wellbeing, suggesting that both measures tap into different facets of wellbeing.

Next, we focused specifically on public transport commutes. First we used multivariate logistic regression to investigate whether London commuters residing in neighbourhoods with better connectivity were more likely to use public transport. Then we explored whether using public transport in neighbourhoods with better connectivity was associated with greater wellbeing.

All analyses were undertaken with Stata 13 software using the appropriate sampling probability weights provided by UKHLS.

3.4. Results

3.4.1. Sample descriptive and subjective wellbeing by commute mode

Of the London commuters in our estimation sample, 53.3% were women and the mean (SD) age was 38.97 (0.47) years. Public transport was the most common travel mode (50.1% of commutes) with underground/light railway mode being the most frequent. About a quarter (25.9%) commuters resided in neighbourhoods with 'good' connectivity and car commutes amongst this group were less than half (15.4%) the level observed amongst those with 'poor' (35.0%) connectivity. Detailed descriptive information is found in supplementary Table 3.A.1.

3.4.2. Relationships between commute mode, public transport connectivity and wellbeing

Table 3.1 shows the results of multivariate linear regressions modelling for the relationship between wellbeing and commute mode and public transport connectivity. In the unadjusted model of life satisfaction, underground/light railway (B = 0.32, $p < .05$), cycling (B = 0.33, $p < .05$) and walking (B = 0.32, $p < .05$) commutes were associated with significantly greater life satisfaction than car commutes. There were no significant differences between train or bus/coach commuters and drivers. Results were unchanged when PTAL was added to the model, and living with 'good' connectivity was not, of itself, related to higher life satisfaction. In the fully adjusted model, only walkers reported significantly higher life satisfaction than drivers and, unsurprisingly, individuals in the highest household income quintile reported higher life satisfaction than individuals in the lowest quintile. When GHQ scores were added, walkers continued reporting significantly higher life satisfaction than drivers (B = 0.35, $p < .05$), suggesting that walking to work affects wellbeing through mechanisms over and above reduction in mental distress.

By contrast, no commute mode was associated with significant differences in GHQ scores compared to travelling by car in any models. Connectivity was, however, negatively associated with GHQ in both the fully-adjusted and life satisfaction-controlled models. Individuals with 'good' connectivity reported fewer symptoms of mental distress than individuals with 'poor' connectivity (fully adjusted model B = -1.10, $p < .05$, see supplementary Table 3.A.2). To better

understand the scale of this effect, note that the average difference in GHQ scores between individuals in the highest vs. lowest income quintiles was only B = -1.79, *p* < .05 (fully adjusted model, supplementary Table 3.A.2), suggesting that the connectivity effect was relatively large and thus potentially meaningful.

Table 3.1.
Results of linear regression models investigating the association between commuting modes, public transport connectivity and life satisfaction amongst London commuters. Values are difference (95% confidence interval) in life satisfaction/GHQ scores.

	Life satisfaction (higher score = better wellbeing)				GHQ (higher score = higher mental distress)			
	Unadjusted (n = 2,704)	PTAL adjusted (n = 2,704)	Fully adjusted[a] (n = 2,574)[b]	GHQ-controlled[c] (n = 2,549)[d]	Unadjusted (n = 2,694)	PTAL adjusted (n = 2,694)	Fully adjusted[a] (n = 2,567)[b]	LS[e]-controlled[c] (n = 2,549)[d]
Commute mode								
Car/van	0	0	0	0	0	0	0	0
Public transport								
Train	0.10 (-0.14, 0.34)	0.10 (-0.14, 0.33)	-0.03 (-0.30, 0.24)	0.02 (-0.23, 0.26)	-0.28 (-1.45, 0.89)	-0.26 (-1.42, 0.91)	0.30 (-0.99, 1.60)	0.29 (-0.87, 1.45)
Bus/coach	-0.14 (-0.48, 0.20)	-0.15 (-0.48, 0.20)	0.23 (-0.08, 0.54)	0.11 (-0.14, 0.36)	-0.32 (-1.56, 0.91)	-0.21 (-1.46, 1.04)	-1.21 (-2.43, 0.01)	-0.80 (-1.83, 0.23)
Underground/light railway	0.32 * (0.06, 0.58)	0.31* (0.04, 0.57)	0.24 (-0.04, 0.52)	0.19 (-0.04, 0.42)	-0.91 (-2.35, 0.53)	-0.69 (-2.05, 0.66)	-0.46 (-1.87, 0.94)	-0.07 (-1.28, 1.13)
Active transport								
Cycle	0.33* (0.02, 0.65)	0.31* (0.00, 0.62)	0.24 (-0.08, 0.55)	0.17 (-0.08, 0.43)	-0.94 (-2.08, 0.20)	-0.73 (-1.91, 0.45)	-0.56 (-1.90, 0.79)	-0.17 (-1.27, 0.94)
Walk	0.32* (0.05, 0.60)	0.31* (0.02, 0.59)	0.48** (0.14, 0.81)	0.35* (0.05, 0.66)	-0.44 (-1.43, 0.55)	-0.26 (-1.28, 0.76)	-0.90 (-2.03, 0.22)	-0.13 (-1.13, 0.88)
Public transport accessibility level (PTAL)								
Very poor to moderate		0	0	0		0	0	0
Good to excellent		0.06 (-0.16, 0.28)	0.16 (-0.03, 0.35)	0.04 (-0.14, 0.21)		-0.70 (-1.72, 0.33)	-1.10* (-2.08, -0.12)	-0.85 (-1.75, 0.06)

Notes:
* Indicates statistical significance at the $p < 0.05$ level.
** Indicates statistical significance at the $p < 0.01$ level.
[a] Fully adjusted models controlled for commute distance, location relative to congestion zone, population density, educational attainment, OECD equivalised gross household income indexed by the consumer price index, number of children, the presence of limiting illness or disability, age, gender, neighbourhood income deprivation, neighbourhood employment deprivation, neighbourhood education deprivation, neighbourhood crime rate deprivation, neighbourhood environment deprivation and neighbourhood percentage of green space.
[b] Changes in *n* are due to missing values in the following variables: commute distance, location relative to congestion zone, population density, educational attainment, OECD equivalised gross household income indexed by the consumer price index, number of children, the presence of limiting illness or disability, neighbourhood income deprivation, neighbourhood employment deprivation, neighbourhood education deprivation, neighbourhood crime rate deprivation, neighbourhood environment deprivation and neighbourhood percentage of green space.

c   The models controlled for the other of wellbeing (life satisfaction or GHQ).
d   Changes in *n* are due to missing values in the additional wellbeing variable.
e   Life satisfaction

3.4.3. Predicting public transport commutes with public transport connectivity

Multivariate logistic regression explored if public transport connectivity influences the use of public over non-public transport (car and active transport combined) commutes. Connectivity did not significantly predict public transport commutes in the unadjusted model, OR (95% CI) = 1.18 (0.84, 1.66). This observed effect remained unchanged with sociodemographic variables added to the model, OR (95% CI) = 1.00 (0.62, 1.16). Nonetheless, public transport commute was significantly more likely as commute distances increased. Whilst household income did not significantly predict public transport commutes, public transport use was significantly lower when commuters had at least one car (OR [95% CI] = 0.19 [0.12, 0.29]) and one child in the household, OR (95% CI) = 0.67 (0.49, 0.91). In addition, the odds of public transport commutes decreased with age, OR (95% CI) = 0.97 (0.96, 0.99) – see Table 3.2.

Table 3.2.
Results of logistic regression models investigating the association between public transport connectivity and the use of public transport amongst London commuters.

	Unadjusted (n = 3,630)	Fully adjusted (n = 3,512)[a]	
	Odds ratio (95% CI)	Odds ratio (95% CI)	Wald
Public transport accessibility level			
Very poor to moderate	1	1	
Good to excellent	1.18 (0.84, 1.66)	1.00 (0.62, 1.16)	
Congestion zone			
Outside zone		0	
Inside zone		0.93 (0.29, 2.96)	
Residential density (1000 person per sq km)		1.00 (1.00, 1.00)	
Distance to work (miles)			p < .001
0 to 2		1	
3 to 5		4.77 (2.74, 8.30)***	
6 to 10		10.89 (6.54, 18.15)***	
11 to 20		21.32 (11.75, 38.68)***	
> 20		5.00 (2.36, 10.61)***	
Equivalised household income (5ths)			p = .76
1 Lowest		1	
2		1.09 (0.57, 2.07)	
3		1.46 (0.75, 2.83)	
4		1.29 (0.69, 2.43)	
5 Highest		1.34 (0.75, 2.42)	
Highest educational qualification			p = .49
None		1	
Other		0.70 (0.35, 1.41)	
≥Degree		0.80 (0.39, 1.66)	
Gender			
Male		1	
Female		1.16 (0.83, 1.63)	
Age		0.97 (0.96, 0.99)***	
Child in household			
No children		1	
Children <16		0.67 (0.49, 0.91)**	
Number of cars in household			
None		1	
At least one		0.19 (0.12, 0.29)***	
Limiting illness or disability			
None		1	
Yes		0.84 (0.56, 1.26)	
Month of interview		1.02 (0.97, 1.06)	

Notes:
** Indicates statistical significance at the $p < 0.01$ level.
*** Indicates statistical significance at the $p < 0.001$ level.
[a] Changes in *n* are due to missing values in the following variables: commute distance, location relative to congestion zone, population density, educational attainment, OECD equivalised gross household income indexed by the consumer price index, number of children and the presence of limiting illness or disability.

3.4.4. Wellbeing amongst public transport commuters

Did those commuting by public transport show higher levels of wellbeing if they lived in areas with better connectivity? Analyses were run for all public transport commuters combined (ref = train commutes) and also by each public transport mode separately (i.e., trains, bus/coaches, underground/light railway) and are presented in Table 3.3. Here we focus only on fully-adjusted and wellbeing-controlled results. When considering all public transport commuters, living in 'good', compared to 'poor', connectivity areas were associated with significantly higher life satisfaction (B = 0.35, p < .01) and lower mental distress (B = -1.74, p < .05). Adding the alternative wellbeing measure to these models rendered both effects non-significant, suggesting that the influence of connectivity on wellbeing may be operating through the general or shared variance assessed by both wellbeing measures. In the fully-adjusted life satisfaction models, bus/coach and underground commuters reported significantly higher life satisfaction than train commuters, with this effect remaining significant for underground commuters even after GHQ was added to the model. These effects were not replicated in the GHQ models, suggesting that for underground commuters in particular, any evidence of higher wellbeing is related to positive aspects of wellbeing rather reductions in mental distress. However, this may also be influenced by whether the commuter is residing within the London congestion zone. Residing within the zone was associated with significantly lower life satisfaction (B = -0.79, p < .01) in the fully-adjusted model with this effect remaining significant after GHQ was added to the model. This effect was not replicated in the GHQ models, suggesting that living within the congestion zone, characteristically with 'good' connectivity, is only related to reductions in positive aspects of wellbeing.

In the fully-adjusted individual transport mode models, 'good' vs. 'poor' connectivity was associated with higher life satisfaction (B = 0.50, p < .05) and lower mental distress among underground users (B = -1.82, p < .05). By contrast, living with good connectivity was associated with greater mental distress amongst train commuters (B = 1.88, p < .05). Controlling for the second wellbeing measure did not affect the relationship between mental distress and connectivity for train commuters but did result in a significant positive relationship between connectivity and life satisfaction. This is particularly

intriguing as it suggests that train commuters' wellbeing may be affected by complex interactions between positive and negative aspects of wellbeing. Adding the second wellbeing variable to the fully-adjusted models for underground commuters rendered previous effects non-significant suggesting that, for these commuters, shared variance between life satisfaction and mental distress was important. Finally, once life satisfaction was added to the model, mental distress scores were significantly lower among bus/coach commuters with 'good' vs. 'poor' connectivity. Interestingly, bus/coach commuters residing within, compared to outside, the congestion zone reported significantly lower life satisfaction (B = -0.78, $p < .05$) and lower mental distress (B = -1.75, $p < .05$) when the alternative wellbeing measure was added to the models. This suggests that whilst living and commuting by bus/coach within the congestion zone potentially reduces negative aspects of wellbeing, it does not necessarily result in corresponding increases in positive aspects of wellbeing. Full results are presented in supplementary Tables 3.A.3 and 3.A.4.

Table 3.3.

Results linear regression models investigating the association between public transport commuting, public transport connectivity and wellbeing.

Life satisfaction: Values are difference (95% confidence interval) in life satisfaction scores (higher score = better wellbeing).

	All public transport		Train		Bus/coach		Underground/light railway	
	Fully adjusted[a] (n = 1,349)[b]	GHQ-controlled[c] (n = 1,331)[d]	Fully adjusted[a] (n = 442)[b]	GHQ-controlled[c] (n = 442)[d]	Fully adjusted[a] (n = 370)[b]	GHQ-controlled[c] (n = 360)[d]	Fully adjusted[a] (n = 537)[b]	GHQ-controlled[c] (n = 529)[d]
Commute mode								
Train	0	0						
Bus/coach	0.34**	0.16						
	(0.01, 0.67)	(-0.09, 0.42)						
Underground/light railway	0.29*	0.22						
	(0.02, 0.57)	(-0.01, 0.46)						
Public transport accessibility level								
Very poor to moderate	0	0	0	0	0	0	0	0
Good to excellent	0.35**	0.18	0.33	0.50*	-0.14	-0.16	0.50*	0.34
	(0.12, 0.59)	(-0.08, 0.45)	(-0.08, 0.74)	(0.12, 0.89)	(-0.39, 0.68)	(-0.65, 0.32)	(0.09, 0.90)	(-0.12, 0.81)

GHQ: Values are difference (95% confidence interval) in GHQ-12 scores (higher score = higher mental distress).

	All public transport		Train		Bus/coach		Underground/light railway	
	Fully adjusted[a] (n = 1,344)[b]	LS[e]-controlled[c] (n = 1,331)[d]	Fully adjusted[a] (n = 445)[b]	LS[e]-controlled[c] (n = 442)[d]	Fully adjusted[a] (n = 362)[b]	LS[e]-controlled[c] (n = 360)[d]	Fully adjusted[a] (n = 536)[b]	LS[e]-controlled[c] (n = 529)[d]
Commute mode								
Train	0	0						
Bus/coach	-1.66	-1.17						
	(-3.42, 0.09)	(-2.67, 0.33)						
Underground/light railway	-0.59	-0.17						
	(-2.11, 0.93)	(-1.52, 1.18)						
Public transport accessibility level								
Very poor to moderate	0	0	0	0	0	0	0	0
Good to excellent	-1.74*	-1.22	1.88*	2.31**	-2.56*	-2.32*	-1.82*	-0.97
	(-3.18, -0.29)	(-2.68, 0.25)	(0.06, 3.70)	(0.58, 4.05)	(-4.61, -0.51)	(-4.19, -0.44)	(-3.60, -0.03)	(-3.04, 1.10)

Notes:

* Indicates statistical significance at the $p < 0.05$ level.

** Indicates statistical significance at the $p < 0.01$ level.

[a] Fully adjusted models controlled for commute distance, location relative to congestion zone, population density, educational attainment, OECD equivalised gross household income indexed by the consumer price index, number of children, the presence of limiting illness or disability, age, gender, neighbourhood income deprivation, neighbourhood employment deprivation, neighbourhood education deprivation, neighbourhood crime rate deprivation, neighbourhood environment deprivation and neighbourhood percentage of green space.

[b] Changes in *n* are due to missing values in the following variables: commute distance, location relative to congestion zone, population density, educational attainment, OECD equivalised gross household income indexed by consumer price index, number of children, the presence of limiting illness or disability, neighbourhood income deprivation, neighbourhood employment deprivation, neighbourhood education deprivation, neighbourhood crime rate deprivation, neighbourhood environment deprivation and neighbourhood percentage of green space.

[c] The models controlled for the other measure of wellbeing (life satisfaction or GHQ).

[d] Changes in *n* are due to missing values in the additional wellbeing variable.

[e] Life satisfaction

3.5. Discussion

We explored the relationships between commute mode, local public transport connectivity and wellbeing among a large sample of London-based commuters, while controlling for a range of area and individual level factors. Our use of 6 specific commute mode categories and both positive and negative wellbeing measures revealed complex patterns of associations previously untested. For example, although both cycling and walking are active commutes, compared to driving, only walkers reported higher life satisfaction compared to driving (even controlling for commute distance and other factors). This is important for interpreting previous results, which despite using longitudinal designs and/or comparatively more advanced methodology (e.g., fixed-effets models; Humphreys et al., 2013; Martin et al., 2014; St-Louis et al., 2014) were unable to address the impacts on wellbeing of different types of active commute. Walking, but not cycling, to work emerged as being associated with higher life satisfaction. This is of particular interest in the context of London where cycling is being increasingly promoted via cycle lanes and the Santander Cycle scheme (a self-service, bike sharing scheme for short journeys). The current data may suggest that cycling in London is still not an enjoyable experience and more could be done to improve this.

Mental distress was lower among all groups of public transport commuters (i.e. bus/train/underground users) in areas with better public transport connectivity. Moreover, the scale of these benefits was only slightly smaller than the benefits of being in the highest versus lowest income quartile. This information may be of interest to both: a) individuals, e.g. when they consider the trade-offs between a better paid job vs. living in an area of London with poorer public transport connectivity; and b) planners, who want to address socio-economic disparities in health and wellbeing; i.e. mental distress among the poorest sectors of the working population might be reduced through better public transport infrastructure.

Residing within versus outside of the congestion zone was associated with lower life satisfaction amongst public transport commuters. However, looking at individual public transport modes, it became clear that this was only observed among bus/coach commuters. Interestingly, commuting by bus/coach while

residing within the zone was also associated with lower mental distress. The magnitude of observed coefficients for residing within the congestion zone was comparable, if not greater, to coefficients observed for having 'good' connectivity. This builds on previous research that found bus/coach commutes were generally associated with poorer wellbeing (Legrain, Eluru, & El-Geneidy, 2015; ONS, 2014) and highlights the importance of considering how travel location potentially attenuates relationships between commute type and wellbeing. Particularly for London, this calls for an assessment of the impact of reducing the congestion zone (in 2011; after this wave of UKHLS) on commuter wellbeing. For instance, bus/coach commuters re-zoned out of the new congestion zone may report increases in life satisfaction but also in mental distress, hypothetically due to increases in traffic-related stressors.

Our findings suggest that while life satisfaction appears to be more closely related to the *type* of public transport used, mental distress appears more closely related to the *connectivity* of public transport. This is supported by the observation that the relationship between walking and life satisfaction remains even after controlling for mental distress, and the relationships between connectivity and mental distress remains for train and bus commutes even after controlling for life satisfaction. We are reluctant, however to speculate as to whether policymakers should *a priori* focus on reducing distress or promoting positive wellbeing. Such decisions depend on contextual factors such as baseline levels of distress and wellbeing, the feasibility and acceptability of interventions and implications for equity. Nonetheless, our findings highlight that different transport policies may affect positive and negative aspects of life differently and policymakers may need to consider this.

3.5.1. Strengths and limitations
Using the UKHLS provided us with a large sample of commuters, often difficult to access through primary studies, providing us with the statistical power to explore these associations. Whilst using a London sample addressed representation heterogeneity of certain travel modes previously reported (Martin et al., 2014) and provided richer data and insights, our findings are also limited to London and cannot be generalised to the wider UK population. However, it is

possible that similar associations may be found in other large cities both in the UK (e.g., Glasgow), and elsewhere (e.g., Singapore and New York).

We used two measures of wellbeing assessing positive and negative aspects and this revealed independent effects. While such analyses are suggestive of how changes in measured variables might impact on wellbeing, the cross-sectional nature of survey data means that these questions can only be definitively answered by experimental studies; evaluation of policy implementation is needed. Future work and policies would also benefit from exploring other individual-level factors influencing travel mode choices and wellbeing such as personal attitude and willingness to modifying commute behaviour.

We also recognise that PTAL does not provide the perfect measure for this kind of work because it does not differentiate between rail and bus connectivity, which may be important given our current findings of different wellbeing across travel modes. Our findings thus suggest a need to keep different forms of travel connectivity separate in future analyses. In addition, connectivity at LSOA level is only a proxy for actual transport availability. Some individuals may live at intersections of two or more LSOAs and it may actually be closer to access a public transport hub in another LSOA than one in the LSOA in which an individual lives. Further work could reduce potential errors of this kind by estimating walking distances to specific public transport sites for each participant, irrespective of small geographical boundaries, to explore marginal gains from improving connectivity.

3.6. Conclusion

These limitations notwithstanding, our study extends previous findings on the potential impact of commute mode on wellbeing by demonstrating that active transport options (i.e. walking and cycling) should not be collapsed for data collection and analysis purposes and that neighbourhood public transport connectivity moderates relationships between wellbeing and public transport use. Though London's public transport infrastructure is relatively well established, policymakers should continue enhancing its accessibility in tandem with growing needs, which potentially helps address growing mental health

disparities. In addition, given walking commutes' associations with higher life satisfaction, perhaps stronger promotion of walking, to augment current policies encouraging cycling, should be considered. More generally, effective interventions could also lead to population-relevant wellbeing benefits in addition to previously documented physical health gains.

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Chapter 4: Driving in London and Singapore; A cross-cultural, qualitative comparison of city transportation experiences.[3]

4.1. Abstract

We interviewed city dwellers in two cities, Singapore and London, with highly developed transport infrastructure. Our aim was to understand individual transport decisions and experiences in the context of two different city cultures supporting distinct transport policies. Compared to London, cars and other private transport are valued and priced beyond the reach of most in Singapore. Seventeen adults from London and sixteen from Singapore were interviewed and presented with an overview of the other city's transportation system to elicit their opinions on the differences and whether an alternate system could be applied in their city. Differences were observed in perceptions of, and beliefs concerning, private transport. In Singapore, cars served more than utilitarian purposes and were viewed as socially desirable status and success symbols. In London, car ownership and usage was viewed as a necessity due to a perceived lack of accessible, alternative transport. Both samples valued accessibility, affordability and comfort in relation to transport mode choice. The acceptance of strict car ownership policies in Singapore and the support for such policies from some London interviewees highlight the importance of public engagement and education in formulating and implementing transport policy.

4.2. Introduction

Economic activities are increasingly concentrated in expanding cities that need efficient transport systems (Rode et al., 2017; Rodrigue, Comtois, & Slack, 2017). Transportation becomes challenging for cities when transport systems, cannot satisfy mobility requirements. Some common transport challenges include (i) traffic congestion and parking difficulties resulting from motorisation and inadequate infrastructures; (ii) longer commutes due to congestion and increasing home-to-workplace distance; (iii) public transport inadequacy and

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cost because of over- or under-utilisation; (iv) high maintenance or replacement costs of aging transport infrastructures; and (v) difficulties incorporating non-motorised transport due to high traffic density or lack of infrastructure and facilities (European Commission, 2016).

Private vehicle use contributes, directly and indirectly, to these challenges and continues to grow globally, fuelled by economic development and the advantages it offers (e.g., on-demand mobility, comfort, status, speed and convenience; Rode et al., 2017; Rodrigue et al., 2017). Since the 1980s, congestion in cities has become increasingly noticeable and cities have been implementing policies and strategies to limit vehicular traffic (e.g., traffic prohibition and tolls). Some cities, including Beijing and Mexico City, attempted to prohibit vehicle use according to license plate numbers and day of the week but affluent drivers circumvented the system by purchasing a second vehicle, so worsening the situation (Gallego, Montero, & Salas, 2013; Yang, Wang, Shao, & Muncrief, 2015). To date, Singapore is the only city that has successfully imposed a heavy tax burden and purchasing permits on ownerships to controlled its vehicle fleet and growth rate (Pow, 2014).

Although car mobility may have peaked in developed countries because of transportation policies and other factors, such as higher energy prices, congestion, shifting economic prospects and an aging population, car ownership and use will continue to grow in emerging economies (PricewaterhouseCoopers, 2016). Private vehicles remain the prime choice for urban mobility in the short to medium term. Therefore, better understanding of transport behaviours in cities and how these relate to transport polices is needed to regulate car use.

4.2.1. The present research

This study interviewed transport users in London and Singapore to investigate: 1) experiences in the two cities; 2) factors considered during transport decisions; 3) cultural differences; and 4) opinions of current transport policies in their own and the other city. These two cities were selected because they are culturally and geographically distinct with advanced but different transport systems and policies. London has one of the world's oldest and most extensive

public transport networks while Singapore uses a unique set of policies to manage vehicular capacity. Table 4.1 highlights selected comparisons between the two cities.

4.2.2. Background of London

London is the capital city of England and the most populous city within the European Union with a population of 8.67 million living within an area of 1,572 square kilometres in 2016 with a population density of 5,510 per square kilometre (Greater London Authority, 2016). In 2015, 2.64 million cars were owned by residents, i.e., 30 cars per 100 persons (Department for Transport, 2016). To manage congestion and encourage alternative modes of transport in Central London during working hours, Congestion Charging, using a £11.50 daily tariff, was introduced in February 2003 for entry into specified zones (Transport for London, 2017). The public transport system network managed by Transport for London consists of buses, the London Underground (Tube), Docklands Light Railway, London Trams, London Overground, Emirates Air Line, River Services and Cycle Hire (more information is found on www.tfl.gov.uk).

4.2.3. Background of Singapore

Singapore, an island city-state in Southeast Asia, has a population of 5.61 million in 2016 in an area of 719.1 square kilometres, has a population density of 7,797 per square kilometre (Deparment of Statistics, 2016). A variety of vehicle population control strategies was introduced to discourage private car ownership and use since 1975 (Menon & Loh, 2015). Currently, new car buyers obtain a Certificate of Entitlement (COE) prior to the purchase, administered by the Vehicle Quota System (VQS) where a set quota of COEs are issued monthly for potential buyers to bid (Meng, Lu, & Ohtman, 2015). The final price of a COE for that bidding round is set at the lowest accepted bid. The Land Transport Authority (LTA) determines the quota of COEs issued based on a prescribed rate of vehicle population growth, currently at 0.25% per annum (LTA, 2017). An Additional Registration Fee is also imposed upon vehicle registration, ranging from 100-180% of the vehicle's value. Car usage is also managed by the Electronic Road Pricing (ERP) scheme which deducts charges electronically when vehicles pass through gantries on roads leading to the

central business district vicinity during peak periods (Lew & Leong, 2009). Singapore's car population in 2016 stood at 602,311 (11 cars per 100 persons; LTA, 2016). The public transport system network managed by LTA consists of buses, the Mass Rapid Transit (MRT) and Light Rapid Transit (LRT; more information is found on www.lta.gov.sg). Further information about Singapore's transport policies is provided in Appendix 4.A.

Table 4.1. Selected comparisons between London and Singapore

	London	Singapore
Per Capita GDP (2015)	£43,629[a]	S$72,711
Big Mac Index (July 2016)	£2.99	£3.05
Public transport monthly season pass (June 2016)	£227	S$190
Unleaded (95) fuel (per litre, June 2016)	£1.12	S$1.95
Mercer Quality of Living ranking	26th	39th
2016 Honda Jazz 1.3[b]	£14,145	S$87,999 (approx. £44,221)

Note: Pre-Brexit exchange rate with reference to 1 June 2016: £1 = S$1.99; [a]Gross Value Added statistics for London; [b]Car prices as current in January 2017.

4.3. Method

4.3.1. Participants

Participants were recruited online to participate in a face-to-face or telephone interview. All interviewees consented to their interviews being recorded and transcribed verbatim with identifiable information removed for confidentiality. Ethical approval was granted prior to data collection and procedures followed the approved protocol.

4.3.1.1. London

17 adult participants (9 men and 8 women, mean age 45.7 years, with a range of 24-65 years) who live and/or work in London were interviewed (mean interview length: 30 min 26 s). Among them, 13 (76%) participants possessed a car driving licence.

4.3.1.2. Singapore

16 adult participants (10 men and 6 women, mean age 36.1 years, with a range of 23-63 years) living in Singapore were recruited to take part in a series of one-on-one interview sessions (mean interview length: 32 min 41 s). Among them, 13 (81%) participants possessed a car driving licence.

4.3.2. Procedure

Semi-structured interviews were conducted in two parts. First, participants were encouraged to reflect on and discuss their experiences of travelling within their city and identify factors important to them when choosing transport modes. Second, participants' opinions of transport policies were elicited. Londoners were initially invited to appraise London transportation policies and were then introduced to transportation policies in Singapore – and vice versa for Singaporeans. Interviews were relatively open but structured by a topic guide presented in Appendix 4.B to ensure all relevant issues were addressed. Where necessary, participants were asked to elaborate or clarify answers.

4.3.3. Thematic analysis

We were interested in experiences and motivations described by participant, rather than seeking to discover unspoken or hidden discourses. Consequently, interview transcripts were analysed using thematic analysis (Braun & Clarke, 2006). Transcripts were read several times for thorough comprehension and patterns within the data noted to form initial categories. Pertinent quotations were then assigned to preliminary categories that were further refined as coding progressed and new insights emerged. This iterative method identifies quotations belonging to the same conceptual labels. This process was undertaken independently by the first and second authors followed by discussions and agreement on a set of higher-level categories encompassing the initial coding results.

4.4. Results

Five key themes surrounding transport decision-making and travel experiences common among London and Singapore interviewees were identified. Each theme consists of sub-themes illustrating its different aspects, and is presented

here with illustrative quotes and discussions of cultural differences when present. A theme map is presented in Table 4.2 and a full set of quotes is available in Appendix 4.C. Approximately 67% of all text in transcripts was categorised into themes.

Table 4.2. Theme map.

Theme 1: Purpose and nature of the journey
- Work versus social travelling
- Challenging trips by public transport

Theme 2: Transport access and feasibility
- Availability of infrastructure*
- Ease of travel
- Financial cost*
- Journey time and distance
- Reliability*
- Weather
- Using journey planning applications or tools

Theme 3: Perception and beliefs of different transport modes
- Perception of the transport
- Desire for having a car^
- Need for a car^
- Cycling as recreation^
- A form of exercise
- Linking transportation to the environment^

Theme 4: Anticipated travel experience
- Stress
- Being able to do something during the journey
- Comfort
- Security^
- Physical safety when cycling
- Autonomy
- Road congestion

Theme 5: Thoughts about transport policies
- Subjectivity surrounding the affordability of cars
- Vehicle Quota System in Singapore: The necessary evil
- Unique transport policies for each city
- Necessity of road usage charging

Notes:
* Denotes where *some* differences were found between interviewees in London and Singapore
^ Denotes *significant* differences

4.4.1. Theme 1: Purpose and nature of the journey

It was common for both London and Singapore interviewees to first consider the purpose and nature of their journeys when making transport decisions. This would often consist of understanding whether their journey was work-related or for social purposes, and if the journey was even possible by alternative transport (i.e., public transport) at all.

4.4.1.1. Work versus social traveling

In both samples, travel expense was considered differently for personal trips, paid for by the participant, and for work trips, paid for by an employer. In the latter case cost was much less important. The distinction between these two purposes would have direct implications on the assessment of what was available to them and the trade offs interviewees were willing to make. This is further elaborated in themes two (see 4.4.2) and four (see 4.4.4).

> *It's very very expensive to travel by rail. Personally, on a business trip it doesn't matter because the company is footing the bill but on a personal basis I hardly travel by rail. Whenever possible, I always use the bus. [LDN02_Male]*

> *…I might need to drive my clients…my job requires a car. But if it's for leisure, like going for shopping, then there is no need for a car. [SGP11_Male]*

4.4.1.2. Challenging trips by public transport

Unsurprisingly, driving was preferred by both groups when a journey involved transporting heavy or bulky items or travelling to places not served by public transport.

> *…it's still more convenient to drive than to take public transport, especially if you are carrying bulky items or going multiple places or if the places you're going are less accessible via public transport. [SGP14_Male]*

> *…if it's just me and a handbag then I would just use the public transport. …I just came back from shopping and I used the car because it would just be too much to grapple with the buses. [LDN13_Female]*

Similarly, driving was preferred when transporting people, especially people with mobility challenges.

The last time I went into London…I had no choice because my husband was in the car and he's not able to walk much, so we've to go by car. [LDN16_Female]

I do have to meet up with my customers once in awhile and I might have to drive to pick them up. [SGP05_Male]

These suggest that the way that people would make transport decisions is dependent on utility-related considerations prior to other 'high level' considerations such as comfort, and that this is common across cultures.

4.4.2. Theme 2: Transport access and feasibility

After considering utility-related considerations, it seemed that the next group of considerations were more related to the access, feasibility and affordability of the different transport options available to them. This was common to both London and Singapore, though, in part due to the differences in the transportation infrastructure in both cities, we observed that interviewees had differing opinions and experiences about their city's transport access, feasibility and affordability.

4.4.2.1. Availability of infrastructure

Availability of transport infrastructure was salient to travel mode choices in both cities.

…if the train is not available I won't go in the first place…somewhere that can be accessed by bus in like 30 minutes, I can do that. [LDN04_Male]

…the public transport is quite good and well connected…so there is no need to drive…because the town itself is very well connected with buses and MRT. [SGP11_Male]

and amongst Londoners, the lack of public transport connectivity was a 'push' factor towards car use:

…in some places you need a car because the public transport isn't good enough to get to wherever. [LDN09_Male]

However the opinion on public transport connectivity was heterogeneous in London.

You know people here complain and complain but I'm so used to the rest of the world I think London is very accessible, compared you know. I really love London. [LDN01_Female]

The availability of road infrastructure was also a consideration for cycling in both cities:

…the cycle routes are not really fit for purpose in London…I would love to cycle to the station from where we live but the roads are very narrow and not wide enough for two cars and a bicycle. [LDN10_Female]

For cycling, I think one key problem is that Singapore doesn't have the proper infrastructure in place. We only have a single lane or pathway for pedestrians mostly and we're not allowed to cycle on the road. [SGP15_Male]

In addition, the availability of disabled-friendly infrastructure when making transport decisions in London, however, this was not highlighted by Singaporeans.

…disabled people, a lot of them need the car because they can't use public transport [LDN01_Female]

The Underground is very quick, very convenient and fast as well but getting into the Underground with the steps and everything is not handicapped- or disabled-friendly. [LDN16_Female]

4.4.2.2. Ease of travel

When infrastructure and alternative transport options were available, ease of use became salient. This was observed amongst both public transport and car users.

You've got to plan when you're leaving work [by public transport]…as opposed to just jumping into the car where obviously you've a lot more flexibility because you don't have to take the trains and choose the trains to get on. [LDN09_Male]

…for most of my colleagues who are not from Singapore, they only travel by train. I feel that for foreigners they'll not travel by buses because it's too confusing and they'll end up in places with no idea where they are. [SGP10_Male]

Availability of parking was frequently cited as a key consideration when deciding whether or not to drive and the difficulty of finding parking is an important disincentive to drivers, particularly when driving into city centres.

> *I very rarely drive to the centre of town as there is no point, because you can't park. If I'm going into the centre of town, into London itself, or to the West End, I would always use public transport. [LDN13_Female]*

> *Driving is one problem, parking is another in Singapore. Finding a parking space in Singapore is a big problem because the parking in here is limited and very expensive. … Coming here today, for instance, if this were a central area I would have to go many rounds or even further away in order to find a parking space. [SGP01_Female]*

4.4.2.3. Financial cost

The financial cost of the journey is also a consideration for most, particularly when they compare between transport modes.

> *…it's also cheaper to drive as well, except the Tube. The train is just so expensive…I think it's overpriced…it's cheaper to fly to another city than taking the train. [LDN03_Female]*

> *SGP03 …but it's going to be more costly.*
> *INT So choosing the bus and train over the LRT then MRT is because of the cost?*
> *SGP03 Yeah, primarily because of the cost.*
> *[SGP03_Male]*

For those who were considering to drive, there were additional considerations of the cost of parking their cars at the destination and the extra charges that they might incur when driving during the journey, in particular the Congestion Charge in London and the Electronic Road Pricing charge in Singapore.

> *…one has to consider the congestion charges as well, it's a deterrent as well…and the cost of parking. [LDN07_Male]*

> *…if I want to drive I will decide if I have to pay for ERP and parking. [SGP06_Female]*

Those who qualified for a Freedom Pass in London, providing them free travel on public transport outside peak hours, were more inclined to use public transport.

…with the freedom pass now, transport within London now is free so I can use whichever options…whereas before the cost of that would have to be considered. [LDN07_Male]

A similar scheme does not exist in Singapore but public transport was generally considered to be affordable, especially with the concessions that are given to students and elderlies.

Actually, it is very affordable. For students you have student prices, for the elderly they give discounts so it's very affordable. In fact, thinking of MRTs and buses they are really affordable [SGP08_Female]

I think that Singapore's public transport is generally affordable compared to places like the UK. In the UK, a single bus trip can be £4 regardless of distance. So when I was in Singapore I averaged about S$100 a month on transport to my workplace and also to go on weekends. Singapore has concession plans for students and people who are not working so in that regard, it is quite affordable. If you're a working adult and you spend S$100 a month on public transport it's actually not that expensive. [SGP15_Male]

4.4.2.4. Journey time and distance

Journey distance and travel time on different transport modes were also taken into consideration by interviewees. This was particularly salient for choosing the Tube and the MRT over the bus when using public transport.

I tend to use the Tube for all aspects of my life mainly because it provides the level of speed compared to bus transportation. [LDN14_Male]

I do the bus a lot. I do not use the bus into Central London; that would be my last resort because it's so much slower. If I'm going into Central London I take the Tube, which is a much quicker way of getting to places. … My default mode is the Tube. Sometimes I would use the bus but my default mode is the Tube. [LDN17_Female]

I will choose between the bus and MRT based on which has the fastest route because when I work in the afternoon there isn't really any traffic issues with buses, so I'll see which one gets me there faster. [SGP09_Female]

I could take the bus if I wanted to but it would be a lot slower. … I guess cost isn't such a big factor since it's so near. For me, the major thing is the amount of time that I spend traveling. [SGP14_Male]

Shorter journey times and distances were major considerations when deciding whether walking or cycling were feasible transport modes.

> *You can take a bus, but there is no need to. It's only a four minutes walk, four to five minutes walk. [LDN02_Male]*

> *I would walk if the place is within walking distance, like within 15 minutes. [SGP09_Female]*

4.4.2.5. Reliability

The importance of knowing that their chosen transport mode will be reliable was also emphasised:

> *…it has to be reliable and…no delays for work, yeah. If it says it comes on this time it has to be on this time. If it takes twenty minutes I want to know it will take twenty minutes, yeah. [LDN03_Female]*

This tended to favour trains/tube over buses as public transport options and even walking, as these modes were relatively independent of the traffic congestion that is commonly found in both cities, particularly during commuting hours. Having a reliable transport mode when commuting to work was important for maintaining punctuality at work for many.

> *If I'm in a hurry I won't take the bus…I'll take the Tube because that's the most reliable way to get there and the quickest way. [LDN15_Male]*

> *My first choice is always to take the train…buses are more unreliable. With trains, you can also predict when it will arrive and you know for certain like you'll reach there in twenty minute. [SGP13_Female]*

> *I try to walk as much as possible even if it's quite far because I enjoy it more and you don't have to worry about anything being late. [LDN08_Female]*

> *Recently I was taking the bus and ended up having to take a cab because the expected waiting time for the next bus was about an hour. [SGP15_Male]*

Nonetheless, concerns were raised about the serviceability trains/tube in both cities affecting reliability:

> *The tube here breaks down a lot you must admit. Some lines are notorious for being unreliable. [LDN02_Male]*

> *You've just got to hope that there isn't a train or bus breakdown, with that you'll definitely feel stressed because you need to get to work. [SGP01_Female]*

and in London, the repercussions of industrial action:

> *The Tube system works well so long they don't go on strike like the rail people…strikes are usually a major problem for a lot of people. [LDN04_Male]*

The reliability of the transport also contributed substantially to the experience of the travel (see 4.4.3.1 and 4.4.4) and consequently, to decisions not to use public transport and to drive instead (see 4.4.3.3).

4.4.2.6. Weather

Weather was another common consideration, though less frequently highlighted by Londoners. Rainy weather, in particular, strongly influenced decisions to use cars. This was also strongly related to the ease of making the journey using the particular transport (see 4.4.2.2).

> *…if it is a nice day, I wouldn't mind just walking…Weather is a huge thing…taxis are good for when it's raining. [LDN01_Female]*

> *Depending on the weather. If it rains, I'll drive. If it doesn't, I'll take public transport. [SGP16_Male]*

Singapore's tropical climate and humidity were also important when considering walking or cycling. Specific to situations of considering cycling, weather and climatic considerations were intertwined with the physical comfort of the travel and the purpose of the trip, whether it is a commute or for leisure:

> *…the weather in Singapore is quite hot…when I get into work through cycling I think it's going to cause me to have a very uneasy day at work because I'll be drenched. [SGP03_Male]*

> *I don't want to feel sweaty when I reach a destination…I want to feel clean and good [SGP06_Female]*

…it actually feels good to walk, especially when the weather is not hot.
[SGP08_Female]

4.4.2.7. Using journey planning applications or tools

The myriad of transport options and routes available to interviewees made journey planning complex. It was noticed that interviewees were using journey planning applications to assess the feasibility of using different alternative transport options. In particular these applications and tools allowed interviewees to compare between the routes (often based on the ease and travel time) prior to the journey, and during the journey, act as a navigation tool. Interviewees were also able to reroute or avoid travel disruptions in real time when using these applications and tools as they are fed with live data about the serviceability of the transport networks. This function, unique to digital journey planning applications and tools, served to enhance the overall travel experience of interviewees.

I can check my Google maps which will tell me you've got to change two buses here and one train here, then one more bus here [LDN05_Male]

I will also use the Google maps when driving…as a navigation tool.
[SGP06_Female]

Overall then, in both cities, assessing access to transport options was followed by consideration of a variety of other factors such as cost, ease and feasibility, speed and reliability and comfort.

4.4.3. Theme 3: Perceptions of, and beliefs about, different transport modes

Following these two sets of factors, the next set of factors concerned with how interviewees characterised and perceived different transport modes were considered. We identified six sub-themes in this third theme that are common to participants in both cities.

4.4.3.1. Perception of the transport

All interviewees held preconceived perceptions of different transport modes and these were shaped by past experiences using the transport and linked with their attitudes and beliefs about different means of travel. Consequently there was a

range of perceptions. Nonetheless, it was clear that these perceptions served to influence personal choices and preferences of one mode over another:

> *Travelling by public transport in London can be quite brutal sometimes and it can definitely have a negative impact on your state of mind. [LDN06_Female]*

> *I think you've got cyclists and non-cyclists. I think we have been brought up in a different culture unlike somewhere like Holland where everybody cycles, we never really had that. [LDN13_Female]*

> *Singapore has never branded itself as a cycling place. [SGP10_Male]*

> *Most people are not happy with the public transport, but for me, I'm very happy…if you don't want to take taxis there are Ubers or Grab, you've a lot of choice. [SGP11_Male]*

4.4.3.2. Desire for car ownership

In particular, the perception of the importance of cars and consequently, the desire for car ownership emerged to as a differentiation between London and Singapore. The desire to own a car and to be able to use one was strong and commonplace in Singapore.

> *…by and large in Singapore, everyone wants to own a car…everybody will try every ways and means to own a car. Even if they can't own a car, they will drive their parents' cars. [SGP05_Male]*

These desires were based on the unattainability and scarcity of cars, both of which were partly the result of the VQS that is implemented in Singapore. These have led to car ownership and use to be construed by individuals, and perceived by others, to be symbols of success.

> *…they would strive to own a car if they can afford it. I hate to use the word 'status symbol' but it's probably that, to tell people that 'I've made it'. [SGP12_Male]*

In contrast, a more utilitarian view of car ownership was observed in London. This is, in turn, linked to the perception of a need for a car (see 4.4.3.3 for further elaboration):

> *I had a really ancient car until three years ago and I used it for over twenty years…It takes me from A to B and that's all I'm interested in [LDN13_Female]*

4.4.3.3. Need for a car

The perception of need for a car was noticeably different between both cities. It was widely acknowledged in Singapore that its small land area and relative ease of availability and access to public transport meant that cars are not necessities.

> *I think that in Singapore, if you can't drive, don't have a licence or don't have a car I don't think it's going to impact your life in a very large way because I think our public transport system is very efficient and taxis and Ubers are not exorbitant. [SGP09_Female]*

However, there was no general consensus about the need for cars in London. Different attitudes were expressed depending on accessibility of alternatives. The level of accessibility that interviewees had was, in turn, related to the location that they resided in. Those who lived more centrally and in areas with easy access to public transport shared a lower need for having a car. In contrast, those who lived further out reflected a higher need for a car.

> *…in some places you need a car because the public transport isn't good enough to get to wherever. [LDN09_Male]*

> *I lived in London for eight years and I've not really needed to drive…Public transport is a better choice than driving in London in my opinion. [LDN06_Female]*

Thus the perception of need for a car seems to be related to the location, accessibility and availability of alternative non-car transport options (further elaborated within 4.4.2).

4.4.3.4. Cycling as recreation

Cycling was also another transport mode that was perceived differently in both cities. In London cycling was perceived as both an alternative transport mode and/or a form of recreation.

I think the bike system within Central London is really good and people have been using it. It has been beneficial and has helped kept cars out of the centre of London. [LDN13_Female]

I use the bicycle for more recreational purposes because I live on the outskirts of London and can get to parks and quieter roads fairly easily. [LDN12_Male]

However, in Singapore, all interviewees rejected cycling as a transport mode and regarded it as a recreational activity.

Cycling for me would be an exercise, something that I would have to actually plan to do instead of using it as a transport system. [SGP06_Female]

4.4.3.5. A form of exercise

Some transport options were also perceived to have positive spillover effects to health and wellbeing and thus were preferred, especially if they incorporated physical activity.

I also find that if I go by Tube and by train I'm walking up and down all the stairs and it has helped me with the problem with my knees and I've lost weight…that is really good for my health rather than being sat in the car. [LDN10_Female]

…a fifty minutes walk to office everyday…it's also another form of exercise. [SGP15_Male]

4.4.3.6. Linking transportation to the environment

The environmental impact was not a primary factor in selecting transport modes in both cited. Nonetheless it was observed to be relatively more salient and important in for those in London than in Singapore.

…you read a lot about pollution levels and how polluted London is and how that's so bad for your health…the pollution levels on the Tube are quite worrying as well…living in a city it's going to be kind of polluted and probably the air that we are breathing in is very dirty. [LDN06_Female]

I think the environment is much more important and irreplaceable and priceless, so we've to find a way of transporting ourselves without killing the planet at the same time. [LDN10_Female]

To be honest, I'm less concerned about the environment…it's like a secondary consideration. Primarily, I will consider the finances, whether

there are children in the family, if there is a need for it, whether I have elderly at home. [SGP08_Female]

I don't think being environmentally-friendly is top of the list there, or even on that list. [SGP07_Male]

Despite this being less of a concern in Singapore, there were some interviewees who called for increased awareness of environmental issues, and these were mainly among younger participants.

…we definitely should be raising awareness, especially with the recent news about the number of deaths in Beijing that resulted from the pollution levels there. [SGP15_Male]

4.4.4. Theme 4: Anticipated travel experience

Transport decisions were also influenced by anticipation of the "quality of travel" [LDN07_Male]. In other words, it was the travel experience that they anticipated. This experience was also highly individualised for the interviewees and often comprised a mix of both positive and negative experiences.

4.4.4.1. Stress

Most anticipated some level of stress when traveling, regardless of the mode used:

…it's always stressful going on the tube as well because there's always more people [LDN01_Female]

…it's a higher level of stress, if you ask me, during the evening congestion because everybody gets off work at the same time but start work at different times. [SGP16_Male]

However, respondents tended to report acceptance and habituation of travel stress, particularly if the journeys were everyday commutes.

I wouldn't say it is stressful partly because I have gotten used to it. [LDN04_Male]

I'm used to it already for so many years so it's not so stressful to me. [SGP05_Male]

Instead, many have developed ways to help them cope with or avoid travel stress, and this is related to being able to also do something during the journey (see 4.4.4.2).

> *I just use the opportunity to watch movies, so that also helps me to pass the time and take my mind off. [LDN04_Male]*

> *Working from home…it makes it less stressful not having to bother about the traffic and human congestion. [SGP16_Male]*

4.4.4.2. Being able to do something during the journey

Meaningful use of the time spent traveling was also important:

> *I think it's important; the time wasted. I prefer to travel by the train as I can read whereas on the crowded tube I can't do anything but stare at the posters so that feels like time wasted. [LDN07_Male]*

> *I'm inclined to doing something on the journey…I believe in making my time on the train more productive as well. [SGP15_Male]*

However, some transport modes were more conducive than others, e.g., public transport allowed commuting interviewees to get some work done while traveling or to use the time to rest. This is an important benefit of public transport as opposed to driving.

> *I can just switch off in the train but you can't when you're driving. [LDN09_Male]*

> *The only thing about driving is that you cannot do other stuff and have to be focused on the road. When you take public transport you can do literally everything, reading the news, checking emails, chatting with friends. [SGP16_Male]*

4.4.4.3. Comfort

Travel comfort was also a common consideration. Four distinct aspects were identified. First, the physical comfort experienced by drivers:

> *I think driving is quite comfortable because you just get into the car, it doesn't matter if it rains or if it snows [LDN03_Female]*

> *…driving is more comfortable given that you're in an air-conditioned environment. [SGP16_Male]*

Second, the design of public transport for comfort.

> *I would use the Overground because it's the newish…it's pleasant to use. In summer and winter, it's either air-conditioned or heated. [LDN14_Male]*

> *I do personally prefer to take the bus…the seats are more comfortable [SGP09_Female]*

Third, the aesthetic and environmental comfort, particularly when choosing between buses and underground trains:

> *If I'm held up on the buses, for example, it doesn't bother me because I do enjoy the view. But on the train, of course, you do not have a view to look at, or the Tube [LDN16_Female]*

> *I don't think the train is uncomfortable but the bus is more comfortable and you can get a seat and scenery outside. [SGP09_Female]*

or when considering walking or cycling for London interviewees.

> *I try to walk as much as possible even if it's quite far because I enjoy it more…And it's nice because you can see sights in London [LDN08_Female]*

Fourth, anticipation of social proximity and interaction especially during peak hours on public transport and in confined spaces, such as underground trains:

> *Where I live is quite near the city and main areas so I can't even get onto the train…even when I do get on, it's right at the door so I've very uncomfortable and really bad. [SGP10_Male]*

> *My experiences are that some people who travel on buses…The nightmare thing is people using their cell phones. You'll have endless people talking and playing games. If you want to read something it can be quite disturbing. [LDN14_Male]*

> *I think it's comfortable except on the trains during peak hours when it may get very squeezy when people push around and I get quite irritated in the morning. [SGP06_Female]*

> *I know people personally who won't use the Tube because they are scared because it's too crowded. I think there is a point that public transport has become too frightening for some people. Overcrowding affects people in different ways. [LDN07_Male]*

Interviewees would seek a combination of these aspects of comfort regardless of what mode they are deliberating on. However, in view of the shared nature of public transport, the comfort of using them also contributed to their sense of security during the journey.

4.4.4.4. Security

Having a sense of security when travelling was important for London interviewees but this was not as salient amongst interviewees in Singapore. These security concerns were most observed among public transport users and these were possibly a manifestation of their anticipations and concerns surrounding potential threats to their personal safety.

> *I always feel nervous when I'm in London Underground because of terrorism. [LDN10_Female]*

> *I've a firm that is local who vet their drivers. If you take Uber…you do not know who they are. Most of the time it is ok but you do hear instances when it's not ok. [LDN17_Female]*

> *…travelling at night…I'll feel safer in North London in my car than on the street waiting for a bus. [LDN17_Female]*

> *I think, compared to other countries, our public transport in Singapore is actually very safe [SGP08_Female]*

4.4.4.5. Physical safety when cycling

Physical safety concerns were also another factor considered by interviewees but they were specific to physical safety when cycling but not security concerns (e.g., potential accidents but not acts of terrorisms). The co-sharing of road space with motor vehicles was often seen as dangerous and threatening to the physical safety of cyclists. In addition, the lack of adequate infrastructure separating these two forms of transport was also highlighted as a concern.

> *I don't cycle because I think it is very dangerous to cycle in London. There is no cycle path so sometimes you see cyclists and drivers racing each other and they get angry with each other. [LDN03_Female]*

> *I tried the bicycle but it's really dangerous to ride in Singapore because the drivers are very inconsiderate when it comes to giving way to bicycle. [SGP11_Male]*

… definitely the lack of segregated cycle lanes. The blue paint on the road doesn't seem to be quite enough. [LDN07_Male]

A lot of cyclists I know have all had accidents and also the worst thing about cyclists that I think I don't like is that they are quite disregarding of pedestrians. [LDN06_Male]

When I'm cycling in Singapore I've to cycle on the road, competing for road space with other vehicles and I'm constantly worrying if the lorry will hit me. There are a lot of cyclists that have been hit on the road here. [SGP01_Female]

This physical safety concern also meant that it discouraged those who would have liked to cycle to dismiss it as a transport option.

But I did get knocked off my bike one night and that rather put me off. [LDN10_Female]

So I think the weather and mindset can be overcome if I really really want to cycle, but if the physical infrastructure doesn't support it… [SGP13_Female]

4.4.4.6. Autonomy

Having autonomy to travel whenever and wherever is important when deciding how to travel and cars provided these in both cities:

People like the freedom of having a car [LDN10_Female]

Having a car would offer the individual freedom and convenience. [SGP01_Female]

However, driving or using the car were not the only form of transport that provided this autonomy as some also felt that walking and cycling could provide similar autonomy over their journey.

I try to walk as much as possible…you don't have to worry about anything being late. [LDN08_Female]

I would do it more for the convenience because I can just take the bike and go, and not have to wait for the bus. [SGP12_Male]

4.4.4.7. Road congestion

Road congestion was also a common experience shared by interviewees in both cities as it affects both car and public transport users. Interviewees who drove or considered driving were aware of the probability of being caught in traffic congestion, especially during peak hours.

> *If you drive, half the time you're parking in a traffic jam. You know, London is so crazy… [LDN01_Female]*

> *There is not much of traffic jam apart from the morning and evening during peak hours, but it's not that bad because the traffic is still moving. [SGP04_Female]*

This was the same for bus users as road congestions also caused delays in their bus journeys and created reliability issues when using buses:

> *Sometimes the bus is delayed or there's traffic, the bus doesn't come on time because it gets stuck in traffic. If there is no traffic, actually the bus takes about less time than the tube. [LDN03_Female]*

> *…I would say that about 85% of the time it's smooth traffic. It's only on some days when it rains then there's a massive jam [SGP03_Male]*

However, experiences of road congestions or the anticipation of these congestions also encouraged some to use public transport:

> *Twenty years ago I wouldn't have dreamt of taking the Tube because the traffic wasn't that bad and there weren't that many cars on the road [LDN15_Male]*

> *I usually take the train to the hospital because it's faster and I'll avoid the jam [SGP08_Female]*

4.4.5. Thoughts about transport policies

Interviewees' discussion of transport policies in their city and different policies in the comparison city generated four subthemes. These subthemes revealed commonality and differences in how the interviewees experienced the transport policies in their cities.

4.4.5.1. The affordability of cars

Perceived affordability of cars in London varied between London interviewees, perhaps due to wealth and, for some, cost was a deterrent.

> *It's expensive both to buy and maintain and insure. It's an indulgence really. [LDN07_Male]*
>
> *…there are some remarkably reasonable cars around…it is amazing what you get for your money these days. [LDN12_Male]*
>
> *It's just the congestion charge and the parking charges which are killing. [LDN 02_Male]*

By contrast, in Singapore, where cars are objectively considerably more expensive there was a clear consensus on their affordability. Nonetheless, among those able to afford cars parking costs still discouraged use.

> *…the cars in Singapore are expensive…too expensive. Imagine your COE can buy a car plus you've to pay for the car. [SGP01_Male]*
>
> *I've a car so I drive, but I do take the public transport if I'm going into the town area because parking is expensive there. [SGP11_Male]*

In both cities, the affordability of cars extended beyond car ownership to the cost of using the cars for their journeys (e.g., parking fees and congestion charges; see 4.4.2.3 for a further discussion).

4.4.5.2. Vehicle Quota System in Singapore: A necessary evil

There were varied reactions among London interviewees when they learnt about Singapore's VQS and expensive car prices. Some thought that they were unreasonable:

> *Ridiculously expensive. The price of the car itself is already ridiculously expensive and the price to maintain and own a car is ridiculously expensive. [LDN04_Male]*
>
> *It's ridiculous isn't it, you tell me. I can buy a house here with the prices of the car. [LDN16_Female]*

But there were also others who welcomed such policies when the rationale of the policies was situated within the context of the land scarcity and increasing density challenges faced by Singapore.

> *I think it's a great idea in terms of how it makes the city run because it's good to have less cars on the road and have everybody using the public transport. It is also much better for the environment. [LDN08_Female]*

> *They're trying to deter people from buying cars…I can understand it really because Singapore is a really small place…they should run without cars. [LDN10_Female]*

> *Singapore is only a small island you cannot have too many cars because of pollution and everything. [LDN16_Female]*

On the other hand, Singaporeans generally recognised the land scarcity and increasing density challenge in Singapore and were unified in their view that the car population should be managed to ensure that the infrastructure can adequately support the mobility needs within the city. Despite some disagreements in terms of how this car population should be managed, most were supportive of the current policies.

> *Car pricing, it's good in the sense that we have less congested streets as not everybody will own a car because of the high prices. Even for me, because of the car price, I may just give up on the car. If it's too cheap then everybody will buy cars and the roads will be congested and you may be stuck for an hour or two in a traffic jam. [SGP11_Male]*

> *I think it is a necessary evil. Honestly, I think that there are too many cars in Singapore. Even with the COE there are still so many cars and there are traffic jams every single day…So while I think the COE is a bit irritating I think it is necessary for preventing people from buying cars. [SGP13_Female]*

> *I think it is a very good system to have…for a country like Singapore which is so small, a land scarce space, controlling the population of cars is very important and I think we have the best system in the world to control of the population of the car and that is the COE. [SGP05_Male]*

4.4.5.3. Unique transport policies for each city

Exploring whether Singapore's system would work in London and vice versa, interviewees from each city were of the opinion that transport policies should be tailored for each city's unique needs. On applying Singapore's system in London:

It might not work because I think people here, they value having a car, whereas in Singapore, the COE system was implemented very long ago when Singapore was still developing…So maybe implementing a COE system, it might only be here for London? But how do you control then, people who buy cars from elsewhere in the UK when you can still come into London? [LDN02_Male]

Certain policies will work for certain countries. It certainly won't work here because you've got to remember that Singaporeans are more obedient as well…No, it won't work here. You can only encourage people. [LDN16_Female]

and on implementing London's system in Singapore:

No. I believe in not having cheap cars in Singapore because I don't want Singapore to end up like Jakarta, Bangkok or KL where people spend two, three hours getting to work. When cars are cheap, people would just buy it and drive all the time. [SGP12_Male]

I think that wouldn't work in Singapore…how a government should work is that you enforce a hard and fast rule even if they don't like it because over time they will grow to accept and adapt and live with it. So if you make cars cheaper I think people will just swap to cars and nobody will take public transport no matter how much you promote because people will always think that the car is more convenient. [SGP13_Female]

These observations highlight the need for in-depth understanding of the city and its population in order to have tailor transport policies, especially with car population management, to meet the unique demands and characteristics of the city and its population.

4.4.5.4. Road usage charging is necessary

Finally, road usage charging is implemented in both cities and many understood its need and role in managing traffic and also felt that it has been effective in reducing congestion and encouraging non-car alternatives:

The reason they brought in the congestion charge was because the traffic jams were so often…they put this charge in place to force people to take the Tube or public transport…Definitely it has worked and that is why since about ten years ago nobody takes their car to work. [LDN15_Male]

The ERP does help a little bit to ease the traffic a little because some people would try to avoid going into the ERP area or make a longer route to get in…the ERP system really did help to ease the traffic, especially in peak hour. [SGP04_Female]

The subthemes here illustrates that though cities in general face transport and congestion challenges, the extent and characteristics of the challenge differ according to the unique characteristics and needs of the city, representing a challenge for transport policy makers when conceptualising and implementing new policies. Nonetheless, from the interviews it seemed that our interviewees were largely able to understand why specific transport policies are in place in their cities even if they might personally have differing opinions as to how the policies should be implemented.

4.5. Discussion

To our knowledge, this is the first interview study comparing transport perceptions, expectations, decisions and policy appraisals in London and Singapore. Our thematic analyses identified five themes with 26 subthemes. It is noteworthy how similar perceptions and considerations were between two samples representing very different locations, cultures and transport polices. Nonetheless, the distinct geographical constraints of the two cities resulted in quite different evaluations of transport policies. Generally, the purpose of the journey preceded assessments of availability of transport options. Access to affordable and reliable public transport was challenging for some in London and this indirectly encouraged car use. However, the smaller land area and high density of public transport meant this was less prevalent in Singapore.

Technology is changing transport behaviours. Journey-planning, smartphone applications using real-time travel information were commonly used to plan and optimise journeys (e.g., rerouting if congestions or disruptions are anticipated). This is encouraging for transport authorities as they further integrate technology and crowd-sourced real-time data to further improve urban transportation demand management (Intelligent Transport Systems Australia, 2017; Chin & Ong, 2015; Lyons & Davidson, 2016). Smartphone applications also provided a new platform for ridesharing services (e.g., Uber) expanding transport options and bringing about improvements in urban transport for users, from service quality to taxi fare restructuring (Çetin, 2017; Schechtner & Hanson, 2017).

These ridesharing services were particularly popular in Singapore as it provides an alternative to expensive car ownership amongst the younger generation. There is emerging evidence of the potential of expanding ridesharing services to reduce congestions in cities and replace car ownership (Berger, Chen, & Frey, 2017; Çetin, 2017; Li, Hong, & Zhang, 2016).

The perceptions and values of cars were different across the two samples. Cars were perceived as luxury goods and social status symbols in Singapore but as affordable necessities for commuting or running errands in London. This reflected the different vehicle control approaches in the two cities. Singapore interviewees readily acknowledged that high car prices are necessary for managing its vehicle population. They recognised that cars are already perceived as luxury goods and removing their city's policies (i.e., moving to London's system) would exponentially increase car ownership and use, resulting in a city in gridlock. As one Singaporean put it, "*…we'll end up with…a giant car park".*

Even though Singapore has piloted these transport management policies with some success and support from the public, this has not been without criticism but now as more cities face increasing congestion, such once-rejected policies are being considered elsewhere. Menon and Loh (2015) note that, "it was often said that only Singapore with its draconian laws and stiff controls could implement such a scheme. That is no more true and many transport pundits are now proposing congestion pricing as inevitable in many cities" (p.24). Thus, Singapore's geographical constraints may yet see it become a transport policy lead, both in educating populations about the need to control car ownership and in creating city transport infrastructure that meets demand with fewer cars.

Education will be crucial to the acceptance of restrictive transportation policy implementation. Many London interviewees rejected Singapore policies when they were described but were accepting or more accepting when the underlying rationale was explained. Thus as been noted elsewhere, ensuring public understanding and managing public expectations were two important elements in Singapore's successful policy implementation (Menon & Loh, 2015). These elements, together with the establishment of accessible and reliable public

transport networks, will be critical to acceptance of restrictive car use policies elsewhere.

Could a VQS-type policy be implemented in London? Interviewees who understood its rationale thought that it is possible and some endorsed such policies as a necessary step towards car-lite societies. This suggests that increasing car prices to manage vehicle demand may be accepted if its rationale and need are communicated clearly and understood. Nonetheless, much work would be required because Londoners value their car access.

City authorities are also promoting public transport, cycling and walking (Rode et al., 2017; Rodrigue et al., 2017), which require sizeable infrastructure investments. Our findings suggest that how potential users perceive and experience these modes is crucial. Infrastructure is important in providing access and, especially for cyclists, safety. Nonetheless non-infrastructure-related factors were also important, for instance, choosing public transport over driving because of the associated 'spill-over' increase in physical activity, health benefits, and ability to engage in other activities while travelling (e.g., reading during train rides). Collectively, these positively reinforce public transport choices and emphasise the importance of choice, comfort and speed if public transport is to rival car use among those who own cars.

Cycling was not considered a viable transportation mode for many, even those who see its recreational benefits. Singapore's humid weather meant that cycling was often viewed as impractical especially with air-conditioned public transport was available. For some would-be London cyclists it was regarded as too dangerous because of poor separation from motor vehicles. Consequently, we observed little discussion relating cycling to physical activity, health and lifestyle choices.

Methodological limitations merit caution when generalising these findings. Our samples comprised of diverse backgrounds in both cities but we cannot ascertain how representative their responses are of the general population. Future studies with samples representing the wider ethnography are needed, though these require considerably more resources. Future studies could adopt

quantitative designs to further explore the themes and sub-themes identified here. Generally, our interviewees understood the other city's transport system when introduced and they felt comfortable sharing their thoughts and evaluations. Nonetheless, we cannot infer that they were able to appreciate the nuances between the two cities. Thus, future studies could consider more immersive approaches when introducing different contexts (e.g., using virtual reality technology; Wilson & Soranzo, 2015) to enable interviewees visualise the discussed environment.

4.6. Conclusion

This study presented a unique opportunity to explore the decision-making process and experiences of a diverse group of transport users in two cities with different transport policies. Expensive car prices in Singapore impose stricter car ownership regulation contributed to the perception of cars as luxury goods, rather than a necessity, as found in London. There was general support for stricter car ownership regulation among those who understood its rationale and need in both cities. This highlights the importance of public engagement and education when seeking to implement new initiatives and policies that may not be readily accepted by the public.

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Chapter 5: "Nice car, but what about the CO^2 emissions?": Who considers environmental factors during car purchase decisions?[4]

5.1. Abstract

Encouraging the purchase of low-emission vehicles could reduce the environmental impact of growing private car ownership, globally. We expected people who were more concerned about climate change, held more pro-environmental attitudes and engaged in more pro-environmental household behaviours to consider more environment-related factors during car purchases. We explored this expectation using data from wave four (2013/14) of Understanding Society, weighted to be representative of the UK population ($N =$ 12,895). Principal components analysis identified three factors considered during car purchases: Utility (e.g., cost/safety), Image (e.g., brand) and Environment (e.g., CO^2 emissions). Logistic and Ordinary Least Squares regressions were conducted to identify pro-environmental attitudinal and behavioural, as well as socio-demographic, predictors of environment-related factor consideration during car purchasing. Approximately 50% of the sample reported considering at least one environmental-related factor. The likelihood of any, as well as the precise number of, environment-related considerations increased with greater climate change concern and engagement, and higher frequencies of pro-environmental attitudes/behaviours. Environmental considerations during car purchases were also higher for women, older adults, non-white ethnic groups, urban residents and among individuals in Scotland (vs. London). Contrary to some previous findings, richer and more educated individuals were less likely to consider environmental features, with income being positively related to image-related features such as brand. Although our findings support the pro-environmental behavioural consistency hypothesis, they also highlight key non-attitudinal, socio-demographic factors underlying car purchases that may help social-marketers and policy makers identify key audiences to more effectively promote low-emission vehicle purchases.

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[4] A version of this chapter has been submitted for publication and is currently under review in the journal *Global Environmental Change* as: Chng, S., White, M., Abraham, C., & Skippon, S., "Nice car, but what about the CO^2 emissions?": Who considers environmental factors during car purchase decisions?

5.2. Introduction

Global private car ownership has been steadily increasing in recent years with little indication that this trend will be reversed in the foreseeable future (PricewaterhouseCoopers, 2016). In the UK for instance, private car ownership increased by 2.2% between 2014 and 2015, making it the fastest year-on-year increase since 2004 (Department for Transport (DfT), 2016). This resulted in some 30.3 million cars being licensed in the UK by the end of 2015, which accounts for 19% of all new cars registered in the EU, the second highest after Germany (DfT, 2016). This increase in private car ownership creates serious risks to the environment (International Energy Agency, 2016) and to human health and wellbeing (World Health Organisation, 2016). There is, therefore, an urgent need to reverse this trend and for more research to be conducted into how this can be achieved.

To date, two key strategies have been adopted. First, to reduce the number of journeys made by private car transport by encouraging people to use public or active transport alternatives. This strategy has met some success particularly in places where there are accessible alternatives to private car use (e.g., Arentze, Borgers, Ponjé, Stams, & Timmermans, 2001; Bamberg, 2006). Second, to reduce the environmental impact of car journeys by encouraging the purchase of Ultra Low Emission Vehicles (ULEV). To date, however, the success of this second strategy has been limited with just 0.9% of new vehicle purchases in 2015 being ULEVs, despite the introduction of UK subsidies to encourage the uptake of these vehicles (Department for Transport, 2016). This highlights the need for a better understanding of car purchase decisions and considerations to steer potential car buyers towards 'low carbon' vehicle options. The central aim of this study was to identify key socio-demographic, attitudinal and behavioural predictors of environmental considerations during car purchases among a large sample of the UK population. The results may help social marketers and policy makers identify groups and individuals who are already thinking about these issues and so may be more open to persuasion in relation to buying a less environmentally damaging car (e.g., Bamberg (2013)).

5.2.1. The psychology of car purchase decisions

For most consumers, buying a new car is an infrequent behaviour with high financial costs and is thus less tied to habit and momentary influences than small-scale regular purchases (Kotler, Brown, Adam, Burton, & Armstrong, 2007). Factors already known to influence car purchasing include the general economic and regulatory environment, vehicle availability and performance, and availability of fuel/road infrastructure (Busse, Knittel, & Zettelmeyer, 2013; Gao, Rasouli, Timmermans, & Wang, 2014; Lieven, Mühlmeier, Henkel, & Waller, 2011). Further, there is growing evidence that psychological factors, including attitudes, self-image, beliefs and personality also affect purchasing decisions (Choo & Mokhtarian, 2004; Lane & Potter, 2007; Peters, de Haan, & Scholz, 2015).

Psychological theories such as the Theory of Planned Behaviour (with its focus on attitudes, normative and efficacy beliefs, and intentions) and the Value-Belief-Norm Model (with its additional focus on values and personal norms) have also been applied to help explain and predict car purchasing behaviours (Peters, Gutscher, & Scholz, 2011). For example, it has been shown that personal norms towards car purchases, i.e., the intrinsic feeling of obligation and recognition of perceived ability to purchase the car are important to car purchasing decisions. More recently, the Comprehensive Action Determination Model (CADM) has been applied to understand car purchase behaviours as ecological behaviours (Klöckner & Blöbaum, 2010). This approach incorporates intentional, normative and situational influences and also, importantly, the influence of habits and past behaviours as predictors of future behaviours (Klöckner, 2013). For instance, when the CADM was used to differentiate between electric and normal car buyers, relations between attitudes towards buying an environmentally-friendly car and (i) attitude towards reducing car use, (ii) introjected norms, and (iii) awareness of consequences, were weaker among those who bought electric cars (Klöckner, Nayum, & Mehmetoglu, 2013).

The present study examines secondary survey data and so had to rely on proxy measures included in the survey. Thus, we recognise that our results speak to some of these models only indirectly. Nonetheless, we were able to draw upon related measures using a very large sample, generated by careful

representative sampling. This investigation, using a larger sample than any comparable study, was able to put, for instance, to consider attitudinal predictors in the context of broader socio-demographic factors such as age, ethnicity, work status and geographical region. Thus the current work may help inform theoretical refinement and specificity, not least by highlighting the importance of situational and socio-demographic factors when considering the role of psychological predictors of car purchases.

5.2.2. Ecological considerations during car purchases

Research to date, much of it in the 'grey literature', often reports that a relatively high number of people claim to take environmental concerns into account in their car purchase decisions (Coad, de Haan, & Woersdorfer, 2009; Kahn, 2007). A 2009/10 national survey of UK car/van buyers, for instance, reported that 22% of participants considered environmental factors, although utility factors such as reliability and costs were reported more frequently (68% and 55% respectively, Thornton et al., 2011). Yet environmental concerns do not appear to translate into action (e.g. Lorenzoni, Nicholson-Cole, and Whitmarsh (2007)) and this is evident in the low market share of and slow growth in 'low carbon' car sales (Lane & Potter, 2007; PricewaterhouseCoopers, 2016).

We might predict that individuals who report concern for the environment and also lead lifestyles that incorporate pro-environmental behaviours (e.g., switching off appliances when not in use and car sharing when possible) into their everyday routines would be more likely to identify with the environmental impact of their choices during car purchases than those who merely report concern for the environment, i.e., exhibit pro-environmental consistency (e.g., Thøgersen and Ölander (2006); Whitmarsh and O'Neill (2010)). Lynn (2014), for instance, reported that people who are more environmentally-friendly in their behaviours at home also tend to be more-environmentally-friendly in their purchase behaviours. However, Lynn (2014) also found that travel patterns were not always related to environmentally-friendly purchases and at-home pro-environmental behaviours (see also Alcock et al. (2017) for a similar pattern regarding recreational flights). Further research is needed to elucidate which pro-environmental behaviours are or are not related with car purchases in particular.

5.2.3. The present study

The current study explores the extent to which environmental factors are considered during car purchases in the UK using cross-sectional data from the Understanding Society panel survey (also known as the UK Household Longitudinal Study, UKHLS). In particular, we focused on a sub-sample of participants who were involved in and had an active influence on decision-making during car purchases. We investigated four key questions: 1) What is the underlying nature of considerations made during car purchases (e.g., are decisions motivated by considerations of the car's impact on the environment or the comfort and/or image that it offers)?; 2) In what way is an individual's concern and engagement with climate change related with the nature of their considerations during car purchases (e.g., is there environmental attitude-behaviour consistency during car purchase considerations)?; 3) How are pro-environmental behaviours related to considerations during car purchases (e.g., is there a pro-environmental behaviour consistency from routine, relatively low cost pro-environmental everyday behaviours to infrequent, and expensive car purchases); and 4) How is an individual's socio-demographic profile related to the nature of their considerations during car purchases?

Our analyses extend previous studies examining this issue by using a large, population representative dataset from the UK that allowed us to explore a range of sociodemographic factors associated with car purchases and relevant observable environmental-related factors such as the number of cars and children under 14 years of age in the household. In addition, all participants in our sample had influence over the car purchase decisions in the household. Finally, we investigated the independent relationships (i.e., controlling for these socio-demographic characteristics) between climate change perceptions and pro-environmental household and travel behaviours with considerations of the pro-environmental aspects of cars during purchase decisions.

5.3. Methods

5.3.1. Data source and sample

The study sample was drawn from wave 4 (2013/14; $n = 47{,}517$) of the UKHLS (University of Essex, 2015). Participants are surveyed annually via a computer-assisted personal interview as part of the longitudinal panel survey of 40,000

households in the UK that began in 2009, to monitor the social and economic changes over time for individuals and households. More details about the study and its sampling methodology can be found elsewhere (Lynn, 2011). Wave 4 also included three modules that are of interest to this study, specifically the 'environment', 'environmental behaviour' and 'transport behaviour' modules. For this study, only participants who were involved in and had an active influence in decision-making during car purchases were included in the analysis resulting in a sample of n = 21,992. In our estimation sample, 54.90% were men and the mean age was 49.23 years (sd = 15.84). See Table 5.1 for detailed sample demographics. The sample sizes reported are weighted respondent samples rounded to integer values as the appropriate UKHLS cross-sectional weights were applied to improve the sample's representativeness of the UK population.

Table 5.1.

Descriptive data

	Scale range	Population mean (SD)	Population n (%)
Sociodemographic Variables			
Sex			
Male			12,074 (54.90)
Female			9,918 (45.10)
Age			
16-25			1,472 (6.69)
26-35			3,375 (15.35)
36-45			4,268 (19.41)
46-55			4,530 (20.60)
56-65			3,827 (17.40)
66-75			2,991 (13.60)
over 75			1,529 (6.95)
Ethnic group			
White			20,527 (93.72)
White Mixed or Black/African/Caribbean/Black British			351 (1.60)
Asia/Asian British			891 (4.07)
Arab or Any other ethnic group			134 (0.61)
Equivalised household income (5ths)[b]			
1 Lowest			2,627 (11.95)
2			3,551 (16.16)
3			4,605 (20.96)
4			5,406 (24.60)
5 Highest			5,788 (26.34)
Labour market status[c]			
Employed			14,354 (65.53)
Unemployed			1,013 (4.62)
Retired			5,434 (24.81)
In education			363 (1.66)
Family carer			741 (3.38)
Highest qualification[d]			
No qualification			1,941 (8.84)
other			2,095 (9.54)
GCSE etc			4,196 (19.10)
A levels			4,572 (20.82)
Other higher cert			2,958 (13.47)
Degree			6,203 (28.24)
Longstanding illness or disability[e]			
Yes			7,491 (34.08)
No			14,491 (65.92)
Number of cars in household			
1			10,970 (49.88)
2			8,233 (37.44)
3 or more			2,789 (12.68)
Children under 14 in household			

0		19,005 (86.42)
1		1,417 (6.44)
2		1,189 (5.41)
3 or more		380 (1.73)
Locality[f]		
Rural		5,972 (27.17)
Urban		16,008 (72.83)
Region[f]		
London		2,011 (9.15)
North East		844 (3.84)
North West		2,441 (11.10)
Yorkshire and the Humber		1,838 (8.36)
East Midlands		1,802 (8.20)
West Midlands		1,985 (9.03)
East of England		2,345 (10.67)
South East		3,216 (14.63)
South West		2,132 (9.70)
Wales		1,103 (5.02)
Scotland		1,670 (7.60)
Northen Ireland		593 (2.70)

Environmental Variables

Climate change engagement[g]	3-15	9.64 (2.25)
Climate change detachment[h]	6-30	16.80 (4.23)
Climate change concern[i]	2-4	3.69 (0.62)
Pro-environmental behaviour		
Turn TV off standby[j]	0-4	2.28 (1.82)
Switch off lights[k]	0-4	3.42 (0.89)
Water conservation[l]	0-4	2.39 (1.68)
Use less heating[k]	0-4	2.48 (1.26)
Buy less packaging[m]	0-4	0.65 (0.94)
Buy recycled paper products[n]	0-4	1.40 (1.28)
Bring own shopping bags[o]	0-4	2.68 (1.49)
Use public transport than car[p]	0-4	0.80 (1.01)
Walk/cycle short journeys[q]	0-4	1.70 (1.32)
Car share[r]	0-4	0.78 (1.11)
Fewer flights[s]	0-4	0.44 (1.00)

Car Purchase

Motivation	
Pure Environmentalist	51 (0.23)
Pure Utilitarian	2,784 (12.66)
Pure Status	274 (1.25)
Environmental Utilitarian	2,499 (11.36)
Status conscious Environmentalist	56 (0.26)
Status conscious Utilitarian	7,990 (36.33)
All rounder	8,337 (37.91)

Eco-motivation
    Not considered   11,048 (50.24)
    Considered   10,944 (49.76)

Notes: N = 21,992
[a] n = 21,902 due to missing values
[b] n = 21,977 due to missing values
[c] n = 21,906 due to missing values
[d] n = 21,965 due to missing values
[e] n = 21,982 due to missing values
[f] n = 21,980 due to missing values
[g] n = 21,877 due to missing values
[h] n = 21,870 due to missing values
[i] n = 21,690 due to missing values
[j] n = 21,774 due to missing values
[k] n = 21,985 due to missing values
[l] n = 21,897 due to missing values
[m] n = 21,711 due to missing values
[n] n = 21,360 due to missing values
[o] n = 21,583 due to missing values
[p] n = 21,146 due to missing values
[q] n = 21,897 due to missing values
[r] n = 19,019 due to missing values
[s] n = 15,512 due to missing values

Of note, compared to analyses with only demographics, the sample sizes for regressions including pro-environmental attitudes and behaviours are notably smaller because only a sub-set of respondents were also asked these questions (n = 12,895). To further explore the implications of this sample reduction we include (in supplementary materials) comparisons of estimates based only on demographics for both the full (n = 21,992) and reduced (n = 12,895) samples.

5.3.2. Dependent variables: Considerations during car purchase

In the transport behaviour module, participants were asked, "Which of these things are important to you when buying a car or van?" with the option to list one or more features from a list of twelve (see Table 5.2). All respondents had at least one or more cars in the household and had reported themselves to be involved in decisions about car/van purchases.

In order to identify the nature of the features considered during car purchases we conducted exploratory analysis to identify the main factors present and then factor analysed the twelve features to explore whether a distinct group were eco-related. As the features were dichotomous, polychoric (tetrachoric) correlations were used as the latent trait underlying considerations of these

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features can be viewed as continuous (Ekström, 2011). All features correlated at least .3 with at least one other feature, suggesting reasonable factorability (see supplementary Table 5.A.1). Principal component analysis was conducted on responses and three principal components with eigenvalues >1 were identified. Varimax rotation of the factor loading matrix was conducted, because of independence of the factors, and the final three factor solution explained 58% of the variance (see supplementary Table 5.A.2).

Table 5.2.
Component items in the car purchase and environmental variables.

Features looked for in car purchases	
Component	Items
Status-concious	Comfort
	Large engine
	Style/design/image of brand/model
	Speed/Performance
	Features (e.g., sat nav)
Utilitarian	Cost - purchase/running/resale value/tax/insurance
	Functionality/interior space/boot size
	Reliability
	Safety
Environmental	Small engine
	Environmentally-friendly/low CO_2 emissions
	Electric - one that's plugged directly into an electricity supply

Component items in the environmental variables.		
Scale	Scale component item	Item response
Climate change engagement		
	Please select the extent to which you agree or disagree with the following statements.	
Q1	My Behaviour and everyday lifestyle contribute to climate change.	1: Strongly disagree
		2: Tend to disagree
Q2	I would be prepared to pay more for environmentally-friendly products.	3: Neither agree nor disagree
		4: Tend to agree
Q3	If things continue on their current course, we will soon experience a major environmental disaster.	5: Strongly agree
Climate change detachment		
	Please select the extent to which you agree or disagree with the following statements.	
Q1	The so-called 'environmental crisis' facing humanity has been greatly exaggerated.	1: Strongly disagree
		2: Tend to disagree

Q2	Climate change is beyond control - it's too late to do anything about it.	3: Neither agree nor disagree
Q3	The effects of climate change are too far in the future to really worry me.	4: Tend to agree 5: Strongly agree
Q4	Any changes I make to help the environment need to fit in with my lifestyle.	
Q5	It's not worth me doing things to help the environment if others don't do the same.	
Q6	It's not worth the UK trying to combat climate change, because other countries will just cancel out what we do.	

Climate change concern

Please select whether, on the whole, you personally believe or do not believe each of the following statements.

Q1	People in the UK will be affected by climate change in the next 30 years.	1: No, don't believe this
Q2	People in the UK will be affected by climate change in the next 200 years.	2: Yes, believe this

Pro-environmental behaviour

Could you tell me how often you personally do each of the following things.

Q1*	Leave your TV on standby for the night	0: Never
Q2	Switch off lights in rooms that aren't being used	1: Not very often
Q3*	Keep the tap running while you brush your teeth	2: Quite often
Q4	Put more clothes on when you feel cold rather than putting the heating on or turning it up	3: Very often 4: Always
Q5	Decide not to buy something because you feel it has too much packaging	
Q6	Buy recycled paper products such as toilet paper or tissues	
Q7	Take your own shopping bag when shopping	
Q8	Use public transport (e.g. bus, train) rather than travel by car	
Q9	Walk or cycle for short journeys less than 2 or 3 miles	
Q10	Car share with others who need to make a similar journey	
Q11	Refering to occassions where the respondent would have travelled by air but decided not to because of environmental concerns: Take fewer flights when possible	

Note: *Items are reverse-coded.

Table 5.2 shows how decision-relevant features loaded on the three factors. The first factor consisted of 5 features: 'large engine', 'style/design', 'speed/performance', 'comfort' and 'features such as sat nav'. This factor explained 25% of the total variance, and was labelled 'image' in keeping with earlier research (Hafner, Walker, & Verplanken, 2017). The second factor consisted of 4 features: 'cost', 'functionality', 'reliability', and 'safety'. This factor

explained 20% of the total variance and was labelled 'utility'. The third factor, consisted of 3 features: 'environmentally-friendly/low CO_2 emissions', 'electric', and 'small engine'. This factor, central to our research questions, explained 13% of the total variance, and was labelled 'environmental'. Figure 5.1 shows the frequency distribution of these three derived factors.
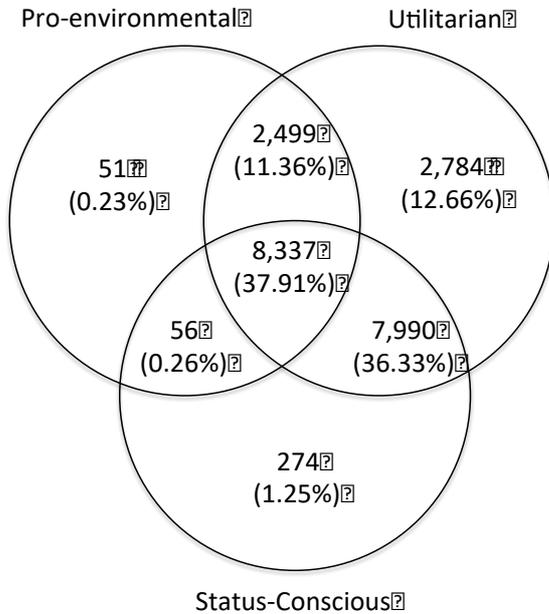
Figure 5.1. Frequency distribution of features considered during car purchases.

From these three factors we derived three key variables of interest: a) Whether the individual had mentioned *any* of the features within the environmental factor (a binary variable of Yes, n = 11,048; or No n = 10,944); b) How many of the pro-environmental factors an individual had considered (ranging from 0-3); and c) The ratio of environmental-related to total considerations using the following formula:

$$Ratio = \frac{\frac{n_{environmental}}{3}}{\frac{n_{environmental}}{3} + \frac{n_{utility}}{4} + \frac{n_{image}}{5}}$$

The first dependent variable included any of the three considerations because only 51 respondents reported only pro-environmental considerations, a number insufficient for further analysis. The ratio score was needed to take into account the possibility that a high pro-environmental score could simply be achieved by

mentioning a lot of different factors, rather than specifically pro-environmental ones. Similar analyses were undertaken for the other two factors but because predicting utility- and image-related considerations was beyond the scope of the aims of this investigation, results of these analyses are only presented in the supplementary document.

5.3.3. Independent variables

Participants completed questions regarding lifestyle and pro-environmental behaviours in the environment and environmental behaviour modules from which the following environmental variables were derived. The list of questions included in creation of each variable is presented in Table 5.2.

5.3.3.1. Climate change concern

Climate change concern was computed from the sum of the responses to the two questions about whether participants believed that 'People in the UK will be affected by climate change in the next 30/200 years'. Higher scores on this variable indicated higher levels of climate change concern, (range = 2-4, mean (*sd*) = 3.69 (0.62)).

5.3.3.2. Climate change engagement/detachment

Nine questions assessed the respondents' engagement with climate change and the distinction between climate change engagement and detachment was investigated using principal components analysis. All items correlated at least .3 with at least one other item to suggest reasonable factorability (see supplementary Table 5.A.3). Two principal components with eigenvalue >1 were identified. Direct oblimin rotation of the factor loading matrix was conducted, because this allows both factors to be correlated, and the final two factor solution explained a total of 55% of variance (see supplementary Table 5.A.4). The first factor, which we labelled 'climate change detachment', consisted of six items (α = .77) and explained 34% of the variance. Higher scores on this factor indicated greater scepticism of or lack of interest in climate change issues (range = 6-30, mean (*sd*) = 16.80 (4.23)). The second factor, which we labelled 'climate change engagement', consisted of three items (α = .64) and explained 21% of the variance. Higher scores on this factor indicated

higher belief in and engagement with issues of climate change (range = 3-15, mean (*sd*) = 9.64 (2.25)).

5.3.3.3. Pro-environmental behaviours

The self-reported frequencies of eleven types of pro-environmental behaviours that included household and travel behaviours were investigated. Scores for each behaviour ranged from 0 to 4 and higher scores indicated higher self-reported frequencies for the behaviour. The mean scores for each behaviour are reported in Table 5.1. Though it was previously suggested by Lynn (2014) that the eleven types of pro-environmental behaviour in this dataset represent three distinct factors (at-home, transport-related and purchasing behaviour), our preliminary analyses showed that they do not form reliable sub-scales (i.e., they have Cronbach's alphas below 0.48). We, therefore, modelled responses relating to individual behaviours so achieving greater analytic specificity.

5.3.4. Sociodemographic variables

The following sociodemographic variables were included in the regression models to account for potentially observable confounds that have been reported previously: sex (reference category [ref] = male), age, ethnic group (ref = White: British/English/Scottish/Welsh/Northern Irish), monthly household income (quintiles equivalised using the Organisation for Economic Co-operation and Development modified scale, ref = lowest quintile), labour market status (ref = employed), educational attainment (ref = no qualifications), presence of work-limiting illness or disability (ref = no illness), number of cars in the household (ref = one car), number of children under 14 years of age in the household (ref = none), locality of dwelling (ref = rural), and region of dwelling (ref = London).

5.3.5. Statistical analysis

The analyses of environment-related considerations during car purchases were undertaken in three stages. First, a series of three multivariate logistic regressions were conducted to investigate whether those reporting (i) higher levels of engagement and concern regarding climate change, and (ii) more frequent pro-environmental behaviours were more likely to report environment-related considerations during car purchases using the binary outcome variable.

Next, a series of multivariate linear regressions was used to explore relationships between the environmental and sociodemographic variables and the frequency of environmental-related considerations using the continuous outcome variable. A final multivariate linear regression used the ratio score to identify, if any, the changes in the relationships after taking into account the utility- and image-related considerations.

In each case several models were tested. The first model regressed the sociodemographic variables using the full sample. A second model then regressed the sociodemographic variables with a reduced sample that accounts for missing data from the environmental variables (the full results of these two stages can be seen in the supplementary materials). The third model, presented in detail here added climate change concern, climate change engagement and detachment and pro-environmental behaviour. By first regressing the sociodemographic variables, significant relationships that emerge when the environmental variables are added in the third models would suggest that these predictors influence the considerations of the particular features over and above the influence of socio-demographics, thus highlighting the potential additional importance of the concern and engagement with climate change and pro-environmental behaviour when understanding factors considered during car purchases.

All analyses were undertaken using Stata 13 and the appropriate sampling probability weights provided by UKHLS to allow us to make inferences to the UK population.

5.4. Results

Descriptive data on all variables in the analyses are presented in Table 5.1 and only the results of the final models in the logistic and linear regressions are presented in Table 5.3 and Figure 5.2. The full results and models from the regressions are presented in supplementary Tables 5.A.5 to 5.A.7.

5.4.1. Sample descriptive

In our estimation sample, 45.1% were women and the mean (*sd*) age was 50.19 (16.50) years. White British participants formed the majority of the sample

(93.72%) followed by participants who are Asian British or from Asia (4.07%), White mixed or Black British (1.60%) and Arab or from any other ethnic groups (0.61%) were less frequent. Most participants resided in urban areas (72.83%) and about half (49.88%) had access to one car in their households while 12.68% had access to three or more cars. In addition, 13.58% of participants reported having one or more child under 14 years in the household. Detailed descriptive can be found in Table 5.1.

5.4.2. Predicting environment-related considerations

The final multivariate logistic regression model exploring the extent to which environmental and sociodemographic variables predicted the consideration of environment-related factors during car purchases is presented as Model 1 in Table 5.3 and graphically in Figure 5.2. The full results and models focusing only on demographic predictors are found in supplementary Table 5.A.5.

First, focusing on the environmental variables, the odds of considering any environment-related factor during car purchases increased significantly with each unit increase in climate change concern (OR [95% CI] = 1.12 [1.04, 1.21]) and engagement (OR = 1.09 [1.07, 1.11]). The reverse was true for climate change detachment (OR = 0.96 [0.95, 0.98]). Environment-related consideration was also significantly more likely among participants who engaged in eight of eleven pro-environmental behaviours, OR = 1.04 to 1.09. Of the three remaining pro-environmental behaviours that were not significant predictors, two concerned transport behaviours: 'using public transport' and walking/cycling for short journeys.

Amongst the sociodemographic variables, female participants (compared to males; OR [95% CI] = 1.40 [1.28, 1.53]), and White mixed or Black (OR [95% CI] = 1.86 [1.37, 2.53]) and Asian/Asian British (OR [95% CI] = 1.77 [1.45, 2.16]) participants, compared to White British participants were significantly more likely to report any environment-related considerations. Age was also important, with participants above 35 years old significantly more likely to report any environment-related consideration than those between 16-25 years old (ORs from 1.26 to 1.72 depending on age group). While household income was non-significant overall, participants in the lowest quintile were less likely to

consider environment-related factors than those in the highest quintile, OR (95% CI) = 0.84 (0.72, 0.99). Environment-related considerations were also significantly less likely as the number of cars and children under 14 years of age increased within the household. Participants with two and three or more cars were 0.89 (95% CI: 0.81, 0.99) and 0.79 (95% CI: 0.68, 0.92) times less likely to report environment-related considerations compared to participants with one car. In addition, participants with three or more children under 14 years of age were 0.49 (95% CI: 0.35, 0.69) times less likely to consider environment-related factors. Finally, participants who lived in urban areas were 1.20 (95% CI: 1.08, 1.32) times more likely to report environment-related considerations than those in rural areas, and compared with London, participants living elsewhere in the UK, apart from in the West Midlands, Wales and Northern Ireland, were all more likely to consider environment-related factors when purchasing a car, ORs ranged from 1.30 to 1.51.

Table 5.3.
Results of regression models investigating the associations between environmental and sociodemographic variables and the pro-environmental considerations car purchase (*n* = 12,895).

	Model 1c[a]		Model 2c[b]	Model 3c[c]
	Odds ratio (95% CI)	Wald	*B*	*B*
Environmental Variables				
Climate change concern	1.12 (1.04, 1.21)**		0.03 (0.01, 0.06)**	0.01 (0.00, 0.01)*
Climate change engagement	1.09 (1.07, 1.11)***		0.03 (0.02, 0.04)***	0.01 (0.01, 0.01)***
Climate change detachment	0.96 (0.95, 0.98)***		-0.01 (-0.01, -0.01)***	-0.00 (-0.00, -0.00)***
Pro-environmental behaviour (higher scores = higher frequency)				
Turn TV off standby	1.04 (1.01, 1.06)**		0.01 (0.00, 0.02)**	0.00 (0.00, 0.00)**
Switch off lights	1.09 (1.04, 1.15)***		0.03 (0.01, 0.04) ***	0.01 (0.00, 0.01)**
Water conservation	1.07 (1.04, 1.10)***		0.02 (0.01, 0.03)***	0.01 (0.00, 0.01)***
Use less heating	0.99 (0.96, 1.03)		0.00 (-0.01, 0.01)	0.00 (-0.00, 0.00)
Buy less packaging	1.09 (1.04, 1.15)**		0.03 (0.01, 0.05)***	0.01 (0.00, 0.01)***
Buy recycled paper products	1.08 (1.04, 1.12)***		0.03 (0.02, 0.04)***	0.01 (0.00, 0.01)**
Bring own shopping bags	1.08 (1.05, 1.12)***		0.02 (0.01, 0.03)***	0.00 (0.00, 0.01)**
Use public transport than car	1.04 (0.99, 1.09)		0.01 (-0.01, 0.03)	0.00 (-0.00, 0.01)
Walk/cycle short journeys	1.02 (0.98, 1.06)		0.00 (-0.01, 0.01)	0.00 (-0.00, 0.01)
Car share	1.07 (1.03, 1.12)**		0.02 (0.01, 0.04)***	0.00 (0.00, 0.01)*
Fewer flights	1.07 (1.02, 1.12)**		0.02 (0.01, 0.04)**	0.00 (0.00, 0.01)**
Sociodemographic Variables				
Sex		52.47***		
Male	1		0	0
Female	1.40 (1.28, 1.53)***		0.12 (0.09, 0.15)***	0.03 (0.02, 0.04)***
Age		6.22***		
16-25	1		0	0

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26-35	1.12 (0.90, 1.40)	0.04 (-0.02, 0.11)	0.00 (-0.01, 0.02)
36-45	1.26 (1.01, 1.56)*	0.08 (0.02, 0.15)*	0.01 (-0.00, 0.03)
46-55	1.58 (1.28, 1.95)***	0.15 (0.09, 0.22)***	0.03 (0.01, 0.05)***
56-65	1.58 (1.26, 1.98)***	0.17 (0.10, 0.24)***	0.03 (0.02, 0.05)***
66-75	1.60 (1.21, 2.11)**	0.17 (0.08, 0.25)***	0.04 (0.02, 0.06)***
over 75	1.72 (1.25, 2.37)**	0.23 (0.12, 0.33)***	0.06 (0.03, 0.09)***
Ethnic group	14.46***		
White	1	0	0
White Mixed or Black/African/Carribean/Black British	1.86 (1.37, 2.53)***	0.21 (0.11, 0.30)***	0.04 (0.02, 0.07)***
Asia/Asian British	1.77 (1.45, 2.16)***	0.25 (0.17, 0.32)***	0.06 (0.04, 0.08)***
Arab or Any other ethnic group	1.44 (0.89, 2.34)	0.19 (0.01, 0.37)*	0.05 (0.00, 0.10)*
Equivalised household income (5ths)	1.88		
1 Lowest	1	0	0
2	0.93 (0.78, 1.11)	-0.03 (-0.08, 0.03)	-0.01 (-0.02, 0.01)
3	0.99 (0.84, 1.17)	-0.03 (-0.08, 0.03)	-0.01 (-0.02, 0.01)
4	0.92 (0.78, 1.08)	-0.05 (-0.10, 0.01)	-0.02 (-0.03, -0.00)*
5 Highest	0.84 (0.72, 0.99)*	-0.08 (-0.13, -0.02)**	-0.02 (-0.04, -0.01)***
Labour market status	0.65		
Employed	1	0	0
Unemployed	1.04 (0.83, 1.30)	0.01 (-0.06, 0.09)	0.00 (-0.01, 0.02)
Retired	1.08 (0.91, 1.27)	0.03 (-0.03, 0.08)	0.00 (-0.01, 0.02)
In education	1.11 (0.75, 1.64)	0.02 (-0.10, 0.14)	0.01 (-0.03, 0.04)
Family carer	0.88 (0.70, 1.09)	-0.07 (-0.14, -0.00)*	-0.02 (-0.03, 0.00)
Highest qualification	1.09		
No qualification	1	0	0
other	0.94 (0.77, 1.16)	0.00 (-0.07, 0.07)	-0.01 (-0.03, 0.00)
GCSE etc	0.83 (0.69, 0.99)*	-0.05 (-0.11, 0.01)	-0.03 (-0.05, -0.01)***
A levels	0.89 (0.75, 1.06)	-0.02 (-0.08, 0.04)	-0.03 (-0.04, -0.01)**

Other higher cert	0.87 (0.72, 1.06)		-0.03 (-0.10, 0.03)	-0.03 (-0.05, -0.01)**
Degree	0.90 (0.75, 1.08)		-0.04 (-0.10, 0.02)	-0.03 (-0.05, -0.02)***
Longstanding illness or disability		0.01		
Yes	1		0	0
No	1.00 (0.91, 1.09)		-0.01 (-0.05, 0.02)	-0.00 (-0.01, 0.01)
Number of cars in household		5.44**		
1	1		0	0
2	0.89 (0.81, 0.99)*		-0.05 (-0.08, -0.02)**	-0.01 (-0.02, -0.00)**
3 or more	0.79 (0.68, 0.92)**		-0.07 (-0.12,-0.02)**	-0.02 (-0.03, -0.01)**
Children under 14 in household		6.12***		
0	1		0	0
1	0.86 (0.72, 1.02)		-0.06 (-0.12, -0.01)*	-0.01 (-0.03, -0.00)*
2	0.86 (0.71, 1.03)		-0.06 (-0.12, 0.00)	-0.02 (-0.03, -0.00)*
3 or more	0.49 (0.35, 0.69)***		-0.22 (-0.32, -0.13)***	-0.05 (-0.07, -0.02)***
Locality		12.60***		
Rural	1		0	0
Urban	1.20 (1.08, 1.32)***		0.06 (0.03, 0.10)***	0.02 (0.01, 0.02)***
Region		1.83*		
London	1		0	0
North East	1.45 (1.09, 1.93)*		0.10 (0.01, 0.19)*	0.02 (-0.00, 0.04)
North West	1.27 (1.03, 1.57)*		0.08 (0.01, 0.15)*	0.01 (-0.01, 0.03)
Yorkshire and the Humber	1.33 (1.06, 1.67)*		0.09 (0.02, 0.17)**	0.02 (-0.00, 0.04)
East Midlands	1.35 (1.08, 1.69)**		0.11 (0.03, 0.18)**	0.01 (-0.01, 0.03)
West Midlands	1.22 (0.98, 1.51)		0.07 (0.00, 0.15)	0.01 (-0.01, 0.03)
East of England	1.32 (1.06, 1.63)*		0.09 (0.02, 0.16)**	0.02 (-0.00, 0.03)
South East	1.30 (1.07, 1.59)*		0.10 (0.03, 0.16)**	0.01 (-0.00, 0.03)
South West	1.31 (1.06, 1.62)*		0.08 (0.01, 0.15)*	0.01 (-0.01, 0.02)
Wales	1.10 (0.87, 1.39)		0.02 (-0.05, 0.10)	0.01 (-0.01, 0.03)

Scotland	1.51 (1.21, 1.88)***	0.15 (0.08, 0.22)***	0.03 (0.01, 0.04)**
Northen Ireland	1.22 (0.96, 1.56)	0.07 (-0.01, 0.15)	0.01 (-0.01, 0.03)

Note:

* Indicates statistical significance at the $p < 0.05$ level.
** Indicates statistical significance at the $p < 0.01$ level.
*** Indicates statistical significance at the $p < 0.001$ level.
[a] Multivariate logistic regression predicting pro-environmental consideration versus non-consideration (reference category)
[b] Multivariate linear regression with frequency of pro-environmental considerations as outcome
[c] Multivariate linear regression with the ratio of pro-environmental considerations over total considerations as outcome
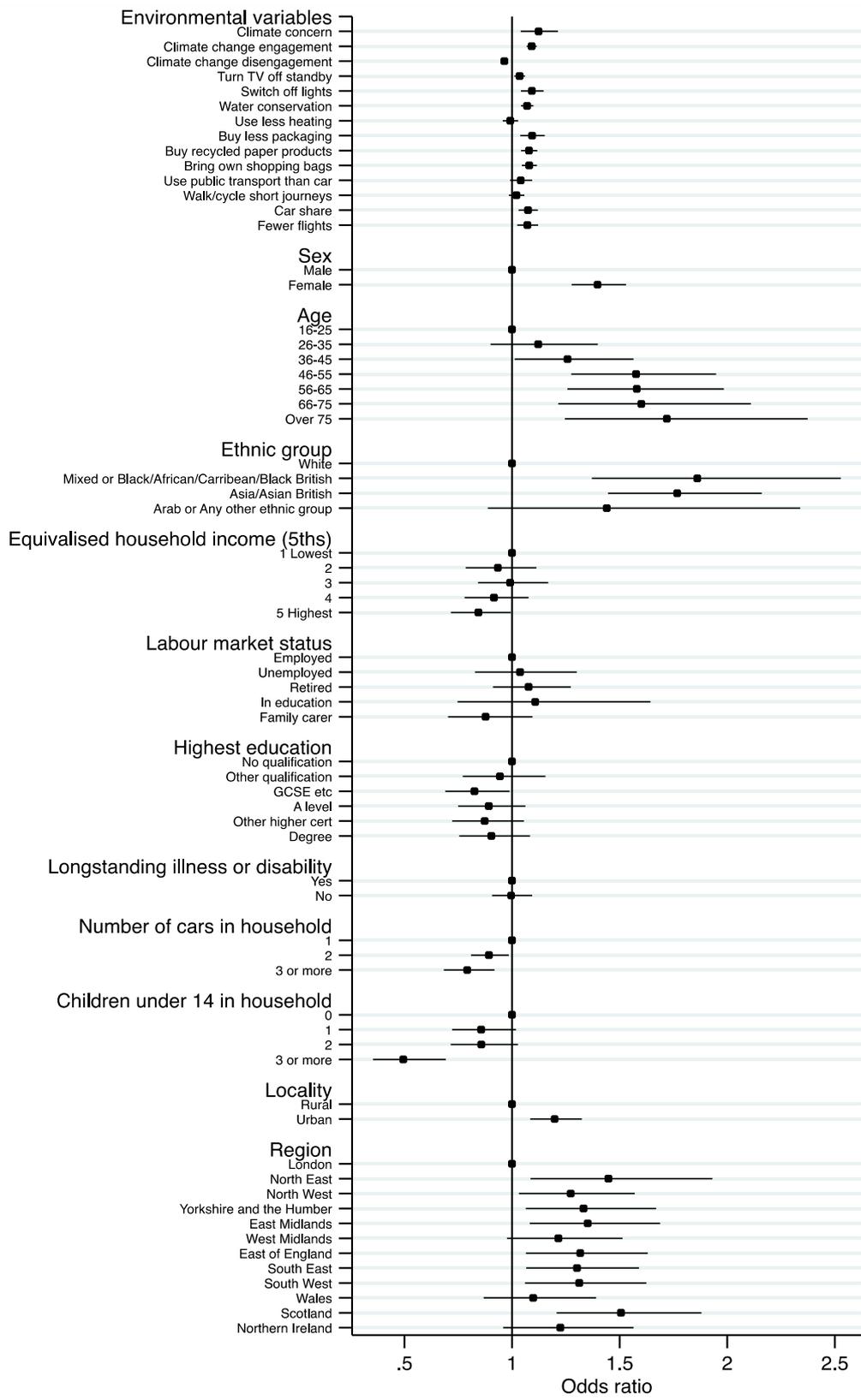
Figure 5.2. Forest plot of multivariate logistic regression results reporting the extent to which environmental and sociodemographic variables predicted the consideration of environment-related factors during car purchases.

5.4.3. Frequency of environment-related considerations

A series of multivariate linear regressions then explored the number of environment-related considerations during car purchases. The final multivariate linear regression explored exploring the number of environment-related considerations during car purchases is presented as Model 2 in Table 5.3, with the demographic only results in supplementary Table 5.A.6.

Results for the environmental variables replicated those in the logistic regressions. Both climate change concern ($B = 0.03$, $p < .01$) and engagement ($B = 0.03$, $p < .001$) were significantly positively related to environment-related considerations while climate change disengagement was significantly negatively related ($B = -0.01$, $p < .001$). The same three pro-environmental behaviours from the logistic model (using less heating [$B = 0.00$, $p < .05$]; using public transport than car [$B = 0.01$, $p < .05$]; and walking/cycling short journeys [$B = 0.00$. $p < .05$]) were again not significantly related to environment-related considerations while the remaining eight pro-environmental behaviours continued to have significant positive relationships (Bs ranging from 0.01 to 0.03).

The findings for sociodemographic variables were largely similar to those in the logistic regression model. Female participants ($B = 0.12$, $p < .001$) and those who lived in urban areas ($B = 0.06$, $p < .001$) reported higher levels of environment-related considerations. Significantly higher levels of considerations were also observed with older participants ($B = 0.08$ to 0.23) and amongst non-White participants (Bs ranged from 0.19 to 0.21). However, environment-related considerations were lower amongst participants who were family carers ($B = -0.07$, $p < .05$) or in the highest household income quintile ($B = -0.08$, $p < .01$) and as the number of cars ($B = -0.05$ to -0.07) and children under 14 years old ($B = -0.06$ to -0.22) increased in the household. It was again observed that participants living elsewhere in the UK, compared to London, reported significantly higher levels of considerations ($B = 0.08$ to 0.15) apart from those in the West Midlands ($B = 0.07$, $p > .05$), Wales ($B = 0.02$, $p > .05$) and Northern Ireland ($B = 0.07$, $p > .05$).

5.4.4. Environment- compared to utility- and image-related considerations

The results from the final multivariate linear regression model using the ratio score is presented as Model 3 in Table 5.3; with the full results reported in supplementary Table 5.7.

The findings for the environmental variables were consistent with the previous regressions, even after accounting for utility- and image-related considerations. Note, the size of the Bs is not directly comparable across models 2 and 3 because the models use two different versions of the dependent variable scale. However, two distinct differences were observed among the sociodemographic variables. First, the ratio of environment-related factors was significantly lower among those with at least GCSE qualifications (all Bs = -0.03). Second, only participants in Scotland reported significantly higher ratio of environment-related considerations than those in London, $B = 0.03$, $p < .01$. These findings suggest that individuals with higher education levels tend to simply report more considerations of all types, not just pro-environmental ones, and that individuals in some regions tend to consider more factors (or are perhaps more loquacious) than those in other regions.

5.5. Discussion
5.5.1. Summary of results

The current research explored four main questions surrounding the consideration of environmental factors during car purchase decision using data from, a large and representative survey of the UK population. First, we looked at the underlying nature of considerations made during car purchases and identified three underlying motivations: environment-, utility- and image-related. Given that car purchases are multi-faceted and often complex decisions (Hensher, Rose, & Black, 2008; Mairesse, Macharis, Lebeau, & Turcksin, 2012; Train & Winston, 2007; Whitmarsh & Xenias, 2015), it was unsurprising that most participants reported combinations of two or more of these considerations. It is encouraging that about half our sample reported considering environment-related factors alongside more utility- or image-related features such as the price and model of the cars. Nonetheless, this also suggests that the other half of our sample did not consider any environment-related features. This is concerning as personal car use continue to contribute to the increase in global

energy demand and emission levels, and encouraging ULEVs potentially mitigates that impact (Garcia-Sierra, van den Bergh, & Miralles-Guasch, 2015). Given that cars are regularly used by most in the UK (Office of National Statistics, 2013), we focused on *who* considered *what* features during car purchases and their relations with environment-related cognitions and everyday behaviours next.

Our second question explored environmental attitude-behaviour consistency during car purchases, looking specifically at climate change concern, engagement and disengagement. This consistency hypothesis is well-documented in other environmental behaviours (e.g., recycling (Poortinga, Whitmarsh, & Suffolk, 2013; Thomas, Poortinga, & Sautkina, 2016)) and was supported in our models. We found that individuals who engaged with climate change (characterised here as higher engagement to and concern of, and lower detachment from climate change) were more likely to consider getting electric, environmentally-friendly and/or smaller engine cars.

Our third question then focused on pro-environmental behaviour consistency from low cost pro-environmental everyday behaviours to car purchases which are relatively more infrequent and costly. Generally, higher frequency in pro-environmental household (e.g., switching off lights) and shopping behaviours (e.g., buying recycled paper products) were associated with higher likelihood of environment-related considerations during car purchases. On the other hand, the findings for pro-environmental travel behaviours were less straightforward. Car sharing and taking fewer flights were both associated with higher likelihood of environment-related considerations but this was not true for those who consciously used public transport over cars and reported walking/cycling during short journeys. This may suggest that regular everyday journeys by public transport or walking/cycling might lead to what some authors refer to as 'moral licensing', where people place less emphasis on environmental factors when purchasing a car because they believe their existing pro-environmental travel behaviours mitigate the potential environmental impact generate by their cars (Meijers, Noordewier, Avramova, & van Trijp, 2013; Nilsson, Bergquist, & Schultz, 2017).

The magnitude of effects was not insubstantial. An increase of one point on the climate change concern scale (3-point Likert scale) and climate change engagement (13-point Likert scale) corresponded with a 12% and 9% increase in likelihood of considering environment-related factors respectively. Likewise, a one-point increase in most of the eleven 5-point Likert pro-environmental behaviour scale corresponded with a 4-9% increase in likelihood. These suggest that for infrequent purchases such as a car, we may be able to encourage environmental considerations or even the purchase of ULEVs by engaging individuals more in climate change discourse and encouraging pro-environmental household and shopping behaviours on a regular basis.

Finally, we explored the socio-demographic profiles of participants who considered environment-related factors during their car purchases. One particularly interesting finding was that participants from non-White compared to White ethnic groups were generally more likely to consider environment-related factors during car purchases, even after potential confounds such as income were taken into account. We know of no previous research reporting similar findings but given the potential implications of our results, further work exploring the car-purchasing motives of different ethnic groups (potentially using more qualitative methods) seems warranted. In addition to differences across ethnic groups, we also found some regional differences with Scottish participants in particular (across both sum and ratio models) more likely to report having considered environment-related considerations than Londoners. This difference may be due to the pursuit of ambitious sustainable transport and carbon reduction targets and policies by the Scottish Parliament and its active Green representation since representative devolution in 1999, which may in turn have contributed to higher awareness and environment-related considerations during car purchases (Scottish Government, 2011; Gray, Laing, & Docherty, 2016; MacKinnon, Shaw, & Docherty, 2008). Participants living in urban, compared to rural, areas also reported more environment-related considerations. This might be due to the exposure to higher concentration of the environmental impact of car use (e.g., air pollution), as well as differences in the expectation of cars (e.g., engine size and speed is less relevant when sat in a city's congested traffic; Mackett, 2015).

It has previously been suggested that considerations of environment-related factors during car purchases are linked to affordability, and thus are more likely among higher income households (Plötz, Schneider, Globisch, & Dütschke, 2014). The current findings challenge this hypothesis. Specifically, compared to individuals in the lowest income households, those in the highest income quintile were significantly less likely to mention any environmental-related features and also tended to report significantly fewer features overall. A closer look at the results (see supplementary Tables 5.A.8 and 5.A.9) indicates that image-related considerations did however increase with income. We also found no evidence that people with more cars in the household (another indicator of income) were more likely to consider pro-environmental aspects in their car purchase decisions, contrary to previous suggestions that people may be more likely to buy electric cars as their second car (Klöckner et al., 2013), although we note that the current findings are based on a UK sample, which might account for the differences with previous work. Our findings do, however, point to the importance of specific constraints on certain consumers. For instance, those with more children in the household appear to primary focus on utility factors, such as size, rather than environmental considerations (Hensher et al., 2008). Collectively, these sociodemographic insights reflect past and ongoing debates surrounding the resource-strapped and the resource-rich segments, and regional differences within the UK (Maskileyson, 2014; Whitaker, Scott, & Wardle, 2015), and highlight the need for calibrated approaches when understanding and intervening in 'green' transport issues.

5.5.2. Limitations and further research

Our study also had several limitations. First, our categorisation of environment-related considerations included small engine, electric cars and environmentally-friendly/CO_2 emission features. However, considering small engine cars may also be motivated by non-environment-related cognitions, such as the car's price, operating costs or even their performance on congested urban roads (Hensher et al., 2008; Mairesse et al., 2012). Nonetheless, these factors were separately considered in the utility-related factor and including socio-demographic variables in our analyses helped control for these possible confounds. Second, because we were relying on secondary data we were unable to test specific theoretical models such as the Value-Belief-Norm Model

(Stern, Dietz, Abel, Guagnano, & Kalof, 1999) or Comprehensive Action Determination Model (Klöckner & Blöbaum, 2010) because data on many of the requisite constructs were not collected. We recognise, therefore, that our results provide only a partial picture. Further large scale studies would benefit from including measures such as pro-environmental related values, norms, attitudes and emotions (Chng, Abraham, White, Hoffmann, & Skippon, 2017), to gain a better understanding of car purchase decisions. Third, we also recognise the self-report nature of the data which may have introduced various elements of bias. Although always a concern with data of this type, it was intriguing to see, for instance, that more educated individuals, who might be expected to be more aware of demand characteristics, were significantly less likely to report pro-environmental considerations. Fourth, although country representative, our data was UK specific, and findings cannot be generalised to other countries (Gifford & Nilsson, 2014; Kollmuss & Agyeman, 2002; Schultz, 2002; Steg, Bolderdijk, Keizer, & Perlaviciute, 2014). Fifth, the cross-sectional nature of the data meant that causality cannot be established, a fact especially pertinent to the associations between environmental considerations and pro-environmental attitudes and behaviours. It is certainly possible that considerations of environmental features during a recent car purchase subsequently influenced other more routine behaviours. Moreover, while all participants were active contributors to car purchase decisions, it is uncertain, and beyond the limits of this data, to ascertain what the cars eventually purchased were. Sixth, we also acknowledge the limitations of using polychoric correlations in our factor analysis. It is difficult, without prior knowledge, to make assertions about the specific underlying distribution of ordinal variables. However, because we assumed an underlying joint distribution in our variables, the generalised polychoric correlation coefficient made it possible to analyse the dependency structure of the postulated underlying distribution in our analysis (Ekström, 2011). Finally, due to space constraints, the current paper has focused only on the environmental related features of the car. More details on utility- and image-related considerations during car purchases using a similar methodology can be found in supplementary Tables 5.A.8 and 5.A.9 alongside a brief discussion of results.

5.5.3. Conclusions and implications

These limitations notwithstanding, our study extends previous research on the sociodemographic profiles underlying the consideration of environmental features during car purchase considerations and demonstrates consistency between environmental concerns during purchase and engagement and pro-environmental behaviours. Our findings support recommendations to identify segments within the population that are most likely, willing and able to consider low-emission cars (Plötz et al., 2014) when they are replacing their existing cars. The results also challenge previous assumptions, showing that richer, better educated individuals were less likely to consider environmental factors, while women, older adults, and those from ethnic minorities, more likely to consider them. Car purchases are a key single decision that individuals can make to contribute towards addressing air pollution and reducing global emissions. That environmental feature consideration was also strongest in Scotland may mean that specific policies adopted by the Scottish Parliament have been somewhat effective although more, preferably longitudinal, research is needed to investigate this further.

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Chapter 6. General Discussion

The research reported in this thesis applied psychological theory to gain a better understanding of personal transport behaviour. The findings contribute towards improving the effectiveness of car use reduction interventions and transport policies. The following four questions were addressed:

1. What can psychological theory tell us about the determinants of car use?
2. Are there psychological consequences of our travel mode choices?
3. How do car use and other transport choices differ across cultures? Are these differences a function of transport policies?
4. What factors do people consider when buying cars, for example, do they consider environmental consequences?

The four studies reported addressed these questions separately and sequentially using a variety of methodologies to gather a range of relevant data. This final chapter aims to integrate the findings from these four studies to discuss their implications for transport-related research, interventions and policies. In the following four sections, a summary of each study is presented, focusing on i) its key findings that represent original contributions to the field, ii) the strengths and limitations of the study, and iii) discussions of future research building on the findings. Following this, the final section of this chapter will discuss the implications of the collective findings and the future directions in applying psychology to understanding and shaping transport use.

6.1. Psychological theories of car use: An integrative review and conceptual framework. (Chapter 2)

The first study in Chapter 2 aimed to consolidate our understanding of the application of psychology in car use and transport research. This was achieved by reviewing the psychological theories and models that have been applied in this area. The findings here served to highlight areas that have been well researched and knowledge gaps that needs to be filled. These served to inform the formulation of the subsequent three studies in the PhD.

6.1.1. Key findings

The review here explored the application of psychological theories in transportation research to consolidate our understanding of the self-regulatory mechanisms of car use behaviours. Fifteen theories that have been applied to understanding car use were identified. However, seven of these accounted for 80% of the studies in the review. So some theories have been more influential in transportation research than others, for example, the Theory of Planned Behaviour (Ajzen, 1991) and the Norm Activation Model (Schwartz, 1977).

Amongst the theories identified, two psychological theories were developed specifically to understand ecological behaviour patterns and to integrate mechanism identified in previous models. Both theories, the Comprehensive Action Determination Model (Klöckner & Blöbaum, 2010) and the Stage Model of Self-Regulated Behaviour Change (Bamberg, 2013b), were more comprehensive than previous theories. The empirically-informed construction of these theories also meant that they were generally well supported for in relation to application to car use behaviour. In particular, the Stage Model of Self-Regulated Behaviour Change proposed a novel time-ordered conceptualisation and operationalisation of the 'intention' construct for behaviour change. There was limited evidence supporting this idea, perhaps because of its recent publication, but evidence from the theorist himself (Bamberg, 2013a, 2013b) suggests its utility in explaining car use. It will be informative to see how such conceptions are supported or developed in light of further independent testing.

Although two integrative and relatively comprehensive theories were identified, neither comprehensively summarises our knowledge in this area. Thus, an overview conceptual framework summarising all potential self-regulatory mechanisms included in existing theories applied to car use was developed. This framework is referred to as the CAUSE (CAr USE) framework. It is not a new theory, as no new mechanisms are proposed; it is an integration and consolidation of theorised self-regulatory mechanisms that have been applied to car use. The CAUSE framework was also presented alongside a summary of the strength of evidence supporting each mechanism and proposed relationships. This served to highlight mechanisms with good empirical support as well as those requiring further testing. This framework has the potential to

clarify what specified mechanistic relationships are being tested in studies theorising personal car use behaviours. In addition, the CAUSE framework may be helpful when conceptualising different approaches to reduce car use and perhaps for researchers investigating other ecologically-relevant behaviours.

6.1.2. Strengths and limitations

Past reviews of psychological antecedents of car use have largely focused on either psychological constructs generally (Gardner & Abraham, 2008) or a single theory (Klöckner, 2013). To the best of our knowledge, this review was the first to systematically review the psychological theories applied in this area and assess the quality of theoretical applications. Reviewing the strength of evidence for each self-regulation mechanism within the identified theories and studies facilitated the development of an empirically-based integrative framework.

The version of the CAUSE framework presented here highlights the complexity of self-regulatory mechanisms underlying car use behaviours and also the limitations of many of the theories that have been applied to car use. Development of this framework does not imply that all the mechanism it specifies need to be tested in any particular study. Rather particular research questions may focus on a subset of relevant mechanisms. However, the framework does highlight the complex psychological content of particular change mechanisms and so highlights the need for sophisticated theorising to support effective behaviour change interventions.

6.1.3. Future research

The CAUSE framework is not a definitive map of self-regulatory mechanisms leading to car use decisions and can be extended by future research. In particular, the growing body of literature on identity and environment-related behaviours (e.g., Clayton et al. (2015); Whitmarsh and O'Neill (2010)) warrants the consideration of identity constructs in the framework. Building on the findings in Chapter 4, it is likely that one's beliefs and attitudes surrounding transportation would contribute towards the development of a transport-related identity in a similar manner as the 'green identity' proposed in research of pro-environmental behaviours.

Given the global relevance of car use and the concentration of theory-based studies in European and Western society, future work should focus on how broader cultural and global factors influence transport-related perceptions and actions. This call is further supported by the qualitative work reported in Chapter 4 that described strong cultural differences in transport perceptions, cognitions and decision-making. In addition, building on the findings from Chapters 3 and 5, we may be able to better represent feedback processes explaining how experiences of car or non-car use reinforce or weaken the self-regulatory processes identified in the framework. In the current version of the CAUSE framework, the 'feedback loop' from the behaviour to habit through behavioural frequency provides a rudimentary example. However in future iterations of similar work it would be useful to explore specific facets of transport experiences to allow for greater understanding and theorisation. For instance, the psychological effects of commuting was found to differ by transport modes (as seen in Chapter 3) and this might suggest that every transport decision (car or non-car) creates either a positive or negative effect on wellbeing that would serve to reinforce or weaken the beliefs and attitudes towards a similar transport decision in future.

More applied work would involve mapping which interventions are most effective for influencing change in each self-regulatory mechanism. This work could then be consolidated to create a logic model for intervention and policy design using an Intervention Mapping approach (Bartholomew et al., 2016). Finally, the CAUSE framework may also be applicable to other ecologically relevant behaviour patterns, such as recycling and water conversation, allowing verification across behavioural domains.

6.2. Commuting and wellbeing in London: The roles of commute mode and local public transport connectivity. (Chapter 3)

One knowledge gap uncovered from the first study was the limited understanding of the experiences and consequences of carrying out transport behaviours. Current research largely focuses on understanding and theorising the antecedents of transport decisions. Thus the second study (Chapter 3) set out to address this knowledge gap by exploring the consequences that travelling by car and other transport modes might have on our wellbeing.

6.2.1. Key findings

The study used data from Understanding Society, the UK Household Longitudinal Study, to explore the relationships between commuting and wellbeing, and the role of public transport connectivity among commuters in London. This secondary data analysis built on the exploratory work on urban density and travel mode choices (see Appendix 1.A) that identified London as the region in the UK with the most extensive public transport network and varied travel mode choices, which included a sizeable proportion of active transport users.

The aim was to explore the role of public transport connectivity in relationships between commuting and wellbeing using i) a more detailed measure of travel mode choices, and ii) two aspects of wellbeing, positive (life satisfaction) and negative (mental distress). Examining six distinct commute modes (compared to three in past studies) revealed that commuting and wellbeing associations are more complex than suggested previously. For example, although previous findings suggest that active transport is associated with better wellbeing (Humphreys, Goodman, & Ogilvie, 2013; Martin, Goryakin, & Suhrcke, 2014; St-Louis, Manaugh, van Lierop, & El-Geneidy, 2014), differences between different active transport modes were identified. Only walking, and not cycling, was associated with higher life satisfaction. These findings strongly indicate that transport options should not be collapsed into broad collections (such as "active" transport) if we are to understand mode-specific motivations and psychological consequences.

It was also interesting to note that positive and negative aspects of wellbeing were not necessarily the inverse of one other. It was possible to report both lower mental distress and also, lower life satisfaction concurrently, as observed in commuters residing within the congestion zone in London. Nevertheless, the overall finding suggested that life satisfaction was more closely related to the type of public transport used while mental distress was more closely related to the connectivity of public transport.

These findings have clear implications for understanding how transport systems and travel choices impact individuals' wellbeing, and highlight that these relationships are moderated by other extraneous factors, such as location and connectivity, in this case. Specifically, in the case of London, policymakers should continue enhancing London's public transport accessibility in tandem with growing needs, as it holds potential to contribute to growing mental health disparities. In addition, given walking commutes' associations with higher life satisfaction, stronger promotion of walking, to augment current policies encouraging cycling, should be considered.

6.2.2. Strengths and limitations

Secondary data analysis of the Understanding Society dataset provided a large representative sample that allowed the use of a six-category commute mode variable as opposed to the more common three mode categorisation. Together with the use of public transport connectivity data at the Lower Layer Super Output Area (LSOA) level (the most detailed level currently available for connectivity data), this led to additional insights into the relationships between commuting, public transport connectivity and wellbeing. In addition, the use of two wellbeing measures revealed independent effects of commuting on different facets of wellbeing.

Nonetheless, the cross-sectional nature of the study and correlational analyses mean that causality cannot be inferred. Thus, further questions on how different commute modes, public transport connectivity, and other sociodemographic variables measured in the study impact wellbeing can only be definitively answered by experimental studies. In addition, it was not possible to differentiate journey types and this may have important implications for

wellbeing. For instance, findings from Chapter 4 suggested that commute journeys heading into the city are experientially different from those heading in the opposite direction, thus it is possible that mental distress may differ with the anticipated destination of travel. Furthermore, although connectivity at the LSOA level provides a good proxy for actual transport availability there may be inaccuracies in on-the-ground representation due to the level of resolution of geographical boundaries.

6.2.3. Future research

As differences in wellbeing were identified between commuters residing inside and outside the London congestion zone, an assessment of the impact of reducing the congestion zone (in 2011; after this data was collected) on commuter wellbeing needs to be investigated. This could deepen our understanding and appreciation of the impact of implementing congestion zones on wellbeing and so to inform future discussions of extending this zone in London and implementing similar schemes elsewhere. Conducting a longitudinal analysis similar to that used by Martin et al. (2014) and White, Alcock, Wheeler, and Depledge (2013) would be well suited for such investigation and could further illuminate the direction and nature of causality in the relationships identified here.

Most urban commuters have access to non-car transport options and it would be interesting to explore how these alternatives are considered in relation to perceptions of accessibility, and how this relationship moderates the impact of commuting on their wellbeing. As suggested in Chapter 4, commuters may choose to use Overground and Underground trains in London despite these being perceived to be more inaccessible and inconvenient because using public transport allowed them to make better use of their time (e.g., being able to read on the trains) and incorporated more physical activity into their routine, thus making them feel more satisfied with their journeys. Such studies could be conducted using mixed-method experimental designs that present hypothetical scenarios or reflections on in vivo experiences of alternative travel modes.

Further work on the impact of good public transport connectivity could, instead of using LSOA level data, use estimates of walking distance to specific public

transport sites so that ease of access could be calculated irrespective of geographical boundaries. Finally, since the findings here are only applicable to London, and similar cities such as New York, cross-cultural replication of these analyses are needed.

6.3. Cross-cultural qualitative exploration of transport decisions and experiences in London and Singapore (Chapter 4)

A second knowledge gap observed from the first study was the limited availability of cross-cultural research and understanding of transport behaviours. Existing research in this area originate largely from Europe. The third study (Chapter 4) aimed to contribute towards closing this knowledge gap by exploring potential cross-cultural in transport behaviour and decisions. Two cities, London and Singapore, were chosen for comparison in this study as they have similar transport infrastructure but distinct transport-related cultures, in part because of the differences in the cost of car ownership. This comparison also allowed the exploratory work for the cross-cultural validity of our understanding of transport decisions in a non-Western society.

6.3.1. Key findings

The interviews with transport users in London and Singapore, generated four shared factors influencing transport decisions: 1) the purpose and nature of the journey; 2) transport access and feasibility; 3) their perception of, and beliefs about, various transport modes; and 4) their anticipated travel experience. These factors were related hierarchically, resembling a transportation decision-making process. Typically for both cities this begins with the fundamental utility considerations underlying the transportation need before proceeding to 'higher level' factors such as the desire for comfort and personal preferences.

The two samples differed in perceptions of, and values attached to, cars. Cars were viewed as luxury goods in Singapore but as necessities for commuting and running errands in London. This difference is in part due to the quota-based car ownership policy and high vehicle purchase tax imposed in Singapore. Despite being described as 'draconian' by some (Menon & Loh, 2015), Singaporeans interviewed generally supported their transport management

system, and, interestingly, most Londoners supported the implementation of this system in Singapore when the policy's rationale was explained. Some London interviewees also thought that stricter car ownership policies could be a useful step towards car-lite societies. However, only a few Londoners could envisage a similar policy being introduced in London. The findings emphasise the importance of communicating with and educating the public on the necessity for current or new transport policies and managing their expectations.

6.3.2. Strengths and limitations

This qualitative study was the first to compare transport-related decisions, experiences and opinions in London and Singapore. A qualitative approach was advantageous for exploring interviewees' transport considerations and experiences in depth. This was particularly evident when interviewees shared personal encounters to explain how their transport opinions were formed. This methodology also provided the opportunity to explore cultural differences whenever they emerged and to explore responses to descriptions of policies in place elsewhere.

The qualitative design necessitated a small sample that cannot be assumed to be representative of the population. Nonetheless, the sample included people from a diversity of backgrounds and population segments. Finally, while these findings are potentially relevant to other cities, more geographically-specific work is needed because every city has unique characteristics that determine how their populations will respond to new policies and interventions.

6.3.3. Future research

The findings from this research raise two important questions. First, how much car ownership regulation is acceptable? Understanding what type of car management systems would be perceived to be equitable and justified by the public in any particular city would be helpful to authorities (globally) as they develop policies to manage increasing car ownership.

Second, how 'good' does alternative transportation (e.g., public transport) have to be to persuade motorists to switch? The findings suggest that driving preferences are based on perceptions of the quality of alternatives, even when

these are misperceptions. Thus, attempts to persuade the use of alternative transportation are more likely to be successful if marginal improvements are identified and then clearly communicated to drivers.

These two questions could be addressed using qualitative methods but quantitative and experimental studies would be needed to determine how qualitative insights can be translated into intervention and policy implementation. Social marketing research could also be used to identify the most effective ways of communicating with city populations.

6.4. "Nice car, but what about the CO_2 emissions?": Who considers environmental factors during car purchase decisions? (Chapter 5)

It was observed in the third study that there were many urban dwellers in London and Singapore who purchased cars despite the relatively diminished need for a car with well-connected public transport networks and the high cost of car ownership and use. Thus the final study (Chapter 5) explored the factors that car buyers have during car purchases to the nature of these considerations and how they are related to their environmental attitudes and everyday behaviours.

Understanding such decisions is important because car use is likely to be the dominant mode of travel over the next few decades (PricewaterhouseCoopers, 2016). If potential buyers can be persuaded to consider cars' potential environmental impact and favour ultra-low emission vehicles (ULEVs) this could limit the impact of car use on our environment and health (International Energy Agency, 2016; World Health Organisation, 2016).

6.4.1. Key findings

The study analysed UK population-representative data from the Understanding Society and identified three main categories of considerations during car purchases: Utility (e.g., cost/safety), Image (e.g., brand) and Environment (e.g., CO_2 emissions). Approximately half the participants reported considering at least one environmental-related factor alongside more utility- or image-related features during car purchases, however, it is disconcerting that half did not.

The analyses also explored *who* considered *what* features during car purchases and how they are related with environment-related cognitions and everyday behaviours. In general, the environmental attitude-behaviour consistency hypothesis was supported in relation to three aspects of environmental attitudes, namely, climate change concern, engagement and disengagement. Individuals who expressed more concerns about climate change and held pro-environmental attitudes considered more environment-related features during car purchases, e.g., getting electric, environmentally-friendly and smaller engine cars. Though all three aspects were related, independent effects for each were also observed, e.g., participants who report greater engagement with climate change may be motivated by more than just their environmental concern.

Higher frequencies of pro-environmental household behaviours (e.g., switching off lights) and shopping behaviours (e.g., buying recycled paper products) were associated with higher likelihood of environment-related considerations during car purchases but this was not always observed in relation to pro-environmental travel behaviour. Car sharing and taking fewer flights were both associated with higher likelihood of environment-related considerations but everyday use of public transport and walking or cycling for short journeys were not. It is possible that regular travel by public transport, walking or cycling might have given rise to 'moral licensing', whereby a person places less emphasis on environmental factors when purchasing a car because they believe their existing pro-environmental travel behaviours mitigate the potential environmental impact generated by their cars (Meijers, Noordewier, Avramova, & van Trijp, 2013; Nilsson, Bergquist, & Schultz, 2017).

Considerations of environment-related factors during car purchase have been found to be related to affordability and the level of disposable income and so may be more likely among higher income households and those acquiring additional cars (Klöckner, Nayum, & Mehmetoglu, 2013; Plötz, Schneider, Globisch, & Dütschke, 2014). This study did not replicate this finding. Those in the highest household income quintile and interested in acquiring additional cars were less likely to consider environment-related features. Regional gender, age and ethnicity differences were also observed. We also found that more educated individuals, who might be expected to be more aware of demand

characteristics, were significantly less likely to report pro-environmental considerations. These findings are potentially useful for social marketers and policy makers when identifying key audiences to more effectively promote ULEVs purchases.

6.4.2. Strengths and limitations

The Understanding Society dataset provided a large sample that was representative of the UK socioeconomic demographics and all included participants had a role to play in car purchase decisions. The inclusion of three different aspects of environmental attitudes provided greater insights into the independent effects of climate change concern, engagement and detachment when exploring the environmental attitude-behaviour consistency hypothesis. In addition, the modelling of the eleven pro-environmental behaviours identified the possibility of moral licensing during car purchases among pro-environmental commuters.

The use of secondary data in this study mean that further tests are needed to explore whether these patterns are reflected in real car purchase decisions. Such pre- post-decision research would be helpful to the design and evaluation of interventions and policies to encourage ULEVs purchases. Unfortunately, it was also not possible to test the CAUSE framework from Chapter 2 or other theories such as the Comprehensive Action Determination Model (Klöckner & Blöbaum, 2010) and the Value-Belief-Norm model (Stern, Dietz, Abel, Guagnano, & Kalof, 1999) as the specified constructs were not measured in the Understanding Society survey.

6.4.3. Future research

Future work building on this study could follow three paths. First, a pre- post-decision questionnaire study could test the mechanisms presented in the CAUSE framework from Chapter 2 as well as further exploring the prevalence of moral licensing following everyday pro-environmental travel behaviour. Second, sociodemographic moderators of the relationships between pro-environmental attitudes and behaviour, and car purchases could be further investigated in pre- post-decision longitudinal studies. Finally, this work should be replicated in other countries, particularly those with rapidly growing car

ownerships, such as China and India. This research could guide the development of culturally-tailored educational programmes to encourage ULEVs purchases.

6.5. Overall implications and future directions

The four studies presented here integrated conceptualisations and perspectives from multiple disciplines (e.g., psychology, economics, geography) using a mixed-method approach to understand car use and transportation decisions. The findings here demonstrate that new insights can be uncovered by integrating the unique perspectives from each adjacent disciplines to enhance our understanding and address the knowledge gap in this research area, demonstrating the importance and need for further multi-disciplinary research. This section builds on the key findings summarised above by highlighting key implications of this programme of research for future transport research, interventions and policies.

6.5.1. The CAUSE framework

The CAUSE framework is a systematic consolidation of our understanding of the self-regulatory mechanisms underlying car use. For researchers, the framework provides opportunities to review available evidence and identify knowledge gaps in our understanding of the self-regulatory mechanisms. This could serve to promote novel research and reduce repetition of tests where adequate evidence is available. The findings reported in Chapters 3 to 5 highlight how the framework could be extended, for example, to include the consequences of car use on wellbeing.

The CAUSE framework may facilitate the translation of theory and research into intervention design by consolidating current theoretical and empirical understanding of change mechanisms. The framework could provide an accessible 'go to' reference for intervention designers and policy makers by helping with the identification of relevant mechanisms using intervention logic models, highlighting how much support particular mechanisms have received as well as linking the mechanisms to the theories specifying them. It may also be relevant beyond car use because most of the specified mechanisms (e.g.,

personal norm and egoistic value) underpin a variety of environmental behaviour patterns.

Our understanding of the complexity of self-regulatory mechanisms underlying transport behaviours has also progressed from simpler theorisation (e.g., the Theory of Planned Behaviour (Ajzen, 1991) to more comprehensive models (e.g., the Comprehensive Action Determination Model (Klöckner & Blöbaum, 2010)). There is increasing research on transport use and wellbeing (e.g., Humphreys et al. (2013), Martin et al. (2014) and Roberts, Hodgson, and Dolan (2011)), but greater theorisation of the mechanisms by which psychological consequences influence subsequent transport decisions and behaviours is needed (Guell, Panter, Jones, & Ogilvie, 2012; Stutzer & Frey, 2008). Integration of this research into existing theorisations may explain why transport interventions sometimes fail to generate sustained behaviour change (Arnott et al., 2014; Steg & Vlek, 2009).

6.5.2. Transport behaviour as environmental behaviour

The review in Chapter 2 and the secondary data analyses in Chapter 5 suggest that transport behaviours are subsets of everyday environmental behaviours, similar to recycling and sustainable purchasing behaviours. Many of these behaviours share similar underlying self-regulation mechanisms. Understanding *how* and *why* they are interrelated is important when the human impact on our environment is highlighting the need for widespread behaviour and lifestyle changes (Berrang-Ford, Ford, & Paterson, 2011; Clayton et al., 2015). Policy makers are searching for ways in which they can effect these changes at the population level with minimal impact on their economy and in the most efficient manner (Barr, 2003, 2012). It would therefore be impractical and resource-inefficient if policies and interventions were created to target these behaviour changes for one domain at a time. When we understand how these environmental behaviour patterns are interrelated, we can target the common mechanisms to effect behaviour change across a broader spectrum of behaviours, achieving positive behaviour spill-over.

6.5.3. More cohesive interdisciplinary collaboration

Studies in this thesis applied psychological theories and methods but it is evident that psychological mechanisms influencing transportation behaviour are linked to non-psychological factors. For example, the perception of availability of transport options is contingent on the actual access to the infrastructure and on one's mobility. As illustrated in Chapter 4, implementing persuasive interventions to change individual intentions to reduce car use may be less efficient than introductions of justified policies to increase the cost of car ownership above the affordability of even medium-level earners. Similarly, as shown in Chapter 3, integrated perspectives from human geography (in the form of public transport accessibility data) are needed to understand the relationship between commuting and wellbeing.

In addition, in reviewing the literature, it became clear that there is also a substantial body of theory and research in the field of behavioural and transport economics (e.g., Daziano and Bolduc (2013), Gallego, Montero, and Salas (2013) and Heesch, Giles-Corti, and Turrell (2014)), transport geography (e.g., Zhang, Yu, and Chikaraishi (2014)), and transport engineering (e.g., Setiawan, Santosa, and Sjafruddin (2017)) that parallels psychological research. Thus, if it is possible to further integrate and promote interdisciplinary work, faster progress will be made with lesser repetition (Soranno, Cheruvelil, Elliott, & Montgomery, 2015). However greater interdisciplinary understanding is needed to provide the conditions that foster further integration and this could start with establishing a common set of terminologies and understanding when describing transportation behaviours. By doing so, the accumulated knowledge from multiple disciplines can then be easily agglomerated and integrated into a framework or conceptual map to highlight both the well-established understandings and knowledge gaps.

6.5.4. Educating and communicating with the public

The interview study reported in Chapter 4 illustrates that despite researchers understanding how our transport behaviour is related to our environment and health and the benefits of behaviour change (e.g., Flint and Cummins (2016) and Martin et al. (2014)), this understanding may not necessarily extend to the general public. Further education in this area is required to empower the public

to contribute towards mitigating the impact of transportation on the environment (Anderson, 2012; Lutz, Muttarak, & Striessnig, 2014). However, such education may need to be tailored to the experiences of different population segments. For instance, air pollution contributed by the exhaust of vehicles provide visual, and perhaps for some, health, indicators of the impact of transport on our environment in cities such as London, Beijing and Mumbai. The focus of education in these cities should be on how individuals can take personal responsibility for the situation and contribute towards changing it. On the other hand, cities like Zurich and Singapore do not have such problems but this does not mean that their transport use has no impact on the environment and their health. For such populations, education might then focus on raising awareness of impact of the transport behaviours beyond the observable (e.g., the increased risk of obesity and its associated illnesses with decreased physical activity when driving instead of using the public transport).

The findings from Chapters 2 to 5 are relevant to the communication and social marketing aspects of transport interventions. Perceptions of transport modes and the anticipated experience of using them are key considerations for users and their experiences reinforce their decisions, both positively and negatively. Thus, when promoting mode change it is also important to promote the transport mode in ways that are meaningful to the users, such as the safety of the travel, the environmental sustainability of the mode, and the physical and psychological wellbeing benefits that they might potentially gain from the mode switch. These education and communication are essential when preparing for the introduction of policy or legislative change and to generate support and adherence after its introduction. This process could also be complemented by engaging the public during policy drafting (Blue & Medlock, 2014; Wibeck, 2014) to facilitate smoother implementation of new policies (Fung, 2015).

6.5.5. Cross-cultural and transcultural research

The review in Chapter 2 identified evidence that was based predominantly on research in Western cultures, highlighting the need for more evidence from the global South and Eastern cultures. This will, in the near term, contribute towards the expansion of our theoretical understanding and the optimisation of interventions and policies in these cultures. In the longer term, however, there is

a need to develop transcultural research that would support global interventions, especially with global initiatives on environmental challenges such as the Paris Agreement (United Nations, 2015). For example, 'global prosociality', is a measure of identification with global, moral citizenship that may, in turn, be related to environmental behaviour through a stronger sense of collective obligation, identification with humankind, and global-level place attachment (Leung, Koh, & Tam, 2015).

6.5.6. Preparing for the next revolution in transportation

This thesis began with a history of revolutions in transportation. Now, we are at the brink of the next revolution in transportation where innovations are rapidly introduced as mainstream transport alternatives. One key area for future research will be the acceptance of autonomous vehicles that are currently undergoing road trials in different cities (e.g., the GATEway driverless shuttles trial in Greenwich, London, the self-driving Uber trial in Pittsburgh, the Waymo self-driving car trial in Phoenix, Arizona, and the nuTonomy self-driving taxi trial in Singapore). Autonomous vehicles are purportedly safer than human drivers and may help to manage traffic demand but it is uncertain how people will respond to the technology (Fagnant & Kockelman, 2015; Kyriakidis, Happee, & de Winter, 2015; Payre, Cestac, & Delhomme, 2014). It is clear, however, that autonomous driving technology will lead to a paradigm shift in how driving will be experienced and defined, potentially changing our transport behaviours (Janasz & Schneidewind, 2017; Le Vine, Zolfaghari, & Polak, 2015; Rödel, Stadler, Meschtscherjakov, & Tscheligi, 2014). Effective public engagement and education will also be needed to pave the way for a smooth introduction of autonomous vehicles and other emerging technologies (Fagnant & Kockelman, 2015).

The context of impending technological disruption on how we use transportation and travel makes the research in this thesis more relevant than before. With machines being designed and programmed to perform specific functions under specific environments and predetermined parameters (e.g., an autonomous shuttle bringing workers from their home to workplace), the need to understand the psychology underlying human-technology interaction in transportation will be increasingly crucial. This will entail going beyond gaining an understanding

of transport decisions by individuals (as in much of the work in this thesis) and would require the application of this understanding during the development of autonomous transport systems so that they become adaptive and responsive to the needs of the human user.

6.6. Conclusion

The research reported in this thesis explored the antecedents and consequences of car use to form a cohesive understanding of car use behaviour. The antecedents of car use from the field of transportation psychology have been consolidated into an integrative framework that provides an easy reference for those who wish to develop theory-based transport research, interventions and policies. Exploratory work on commuting and wellbeing reported here suggests that different transport modes affect our wellbeing differently and this might also be influenced by spatial factors such as public transport connectivity. Transport experiences and perceptions of policies were explored cross-culturally in London and Singapore and findings suggest that transport policies need to be tailored to cultural sensitivities. Finally, environmental considerations during car purchase were found to be related to one's environmental attitudes but less so to everyday pro-environmental travel behaviours. Collectively, these four studies demonstrate the potential of applying psychological perspective in transportation research but the next challenge will be to develop multidisciplinary, transcultural research that keeps pace with emerging technologies that will change how people travel and think about travel.

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Supplementary files for Chapter 1

The following pages present the supplementary file for Chapter 1: Introduction.

Appendix 1.A: Commuting in England and Wales: The role of urban density, travel distance and public transport accessibility.

This appendix reports the preliminary work that was carried out to understand how transport choices and urban form are related in the UK.

1. Abstract

This study explored the relationships between urban density, public transport accessibility, and commute mode (car/van, public transport, and active [walking and cycling] transport) in urban England and Wales using a novel categorisation of urban density. Research questions were investigated using cross sectional analyses of data from 13,655 commuters with car access in the urban England and Wales from wave 2 of the Understanding Society (2010/2011) study. Distributions of commute modes differed with urban density. Car/van commutes were most prevalent in less dense urban regions (smaller city and towns, and major conurbations), while public transport use was more common in more dense urban regions (London). Active transport commutes was the third most common mode and most common both in the least dense (smaller city and towns) and most dense (inner London) regions. Multivariate logistic regression analyses suggested that, with rising urban density and public transport accessibility, commuters were less likely to drive and more likely to use public transport. However, mixed results on the associations with active commutes were found. These results suggest that it might possible to encourage drivers to use more sustainable transport if it were more accessible.

2. Introduction

In the UK, ownership and use of motor vehicles, such as cars and vans, has grown significantly over the past six decades due, in part, to increasing affluence in a growing population (Department for Transport, 2014). Many people and households value the convenience and flexibility offered by driving as opposed to public transport, walking and cycling (Mackett, 2009). This has created increasing congestion, local environmental degradation (especially in high density urban areas), and carbon emissions (Beevers, Carslaw, Westmoreland, & Mittal, 2009; Gatersleben, 2007).

The mid-2014 estimate (Office of National Statistics, 2015) of the UK population was 64.6 million, 84.0% of whom lived in England. Overall England has a population density of 413 people per square kilometre, but there are marked regional differences. For instance, population densities in London are far higher than average with outer London and inner London having densities of 4,140 and 10,775 people per km^2 respectively (Greater London Authority, 2015). Moreover, there is a temporal trend towards greater urban density in the future. For instance, whereas the percentage of the UK population living in cities reached 83% in 2015, it is expected to be 89% by 2050 (United Nations, 2015). A growing population and increasing urbanisation means that population density will continue rising and the demand for transportation will increase similarly.

The challenge of managing transportation demand in increasingly dense urban areas is illustrated by London where road congestion has been a problem since the later 1950's (Kay & Evans, 1992). The ensuing increase in emissions from petrol and diesel has contributed to a rise in air pollutants that affects air quality and human health (Beevers et al., 2009; Department for Transport, 2004). This pattern is repeated, although less intensely, in other cities, such as Manchester and Edinburgh (Echenique, Hargreaves, Mitchell, & Namdeo, 2012).

Numerous national and city-wide initiatives and policies have been implemented to address the growing use of personal motorised transport, including taxation on vehicles (Brand, Anable, & Tran, 2013), charging for road usage such as congestion charging (Santos, 2004; Santos, Button, & Noll, 2008), and the introduction of car sharing schemes to reduce single occupancy journeys and in some instances personal car ownership (Transport for London, 2015a). However, there is little evidence supporting the effectiveness of these strategies (Möser & Bamberg, 2008). In a systematic review of the literature on car-use reduction schemes, Graham-Rowe, Skippon, Gardner and Abraham (2011) concluded that the evidence base was weak. Out of 77 evaluations identified, only 12, one of which was conducted in the UK, were found to be methodologically strong. Of these, four found no evidence of car use reduction while eight found at least some evidence of effectiveness, although few examined long-term effects.

With the growing acknowledgement of the need to reduce carbon emissions to mitigate climate change, the British government is keen to encourage sustainable behaviour changes among transport users (Department for Transport, 2004) such as the introduction of public bicycle hire schemes in cities (Transport for London, 2015b). However, the long-term effectiveness of these behavioural modification initiatives is yet to be established (Lathia, Ahmed, & Capra, 2012). Despite these efforts, private motorised vehicles remain the main mode of transport in the UK, especially for daily work commutes. Data from the 2011 census (Office of National Statistics, 2013a) of 23.7 million regular commuters in England and Wales show that car/van is the most common commute mode accounting for 64% of all commutes followed by public transport (16%) and active commuting (walking and cycling; 14%).

Mackett (2015) suggests that an alternative approach to reducing car/van use is to increase residential density within urban areas. With an increase in urban density, the pressure to develop new transport infrastructures to meet the increasing demand of the population also increases, and with careful planning, alternative modes of transport can be made more accessible and desirable to commuters. For instance, a comprehensive network of bus stops and cycling lanes linking residential areas to commercial and shopping areas could encourage the use of public and active transport to replace work and leisure commutes. Past studies have suggested that this approach may result in a shift in commute patterns from predominantly car/van use towards more public and active transport (Echenique et al., 2012; Gordon, 2008; Mitchell, Hargreaves, Namdeo, & Echenique, 2011) although long-term efficacy is yet to be established (Ford, Barr, Dawson, & James, 2015; Melia, Parkhurst, & Barton, 2011). However, it is unclear if this would work in the UK as there is limited understanding of how commutes vary with urban density. This is because past studies largely used older rural-urban classification schemes that were unable to differentiate between varying levels of urban density in the UK Dargay & Hanly, 2007; Hutchinson et al., 2014; Mitchell et al., 2011).
To evaluate the viability of Mackett's (2015) suggestion in UK, the present study incorporated an updated rural-urban classification framework that differentiates between varying levels of urban density to investigate potential differences in

the three main commute modes (car/van, public and active transport) across varying levels of urban density in England and Wales. In addition, a measure of public transport accessibility within London was explored for London commuters to gain greater understanding of the role of accessible public transport. With the data from the Understanding Society, a UK Household Longitudinal Study (UKHLS), on commuters with car access in urban England and Wales, we investigated which commuters are most likely to use the more sustainable modes of public and active transport.

3. Material and Methods

3.1. Study design and sample

The sample was drawn from 50,389 respondents to wave 2 (2010/11) of the UKHLS (University of Essex, 2013). The UKHLS is a longitudinal panel survey of UK households that began in 2009 (although the British Household Panel, from which the UKHLS was developed, ran from 1991). Detailed information on the study and its sampling methodology is reported elsewhere (Lynn, 2011). Participants are surveyed annually and contribute information relating to their socioeconomic circumstances, attitudes, and behaviour via a computer-assisted personal interview. A commuting module was introduced at wave 2 to explore commute behaviour and patterns. For current purposes, participants were categorised as commuters if they were employed in a job and worked somewhere other than at home.

Analytic samples were drawn from urban commuters in England and Wales. The appropriate UKHLS cross-sectional weight was applied in all analyses, which improves the population representativeness of samples. Sample sizes reported are weighted respondent samples rounded to integer values. Urban commuters were classified on the basis of their residential area into four levels of urban density. Inner and outer London categories were derived using the London borough boundaries (Office of National Statistics, 2013c). The Rural and Urban Classification of Lower Layer Super Output Area (Office of National Statistics, 2013b) was used for the rest of England and Wales as it classifies urban areas as a function of population density.

A sample was derived (n = 13,083) consisting of commuters who were resident in four areas of increasing urban density: less sparse city and town (n = 7,796), major conurbation (n = 3,016), outer London (n = 1,336), and inner London (n = 935); due to low numbers, urban commuters resident in minor conurbations and more sparse towns and cities were excluded from the sample. A further sample was derived (n = 11,489) which was limited to commuters with car access (availability of one or more car within the household) who were resident in the same four urban density categories. Ethical approval was not required for the analysis of secondary data presented here.

3.2 .Measures

The dependent variables used in regression analyses were binary indicators of three commute modes, car/van, public transport, and active transport (cycling and walking combined) commutes, and the independent variables of interest were the four urban density classifications described above. The binary commute mode measures were derived by collapsing responses to the following question: "How do you usually get to your place of work?" Respondents were asked to select one of the 10 listed transportation modes that best represented their main commute mode, meaning that information on multi-mode trips was not captured. In addition to the three binary outcome measures, a seven category variable was derived for descriptive analysis of the samples: (i) car/van; (ii) public transport (bus/coach/train/underground); (iii) active transport (walk/cycle); (iv) car share (as passenger); (v) taxi/minicab; (vi) motorcycle/moped/scooter; (vii) other (combination of two or more transport mode).

Two covariates measuring commute distances and Public Transport Accessibility Levels (PTALs) were investigated. Commute distances were derived from the responses to the following question: "About how far, in miles, do you live from your usual place of work?" The responses were classified into six incremental categories (0 to 1, 2 to 3, 4 to 5, 6 to 10, 11 to 15, 16 and more miles). Public Transport Accessibility Levels data, measuring the public transport network density at the Lower Layer Super Output Area level after taking into account walk access time and service availability, was only available for London (Transport for London, 2013). This was merged into the UKHLS

data set at the Lower Layer Super Output Area level for each commuter in London. The PTAL is categorised in 6 levels, 1 (low level of accessibility) to 6 (high level of accessibility) with levels 1 and 6 further sub-divided into 2 sub-levels to provide greater clarity. More information about the derivation of this measure is available elsewhere (Transport for London, 2013). For current purposes, in part due to sample sizes, we derived three categories that reflect progressive increments in accessibility: (i) very poor (levels 1a and 1b); (ii) poor to moderate (levels 2 and 3); (iii) good to excellent (levels 3 to 6b).

A range of sociodemographic factors that may be related to urban density and car commutes were also identified and used as covariates in the model: age (six-category variable of 16-24, 25-34, 35-44, 45-44, 54, 55-64, ≥65 years); gender (binary variable); educational attainment (three-category variable of degree, other qualifications, no qualifications); gross household income (OECD equivalised quintiles indexed to March 2012); and household type (binary variable of no children or children <16 years old).

3.3. Statistical analysis

Descriptive statistics were calculated on the demographic characteristics and the commute mode of the sample of all urban commuters, and the subsample with car access, stratified by urban density, with less sparse city and town as the reference category. Multivariate logistic regressions were then used to estimate the relationship between the three commute modes (car/van, public transport, and active transport), and urban density, adjusting for hypothesised confounding factors, in the sample of urban commuters with car access. In addition, these logistic regression models were re-specified for those urban commuters with car access who were resident in inner London and outer London only, and the PTAL category was then included as a further independent variable. We therefore focus on six estimations of relationships between commute mode and urban density. A blocked approach was taken to these regression analyses, with initial unadjusted models regressing commute modes against urban density; block 2 models controlling on distance to work (and PTAL in the case of the London subsamples); and block 3 models further controlling for individual level socio-demographic factors. In every case, regression models were specified using the survey sample functions in STATA

13 software, which adjusted the standard errors and associated confidence intervals to account for the stratified clustered sampling design of the UKHLS survey.

4. Results

4.1. Sample descriptive

Table 1 presents sample descriptive statistics on all commuters in urban England and Wales, and those with car access, stratified by urban density category. The distributions of commute modes amongst these two samples of commuters are presented in Table 2. Car/van, public transport and active transport were the three main commute modes of choice. Across the whole urban commuter sample, car/van commute was most common in less sparse city and town, and major conurbation regions, while public transport was most common for London commuters. However, after accounting for commuters with car access only, car/van commute was most common in all urban localities except inner London. Across all samples, higher percentages of active transport commute were observed in less sparse city and town, and inner London regions.

4.2. Logistic regression analyses

Tables 3 to 5 show results for the analyses of car/van, public transport and active transport commutes within the sample of commuters with car access. The logistic regressions were modelled for all urban commuters with car access in England and Wales, and separately for London commuters. The descriptive statistics for each group of commuters are found in Tables A.1 to A.3.

4.2.1. Car/van commute

In the un-adjusted model, urban density significantly predicted car/van commute such that the probability of using a car/van to get to work systematically fell as urban density increased. Specifically, compared with living in the least dense region, the odds of commuting by car/van were 0.41 (95% CI: 0.35, 0.49) in outer London and 0.21 (95% CI: 0.16, 0.26) in inner London (Model A, Table 3). These relationships remained significant after adjusting for the covariate of commute distance (Model B). A similar decrease in odds of car/van commute was also observed in the denser major conurbation region (OR (95% CI) = 0.87

(0.78, 0.98)) in the fully adjusted model which saw the odds of car/van commutes decrease with increasing urban density (Model C). Older commuters and those with higher educational attainment were more likely to drive. However, this likelihood decreased with higher household income.

For the London-only sample, the minimally adjusted model was significant and car/van commute was 0.50 (95% CI: 0.38, 0.65) times less likely in inner London than outer London (Model D). In the covariate-adjusted model, commute distance and PTAL were significant predictors (Model E). Car/van commutes were 1.73 to 2.75 times more likely for short distances of up to 10 miles compared to distances of up to 1 mile, while they were 0.55 (95% CI: 0.35, 0.86) times less likely with PTALs of 'good to excellent' compared with 'very poor'. In the fully adjusted model, car/van commute remained significantly less likely in inner compared to outer London, with the only significant individual socio-demographic factor being age, where car commutes were more likely as it increased (Model F).

4.2.2. Public transport commute

In the minimally adjusted model for urban England and Wales commuters, urban density significantly predicted public transport commute to be 1.64 (95% CI: 1.36, 1.98), 7.32 (95% CI: 6.18, 8.68) and 10.66 (95% CI: 8.22, 13.84) times more likely in major conurbation, outer London and inner London regions compared to less sparse city and town regions (Model G, Table 4). The odds remained significant in the covariate-adjusted model (Model H). All variables in the fully adjusted model were significant except educational attainment and household income, with the odds of public transport commute rising with increasing urban density (Model I).

The minimally adjusted model for the London-only sample was significant and public transport commutes were 1.46 (95% CI: 1.11, 1.92) times more likely in inner than outer London (Model J). In the covariate-adjusted model, with commute distance and PTAL, the odds of public transport commute in inner London compared to outer London increased (Model K; OR (95% CI) = 1.58 (1.12, 2.23)). In addition, public transport commute was 1.70 (95% CI: 1.09, 2.65) times more likely when PTAL was 'good to excellent', compared with 'very

poor'. These odds remained significant in the fully adjusted model in addition to the commuter's age (Model L).

4.2.3. Active transport commute

In the minimally adjusted model, urban commuters in England and Wales were less likely to use active commutes in major conurbations (OR (95% CI) = 0.63 (0.54, 0.73)) and outer London (OR (95% CI) = 0.74 (0.60, 0.93)) regions (Model M, Table 5). After adjusting for commute distance, active commutes were 0.69 (95% CI: 0.58, 0.82) times less likely in major conurbations and 2.06 (95% CI: 1.42, 2.98) times more likely in inner London, with the odds of active commutes in outer London not significantly different than in less sparse city and town regions (Model N). In the fully adjusted model, the odds for active commute in major conurbation and inner London regions remained significant (Model O). Though the model was statistically significant, educational attainment and having a child in the household were not significant predictors of active commute.

In the London-only sample, the minimally adjusted model revealed that commuters in inner London were 1.77 (95% CI: 1.24, 2.52) times more likely to commute actively than those in outer London (Model P). The odds remained significant in the covariate-adjusted model, though PTAL did not significantly predict active commutes (Model Q). In the fully adjusted model, inner London, together with commute distance and gender were the only significant predictors of active commutes (Model R). Active commuting was less likely amongst females as well as with increasing commute distances.

5. Discussion

This study investigated associations between urban density, commute distance, public transport accessibility and the three main commute modes (car/van, public transport and active transport) using a large, representative dataset of England and Wales urban commuters with car access. Differing distributions of commute modes were found. Lower density regions (smaller cities and towns, and major conurbations) had higher proportions of car/van commutes and lower proportions of public transport commutes than higher density regions (outer and inner London). Subsequent logistic regression analyses suggested that

commuters were less likely to commute by car/van and more likely to commute by public transport as urban density increases. Thus in areas of greater urban density commuters are less reliant on driving to work. Areas of London with higher public transport accessibility had significantly less car/van commutes and significantly more public transport commutes. Lastly, active transport commutes were less likely in major conurbations but increased in likelihood for the higher urban density regions of outer and inner London. These results corroborate findings from previous observational studies of urban commutes (RAC Foundation, 2013; Hutchinson, White, & Graham, 2014; Liu & Lam, 2013; St-Louis, Manaugh, van Lierop, & El-Geneidy, 2014) whilst contributing novel findings capturing commuting differences associated with urban density, travel distance and public transport accessibility.

A key finding of this study is the inverse association between urban density and car/van commutes. The lower prevalence of car/van commutes found in higher urban density outer and inner London might have important implications for transportation policy and land-use and environmental policy in the context of increasing urbanisation. Recent years have seen much emphasis in promoting travel behaviour change, encouraging the use of public and active transport and to reduce pressure on road transport networks and the associated environmental pollution and impacts on health and wellbeing (Department for Transport, 2004). Our findings suggest that the impact of these initiatives may be greater in higher urban density regions, especially in London where we observed higher levels of active commutes and lower levels of car/van commutes. This is likely to reflect better established public and active transportation infrastructure (e.g., more bus routes and cycle lanes) in higher urban density regions that provides commuters with a viable alternative to car/van commutes (Dargay & Hanly, 2007; Echenique et al., 2012; Woods & Ferguson, 2014). Transport and environment policies could be aimed at encouraging commuters to modify commute routines where such opportunities exist (Santos, Behrendt, & Teytelboym, 2010). This is epitomised in the case of London where a combination of transport (e.g., the introduction of congestion charge) and environment policies (e.g., the introduction of the Ultra Low Emission Zone), and the availability of reliable and accessible public and active transport alternatives (measured by PTALs), have reduced environmental

pollution and the stress on the existing transport network (Greater London Authority, 2010; Ford et al., 2015).

The availability of an objective measure of public transport accessibility in the London sample provides some insights into its relationship with urban density and commute mode. Unsurprisingly, as with past findings (Felix, Rainer, & Julia, 2012; Ford et al., 2015; Graham-Rowe et al., 2011; Mackett, 2015), commuters with better public transport accessibility were less likely to drive and more likely to use public transport, even if they themselves had direct access to a car. However, only 7.4% of outer London commuters with car access, compared 38.1% in inner London, reside in areas with good to excellent levels of public transport accessibility, indicating real potential to further enhance public transport accessibility and encourage non-car-van commutes. A similar measure of PTAL is not currently available for urban regions outside London but it seems plausible to suggest that a similar trend might exist (Echenique et al., 2012).

Daily commute distance, a potential moderator of the association between commute choice and urban density, was a significant covariate in the fully adjusted models. Interestingly, despite the availability of an established public transport network and proliferation of hire-bicycles, short-distance (2 to 3 miles) commuters in London were more likely to drive compared to longer-distance commuters. This may highlight the importance of habitual commuting and goals other than transportation efficiency among short-commute drivers, for example, time saving and social identity (Gatersleben, 2007; Gkouskos, Normark, & Lundgren, 2014). Thus, interventions promoting travel behaviour change may need to consider going beyond creating awareness of how transportation goals can continue to be met and address how implicit goals of car/van use can be met with alternative sustainable transports (Eriksson & Forward, 2011; Gardner & Abraham, 2007; Klöckner & Blöbaum, 2010; Van Acker, Goodwin, & Witlox, In Press).

Together, these results appear to suggest that the likelihood of car/van commutes decreases with urban density, in part due to the higher availability of alternative commute options such as better public transport and opportunities

for more active commuting. London, the densest urban region in the UK, has managed to achieve a lower usage of car/van and higher uptake of public transport relative to England and Wales (RAC Foundation, 2013). Perhaps London's relative success could be replicated in other urban regions through enhancing existing transport infrastructures and accessibility alongside appropriate transport and environment policies (Felix et al., 2012). This would require substantial financial investment but has great potential to create sustained shifts in commuting patterns, thereby mitigating congestion and environmental degradation and promoting human health and wellbeing (Flint, Cummins, & Sacker, 2014; Martin, Goryakin, & Suhrcke, 2014; Santos et al., 2010).

5.1. Strengths and limitations

An important strength of this study is that individual level data was available on a large and representative sample, which allows inferences about the population of urban commuters in England and Wales. Moreover, the UKHLS provides rich socio-demographic data which allowed our estimates to be adjusted for a wide range of potential confounding covariates, such as socioeconomics and family circumstances, commute distances and, in London at least, public transport accessibility. Incorporating the updated rural-urban classification scheme that differentiates between varying levels of urban density made comparison commute modes between urban commuters possible. Most previous studies using the older rural-urban classification scheme were only able to elicit urban-rural differences and not differentiate between types of urban commute (Dargay & Hanly, 2007; Hutchinson et al., 2014; Mitchell et al., 2011). In addition, the most frequent three commute modes (car/van, public transport, and active transport) included in the study captured more than 90% of commutes across all urban categories. While residual confounding may continue to exist, the models only included commuters with car access, indicating that these commuters are those most likely to be making a choice between available commute modes.

Several limitations of this study should be borne in mind. First, though all the commuters in our analyses were employed and worked away from home, ensuring the commutes measured were specifically home to work commute,

limitations in the information available in the UKHLS meant that it was not possible to account for the direction of travel in terms of urban density. For example, it was not possible to differentiate between commuters travelling from lower urban density regions to higher density regions apart from commuters travelling in the opposite direction. The commute direction is potentially important as accessibility of alternative transportation generally increases with urban density, as seen in the case of London. Second, the lack of an objective measure of public transport accessibility in regions outside London that meant that it was not possible to explore how the availability of transport infrastructure affects commuting patterns across England and Wales more generally. Thus, it would be useful for Local Authorities outside of London to replicate the creation of a similar PTAL measure for a unified measure of public transport accessibility across the UK that will be helpful for future policy development and evaluation. Third, the data analysed in this study provides only a cross-sectional view of commuting patterns, and the direction of causality can therefore not be inferred. Finally, the UKHLS measurement of commuting is restricted as participants gave their main commute mode; meaning mixed-mode journeys were not adequately captured. Longitudinal or quasi-experimental study designs with more comprehensive measurements of commute modes to exploration of causal mechanisms by which urban commuters decide to modify their commutes are needed, and this may be possible as data from future waves of the UKHLS are collected.

5.2. Conclusion

This study provides evidence that as urban density and public transport accessibility increase, the odds of commuting by car/van decrease and the odds of commuting by public transport increase. Consequently, as initiatives to encourage greater use of public transport and more active commuting grow, it is important to consider how to improve the quality and accessibility of available transport options, and perhaps to focus such efforts on the highest urban density areas. Further research using longitudinal data and with a unified measure of urban public transport accessibility across the UK, not just London, would further aid our understanding of commuting patterns.

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Table 1. Descriptive characteristics of commuters

	All commuters								Commuters with car access							
	Less sparse city and town (n = 7,796)		Major conurbation (n = 3,016)		Outer London (n = 1,336)		Inner London (n =935)		Less sparse city and town (n = 7,171)		Major conurbation (n = 2,656)		Greater London (n = 1,143)		Inner London (n = 519)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Distance to work (miles)[a]																
0-1	1,581	20.4	481	16.1	149	11.4	122	13.5	1,346	18.9	379	14.4	137	12.2	63	12.6
2-3	1,856	24.0	697	23.3	202	15.4	201	22.4	1,664	23.4	588	22.3	163	14.5	97	19.4
4-5	969	12.5	480	16.1	190	14.5	240	26.8	916	12.9	428	16.2	168	15.0	119	23.7
6-10	1,287	16.6	671	21.5	350	26.8	203	22.7	1,225	17.2	616	23.4	294	26.1	139	27.7
11-15	676	8.7	285	9.5	230	17.6	79	8.8	639	9.0	262	9.9	199	17.7	49	9.7
16+	1,365	17.7	375	12.6	187	14.3	52	5.8	1,330	18.7	360	13.7	163	14.5	35	7.0
Public Transport Accessibility Levels (London)[a]																
Very Poor	-	-	-	-	496	37.2	62	6.6	-	-	-	-	447	39.1	56	10.7
Poor to Moderate	-	-	-	-	713	53.4	452	48.3	-	-	-	-	612	53.5	265	51.2
Good to Excellent	-	-	-	-	126	9.5	422	45.1	-	-	-	-	84	7.4	198	38.1
Age																
16-24	1,146	14.7	389	12.9	151	11.3	106	11.3	1,016	14.2	311	11.7	123	10.7	44	8.5
25-34	1,730	22.2	765	25.4	319	23.9	329	35.2	1,546	21.6	663	25.0	257	22.4	163	31.4
35-44	1,883	24.2	724	24.0	337	25.2	275	29.4	1,761	24.6	654	24.6	292	25.5	157	30.4
45-54	1,884	24.2	700	23.2	346	25.9	137	14.6	1,770	24.7	626	23.6	309	27.0	96	18.6
55-64	1,009	12.9	387	12.8	162	12.1	84	9.0	944	13.2	357	13.5	145	12.7	54	10.4
65+	144	1.8	51	1.7	22	1.6	5	0.6	134	1.9	46	1.7	18	1.6	4	0.8
Gender																
Male	3,625	46.5	1,370	45.4	636	47.6	475	50.7	3,337	46.5	1,217	45.8	535	46.8	280	53.9
Female	4,171	53.5	1,646	54.6	699	52.4	461	49.3	3,835	53.5	1,439	54.2	608	53.2	239	46.1
Highest educational qualification[a]																
None	422	5.5	166	5.5	60	4.5	41	4.4	346	4.9	121	4.6	51	4.5	23	4.5
Other	4,265	55.1	1,634	54.2	578	43.4	285	30.5	3,882	54.5	1,416	53.4	493	43.2	145	28.0
≥Degree	3,056	39.5	1,213	40.3	695	52.2	609	65.1	2,895	40.6	1,115	42.1	596	52.3	350	67.5

Equivalalised household income (5ths)[a]

1 Lowest	555	7.1	260	8.6	79	5.9	87	9.3	418	5.8	174	6.6	59	5.2	31	5.9
2	1,201	15.4	497	16.5	142	10.7	124	13.3	1,020	14.2	390	14.7	103	9.0	49	9.4
3	1,762	22.6	696	23.1	262	19.6	119	12.7	1,592	22.2	617	23.2	218	19.0	65	12.6
4	2,191	28.1	857	28.4	348	26.1	203	21.8	2,094	29.2	797	30.0	305	26.7	116	22.4
5 Highest	2,084	26.7	706	23.4	504	37.7	402	43.0	2,044	28.5	678	25.5	459	40.1	258	49.8

Child in household[a]

No children	4,774	61.2	1,832	60.8	802	60.1	648	69.3	4,344	60.6	1,598	60.2	660	57.8	318	61.3
Children <16	3,022	38.8	1,184	39.3	533	39.9	287	30.7	2,827	39.4	1,058	39.9	483	42.2	201	38.7

Note: [a]After exclusion of missing values in the respective variables.

Table 2. Commute modes

Commute mode	All commuters								Commuters with car access							
	Less sparse city and town (n = 7,796)		Major conurbation (n = 3,016)		Outer London (n = 1,336)		Inner London (n = 935)		Less sparse city and town (n = 7,171)		Major conurbation (n = 2,656)		Greater London (n = 1,143)		Inner London (n = 519)	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Car/van	4,998	64.1	1,852	61.4	559	41.9	168	18.0	4,976	69.4	1,843	69.4	554	48.4	165	31.8
Public transport (bus/coach/train/underground)	659	8.5	442	14.6	548	41.0	530	56.7	501	7.0	292	11.0	406	35.5	231	44.5
Active transport (walk/cycle)	1,482	19.0	435	14.4	176	13.2	203	21.7	1,117	15.6	277	10.4	138	12.1	101	19.5
Car share (as passenger)	512	6.6	232	7.7	34	2.5	13	1.4	448	6.3	201	7.6	32	2.8	9	1.8
Taxi/minicab	25	0.3	21	0.7	4	0.3	0	0.0	20	0.3	14	0.5	3	0.2	0	0.0
Motocycle/moped/scooter	64	0.8	11	0.4	11	0.8	9	1.0	57	0.8	10	0.4	8	0.7	7	1.4
Other (combination of two or more)	57	0.7	23	0.8	3	0.3	12	1.3	52	0.7	20	0.8	3	0.3	6	1.1

Table 3. Predictors of car/van commutes by urban England and Wales commuters with car access

	England and Wales						London-only sample					
	Model A (n = 11,489)		Model B (n = 11,380)[a]		Model C (n = 11,327)[b]		Model D (n = 1,662)		Model E (n = 1,627)		Model F (n = 1,624)	
	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)		Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald
Urban density		101.16***		115.15***		117.85***						
Less sparse city and town	1		1		1		-		-		-	
Major conurbation	1.00 (0.90, 1.12)		0.90 (0.81, 1.01)		0.87 (0.78, 0.98)*		-		-		-	
Outer London	0.41 (0.35, 0.49)***		0.33 (0.28, 0.39)***		0.31 (0.26, 0.37)***		1		1		1	
Inner London	0.21 (0.16, 0.26)***		0.16 (0.13, 0.20)***		0.15 (0.11, 0.19)***		0.50 (0.38, 0.65)***		0.52 (0.39, 0.70)***		0.56 (0.41, 0.76)***	
Distance to work (miles)				110.00***		93.92***				6.40***		6.59***
0-1			1		1				1		1	
2-3			2.80 (2.41, 3.26)***		2.81 (2.41, 3.29)***				2.75 (1.59, 4.75)***		2.93 (1.68, 5.11)***	
4-5			4.14 (3.49, 4.91)***		4.16 (3.49, 4.96)***				2.34 (1.45, 3.75)***		2.61 (1.62, 4.22)***	
6-10			5.31 (4.53, 6.23)***		5.17 (4.40, 6.12)***				1.73 (1.11, 2.70)*		1.95 (1.22, 3.12)**	
11-15			4.61 (3.84, 5.54)***		4.40 (3.64, 5.33)***				0.95 (0.56, 1.61)		1.14 (0.64, 2.04)	
16+			4.28 (3.65, 5.02)***		3.84 (3.25, 4.54)***				2.13 (1.25, 3.61)**		2.50 (1.41, 4.43)**	
Public Transport Accessibility Levels (London)	-	-	-	-	-	-				3.73*		3.36*
Very Poor	-	-	-	-	-	-			1		1	
Poor to Moderate	-	-	-	-	-	-			0.76 (0.57, 1.02)		0.76 (0.57, 1.02)	
Good to Excellent	-	-	-	-	-	-			0.55 (0.35, 0.86)**		0.57 (0.37, 0.90)*	
Age						33.89***						3.69**
16-24					1						1	
25-34					2.32 (1.94, 2.76)***						2.49 (1.40, 4.43)**	
35-44					2.54 (2.13, 3.02)***						2.30 (1.38, 3.83)**	
45-54					2.72 (2.29, 3.24)***						3.09 (1.83, 5.21)***	
55-64					2.82 (2.33, 3.41)***						2.84 (1.59, 5.08)***	
65+					4.05 (2.81, 5.85)***						3.78 (1.13, 12.62)*	
Gender												
Male					1						1	
Female					0.93 (0.84, 1.02)						0.98 (0.76, 1.26)	

Equivalised household income (5ths)^	1.76	1.38
1 Lowest	1	1
2	0.91 (0.74, 1.12)	1.09 (0.61, 1.93)
3	1.02 (0.83, 1.24)	1.06 (0.60, 1.88)
4	1.12 (0.92, 1.36)	1.03 (0.60, 1.76)
5 Highest	1.08 (0.89, 1.31)	0.79 (0.46, 1.26)
Highest educational qualification	6.35**	1.81
None	1	1
Other	1.45 (1.74, 1.79)***	1.48 (0.78, 2.79)
≥Degree	1.34 (1.08, 1.67)**	1.12 (0.60, 2.09)
Child in household		
No children	1	1
Children <16	1.11 (1.00, 1.24)	1.22 (0.92, 1.63)

Note: * $p < .05$; ** $p < .01$; *** $p < .001$. [a]109 observations were excluded from the analysis due to missing values in the distance to work variable. [b]An additional 53 observations were excluded from Model C, when compared to Model B, due to missing values in the following variables: equivalised household income, educational attainment and number of children in the household.

Table 4. Predictors of public transport commutes by urban England and Wales commuters with car access

	England and Wales						London-only sample					
	Model G (*n* = 11,489)		Model H (*n* = 11,380)		Model I (*n* = 11,327)		Model J (*n* = 1,662)		Model K (*n* = 1,627)		Model L (*n* = 1,624)	
	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald
Urban density		236.79***		220.82***		200.08***						
Less sparse city and town	1		1		1		-		-		-	
Major conurbation	1.64 (1.36, 1.98)***		1.67 (1.39, 2.01)***		1.71 (1.42, 2.06)***		-		-		-	
Outer London	7.32 (6.18, 8.68)***		7.22 (6.05, 8.61)***		7.62 (6.32, 9.20)***		1		1		1	
Inner London	10.66 (8.22, 13.84)***		12.64 (9.52, 16.79)***		13.23 (9.82, 17.82)***		1.46 (1.11, 1.92)**		1.58 (1.12, 2.23)***		1.53 (1.09, 2.14)*	
Distance to work (miles)				47.92***		51.75***				19.28***		18.99***
0-1			1		1				1		1	
2-3			4.15 (2.71, 6.35)***		4.18 (2.74, 6.36)***				3.90 (1.85, 8.22)***		4.01 (1.96, 8.21)***	
4-5			6.55 (4.22, 10.15)***		6.81 (4.42, 10.50)***				6.67 (3.12, 14.24)***		6.92 (3.36, 14.23)***	
6-10			7.69 (5.08, 11.66)***		8.16 (5.42, 12.30)***				11.95 (5.89, 24.22)***		12.147 (6.37, 24.41)***	
11-15			10.72 (6.97, 16.49)***		11.63 (7.58, 17.83)***				22.61 (10.60, 48.22)***		23.06 (10.99, 48.41)***	
16+			14.39 (9.53, 21.72)***		16.33 (10.84, 24.62)***				10.52 (5.03, 21.99)***		11.28 (5.53, 23.00)***	
Public Transport Accessibility Levels (London)	-	-	-	-						2.80		2.63
Very Poor	-	-	-	-					1		1	
Poor to Moderate	-	-	-	-					1.15 (0.83, 1.60)		1.15 (0.82, 1.60)	
Good to Excellent	-	-	-	-					1.70 (1.09, 2.65)*		1.67 (1.07, 2.61)*	
Age						18.03***						4.32***
16-24					1						1	
25-34					0.43 (0.34, 0.55)***						0.47 (0.27, 0.82)**	
35-44					0.43 (0.33, 0.54)***						0.48 (0.30, 0.78)**	
45-54					0.35 (0.27, 0.45)***						0.32 (0.18, 0.55)***	
55-64					0.29 (0.22, 0.39)***						0.32 (0.18, 0.56)***	
65+					0.29 (0.15, 0.59)**						0.18 (0.03, 1.00)*	
Gender												
Male					1						1	
Female					1.28 (1.10, 1.48)**						1.33 (1.01, 1.77)*	

Equivalised household income (5ths)	1.08	1.15
1 Lowest	1	1
2	1.28 (0.87, 1.87)	1.78 (0.85, 3.73)
3	1.07 (0.74, 1.57)	1.52 (0.79, 2.94)
4	1.16 (0.80, 1.66)	1.69 (0.93, 3.09)
5 Highest	1.27 (0.89, 1.81)	1.82 (1.02, 3.25)*
Highest educational qualification	2.79	0.64
None	1	1
Other	0.79 (0.54, 1.15)	0.82 (0.40, 1.67)
≥Degree	0.94 (0.64, 1.37)	1.00 (0.50, 1.99)
Child in household		
No children	1	1
Children <16	0.78 (0.66, 0.91)**	0.69 (0.52, 0.91)**

Note: * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 5. Predictors of active transport commutes by urban England and Wales commuters with car access

	England and Wales						London-only sample					
	Model M (n = 11,489)		Model N (n = 11,380)		Model O (n = 11,327)		Model P (n = 1,662)		Model Q (n = 1,627)		Model R (n = 1,624)	
	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald
Urban density		15.02***		13.04***		12.68***						
Less sparse city and town	1		1		1		-		-		-	
Major conurbation	0.63 (0.54, 0.73)***		0.69 (0.58, 0.82)***		0.69 (0.59, 0.82)***		-		-		-	
Outer London	0.74 (0.60, 0.93)**		1.14 (0.86, 1.52)		1.18 (0.89, 1.56)		1		1		1	
Inner London	1.31 (0.98, 1.76)		2.06 (1.42, 2.98)***		2.01 (1.39, 2.91)***		1.77 (1.24, 2.52)**		1.66 (1.04, 2.64)*		1.48 (0.94, 2.34)	
Distance to work (miles)				240.85***		237.401***				28.51***		29.02***
0-1			1		1				1		1	
2-3			0.22 (0.19, 0.26)***		0.22 (0.19, 0.26)***				0.13 (0.07, 0.23)***		0.11 (0.06, 0.21)***	
4-5			0.07 (0.05, 0.09)***		0.07 (0.05, 0.09)***				0.10 (0.06, 0.18)***		0.08 (0.04, 0.15)***	
6-10			0.03 (0.02, 0.04)***		0.03 (0.02, 0.04)***				0.06 (0.03, 0.10)***		0.04 (0.03, 0.08)***	
11-15			0.03 (0.02, 0.04)***		0.03 (0.02, 0.04)***				0.04 (0.02, 0.09)***		0.03 (0.01, 0.07)***	
16+			0.01 (0.00, 0.02)***		0.01 (0.00, 0.02)***				0.02 (0.00, 0.07)***		0.01 (0.00, 0.06)***	
Public Transport Accessibility Levels (London)	-	-	-	-	-	-				0.87		0.66
Very Poor	-	-	-	-	-	-			1		1	
Poor to Moderate	-	-	-	-	-	-			1.35 (0.86, 2.13)		1.32 (0.82, 2.14)	
Good to Excellent	-	-	-	-	-	-			1.32 (0.69, 2.53)		1.29 (0.67, 2.48)	
Age						2.72*						0.21
16-24					1						1	
25-34					0.78 (0.61, 0.99)*						0.99 (0.45, 2.19)	
35-44					0.82 (0.65, 1.04)						1.13 (0.50, 2.53)	
45-54					0.87 (0.69, 1.09)						1.25 (0.56, 2.80)	
55-64					0.82 (0.64, 1.06)						1.24 (0.55, 2.77)	
65+					0.42 (0.26, 0.69)***						1.13 (0.25, 5.11)	
Gender												
Male					1						1	
Female					0.80 (0.69, 0.92)**						0.63 (0.42, 0.94)*	

Equivalised household income (5ths)	1.46	0.81
1 Lowest	1	1
2	1.02 (0.77, 1.36)	0.49 (0.15, 1.63)
3	0.97 (0.74, 1.27)	0.71 (0.31, 1.65)
4	0.82 (0.63, 1.07)	0.70 (0.30, 1.62)
5 Highest	0.85 (0.65, 1.12)	0.94 (0.44, 2.04)
Highest educational qualification	2.51	1.61
None	1	1
Other	0.86 (0.64, 1.15)	0.68 (0.26, 1.77)
≥Degree	1.02 (0.75, 1.38)	1.00 (0.40, 2.52)
Child in household		
No children	1	1
Children <16	1.06 (1.07, 2.46)	1.40 (0.93, 2.12)

Note: * $p < .05$; ** $p < .01$; *** $p < .001$.

Table A.1. Descriptives of car/van commuters with car access

	Less sparse city and town (n = 4,976)		Major conurbation (n = 1,843)		Greater London (n = 554)		Inner London (n = 165)	
	n	%	*n*	%	*n*	%	*n*	%
Distance to work (miles)[a]								
0-1	552	11.15	172	9.39	49	9.02	12	7.27
2-3	1,103	22.28	388	21.25	107	19.44	32	19.82
4-5	699	14.12	308	16.88	104	18.99	36	22.49
6-10	1,041	21.03	474	25.94	151	27.59	35	22.04
11-15	542	10.95	206	11.26	60	10.87	20	12.55
16+	1,013	20.46	279	15.28	77	14.10	25	15.83
Public Transport Accessibility Levels (London)[a]								
Very Poor	-	-	-	-	240	43.35	23	13.67
Poor to Moderate	-	-	-	-	279	50.33	91	55.10
Good to Excellent	-	-	-	-	35	6.32	51	31.23
Age								
16-24	494	9.93	129	6.98	33	5.91	14	8.30
25-34	1,126	22.63	463	25.12	125	22.53	46	27.99
35-44	1,305	26.23	491	26.64	142	25.57	48	29.32
45-54	1,273	25.59	473	25.68	165	29.78	39	23.87
55-64	676	13.58	255	13.84	78	14.02	17	10.52
65+	102	2.04	32	1.74	12	2.18	0	0.00
Gender								
Male	2,408	48.38	882	47.83	249	44.89	102	61.81
Female	2,569	51.62	961	52.17	305	55.11	63	38.19
Highest educational qualification[a]								
None	214	4.31	72	3.89	24	4.40	9	0.53
Other	2,632	52.91	972	52.73	252	45.44	61	36.84
≥Degree	2,128	42.78	800	43.38	278	50.16	95	57.86
Equivalised household income (5ths)[a]								
1 Lowest	250	5.02	116	6.29	25	4.43	13	8.04
2	635	12.76	254	13.79	51	9.21	20	12.26
3	1,068	21.47	394	21.38	123	22.13	19	11.52
4	1,512	30.41	558	30.26	150	27.02	45	27.46
5 Highest	1,509	30.35	521	28.29	206	37.21	67	40.72
Child in household[a]								
No children	2,997	60.23	1,093	59.33	314	56.66	89	53.90
Children <16	1,979	39.77	749	40.67	240	43.34	76	46.10

Note: [a]After exclusion of missing values in the respective variables.

Table A.2. Descriptives of public transport commuters with car access

	Less sparse city and town (n = 501)		Major conurbation (n = 292)		Greater London (n = 406)		Inner London (n = 231)	
	n	%	n	%	n	%	n	%
Distance to work (miles)[a]								
0-1	17	3.58	6	2.14	6	1.51	9	4.14
2-3	76	15.45	50	17.48	24	5.97	39	17.61
4-5	66	13.60	52	18.26	45	11.42	56	25.12
6-10	57	11.70	89	30.96	120	30.30	87	38.80
11-15	40	8.08	40	13.81	125	31.68	25	11.26
16+	233	47.60	50	17.36	76	19.13	7	3.06
Public Transport Accessibility Levels (London)[a]								
Very Poor	-	-	-	-	143	35.27	27	11.76
Poor to Moderate	-	-	-	-	231	56.83	109	47.16
Good to Excellent	-	-	-	-	32	7.90	95	41.08
Age								
16-24	113	22.62	71	24.41	58	14.39	27	11.83
25-34	103	20.59	78	26.77	100	24.75	82	35.40
35-44	117	23.37	62	21.26	114	28.09	72	31.13
45-54	118	23.52	52	17.84	89	22.03	32	13.85
55-64	43	8.63	25	8.62	42	10.24	18	7.77
65+	6	1.28	3	1.09	2	0.50	0	0.00
Gender								
Male	240	47.90	124	42.41	208	51.27	106	46.10
Female	261	52.10	168	57.59	198	48.73	124	53.90
Highest educational qualification[a]								
None	17	3.42	9	3.06	12	2.92	12	4.87
Other	235	47.50	141	49.03	150	37.18	55	23.97
≥Degree	242	49.08	138	47.90	241	59.89	164	71.16
Equivalised household income (5ths)[a,^]								
1 Lowest	26	5.26	16	5.35	17	4.20	7	3.13
2	68	13.65	33	11.23	31	7.70	19	8.26
3	82	16.42	71	24.40	65	16.00	23	10.14
4	140	27.88	95	32.57	102	25.18	59	25.78
5 Highest	184	36.80	77	26.45	190	46.92	122	52.70
Child in household[a]								
No children	315	62.93	195	66.84	246	60.63	157	67.88
Children <16	186	37.07	97	33.16	160	39.37	74	32.12

Note: [a]After exclusion of missing values in the respective variables.

Table A.3. Descriptives of active transport commuters with car access

	Less sparse city and town (n = 1,117)		Major conurbation (n = 277)		Greater London (n = 138)		Inner London (n = 101)	
	n	%	n	%	n	%	n	%
Distance to work (miles)[a]								
0-1	678	60.92	161	58.46	75	54.71	38	38.04
2-3	328	29.47	81	29.47	22	15.64	18	18.13
4-5	53	4.74	17	6.25	13	9.13	24	23.80
6-10	30	2.67	9	3.10	17	12.02	15	15.08
11-15	15	1.39	5	1.73	10	6.92	3	2.52
16+	9	0.81	3	0.99	2	1.58	2	2.43
Public Transport Accessibility Levels (London)[a]								
Very Poor	-	-	-	-	51	37.32	2	2.46
Poor to Moderate	-	-	-	-	74	53.99	52	50.89
Good to Excellent	-	-	-	-	12	8.68	47	46.65
Age								
16-24	235	21.00	47	17.11	18	13.26	3	3.00
25-34	195	17.44	62	22.30	23	16.69	33	32.95
35-44	238	21.25	62	22.54	29	20.99	33	32.61
45-54	275	24.62	58	20.98	46	33.60	18	17.93
55-64	160	14.32	41	14.74	17	12.43	14	13.50
65+	15	1.37	6	2.33	4	3.03	0	0.00
Gender								
Male	450	40.25	118	42.57	54	39.25	61	60.02
Female	668	59.75	159	57.43	84	60.75	40	39.98
Highest educational qualification[a]								
None	72	6.53	25	8.93	11	7.96	3	3.20
Other	666	60.37	157	56.64	68	49.27	19	18.47
≥Degree	365	33.10	95	34.43	59	42.78	79	78.32
Equivalised household income (5ths)[a]								
1 Lowest	95	8.49	29	10.34	11	8.00	8	8.24
2	212	18.93	59	21.23	17	12.42	3	3.10
3	304	27.19	82	29.52	22	15.94	20	19.28
4	286	25.61	63	22.74	43	31.29	11	11.09
5 Highest	221	19.79	45	16.17	45	32.35	59	58.30
Child in household[a]								
No children	663	59.33	165	59.54	75	54.60	53	52.82
Children <16	454	40.67	112	40.46	62	45.40	48	47.18

Note: [a]After exclusion of missing values in the respective variables.

Supplementary files for Chapter 2

The following pages present the supplementary files for Chapter 2:
Understanding car use: A review of key psychological theories.

This companion file consists of the supplementary documents for Chapter 2:
Psychological theories of car use: An integrative review and conceptual
framework.

Table of content

Appendix 2.A. Search Strategy

1. Car use	(Car OR cars OR motor# OR automobile# OR automotive# OR driv* OR drove OR (mode# W/2 (travel* OR transport*)) OR travel* OR transport*)
2. Theory/Model	(theor* OR model* OR concept* OR framework# OR map* OR hierarch* OR (traffic W/2 psychology) OR (transportation W/2 psychology))
3. Theoretical components	(intention# OR motivat* OR goal# OR aim# OR norm# OR subjective W2 norm# OR perceive# W2 norm# OR behaviour* W2 control# OR behaviour* W2 belief# OR normative W2 control# OR normative W2 belief# OR role W2 control# OR role W2 belief# OR control W2 belief# OR attitude# OR belief# OR affect# OR habit* OR identit*)
TITLE(1&2) AND ABS(1&2&3)	

Appendix 2.B. Quality Assessment Tool

This tool consists of two parts (i) the assessment tool and (ii) the companion dictionary that explains each rating scale.

This tool is a modified version of the Quality Assessment Tool for Quantitative Studies in public health developed by the Effective Public Health Practice Project. More information about the original tool and studies that have used it can be found on http://www.ephpp.ca/tools.html

The original tool was modified to include a second set of assessment about the application of theory in the study. As such, three additional components (I, J and K) were added, with the scores for components I and J determining the final assessment of the quality of theory application. Component K (analysis of theory application) did not influence the final assessment of the quality of theory application but served informational purposes, similar to component H (analysis) in the original tool as intended by its creators.

Thus, completing this modified version of the quality assessment tool will elicit two scores, one for the study's overall quality and the other specifically for the quality of theory application.

Quality assessment tool for theory application in quantitative studies

Component ratings

A) Selection bias

What is the target population? _____

Q1) Are the individuals selected to participate in the study likely to be representative of the target population?
1. Very likely
2. Somewhat likely
3. Not likely
4. Can't tell

Q2) What percentage of selected individuals agreed to participate?
1. 80 – 100% agreement
2. 60 – 79% agreement
3. Less than 60% agreement
4. Not applicable
5. Can't tell

Rate this section	Strong	Moderate	Weak
See dictionary	1	2	3

B) Study design

What is the study's aim? _____

Indicate the study design.
1. Randomised controlled trial
2. Controlled clinical trial
3. Cohort analytic (two group pre + post)
4. Case-control
5. Cohort (one group pre + post (before and after))
6. Interrupted time series
7. Prospective
8. Retrospective
9. Cross-sectional
10. Other, specify _____
11. Can't tell

Was the study described as randomised? If no, go to component C.
1. Yes
2. No

If yes, was the method of randomisation described? (See dictionary)
1. Yes
2. No

If yes, was the method appropriate? (See dictionary)
1. Yes
2. No

Rate this section	Strong	Moderate	Weak
See dictionary	1	2	3

C) Confounders

Does the study include a control/comparison group?
1. Yes
2. No (Assessment is not applicable, proceed to component D)

Q1) Were there important differences between groups prior to the intervention?
1. Yes
2. No
3. Can't tell

The following are examples of confounders:
1. Race
2. Sex
3. Marital status/family
4. Age
5. SES (income or class)
6. Education
7. Health status
8. Pre-intervention score on outcome measure

Q2) If yes, indicate the percentage of relevant confounders that were controlled (either in the design (e.g. stratification, matching) or analysis)?
1. 80 – 100% (most)
2. 60 – 79% (some)
3. Less than 60% (few or none)
4. Can't tell

Rate this section	Strong	Moderate	Weak	NA
See dictionary	1	2	3	

D) Blinding

Q1) Were the study participants aware of the research aim/s?
1. Yes
2. No
3. Can't tell
4. Not applicable

Q2) Was (were) the outcome assessor(s) aware of the intervention or exposure status of participants?
1. Yes
2. No
3. Can't tell
4. Not applicable

Rate this section	Strong	Moderate	Weak	
See dictionary	1	2	3	NA

E) Data collection methods

Q1) Were data collection tools shown to be valid?
   1. Yes
   2. No
   3. Can't tell

Q2) Were data collection tools shown to be reliable?
   1. Yes
   2. No
   3. Can't tell

Rate this section	Strong	Moderate	Weak
See dictionary	1	2	3

F) Withdrawals and drop-outs

Q1) Were withdrawals and drop-outs reported in terms of numbers and/or reasons per group? If not applicable, proceed to component G.
   1. Yes
   2. No
   3. Can't tell
   4. Not applicable (i.e. one-time surveys or interviews)

Q2) Indicate the percentage of participants completing the study. (If the percentage differs by groups, record the lowest).
   1. 80 – 100%
   2. 60 – 79%
   3. Less than 60%
   4. Can't tell

Rate this section	Strong	Moderate	Weak	NA
See dictionary	1	2	3	

G) Intervention integrity

Q1) What percentage of participants received the allocated intervention or exposure of interest? If not applicable, proceed to component H.
1. 80 – 100%
2. 60 – 79%
3. Less than 60%
4. Can't tell
5. Not applicable

Q2) Was the consistency of the intervention measured?
1. Yes
2. No
3. Can't tell

Q3) Is it likely that subjects received an unintended intervention (contamination or co-intervention) that may influence the results?
1. Yes
2. No
3. Can't tell

H) Analyses

Q1) Are the statistical methods described?
1. Yes
2. No
3. Can't tell

Q2) Is the rationale of the statistical methods used explained?
1. Yes
2. No
3. Can't tell

Q3) Is the analysis performed by intervention allocation status (i.e. allocation to intervention group) rather than the actual intervention received?
1. Yes
2. No
3. Can't tell
4. Not applicable

I) Theory-informed study design

Q1) Was the study design informed by a theory? If no or not applicable, go to Global rating. (See dictionary)
1. Yes
2. No
3. Can't tell
4. Not applicable

What was the theory used? _____

Q2) Was the theory described?
1. Yes
2. No
3. Can't tell

Q3) Was the choice of theory adequately justified? (See dictionary)
1. Yes
2. No
3. Can't tell

Q4) What percentage of the theory was operationalized? (See dictionary)
1. 80 – 100%
2. 60 – 79%
3. 40 – 59%
4. Less than 40%
5. Can't tell

Q5) Were additional constructs added to the theory?
1. Yes
2. No
3. Can't tell

If yes, what were they? _____

Rate this section	Strong	Moderate	Weak	
See dictionary	1	2	3	NA

J) Theory measurement

Q1) Were the data collection tools for the operationalized theoretical constructs shown to be valid?
1. Yes
2. No
3. Can't tell

Q2) Were the data collection tools for the operationalized theoretical constructs shown to be reliable?
1. Yes
2. No
3. Can't tell

Rate this section	Strong	Moderate	Weak
See dictionary	1	2	3

K) Analyses of theory application

Q1) Is the application of theory tested? If no, go to Global rating.
1. Yes
2. No
3. Can't tell

Q2) Is the rationale of the statistical methods used explained?
1. Yes
2. No
3. Can't tell

Q3) When possible, is the analysis performed to test the overall fit of the data to the theory?
1. Yes
2. No
3. Can't tell

Global rating

Component ratings
Please transcribe the information from the grey boxes on pages 1-6 onto this page. See dictionary on how to rate this section.

A	Selection bias	Strong	Moderate	Weak	
		1	2	3	
B	Study design	Strong	Moderate	Weak	
		1	2	3	
C	Confounders	Strong	Moderate	Weak	NA
		1	2	3	
D	Blinding	Strong	Moderate	Weak	NA
		1	2	3	
E	Data collection method	Strong	Moderate	Weak	
		1	2	3	
F	Withdrawals and dropouts	Strong	Moderate	Weak	NA
		1	2	3	

I	Theory-based study design	Strong	Moderate	Weak	NA
		1	2	3	
J	Theory measurement	Strong	Moderate	Weak	
		1	2	3	

General quality (A – F) rating for this paper (circle one):
- 1 Strong   (no weak ratings)
- 2 Moderate   (one weak ratings)
- 3 Weak   (two or more weak ratings)

With both reviewers discussing the ratings:
  Is there a discrepancy between the two reviewers with respect to the general quality component (A – F) ratings?
  1. No
  2. Yes

If yes, indicate the reason for the discrepancy
  1. Oversight
  2. Differences in interpretation of criteria
  3. Differences in interpretation of study

Final decision of both reviewers (circle one):   1 Strong
2 Moderate
3 Weak

Theory application (I – J) rating for this paper (circle one):
    1 Strong   (no weak ratings)
    2 Moderate   (one weak ratings)
    3 Weak   (two weak ratings)

With both reviewers discussing the ratings:
    Is there a discrepancy between the two reviewers with respect to the theory application component (I – J) ratings?
        1. No
        2. Yes

    If yes, indicate the reason for the discrepancy
        1. Oversight
        2. Differences in interpretation of criteria
        3. Differences in interpretation of study

Final decision of both reviewers (circle one):   1 Strong
                                                       2 Moderate
                                                    3 Weak

Quality assessment tool for theory application in quantitative studies (Dictionary companion)

The purpose of this dictionary is to describe items in the tool thereby assisting raters to score the quality of the study and its application of theory. Due to under-reporting or lack of clarity in the primary study, raters will need to make judgements about the extent that bias may be present. When making judgements about each component, raters should form their opinion based upon information contained in the study rather than making inferences about what the author intended.

General study quality

A) Selection bias

Q1) Participants are more likely to be representative of the target population if they are randomly selected from a comprehensive list of individuals in the target population (score very likely). They may not be representative if they are referred from a source (e.g. clinic) in a systematic manner (score somewhat likely) or self-referred (score not likely).

Q2) Refers to the percentage of subjects in the control and intervention groups that agreed to participate in the study before they were assigned to intervention or control groups.

B) Study design

In this section, raters assess the likelihood of bias due to the allocation process in an experimental study. For observational studies, raters assess the extent that assessments of exposure and outcome are likely to be independent. Generally, the type of design is a good indicator of the extent of bias. In stronger designs, an equivalent control group is present and the allocation process is such that the investigators are unable to predict the sequence.

Randomised controlled trial (RCT)
An experimental design where investigators randomly allocate eligible people to an intervention or control group. A rater should describe a study as an RCT if the randomisation sequence allows each study participant to have the same chance of receiving each intervention and the investigators could not predict which intervention was next. If the investigators do not describe the allocation process and only use the words 'random' or 'randomly', the study is described as a controlled clinical trial.

See below for more details.

Was the study described as randomised?
Score YES, if the authors used words such as random allocation, randomly assigned, and random assignment.
Score No, if no mention of randomisation is made.

Was the method of randomisation described?
Score YES, if the authors described any method used to generate a random allocation sequence.
Score NO, if the authors do not describe the allocation method or describe methods of allocation such as alteration, case record numbers, dates of birth, day of the week, and any allocation procedure that is entirely transparent before assignment, such as an open list of random numbers of assignments.
If No is scored, then the study is a controlled clinical trial.

Was the method appropriate?
Score YES, if the randomisation sequence allowed each study participant to have the same chance of receiving each intervention and the investigators could not predict which intervention was next. Examples of appropriate approaches including assignment of subjects by a central office unaware of the subject characteristics, or sequentially numbered sealed, opaque envelopes.
Score NO if the randomisation sequence is open to the individuals responsible for recruiting and allocating participants or providing the intervention, since those individuals can influence the allocation process, either knowingly or unknowingly.
If NO is scored, then the study is a controlled clinical trial.

Controlled clinical trial (CCT)
An experimental study design where the method of allocating study subjects to intervention or control groups is open to individuals responsible for recruiting subjects or providing the intervention. The method of allocation is transparent before assignment, e.g. an open list of random numbers or allocation by date of birth, etc.

Cohort analytic (two group pre and post)
An observational study design where groups are assembled according to whether or not exposure to the intervention has occurred. Exposure to the intervention is not under the control of the investigators. Study groups might be non-equivalent or not comparable on some feature that affects outcome.

Case control study
A retrospective study design where the investigators gather 'cases' of people who already have the outcome of interest and 'controls' who do not. Both groups are then questioned or their records examined about whether they received the intervention exposure of interest.

Cohort (one group pre + post (before and after))
The same group is pretested, given an intervention, and tested immediately after the intervention. The intervention group, by means of the pretest, acts as their own control group.

Interrupted time series
A time series consists of multiple observations over time. Observations can be on the same units (e.g. individuals over time) or on different but similar units (e.g. student achievement scores for particular grade and school). Interrupted time series analysis requires knowing the specific point in the series when an intervention occurred.

Prospective

A prospective study watches for outcomes, such as the development of a disease, during the study period and relates this to other factors such as suspected risk or protection factor(s). The study usually involves taking a cohort of subjects and watching them over a long period. The outcome of interest should be common; otherwise, the number of outcomes observed will be too small to be statistically meaningful (indistinguishable from those that may have arisen by chance). All efforts should be made to avoid sources of bias such as the loss of individuals to follow up during the study. Prospective studies usually have fewer potential sources of bias and confounding than retrospective studies.

Retrospective

A retrospective study looks backwards and examines exposures to suspected risk or protection factors in relation to an outcome that is established at the start of the study. Many valuable case-control studies, such as Lane and Claypon's 1926 investigation of risk factors for breast cancer, were retrospective investigations. Most sources of error due to confounding and bias are more common in retrospective studies than in prospective studies. For this reason, retrospective investigations are often criticised. If the outcome of interest is uncommon, however, the size of prospective investigation required to estimate relative risk is often too large to be feasible. In retrospective studies the odds ratio provides an estimate of relative risk. You should take special care to avoid sources of bias and confounding in retrospective studies.

Cross-sectional

Observational studies attempt to understand cause-and-effect relationships. However, unlike experiments, the researcher is not able to control (1) how subjects are assigned to groups and/or (2) which treatments each group receives.

C) Confounders

If the study does not include a control/comparison group, the assessment is not applicable.

By definition, a confounder is a variable that is associated with the intervention or exposure and causally related to the outcome of interest. Even in a robust study design, groups may not be balanced with respect to important variables prior to the intervention. The authors should indicate if confounders were controlled in the design (by stratification or matching) or in the analysis. If the allocation to intervention and control groups is randomised, the authors must report that the groups were balanced at baseline with respect to confounders (either in the text or a table).

D) Blinding

Q1) Assessors should be described as blinded to which participants were in the control and intervention groups. The purpose of blinding the outcome assessors (who might also be involved in the intervention) is to protect against detection bias. If the questionnaire was self-administered, the assessment for Q1 is 'Can't tell'.

Q2) Study participants should not be aware of (i.e. blinded to) the research question. The purpose of blinding the participants is to protect against reporting bias.

E) Data collection methods

Tools for primary outcome measures must be described as reliable and valid. If 'face' validity or 'content' validity has been demonstrated, this is acceptable. Some sources from which data may be collected are described below:

<u>Self-reported data</u> includes data that is collected from participants in the study (e.g. completing a questionnaire, survey answering questions during an interview, etc.).

<u>Assessment/screening</u> includes objective data that is retrieved by the researchers (e.g. observations by investigators).

<u>Medical records/vital statistics</u> refers to the types of formal records used for the extraction of the data.

Reliability and validity can be reported in the study or in a separate study. For example, some standard assessment tools have known reliability and validity.

If there is no reference to the data collection tools used in the study or no indication about validity or reliability, then it is assumed to not be available and the answer to Q1 and Q2 are 2 (No).

F) Withdrawals and drop-outs

Score YES if the authors describe BOTH the numbers and reasons for withdrawals and drop-outs.

Score NO if either the numbers or reasons for withdrawals and drop-outs are not reported.

The percentage of participants completing the study refers to the percentage of subjects remaining in the study at the final data collection period in all groups (i.e. control and intervention groups).

If the study only has measurement/s at one time point, the assessment is not applicable (NA).

G) Intervention integrity

The number of participants receiving the intended intervention should be noted (consider both frequency and intensity). For example, the authors may have reported that at least 80 percent of the participants received the complete intervention. The authors should describe a method of measuring if the intervention was provided to all participants the same way. As well, the authors should indicate if subjects received an unintended intervention that may have influenced the outcomes. For example, co-intervention occurs when the study group receives an additional intervention (other than that intended). In this case, it is possible that the effect of the intervention may be over-estimated. Contamination refers to situations where the control group accidentally receives the study intervention. This could result in an under-estimation of the impact of the intervention.

If the study does not include an intervention, the assessment is not applicable (NA).

H) Analysis appropriate to question

Was the quantitative analysis appropriate to the research question being asked?

An analysis performed by intervention allocation status is one in which all the participants in a trial are analysed according to the intervention to which they were allocated, whether they received it or not. This analysis is favoured when the intervention is used in practice, and because of the risk of attrition bias when participants are excluded from the analysis.

If the study does not include an intervention, the assessment of Q3 is not applicable (NA).

Quality of theory application

I) Theory-informed study design

Theory is defined as: "a set of concepts and/or statements with specification of how phenomena relate to each other. Theory provides an organising description of a system that accounts for what is known, and explains and predicts phenomena."

Was the use of the theory adequately justified?
Score YES if the theory used was adequately explained and justified about how it predicts the outcome of interest.
Score NO if the theory used was not adequately explained and justified about how it predicts the outcome of interest.

What percentage of the theory was operationalized?
Refers to the number of constructs within the theory that were operationalized as variables within the study and measured relative to the total number of constructs described in the theory.

J) Theory measurement

Measures of the theoretical constructs must be described as reliable and valid. If 'face' validity or 'content' validity has been demonstrated, this is acceptable.

Reliability and validity can be reported in the study or in a separate study. For example, some standard assessment tools have known reliability and validity.

If there is no reference to the data collection tools used in the study or no indication about validity or reliability, then it is assumed to not be available and the answers to Q1 and Q2 are 2 (No).

K) Analyses of theory application

Was the quantitative analysis appropriate to test whether the theory adequately explains and predicts the outcome of interest in the research question being asked?

When possible, analyses should include a goodness of fit statistics that reports the amount of variance in the outcome of interest that was explained by theory used.

Component ratings of study

For each of the eleven components (A – K), use the following descriptions as a roadmap.

General study quality

A) Selection bias

Strong: The selected individuals are very likely to be representative of the target population (Q1 is 1) AND there is greater than 80% participation (Q2 is 1).

Moderate: The selected individuals are at least somewhat likely to be representative of the target population (Q1 is 1 or 2) AND there is greater than 60 – 79% participation (Q2 is 2). 'Moderate' may also be assigned if Q1 is 1 or 2 and Q2 is 5 (can't tell).

Weak: The selected individuals are not likely to be representative of the target population (Q1 is 3); OR there is less than 60% participation (Q2 is 3) OR selection is not described (Q1 is 4); and the level of participation is not described (Q2 is 5).

B) Study design

Strong: Will be assigned to those articles that described RCTs and CCTs.

Moderate: Will be assigned to those that described a cohort analytic study, a case control study, a cohort design, an interrupted time series, prospective, retrospective or cross-sectional study designs.

Weak: Will be assigned to those that used any other method or did not state the method used.

C) Confounders

Strong: Will be assigned to those articles that controlled for at least 80% of relevant confounders (Q1 is 2) or (Q2 is 1).

Moderate: Will be assigned to those studies that controlled for 60 – 79% of relevant confounders (Q1 is 1) AND (Q2 is 2).

Weak: Will be assigned when less than 60% of relevant confounders were controlled (Q1 is 1) AND (Q2 is 3) OR control of confounders was not described (Q1 is 3) AND (Q2 is 4).

D) Blinding

Strong: The outcome assessor is not aware of the intervention status of participants (Q1 is 2); AND the study participants are not aware of the research question (Q2 is 2).

Moderate: The outcome assessor is not aware of the intervention status of participants (Q1 is 2); OR the study participants are not aware of the research question (Q2 is 2); OR blinding is not described (Q1 is 3 and Q2 is 3); OR in the

case that Q1 is not applicable and the study participants are aware of the research question (Q1 is 4 and Q2 is 1). 'Moderate' may also be assigned if (Q1 is 4 and Q2 is 3 (can't tell)) OR (Q1 is 3 and Q2 is 1).

Weak: The outcome assessor is aware of the intervention status of participants (Q1 is 1); AND the study participants are aware of the research question (Q2 is 1).

E) Data collection methods

Strong: The data collection tools have been shown to be valid (Q1 is 1) AND the data collection tools have been shown to be reliable (Q2 is 1).

Moderate: The data collection tools have been shown to be valid (Q1 is 1) AND the data collection tools have not been shown to be reliable (Q2 is 2) OR reliability is not described (Q2 is 3); OR validity is not described AND reliability is shown (Q1 is 3 and Q2 is 1).

Weak: The data collection tools have not been shown to be valid (Q1 is 2) OR both reliability and validity are not described (Q1 is 3 and Q2 is 3).

F) Withdrawals and drop-outs

Strong: Will be assigned when the follow-up rate is 80% or greater (Q2 is 1).

Moderate: Will be assigned when the follow-up rate is 60 – 79% (Q2 is 2)

Weak: Will be assigned when a follow-up rate is less than 60% (Q2 is 3) OR if the withdrawals and drop-outs were not described (Q2 is 4).

Quality of theory application

H) Theory-informed study design

Strong: Will be assigned to those studies which design was informed by a theory (Q1 is 1) that is described (Q2 is 1) and justified for the research question (Q3 is 1). In addition, 80-100% of the constructs within the theory was operationalized and measured (Q4 is 1).

Moderate: Will be assigned to those studies which design was informed by a theory (Q1 is 1) that is described (Q2 is 1) and justified for the research question (Q3 is 1). However, only 40-79% of the constructs within the theory was operationalized and measured (Q4 is 2 or 3).

Weak: Will be assigned to those studies which design was informed by a theory (Q1 is 1) but it was not described (Q2 is 2) or inappropriate for the research question (Q3 is 2) or less than 40% of the constructs within the theory was operationalized and measured (Q4 is 4). 'Weak' may also be assigned to a study that is not informed a theory (Q1 is 2).

I) Theory measurement

Strong: The data collection tools have been shown to be valid (Q1 is 1) AND the data collection tools have been shown to be reliable (Q2 is 1).

Moderate: The data collection tools have been shown to be valid (Q1 is 1) AND the data collection tools have not been shown to be reliable (Q2 is 2) OR reliability is not described (Q2 is 3); OR validity is not described AND reliability is shown (Q1 is 3 and Q2 is 1).

Weak: The data collection tools have not been shown to be valid (Q1 is 2) OR both reliability and validity are not described (Q1 is 3 and Q2 is 3).

Appendix 2.C. Author information, detailed references and the graphical representation of theories identified in the review when possible.

Theory of Planned Behaviour

> Ajzen, I. (1991). The Theory of Planned Behaviour. *Organisational Behaviour and Human Decision Processes, 50*, 179-211.

"The Theory of Planned Behaviour proposes that volitional human behaviour is a function of the intention to perform the behaviour and perceived behavioural control (PBC). Intention is hypothesised to be a function of attitudes towards the behaviour, subjective norm and perceived behavioural control. The degree to which PBC influences behaviour directly (rather than indirectly through intention) is hypothesised to depend on the degree of actual control over the behaviour. Attitudes, subjective norms and PBC are assumed to be based on the strength and evaluation of accessible behavioural, normative and control beliefs."

Extracted from: Sniehotta, F. F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review, 8*(1), 1-7. doi:10.1080/17437199.2013.869710
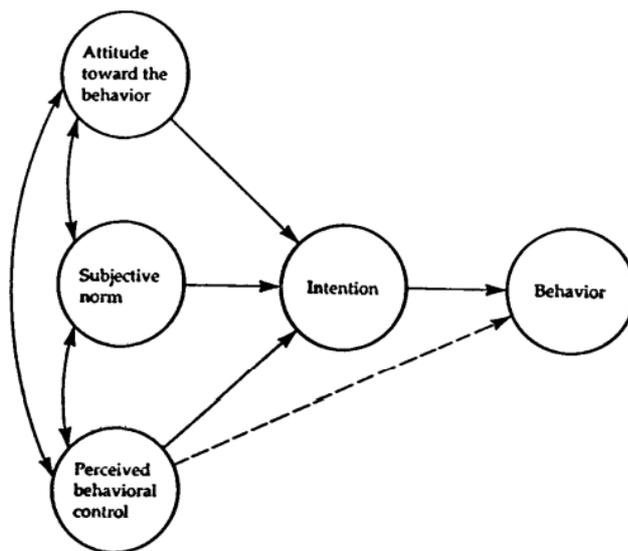
Norm Activation Model/Theory (Subset of the Normative Decision-Making Model)

> Schwartz, S. H. (1977). Normative influences on altruism. *Advances in Experimental Social Psychology, 10*, 221-279.
>
> Schwartz, S. H., & Howard, J. A. (1980). Explanation of the moderating effect of responsibility denial on a personal norm-behaviour relationship. *Social Psychology Quarterly, 43*, 441-446.

"The NAM includes three types of variables to predict prosocial behavior. The first of these is personal norms (PN), referred to as feeling a "moral obligation to

perform or refrain from specific actions" (Schwartz & Howard, 1981, p. 191). The second, awareness of consequences (AC), is defined as whether someone is aware of the negative consequences for others or for other things one values when not acting prosocially. The third, ascription of responsibility (AR), is described as feelings of responsibility for the negative consequences of not acting prosocially.

In essence, two interpretations of the NAM have been postulated. Some scholars suggest that AC is an antecedent of AR, AR is an antecedent of PN, and PN influences behavior, whereas others assume that the influence of PN on prosocial behavior is moderated by AC and AR (see figure below). Researchers proposing a mediator model assume that AC and AR have indirect effects on intentions and behavior via PN. More specifically, PN is assumed to mediate the relationship between AR and prosocial intentions and behaviors, and AR is assumed to mediate the relationship between AC and PN."

Extracted from: Judith I. M. De Groot & Linda Steg (2009) Morality and Prosocial Behavior: The Role of Awareness, Responsibility, and Norms in the Norm Activation Model. *The Journal of Social Psychology, 149*(4), 425-449, doi: 10.3200/SOCP.149.4.425-449
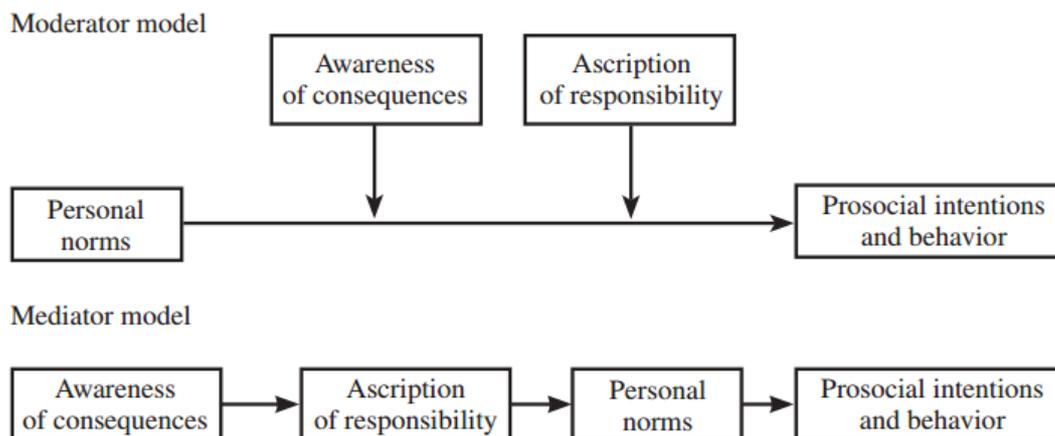
Value-Belief-Norm theory

> Stern., P. C., Dietz., T., Abel., T., Guagnano., G. A., & Kalof., L. (1999). A Value-Belief-Norm Theory of support for social movements: The case of environmentalisam. *Human Ecology Review, 6*, 81-97.

"The Value-Belief-Norm theory links a person's ecological worldview, assessed by the new environmental paradigm (NEP), and environmental values with the norm-activation theory. It postulate moral norms (called personal norms) – a person's sense of obligation – to be the ultimate predictor of conservation behaviour. Personal norms, in turn, are seen as a function of a chain of 3 beliefs: one's self-ascribed responsibility, one's awareness of the consequences of a behaviour for the valued object, and one's ecological worldview (i.e., the NEP), which in turn is determined by environment-relevant values. In this model, a person's awareness of the behavioural consequence depends on his or her ecological worldview and, at the same time, determines a

person's self-ascribed responsibility to act, which then leads to a person's sense of obligation to act (i.e., his or her personal norms)."

Extracted from: Kaiser, F. G., Hübner, G. & Bogner, F. X. (2005). Contrasting the Theory of Planned Behaviour With the Value-Belief-Norm Model in Explaining Conservation Behaviour. *Journal of Applied Social Psychology, 35,* 2150–2170. doi: 10.1111/j.1559-1816.2005.tb02213.x
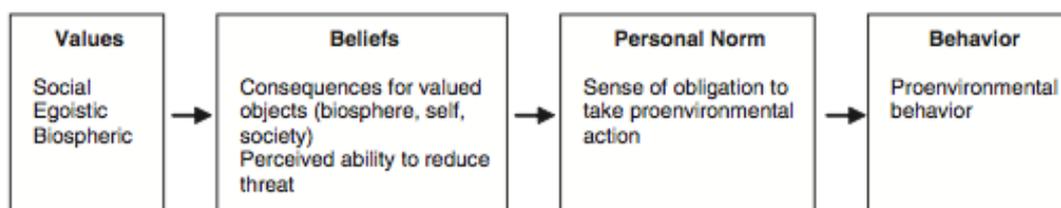
Theory of Interpersonal Behaviour

Triandis, H. C. (1977). *Interpersonal Behaviour*. Monterey, CA: Brookes/Cole.

"In the Theory of Interpersonal Behaviour, intention is formed by attitudinal, normative, and identity beliefs. Affect represents an emotional state that the performance of a given behaviour evokes for an individual. It is considered as the affective perceived consequences of the behaviour, whereas perceived consequences refer to the cognitive evaluation of the probable consequences of the behaviour. The TIB incorporates two different normative dimensions: social and personal norms. Perceived social norms are formed by normative and role beliefs. Normative beliefs consist of the internalisation by an individual of referent people or groups' opinion about the realisation of the behaviour, whereas role beliefs reflect the extent to which an individual thinks someone of his or her age, gender and social position should or should not behave. The other normative component of the TIB is the personal normative belief that represents the feeling of personal obligation regarding the performance or not of a given behaviour. Finally, self identity refers to the degree of congruence between the individual's perception of himself or herself and the characteristics he or she associates with the realisation of the behaviour."

Extracted from: Gagnon, M. P., Godin, G., Gagné, C., Fortin, J. P., Lamothe, L., Reinharz, D., & Cloutier, A. (2003). An adaptation of the theory of interpersonal behaviour to the study of telemedicine adoption by physicians. *International Journal of Medical Informatics, 71*(2–3), 103-115. doi: 10.1016/S1386-5056(03)00094-7

In addition, habit and contextual aspects are also hypothesised to interact with intention to produce a final behaviour.
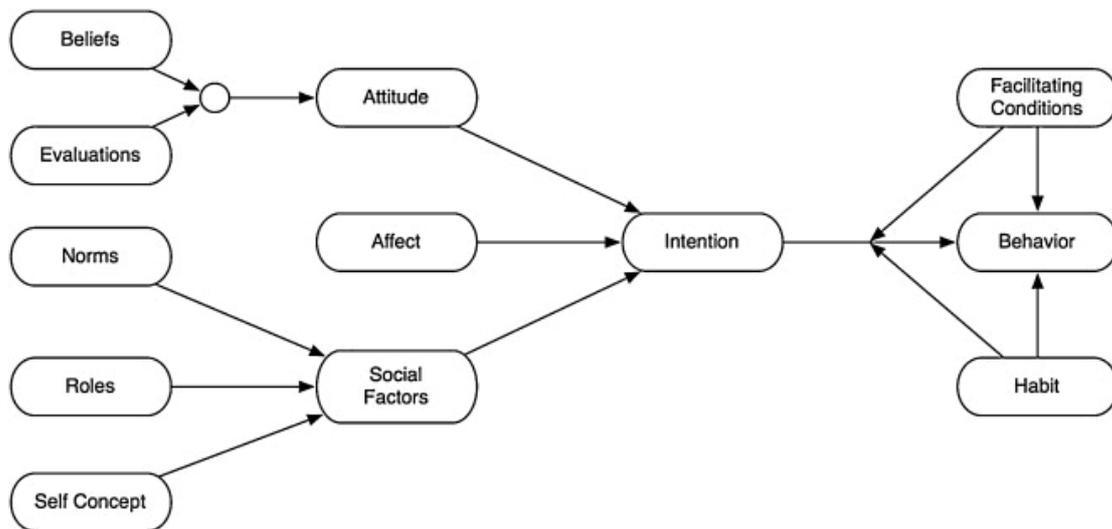
Comprehensive Action Determination Model

Klöckner, C. A., & Blöbaum, A. (2010). A comprehensive action determination model: Toward a broader understanding of ecological behaviour using the example of travel mode choice. *Journal of Environmental Psychology*, *30*, 574-586.

Klöckner, C. A., & Friedrichsmeier, T. (2011). A multi-level approach to travel mode choice – How person characteristics and situation specific aspects determine car use in a student sample. *Transportation Research Part F: Traffic Psychology and Behaviour, 14*, 261-277.

"The model assumes that individual environmentally relevant behaviour is determined directly by intentions and perceived behavioural control. In addition it integrates habit strength as a third direct predictor of behaviour. Habit strength is also assumed to moderate the relation between intention and behaviour, meaning that the intention behaviour link is weakened if habits are strong. Intentions typically integrate the influence of attitudes, social norms and perceived behavioural control, but furthermore include the impacts of personal norms. Personal norms are assumed to be predicted by awareness of consequences and ascription of responsibility, perceived behavioural control, and social norms. Attitudes in contrast are included as specific evaluations of the respective behaviour. Although habit strength is theoretically not related to the other model variables, correlations with the central determinants of behaviour might still appear, given that the deliberate determinants of behaviour are stable over time. Habits are generated by repeated action in stable contexts. At an earlier point in time, when a behaviour was performed for the first couple of times, intentions and PBC were the main determinants. By repeating it, a habit was established and it took over control from the two variables. However, if intentions, behavioural control and personal norms did not change, they would remain correlated to habit strength because they determined behaviour at a previous point in time."
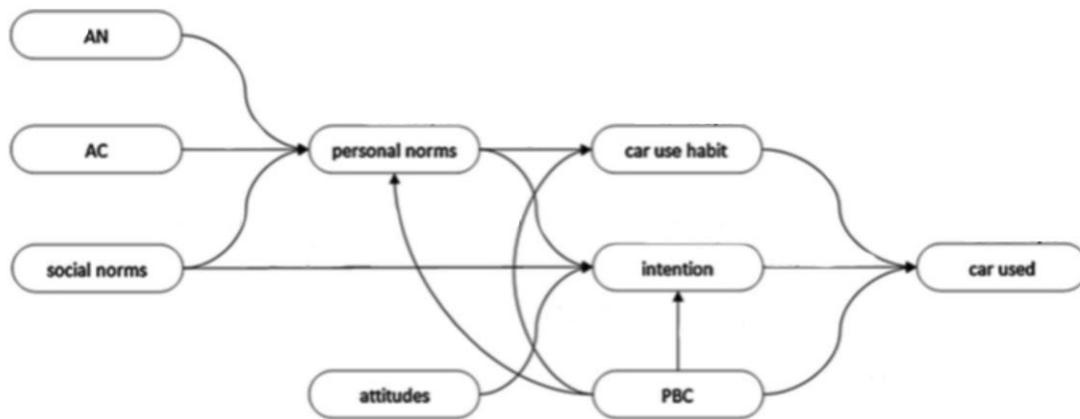
Model of Material Possessions

"According to Dittmar, material possessions, such as cars, represent instrumental values as well as by symbolic values. The symbolic values refer to the identity of a person. They are twofold: the expression of the self and a social–categorical expression indicating one's social position or group membership. Moreover, Dittmar contends that the use of material goods fulfils three functions: instrumental, symbolic, and affective. This implies that car use may have an instrumental function (i.e., it enables activities), a symbolic function (i.e., the car is a means to express yourself or your social position), and an affective function in connection with deeper, non-instrumental needs and desires. These functions may be considered as different types of motives for car use. So, three categories of car use motives may be distinguished. Instrumental motives may be defined as the convenience or inconvenience caused by car use, which is related to, among other things, its speed, flexibility and safety. Symbolic or social motives refer to the fact that people can express themselves and their social position by means of (the use of) their car, they can compare their (use of the) car with others and to social norms. Affective motives refer to emotions evoked by driving a car, i.e., driving may potentially affect people's mood and they may anticipate these feelings when making travel choices."
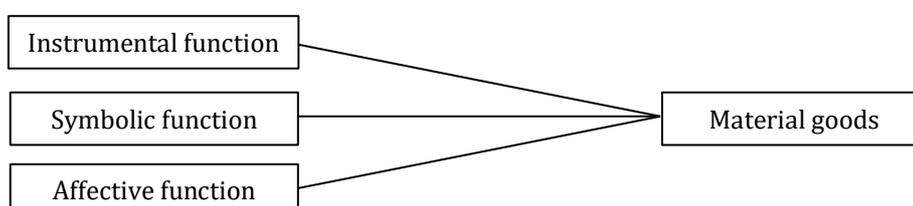
Model of Determinants of Script-Based Driving Choice

Gärling, T., Fujii, S., & Boe, O. (2001). Empirical tests of a model of determinants of script-based driving choice. *Transportation Research Part F: Traffic Psychology and Behaviour, 4*, 89-102.

"Although a choice between alternatives the first time requires deliberation, repeatedly making the same choice is likely to reduce information processing preceding the choice. We suggest that less deliberate decision making implies using simplifying decision strategies which utilizes observed regularities. If a choice alternative is conceptualized as a set of attribute levels, a salient regularity is that attribute levels covary. If so, it is no longer necessary to search all attribute information since the same choice can be made on the basis of a subset of the information. We term this *script-based* choice, since it is presupposed that the information about the choice alternatives is stored in memory as a script that can be retrieved if only a subset of the information is available. Script-based choice is cognitively economical in that demand for deliberate information processing is reduced. Furthermore, it may also be goal-directed or rational. As illustrated in the figure below, a positive attitude towards or positive evaluation of a choice alternative is assumed to lead to that it is chosen. If nothing changes, the choice will be made over and over again. Eventually information accessible in memory makes possible to infer regularities between the attributes of the choice alternatives."

Extracted from: Gärling, T., Fujii, S., & Boe, O. (2001). Empirical tests of a model of determinants of script-based driving choice. *Transportation Research Part F: Traffic Psychology and Behaviour, 4*(2), 89-102. doi:10.1016/S1369-8478(01)00016-X

Attitude $\longrightarrow$ Frequency of choice $\longrightarrow$ Script-based choice
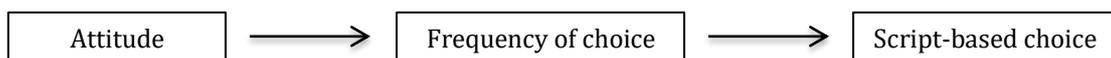
Model of Action Phases

Heckhausen, H., & Gollwitzer, P. M. (1987). Thought contents and cognitive functioning in motivational versus volitional states of mind. *Motivation and Emotion, 11*, 101–120.

Gollwitzer, P. M. (1996). *The volitional benefits of planning*. In P. M. Gollwitzer & J. A. Bargh (Eds.), *The psychology of action: Linking cognition and motivation to behaviour* (pp. 287–312). London: Guilford.

"The "Rubicon model" of action phases goes beyond the useful conceptual distinction between goal setting and goal striving. Although the model keeps these two problems of goal-oriented behaviour separate, it encompasses both within a single theoretical model, thus permitting them to be analysed in relation to each other. Furthermore, it provides a temporal perspective that begins with the awakening of a person's wishes prior to goal setting and continues through the evaluative thoughts entertained after goal striving has ended.

Separating the sequence of events occurring within this comprehensive time frame into discrete phenomena, the model posits four distinct phases: first, the predecisional phase; second, the postdecisional but still preactional phase; third, the actional phase; and last, the postactional phase. These phases are separated by three clear boundaries or transition points: the making of a decision, the initiation of respective actions, and the conclusion of these actions."

Extracted from: Gollwitzer, P. M. 1990. Action phases and mind-sets. In *Handbook of Motivation and Social Cognition: Foundations of social behaviour*, Vol. 2, E. T. Higgins & R. M. Sorrentino (Eds). Guilford: New York; 53-92.
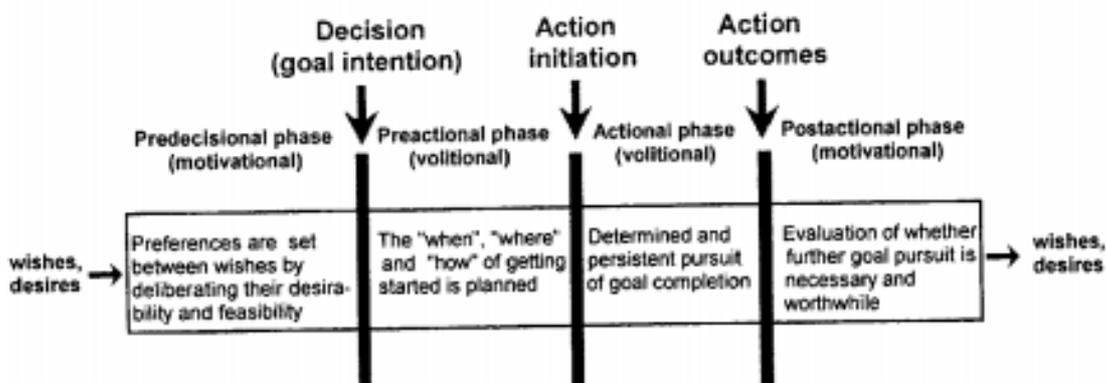
FIGURE 13.1. The model of action phases dissects the course of wish fulfillment into two motivational and two volitional phases. The boxes between the transition points (decision, action initiation, and action outcomes) describe the distinct tasks associated with each of the four phases (predecisional, preactional, actional, and postactional).

Stage Model of Self-Regulated Behavioural Change

> Bamberg, S. (2013). Changing environmentally harmful behaviors: A stage model of self-regulated behavioural change. *Journal of Environmental Psychology, 34*, 151-159.

"In its current form, Bamberg's stage model contains the following stages: (1) pre-decisional, (2) pre-actional, (3) actional, and (4) post-actional. Forming a goal intention to change marks the transition from pre-decision to pre-action, forming a behavioral intention marks the transition from pre-action to action, and the implementation intention marks the transition into post-action. In other words, people in different stages focus on different aspects: Firstly, it has to be discovered that something has to be done, then what should be done, then how it will be done and then how it can be maintained.

In each stage each specific intention type is expected to be influenced by characteristic variables. In line with the norm-activation theory goal intentions are assumed to be formed based on personal norms (which are feelings of moral obligation to act), anticipated positive emotions with the behaviour and goal feasibility. The personal norm is activated through a process as described in the value-belief-norm theory: Perceived negative consequences of a behaviour trigger a feeling of responsibility which lead to anticipated negative emotions in case of non-action. This anticipated negative emotion then

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activates personal norms. Furthermore, social norms (which are perceived expectations of relevant other people) are assumed to trigger personal norms.

In the pre-actional stage, when a choice between alternative behaviours is made, the behavioural intention is assumed to be impacted by attitudes to the different alternatives as well as the perceived difficulty of the alternatives. This is in line with the Theory of Planned Behaviour. However, contrary to the Theory of Planned Behaviour, social norms are not intended to be relevant in this stage of decision making, their impact lies in the previous stage as described in the preceding paragraph.

In the actional stage, different types of planning abilities are assumed to impact implementation intentions. Bamberg makes a references for this stage to Schwarzer, who assumed that planning abilities include both being able to anticipate what to do when something goes wrong – having a plan b (coping planning) – and being able to plan the action in detail (action planning). Finally, in the post-actional stage, the perceived ability to recover from relapse (recovery self-efficacy) should increase probability to maintain a behaviour."

Extracted from: Klöckner, C. A. (2014). The dynamics of purchasing an electric vehicle – A prospective longitudinal study of the decision-making process. *Transportation Research Part F: Traffic Psychology and Behaviour, 24*, 103-116. doi: 10.1016/j.trf.2014.04.015
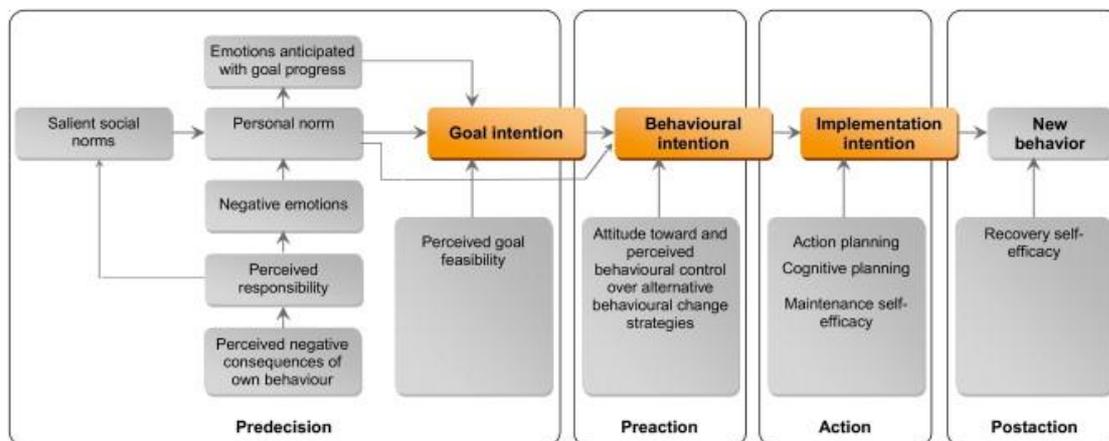
Normative Decision-Making Model

Schwartz, S. H., & Howard, J. A. (1981). A normative decision-making model of altruism. In Rushton, J. P. (Ed.), *Altruism and helping behaviour. Social, personality and developmental perspective.* Hillsdale, NJ: Earlbaum.

"Schwartz' *Model of Normative Decision-Making* (NDM) deals with behaviour that is referring to social and personal norms and is therefore triggering the individual's normative system. Schwartz and Howard conceptualize behaviour in these contexts as being caused by feelings of moral obligation to act in a norm concordant way. This feeling of moral obligation in turn is caused by activated *Personal Norms* (PN), which are—from a biographical point of view—

internalized and therefore adapted *Social Norms* (SN) that might themselves be understood as perceived expectations of relevant others."

Extracted from: Klöckner, C. A., & Matthies, E. (2004). How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice. *Journal of Environmental Psychology, 24*(3), 319-327. doi: 10.1016/j.jenvp.2004.08.004
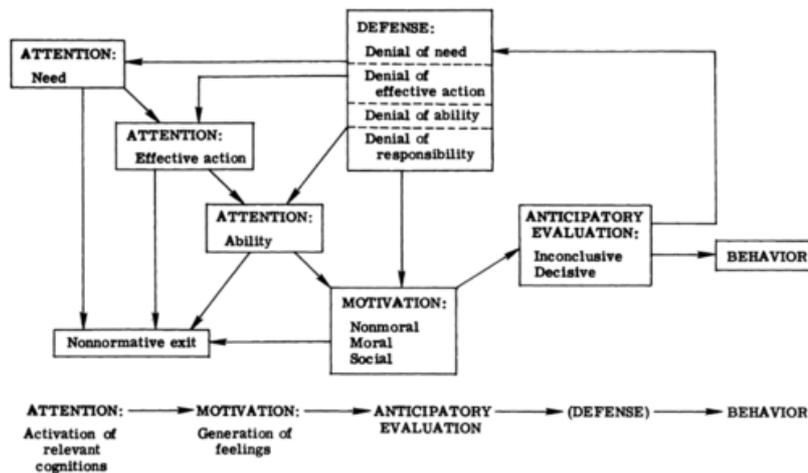
Figure 14.1 Cycling through a normative decision-making model. (Adapted from Schwartz & Howard, 1981. Reprinted by permission of Lawrence Erlbaum Associates.)

Value Attitude Behaviour Hierarchy Model

Homer, P. M., & Kahle, L. R. (1988). A structural equation test of the value–attitude–behaviour hierarchy. *Journal of Personality and Social Psychology*, **54**, 638–646.

"In terms of social adaptation theory, values are a type of social cognition that function to facilitate adaptation to one's environment. Values are similar to attitudes in that both are adaptation abstractions that emerge continuously from the assimilation, accommodation, organisation and integration of environmental information in order to promote interchanges with the environmental favourable to the preservation of optimal functioning. Because values are the most abstract of the social cognitions, they reflect the most basic characteristics of adaptation. These abstractions serve as prototypes from which attitudes and behaviours are manufactured. Cognitions and therefore values, also guide individuals about which situations to enter and about what they do in those situations. Within a given situation, the influence should theoretically flow from abstract values to midrange attitudes to specific behaviours. This sequence can be called the value → attitude → behaviour hierarchy."

Extracted from: Homer, P. M., & Kahle, L. R. (1988). A structural equation test of the value–attitude–behaviour hierarchy. *Journal of Personality and Social Psychology*, **54**, 638–646.
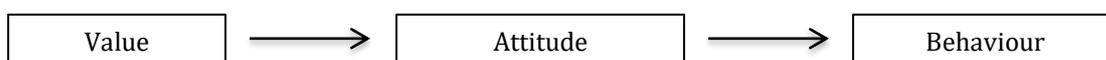
Prospect Theory

> Kahneman, D., & Tversky, A.. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, *47*(2), 263–291.

"The theory is developed for simple prospects with monetary outcomes and state probabilities, but it can be extended to more involved choices. Prospect theory distinguishes two phases in the choice process: an early phase of editing and a subsequent phase of evaluation. The editing phase consists of a preliminary analysis of the offered prospects, which often yields a simpler representation of these prospects. In the second phase, the edited prospects are evaluated and the prospect of highest value is chosen."

Extracted from: Kahneman, D., & Tversky, A.. (1979). Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, *47*(2), 263–291.

Selection, Optimism and Compensation Model

> Baltes, P. B., & Baltes, M. M. (1990) Psychological perspectives on successful aging: The model of selective optimisation with compensation. In P. B. Baltes & M. M. Baltes (Eds.), Successful aging: Perspectives from the behavioural sciences (pp.1-34). New York: Cambridge University Press

"The Selection, Optimism and Compensation model provides a way to conceptualize the approaches that older adults take to cope with losses such as the ability to drive. In this model, selection refers to the restriction of activities associated with age-related declines. The task of the person is to select those activities that are the most important and to focus more of their available resources to these undertakings. Optimization refers to the refinement of skills so that abilities will correspond with goals. Compensation refers to the use of new methods for reaching one's desired goals and can include new behaviours or modification of existing behaviours. This life span developmental approach argues that as older adults are confronted by losses, they should still be able to age successfully as they modify their coping behaviours. The implications of this model as applied to driving retirement are that as people face the losses of health, functional capacity, and cognitive abilities commonly associated with reduction in driving, they will compensate by modifying their driving habits and, eventually, find ways to substitute other means of transportation."

Extracted from: Pickard, J. G., Tan, J., Morrow-Howell, N., & Jung, Y. (2009). Older drivers retiring from the road: An application of the selection, optimization, and compensation model. *Journal of Human Behavior in the Social Environment, 19*(2), 213-229. doi:10.1080/10911350802687232

Theory of Cognitive Dissonance

Festinger, L. (1957). *A Theory of cognitive dissonance*. Stanford, CA: Stanford University Press.

"Cognitive dissonance is defined as inconsistency between attitudes or between attitudes and behaviour. Cognitive dissonance, or a threat of it, creates an unpleasant psychological tension. If a person believes that preservation of the environment is desirable but is still driving a car, the person is engaged in attitude-discrepant behaviour. Cognitive dissonance is experienced especially if the inconsistency is stressed, e.g. by mass-media campaigns. The dissonance, being psychologically uncomfortable, will motivate the person to try to reduce it by either decreasing car use (behavioural change) or by making attitudes to the undesirable effects of car use less negative (attitude change)."

Extracted from: Tertoolen, G., van Kreveld, D., & Verstraten, B. (1998). Psychological resistance against attempts to reduce private car use. *Transportation Research Part A: Policy and Practice, 32*(3), 171-181. doi:10.1016/S0965-8564(97)00006-2

Theory of Cognitive Evaluation

Deci, E. L. (1975). *Intrinsic motivation*. New York: Plenum.

"The theory suggests that the presence of a salient external reward or constraint can induce a change in the perceived locus of causality from internal to external, resulting in decreased intrinsic motivation, whereas the absence of a salient or constraint and the presence of choice can induce a change in the perceived locus of causality from external to internal resulting in increased intrinsic motivation. The theory also points to a second process through which intrinsic motivation can be affected: a change in perceived competence. If an environmental even enhances people's perceptions of competence, their intrinsic motivation will increase; if it diminishes their perceptions of competence, their intrinsic motivation will decrease. This means that an environmental even can decrease intrinsic motivation by making the perceived locus of causality more external or by deflating one's perceptions of competence and, conversely, an even can increase intrinsic motivation by making the perceived locus of causality more internal or by bolstering one's perceptions of competence."

Extracted from: Ryan, R. M. (1982). Control and information in the intrapersonal sphere: An extension of cognitive evaluation theory. *Journal of Personality and Social Psychology*, *43*(3), 450-461. doi: 10.1037/0022-3514.43.3.450

Table 2.A.1.
Summary of studies identified in the review.

Study (Lead author & date)	Country	Sample details	Outcome variable(s)	Study design	Methodological quality	Theory application quality	Theory used	Additional constructs
Abrahamse (2009)	Canada	244 commuters	Behaviour (typical): Self-reported car use frequency for commuting	Retrospective	Moderate	Strong	Theory of Planned Behaviour Norm Activation Model	-
Anable (2005)	UK	666 members of general population	Behaviour (typical): Self-reported car use frequency and average mileage Behaviour (typical): Self-reported use of alternatives to car for a leisure day trip Behaviour (actual): Self-reported car or public transport use for journey on day of study completion, leisure day trip	Retrospective (Behaviour)	Strong	Strong	Theory of Planned Behaviour	Moral norm Environmental attitudes, worldview and knowledge Efficacy Identity (behavioural norm) Habit
Bamberg (2006)* Bamberg (2003b)*^	Germany	169 members of general population who have recently relocated	Behaviour (actual): Self-reported frequency of car and public transport use in a specified day	Controlled Clinical Trial	Strong	Strong	Theory of Planned Behaviour	Habit Car availability Public transport service quality Change intention
Bamberg (2007)	Germany	744 drivers	Behaviour (actual): Self-reported frequency of car and public transport use	Cross-sectional	Strong	Strong	Model of Action Phases	Precontemplation

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Bamberg (2013a)*	Germany	625 members of general population with car access	Behaviour (actual): Self-reported car use relative to other modes over preceding month, week and three days prior to interview, general trips	Controlled Clinical Trial	Weak	Weak	Stage Model of Self-regulated Behavioural Change	-
Bamberg (2013b)	Austria France Germany Greece Slovenia UK	1815 members of general population	Behaviour (actual): Self-reported frequency of car and public transport use in the past month and week	Retrospective (Behaviour)	Strong	Strong	Stage Model of Self-regulated Behavioural Change	-
Bamberg (1999b)* Bamberg (1998)*^ Bamberg (1999a)*^ Bamberg (2001)*^ Bamberg (2003a)*^	Germany	1036 members of student population	Behaviour (actual): Self-reported car, public transport, cycling and walking trips for commute from home to school in the morning	Cohort (one group pre + post (before and after))	Moderate	Moderate	Theory of Planned Behaviour	-
Bamberg (2003c)	Germany	321 members of student population	Behaviour (actual): Self-reported frequency of car or non-car use on a specified day for commuting to university	Prospective	Moderate	Strong	Norm Activation Model Theory of Planned Behaviour Theory of Interpersonal Behaviour	-

Ben-Elia (2011)*	Netherlands	341 members of general population with car access	Behaviour (actual): Self-reported car and non-car use for daily commuting trips Behaviour (actual): Objective data on car use (telematrics)	Interrupted time series	Strong	Weak	Theory of Planned Behaviour Prospect Theory Theory of Interpersonal Behaviour Norm Activation Model Theory of Cognitive Evaluation	-
Domarchi (2008)	Chile	183 university employees	Behaviour (actual): Self-reported car, public transport or walking commute mode to university on the day of the interview	Cross-sectional	Moderate	Moderate	Theory of Interpersonal Behaviour	-
Donald (2014)	UK	827 commuters	Behaviour (actual): Self-reported car, train, bus, coach, walking, cycling mode choice in the three months preceding the interview	Cross-sectional	Moderate	Strong	Theory of Planned Behaviour	Habit Moral norm Descriptive norm Environmental concern
Eriksson (2008)*	Sweden	71 members of general population with car access	Behaviour (actual): Self-reported car trips during the week pre and post intervention	Controlled Clinical Trial	Strong	Moderate	Value Belief Norm Theory	Habit

| Fujii (2003)[1] | Japan | 53 members of general population who are changing residence and workplace | Behaviour (actual): Self-reported car vs. public transport use before and after changing residence and workplace | Cohort (one group pre + post (before and after)) | Moderate | Moderate | Model of determinants of script-based driving choice | - |
| Fujii (2003)[2] | Japan | 204 members of general population who are drivers | Behaviour (actual): Self-reported car vs. public transport use before, during and after road closure | Cohort (one group pre + post (before and after)) | Weak | Moderate | Model of determinants of script-based driving choice | - |

Study	Country	Sample	Behaviour	Design	Col6	Col7	Theory	Predictors
Gardner (2010)	UK	190 members of general population who are drivers	Behaviour (actual): Self-reported car vs. non-car journeys during the week before the study	Cross-sectional	Strong	Strong	Theory of Planned Behaviour	Attitude towards non-car modes Perceived behavioural control over non-car use [not significant] Subjective norms relating to non-car use Descriptive norms for car use Personal norm for non-car use Environmental problem awareness [not significant] Environmental concern [not significant] Perceived control over (car-related) environmental problem reduction
Gardner (2009)	UK	107 university staff and students with car access	Behaviour (actual): Self-reported car vs. non-car commutes to university campus in the week preceding the study	Prospective	Strong	Moderate	Theory of Planned Behaviour	Habit

Gärling (2001)	Sweden	60 members of student population with driving licence	Behaviour (actual): Self-reported car use for general trips in the month preceding the study	Retrospective	Strong	Strong	Model of determinants of script-based driving choice	-
Haustein (2009)	Germany	2612 members of student population with driving licence and access to car	Behaviour (actual): Self-reported car use for travels to four defined frequently visited destinations in the week following the study	Prospective	Moderate	Moderate	Theory of Planned Behaviour Norm Activation Model	Receiving a driving license and driving a car as initiation to adulthood and autonomy Multi-mobility of peers Habit
Klöckner (2010)	Germany	389 members of student population	Behaviour (actual): Self-reported car use for travels to four defined frequently visited destinations in the week following the study	Prospective	Moderate	Strong	Comprehensive Action Determination Model Norm Activation Model Theory of Planned Behaviour	-
Klöckner (2004)	Germany	160 members of general population with car access	Behaviour (actual); Self-reported car and public transport use over a period of 4 weeks	Prospective	Moderate	Moderate	Normative Decision-Making Model	Habit

Klöckner (2009)	Germany	430 members of student population	Behaviour (actual); Self-reported car use over a period of 1 week following the study	Prospective	Moderate	Moderate	Norm Activation Model	Habit Perceived behavioural control Car access Effort required to use public transport
Klöckner (2011)	Germany	3560 members of student population	Behaviour (actual); Self-reported car vs. alternative transport use over a period of 1 week following the study	Prospective	Moderate	Strong	Comprehensive Action Determination Model	Situation specific variables (Weather, Disruption of public transportation, Weather, Destination)
Lind (2015)	Norway	1043 members of general population	Behaviour (actual): Self-reported car, train, tram, underground, bus, bicycle and walking frequency in an ordinary week	Cross-sectional	Moderate	Strong	Value-Belief-Norm Theory	-
Mann (2012)	UK	229 university employees	Behaviour (actual): Self-reported car and public transport use for commute to campus	Prospective	Strong	Strong	Theory of Planned Behaviour	Descriptive norm Moral norm Perceived behavioural control of not using the car

Matthies (2006)*	Germany	297 members of general population with car access and living in areas with accessible public transport	Behaviour (actual): Self-reported trips done by a travel mode different from car during the intervention period	Controlled Clinical Trial	Weak	Moderate	Norm Activation Model	Habit Social norm Perceived behavioural control
Paulssen (2014)	Germany	519 members of general population	Behaviour (actual): Self-reported car and public transport use for daily trips to work	Cross-sectional	Moderate	Strong	Value-attitude-behaviour hierarchical model	
Pickard (2009)	USA	281 members of general population above 65 years old	Behaviour (actual): Self-reported use of car use (driving status)	Cross-sectional	Strong	Weak	Selection, optimisation and compensation model	-
Setiawan (2014)	Indonesia	312 members of student population	Behaviour (actual): Self-reported car use for university routes in the previous semester	Cross-sectional	Strong	Strong	Theory of Planned Behaviour Norm Activation Model	-
Steg (2005)	Netherlands	113 members of general population of rush hour commuters	Behaviour (actual): Self-reported percentage of commuter trips made by car	Cross-sectional	Moderate	Strong	Dittmar's model on the meaning of material possessions	Descriptive norms Social comparison and self-presentation Pleasure of car use Arousal

Tertoolen (1998)*	Netherlands	350 members of general population with car access	Behaviour (actual): Self-reported car use over eight weeks	Controlled Clinical Trial	Weak	Weak	Theory of Cognitive Dissonance	-
Verplanken (1998)*	Netherlands	200 members of general population with car access	Behaviour (actual): Self-reported car use for trips outside the village over a week	Controlled Clinical Trial	Strong	Strong	Theory of Planned Behaviour	Habit
Verplanken (2008)	UK	433 university employees	Behaviour (actual): Self-reported car versus alternative modes of transportation use	Cross-sectional	Strong	Moderate	Value Belief Norm Theory	Context change

Note:
*Indicates that these studies are interventions
^Studies that were identified by the review but excluded from analysis as the dataset used was reported in another study
[1]Study 1 in Fuji & Gärling (2003)
[2]Study 2 in Fuji & Gärling (2003)

Table 2.A.2.
Quality assessment ratings for studies identified in the review.

Study (Author & date)	Methodological quality							Theory application quality		
	Overall[a]	Selection bias	Study design	Confound-ers	Blinding	Data collection method	Withdrawal and dropouts	Overall[b]	Theory-based study design	Theory measure-ment
Abrahamse et al. (2009)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Anable (2005)	Strong	Moderate	Moderate	NA	Moderate	Strong	Moderate	Strong	Strong	Strong
Bamberg (2006)*	Strong	Moderate	Strong	Strong	Moderate	Strong	Strong	Strong	Strong	Strong
Bamberg (2007)	Strong	Moderate	Moderate	Strong	Moderate	Strong	NA	Strong	Strong	Strong
Bamberg (2013a)*	Weak	Weak	Strong	Weak	Moderate	Strong	Weak	Weak	Weak	Strong
Bamberg (2013b)	Strong	Moderate	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Bamberg & Schmidt (1999)*	Moderate	Weak	Moderate	NA	Strong	Moderate	Moderate	Moderate	Strong	Moderate
Bamberg & Schmidt (2003)	Moderate	Moderate	Moderate	NA	Moderate	Strong	Weak	Strong	Strong	Strong
Ben-Elia & Ettema (2011)*	Strong	Moderate	Moderate	Moderate	Moderate	Strong	NA	Weak	Weak	Weak
Domarchi et al. (2008)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Moderate	Moderate	Strong
Donald et al. (2014)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Erikssonet al. (2008)*	Strong	Moderate	Strong	Strong	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Fujii & Gärling (2003)[1]	Moderate	Weak	Moderate	NA	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Fujii & Gärling (2003)[2]	Weak	Weak	Moderate	NA	Moderate	Strong	Weak	Moderate	Moderate	Strong
Gardner & Abraham (2010)	Strong	Moderate	Moderate	NA	Strong	Strong	NA	Strong	Strong	Strong
Gardner (2009)	Strong	Weak	Moderate	NA	Moderate	Strong	NA	Moderate	Moderate	Strong
Gärling et al. (2001)	Strong	Moderate	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Haustein et al. (2009)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Moderate	Moderate	Strong
Klöckner & Blöbaum (2010)	Moderate	Weak	Moderate	NA	Moderate	Strong	Strong	Strong	Strong	Strong

Klöckner & Matthies (2004)	Moderate	Weak	Moderate	NA	Moderate	Strong	Strong	Moderate	Moderate	Strong
Klöckner & Matthies (2009)	Moderate	Moderate	Moderate	NA	Moderate	Strong	Weak	Moderate	Moderate	Strong
Klöckner & Friedrichsmeier (2011)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Lind et al. (2015)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Mann & Abraham (2012)	Strong	Moderate	Moderate	NA	Moderate	Strong	Strong	Strong	Strong	Strong
Matthies et al. (2006)*	Weak	Weak	Strong	Weak	Weak	Strong	Moderate	Moderate	Moderate	Strong
Paulssen et al. (2014)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Pickard et al. (2009)	Strong	Moderate	Moderate	NA	Moderate	Strong	NA	Weak	Weak	Weak
Setiawan et al. (2014)	Strong	Weak	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Steg (2005)	Moderate	Weak	Moderate	NA	Moderate	Strong	NA	Strong	Strong	Strong
Tertoolen et al. (1998)*	Weak	Moderate	Strong	Strong	Moderate	Weak	Weak	Weak	Weak	Weak
Verplanken et al. (1998)*	Strong	Moderate	Strong	Strong	Moderate	Strong	Strong	Strong	Strong	Strong
Verplanken et al. (2008)	Strong	Moderate	Moderate	NA	Strong	Strong	NA	Moderate	Moderate	Strong

Note: *Indicates that these studies are interventions
[a]Overall methodological quality is rated as follow: strong (no weak ratings); moderate (one weak rating); weak (two or more weak ratings)
[b]Overall theory application quality is rated as follow: strong (two strong ratings); moderate (no weak ratings); weak (one or more weak ratings)
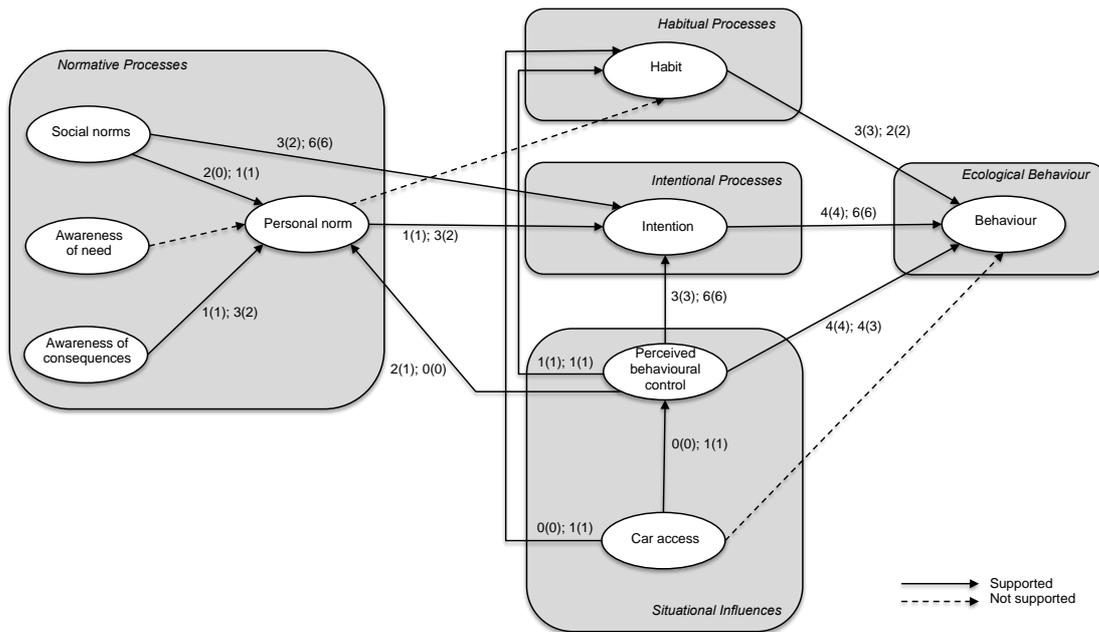
Figure 2.A.1. Supporting findings for the Comprehensive Action Determination Model after excluding studies that were authored/co-authored by the theorist (*n* = 26).

Note: The numerical figures associated with each theorised relationship represent the number of studies within our review that reported support in the following sequence: Correlations (Significant correlations); Path coefficients (Significant path coefficients), e.g., for the theorised relationship from personal norm to intention we identified 1 correlational study that reported a significant relationship and 3 studies reporting path coefficients, of which only 2 studies reported significant findings.
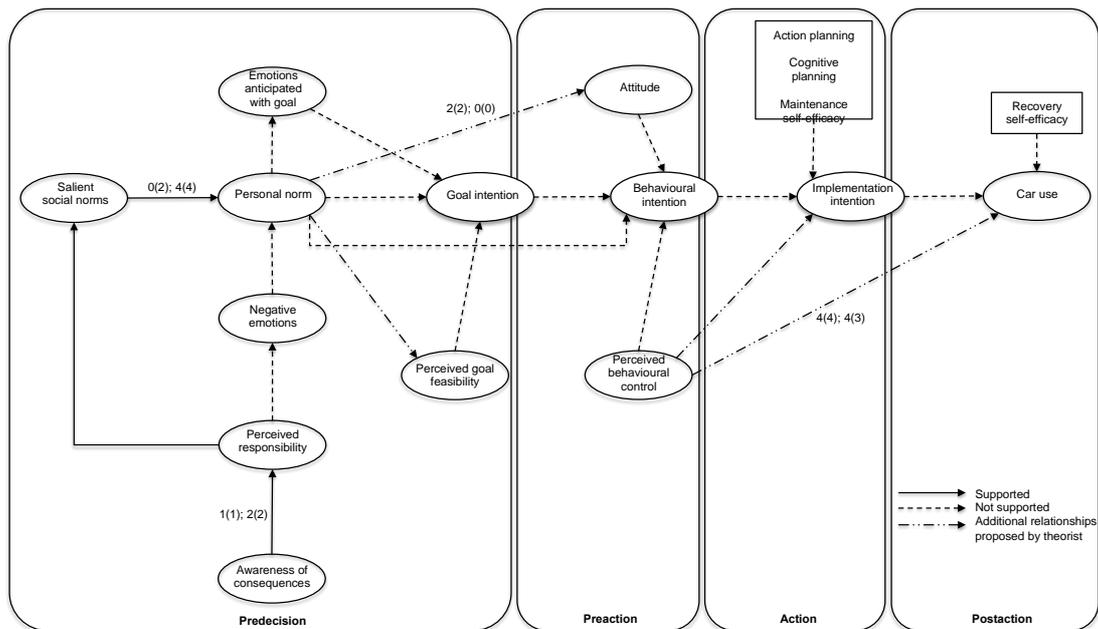
Figure 2.A.2. Supporting findings for the Stage Model of Self-Regulated Behaviour Change after excluding studies that were authored/co-authored by the theorist (*n* = 26).

Note: The numerical figures associated with each theorised relationship represent the number of studies within our review that reported support in the following sequence: Correlations (Significant correlations); Path coefficients (Significant path coefficients), e.g., for the theorised relationship from personal norm to attitude we only identified 2 studies reporting significant correlation coefficients.

Supplementary files for Chapter 3

The following pages present the supplementary files for Chapter 3: Commuting and wellbeing in London: The roles of commute mode and local public transport connectivity.

Table 3.A.1.
Descriptive statistics for selected variable, N = 3,630.

	% of commuters	Mean age (s.d.) within mode	Male % within mode	% within congestion zone	Mean distance (s.d.) to work	Life satisfaction (7-point scale), (s.d.)[a]	General Health Questionnaire (36-point Likert scale), (s.d.)[b]	Public transport connectivity[c]	
								Very poor to moderate %	Good to excellent %
Car/van	28.79%	41.57 (0.85)	38.55%	2.41%	9.81 (0.75)	5.09 (0.10)	11.17 (0.46)	86.90%	13.10%
Public transport	50.10%	37.19 (0.66)	48.14%	6.12%	10.10 (0.92)	5.22 (0.08)	10.63 (0.38)	72.53%	27.47%
Train	15.34%	37.22 (1.14)	58.65%	0.41%	14.86 (3.88)	5.19 (0.14)	10.89 (0.75)	87.70%	12.30%
Bus/coach	15.22%	38.02 (1.37)	38.16%	8.71%	6.48 (0.32)	4.96 (0.23)	10.84 (0.61)	73.13%	26.87%
Underground/light railway	19.54%	36.52 (1.04)	47.66%	8.58%	9.19 (0.61)	5.42 (0.12)	10.26 (0.92)	60.16%	39.84%
Active transport	17.03%	39.87 (1.17)	44.93%	11.54%	3.50 (0.33)	5.42 (0.10)	10.53 (0.33)	59.54%	40.46%
Cycle	5.91%	40.97 (1.87)	68.16%	5.36%	5.50 (0.56)	5.43 (0.29)	10.23 (0.68)	61.66%	38.34%
Walk	11.11%	39.29 (1.67)	32.56%	14.82%	2.44 (0.31)	5.42 (0.08)	10.73 (0.43)	58.42%	41.58%
Others	4.08%	-	-	-	-	-	-	-	-

Notes:

[a] After exclusion, first, of 148 observations of the following travel modes: car/van passengers, motorcycle and combination or travel modes (see methods) and second, after excluding 778 observations due to missing values in the dependent subjective wellbeing variable. Higher scores indicate high life satisfaction.

[b] After exclusion, first, of 148 observations of the following travel modes: car/van passengers, motorcycle and combination or travel modes (see methods) and second, after excluding 788 observations due to missing values in the dependent GHQ12 variable. Higher scores indicate higher levels of mental distress.

[c] Distribution of public transport connectivity within each category transport mode after excluding 148 observations of the following travel modes: car/van passengers, motorcycle and combination or travel modes (see methods).

Table 3.A.2.
Results of linear regression models investigating the association between commuting modes, public transport connectivity and wellbeing amongst London commuters. Values are difference (95% confidence interval) in life satisfaction/GHQ scores.

	Life satisfaction (higher score = better wellbeing)				GHQ (higher score = higher mental distress)			
	Unadjusted (*n* = 2,704)	PTAL adjusted (*n* = 2,704)	Fully adjusted[a] (*n* = 2,574)[b]	GHQ-controlled[c] (*n* = 2,549)[d]	Unadjusted (*n* = 2,694)	PTAL adjusted (*n* = 2,694)	Fully adjusted[a] (*n* = 2,567)[b]	LS[e]-controlled[c] (*n* = 2,549)[d]
Commute mode								
Car/van	0	0	0	0	0	0	0	0
Public transport								
Train	0.10 (-0.14, 0.34)	0.10 (-0.14, 0.33)	-0.03 (-0.30, 0.24)	0.02 (-0.23, 0.26)	-0.28 (-1.45, 0.89)	-0.26 (-1.42, 0.91)	0.30 (-0.99, 1.60)	0.29 (-0.87, 1.45)
Bus/coach	-0.14 (-0.48, 0.20)	-0.15 (-0.48, 0.20)	0.23 (-0.08, 0.54)	0.11 (-0.14, 0.36)	-0.32 (-1.56, 0.91)	-0.21 (-1.46, 1.04)	-1.21 (-2.43, 0.01)	-0.80 (-1.83, 0.23)
Underground/light railway	0.32 (0.06, 0.58)*	0.31 (0.04, 0.57)*	0.24 (-0.04, 0.52)	0.19 (-0.04, 0.42)	-0.91 (-2.35, 0.53)	-0.69 (-2.05, 0.66)	-0.46 (-1.87, 0.94)	-0.07 (-1.28, 1.13)
Active transport								
Cycle	0.33 (0.02, 0.65)*	0.31 (0.00, 0.62)*	0.24 (-0.08, 0.55)	0.17 (-0.08, 0.43)	-0.94 (-2.08, 0.20)	-0.73 (-1.91, 0.45)	-0.56 (-1.90, 0.79)	-0.17 (-1.27, 0.94)
Walk	0.32 (0.05, 0.60)*	0.31 (0.02, 0.59)*	0.48 (0.14, 0.81)**	0.35 (0.05, 0.66)*	-0.44 (-1.43, 0.55)	-0.26 (-1.28, 0.76)	-0.90 (-2.03, 0.22)	-0.13 (-1.13, 0.88)
Public transport accessibility level								
Very poor to moderate		0	0	0		0	0	0
Good to excellent		0.06 (-0.16, 0.28)	0.16 (-0.03, 0.35)	0.04 (-0.14, 0.21)		-0.70 (-1.72, 0.33)	-1.10 (-2.08, -0.12)*	-0.85 (-1.75, 0.06)
Congestion zone								
Outside zone			0	0			0	0
Inside zone			-0.34 (-0.80, 0.13)	-0.25 (-0.67, 0.16)			0.32 (-1.12, 1.77)	-0.15 (-1.53, 1.24)
Residential density (1000 person per sq km)			-0.00 (-0.00, 0.00)	-0.00 (-0.00, 0.00)			0.00 (0.00, 0.00)*	0.00 (0.00, 0.00)*

Distance to work (miles)	0.00	0.00	-0.00	0.00
	(-0.00, 0.01)	(-0.00, 0.01)	(-0.02, 0.02)	(-0.02, 0.02)
Equivalised household income (5ths)				
1 Lowest	0		0	0
2	0.27	0.33	-0.20	0.45
	(-0.29, 0.82)	(-0.16, 0.83)	(-1.67, 1.27)	(-0.81, 1.70)
3	0.39	0.35	-0.84	-0.05
	(-0.08, 0.87)	(-0.04, 0.75)	(-2.34, 0.67)	(-1.19, 1.10)
4	0.42	0.45	-0.22	0.60
	(-0.04, 0.88)	(0.05, 0.84)*	(-1.65. 1.20)	(-0.54. 1.74)
5 Highest	0.89	0.74	-1.79	-0.19
	(0.44, 1.34)***	(0.34, 1.13)***	(-3.16, -0.42)*	(-1.37, 0.99)
Highest educational qualification				
None	0	0	0	0
Other	0.45	0.44	-0.68	0.21
	(-0.18, 1.07)	(-0.20, 1.08)	(-2.81, 1.44)	(-1.81, 2.23)
≥Degree	0.46	0.49	-0.37	0.52
	(-0.14, 1.07)	(-0.14, 1.12)	(-2.57, 1.82)	(-1.59, 2.63)
Gender				
Male	0	0	0	0
Female	0.00	0.09	0.80	0.80
	(-0.16, 0.16)	(-0.04, 0.22)	(0.08, 1.53)*	(0.16, 1.45)*
Age	0.01	0.01	0.03	0.04
	(-0.00, 0.01)	(0.00, 0.01)**	(-0.00, 0.06)	(0.01, 0.07)*

Child in household				
No children	0	0	0	0
Children <16	0.16 (-0.01, 0.33)	0.16 (0.01, 0.31)*	-0.03 (-0.86, 0.80)	0.25 (-0.50, 1.00)
Number of cars in household	0.05 (-0.05, 0.15)	0.02 (-0.07, 0.10)	-0.39 (-0.81, 0.02)	-0.30 (-0.66, 0.05)
Limiting illness or disability	-0.26 (-0.55, 0.03)	-0.00 (-0.24, 0.24)	2.19 (0.80, 3.59)**	1.78 (0.60, 2.95)**
Month of interview	0.02 (-0.01, 0.05)	0.01 (-0.01, 0.03)	-0.11 (-0.20, -0.01)*	-0.07 (-0.16, 0.01)
Neighbourhood income deprivation	-0.05 (-0.23, 0.12)	-0.04 (-0.20, 0.11)	0.03 (-0.61, 0.67)	-0.05 (-0.61, 0.51)
Neighbourhood employment deprivation	0.04 (-0.10, 0.18)	0.02 (-0.11, 0.15)	-0.09 (-0.75, 0.57)	-0.03 (-0.62, 0.57)
Neighbourhood education deprivation	0.03 (-0.07, 0.13)	0.08 (-0.02, 0.17)	0.40 (-0.01, 0.81)	0.45 (0.06, 0.85)*
Neighbourhood crime rate deprivation	-0.02 (-0.11, 0.07)	-0.00 (-0.09, 0.09)	0.13 (-0.30, 0.56)	0.10 (-0.32, 0.51)
Neighbourhood environment deprivation	0.03 (-0.11, 0.16)	0.00 (-0.12, 0.12)	-0.14 (-0.57, 0.28)	-0.12 (-0.51, 0.27)
Neighbourhood percentage of green space	0.00 (-0.00, 0.01)	0.00 (-0.00, 0.01)	0.02 (-0.01, 0.04)	0.02 (-0.00, 0.04)
GHQ		-0.11 (-0.13, -0.10)***		-

| Life satisfaction | - | -1.69
(-2.01, -1.38)*** |

Table 3.A.3.
Results of linear regression models investigating the association between public transport commuting, public transport connectivity and life satisfaction. Values are difference (95% confidence interval) in life satisfaction scores (higher score = better wellbeing).

	All public transport commuters		Train commuters		Bus/coach commuters		Underground/light railway commuters	
	Fully adjusted (*n* = 1,298)[a]	GHQ-controlled (*n* = 1,280)[b]	Fully adjusted (*n* = 438)[a]	GHQ-controlled (*n* = 437)[b]	Fully adjusted (*n* = 362)[a]	GHQ-controlled (*n* = 352)[b]	Fully adjusted (*n* = 499)[a]	GHQ-controlled (*n* = 491)[b]
Commute mode								
Train	0	0						
Bus/coach	0.34 (0.01, 0.67)*	0.16 (-0.09, 0.42)						
Underground/light railway	0.29 (0.02, 0.57)*	0.22 (-0.01, 0.46)						
Public transport accessibility level								
Very poor to moderate	0	0	0	0	0	0	0	0
Good to excellent	0.35 (0.12, 0.59)**	0.18 (-0.08, 0.45)	0.33 (-0.08, 0.74)	0.50 (0.12, 0.89)*	-0.14 (-0.39, 0.68)	-0.16 (-0.65, 0.32)	0.50 (0.09, 0.90)*	0.34 (-0.12, 0.81)
Congestion zone								
Outside zone	0	0	0	0	0	0	0	0
Inside zone	-0.79 (-1.38, -0.21)**	-0.73 (-1.29, -0.16)*	0.67 (-0.46, 1.80)	0.36 (-0.73, 1.45)	-0.78 (-1.38, -0.19)*	-0.88 (-1.46, -0.29)**	-0.13 (-0.80, 0.54)	-0.10 (-0.71, 0.51)
Residential density (1000 person per sq km)	0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)	0.00 (0.00, 0.00)*	0.00 (0.00, 0.00)	-0.00 (-0.00, 0.00)	-0.00 (-0.00, 0.00)	-0.00 (-0.00, 0.00)	-0.00 (-0.00, 0.00)
Distance to work (miles)	-0.00 (-0.01, 0.00)	-0.00 (-0.00, 0.00)	-0.00 (-0.00, 0.00)	-0.00 (-0.01, 0.00)	0.00 (-0.00, 0.01)	0.01 (-0.00, 0.02)	0.00 (-0.03, 0.04)	0.00 (-0.02, 0.03)

Equivalised household income (5ths)

1 Lowest	0	0	0	0	0	0	0	0
2	-0.07	0.01	0.06	-0.01	-0.05	-0.06	-0.25	-0.15
	(-0.79, 0.64)	(-0.65, 0.67)	(-2.08, 2.20)	(-1.74, 1.73)	(-0.69, 0.58)	(-0.73, 0.60)	(-1.50, 1.01)	(-1.41, 1.12)
3	0.46	0.46	0.69	0.46	0.57	0.30	-0.34	0.03
	(-0.16, 1.07)	(-0.08, 1.00)	(-0.99, 2.36)	(-0.82, 1.74)	(-0.07, 1.21)	(-0.32, 0.92)	(-1.71, 1.03)	(-1.23, 1.30)
4	0.39	0.47	0.46	0.29	-0.17	-0.25	0.30	0.62
	(-0.18, 0.96)	(-0.01, 0.95)	(-1.13, 2.05)	(-0.89, 1.46)	(-0.77, 0.43)	(-0.81, 0.31)	(-0.85, 1.45)	(-0.53, 1.76)
5 Highest	0.85	0.73	0.72	0.45	0.75	0.63	0.56	0.66
	(0.31, 1.40)**	(0.28, 1.18)**	(-0.92, 2.36)	(-0.76, 1.67)	(0.16, 1.34)*	(0.08, 1.18)*	(-0.60, 1.71)	(-0.49, 1.81)

Highest educational qualification

None	0	0	0	0	0	0	0	0
Other	0.80	0.64	-1.02	-0.92	0.66	0.44	-0.99	-0.67
	(-0.17, 1.78)	(-0.42, 1.69)	(-1.79, -0.25)**	(-1.64, -0.19)*	(-0.28, 1.59)	(-0.48, 1.37)	(-1.76, -0.22)*	(-1.39, 0.05)
≥Degree	0.73	0.61	-0.67	-0.61	0.71	0.45	-1.04	-0.71
	(-0.22, 1.68)	(-0.43, 1.65)	(-1.37, 0.03)	(-1.27, 0.05)	(-0.15, 1.58)	(-0.44, 1.34)	(-1.70, -0.38)**	(-1.37, -0.04)*

Gender

Male	0	0	0	0	0	0	0	0
Female	0.09	0.14	0.32	0.31	0.30	0.21	-0.07	0.08
	(-0.14, 0.33)	(-0.08, 0.36)	(-0.09, 0.72)	(-0.07, 0.68)	(-0.17, 0.77)	(-0.27, 0.69)	(-0.37, 0.24)	(-0.21, 0.36)

Age	0.01	0.01	0.03	0.02	-0.00	0.00	0.01	0.01
	(-0.00, 0.02)	(0.00, 0.02)*	(0.00, 0.05)*	(0.00, 0.04)*	(-0.02, 0.01)	(-0.01, 0.02)	(-0.01, 0.03)	(-0.01, 0.03)

Child in household

No children	0	0	0	0	0	0	0	0
Children <16	0.37	0.36	0.37	0.37	0.33	0.30	0.02	0.13
	(0.15, 0.60)**	(0.15, 0.57)**	(-0.07, 0.81)	(-0.06, 0.79)	(0.02, 0.63)*	(-0.01, 0.61)	(-0.31, 0.35)	(-0.17, 0.42)

Number of cars in household	0.07 (-0.07, 0.22)	0.05 (-0.08, 0.18)	0.17 (-0.00, 0.33)	0.13 (-0.02, 0.28)	0.18 (-0.13, 0.49)	0.07 (-0.24, 0.38)	-0.08 (-0.31, 0.15)	-0.03 (-0.26, 0.20)
Limiting illness or disability	-0.35 (-0.70, 0.00)	-0.04 (-0.34, 0.27)	0.14 (-0.40, 0.69)	0.39 (-0.10, 0.89)	-0.30 (-0.77, 0.18)	0.02 (-0.45, 0.49)	-0.47 (-0.93, -0.02)*	-0.24 (-0.62, 0.15)
Month of interview	0.02 (-0.01, 0.06)	0.01 (-0.02, 0.04)	0.03 (-0.03, 0.08)	0.03 (-0.01, 0.08)	-0.05 (-0.11, 0.00)	-0.07 (-0.12, -0.01)*	0.09 (0.05, 0.13)***	0.06 (0.02, 0.09)**
Neighbourhood income deprivation	0.07 (-0.13, 0.27)	0.06 (-0.13, 0.24)	0.42 (0.19, 0.64)***	0.27 (0.05, 0.48)***	-0.22 (-0.63, 0.18)	-0.04 (-0.47, 0.39)	-0.01 (-0.33, 0.32)	-0.01 (-0.34, 0.31)
Neighbourhood employment deprivation	-0.05 (-0.26, 0.16)	-0.05 (-0.24, 0.15)	-0.27 (-0.52, -0.02)*	-0.10 (-0.33, 0.13)	0.11 (-0.33, 0.54)	-0.05 (-0.51, 0.41)	-0.03 (-0.32, 0.25)	-0.04 (-0.34, 0.25)
Neighbourhood education deprivation	-0.01 (-0.15, 0.12)	0.03 (-0.10, 0.16)	-0.10 (-0.33, 0.13)	-0.02 (-0.23, 0.18)	0.03 (-0.17, 0.23)	0.06 (-0.15, 0.27)	0.02 (-0.17, 0.21)	0.03 (-0.34, 0.25)
Neighbourhood crime rate deprivation	-0.06 (-0.17, 0.05)	-0.07 (-0.17, 0.03)	-0.02 (-0.18, 0.14)	-0.06 (-0.20, 0.08)	-0.08 (-0.29, 0.12)	-0.12 (-0.33, 0.09)	-0.05 (-0.19, 0.09)	-0.05 (-0.20, 0.10)
Neighbourhood environment deprivation	0.12 (-0.02, 0.27)	0.10 (-0.03, 0.23)	0.02 (-0.22, 0.27)	0.07 (-0.15, 0.29)	0.41 (0.17, 0.65)**	0.38 (0.10, 0.67)**	0.10 (-0.06, 0.25)	0.08 (-0.07, 0.23)
Neighbourhood percentage of green space	0.00 (-0.00, 0.01)	0.01 (-0.00, 0.01)	0.01 (-0.00, 0.03)	0.02 (0.00, 0.03)	0.01 (-0.01, 0.02)	0.00 (-0.01, 0.02)	-0.01 (-0.02, 0.00)	-0.01 (-0.02, 0.00)
GHQ		-0.10 (-0.12, -0.08)***		-0.10 (-0.13, -0.06)***		-0.12 (-0.15, -0.09)***		-0.08 (-0.11, -0.05)***

Notes:

* Indicates statistical significance at the *p* < 0.05 level.
** Indicates statistical significance at the *p* < 0.01 level.

*** Indicates statistical significance at the $p < 0.001$ level.

[a] Changes in n are due to missing values in the following variables: commute distance, location relative to congestion zone, population density, educational attainment, OECD equivalalised gross household income indexed by the consumer price index, number of children, the presence of limiting illness or disability, neighbourhood income deprivation, neighbourhood employment deprivation, neighbourhood education deprivation, neighbourhood crime rate deprivation, neighbourhood environment deprivation and neighbourhood percentage of green space.

[b] Changes in n are due to missing values in the GHQ variable.

Table 3.A.4.
Results of linear regression models investigating the association between public transport commuting public transport connectivity and mental distress. Values are difference (95% confidence interval) in GHQ-12 scores (higher score = higher mental distress).

	All public transport commuters		Train commuters		Bus/coach commuters		Underground/light railway commuters	
	Fully adjusted (n = 1,293)[a]	LS-controlled (n = 1,280)[b]	Fully adjusted (n = 441)[a]	LS-controlled (n = 437)[b]	Fully adjusted (n = 355)[a]	LS-controlled (n = 352)[b]	Fully adjusted (n = 498)[a]	LS-controlled (n = 491)[b]
Commute mode								
Train	0	0						
Bus/coach	-1.66 (-3.42, 0.09)	-1.17 (-2.67, 0.33)						
Underground/light railway	-0.59 (-2.11, 0.93)	-0.17 (-1.52, 1.18)						
Public transport accessibility level								
Very poor to moderate	0	0	0	0	0	0	0	0
Good to excellent	-1.74 (-3.18, -0.29)*	-1.22 (-2.68, 0.25)	1.88 (0.06, 3.70)*	2.31 (0.58, 4.05)**	-2.56 (-4.61, -0.51)*	-2.32 (-4.19, -0.44)*	-1.82 (-3.60, -0.03)*	-0.97 (-3.04, 1.10)
Congestion zone								
Outside zone	0	0	0	0	0	0	0	0
Inside zone	0.53 (-1.53, 2.59)	-0.70 (-2.66, 1.27)	-3.53 (-6.92, -0.14)*	-2.57 (-5.96, 0.82)	-0.55 (-2.44, 1.34)	-1.75 (-3.49, -0.01)*	0.90 (-2.61, 4.41)	0.66 (-2.59, 3.90)
Residential density (1000 person per sq km)	0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)	-0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)	0.00 (-0.00, 0.00)
Distance to work (miles)	0.01 (-0.01, 0.03)	0.01 (-0.01, 0.03)	-0.01 (-0.03, 0.00)	-0.01 (-0.03, 0.00)	0.07 (0.01, 0.13)*	0.07 (0.01, 0.13)*	-0.02 (-0.16, 0.11)	-0.02 (-0.13, 0.09)

Equivalised household income (5ths)

1 Lowest	0	0	0	0	0	0	0	0
2	-0.88 (-2.94, 1.19)	-0.67 (-2.61, 1.26)	-1.17 (-6.49, 4.14)	-1.03 (-4.36, 2.31)	-0.46 (-2.90, 1.98)	-0.44 (-2.84, 1.96)	-1.95 (-6.55, 2.64)	-1.90 (-7.04, 3.24)
3	-1.18 (-3.42, 1.06)	-0.26 (-2.19, 1.67)	-2.24 (-7.52, 3.05)	-1.24 (-4.85, 2.36)	-2.75 (-4.82, -0.68)**	-1.82 (-3.72, 0.08)	1.61 (-3.16, 6.38)	1.49 (-3.25, 6.24)
4	-0.47 (-2.11, 1.17)	0.36 (-0.99, 1.70)	-1.72 (-6.72, 3.29)	-1.05 (-4.23, 2.12)	-0.99 (-2.87, 0.89)	-1.20 (-2.80, 0.41)	0.55 (-4.58, 5.68)	1.64 (-3.96, 7.24)
5 Highest	-2.40 (-4.27, -0.54)*	-0.87 (-2.36, 0.62)	-2.66 (-7.65, 2.34)	-1.60 (-4.70, 1.49)	-1.32 (-3.55, 0.91)	-0.13 (-2.17, 1.92)	-1.85 (-5.93, 2.23)	-0.35 (-5.15, 4.45)

Highest educational qualification

None	0	0	0	0	0	0	0	0
Other	-1.83 (-4.60, 0.94)	-0.50 (-3.85, 2.84)	1.48 (-1.71, 4.67)	0.01 (-3.12, 3.14)	-1.82 (-4.13, 0.48)	-0.86 (-3.31, 1.59)	3.05 (-5.04, 11.14)	1.41 (-6.06, 8.87)
≥Degree	-1.34 (-4.36, 1.67)	0.18 (-3.72, 3.36)	0.77 (-1.65, 3.18)	-0.22 (-2.62, 2.18)	-2.46 (-4.78, -1.13)	-1.43 (-3.92, 1.06)	3.59 (-3.41, 10.59)	1.78 (-4.88, 8.44)

Gender

Male	0	0	0	0	0	0	0	0
Female	0.66 (-0.33, 1.65)	0.78 (-0.17, 1.72)	-0.07 (-1.35, 1.21)	0.41 (-0.82, 1.64)	-0.50 (1.83, 0.83)	-0.15 (-1.53, 1.23)	1.65 (0.10, 3.20)*	1.51 (0.06, 2.96)*

Age	0.00 (-0.04, 0.04)	0.02 (-0.02, 0.06)	-0.04 (-0.12, 0.04)	0.00 (-0.08, 0.08)	0.03 (-0.03, 0.09)	0.03 (-0.03, 0.08)	0.00 (-0.06, 0.07)	0.02 (-0.05, 0.09)

Child in household

No children	0	0	0	0	0	0	0	0
Children <16	1.66 (-1.26, 0.93)	0.45 (-0.61, 1.52)	0.00 (-1.21, 1.21)	0.55 (-0.63, 1.73)	-0.28 (-1.65, 1.10)	0.20 (-1.16, 1.56)	1.05 (-1.08, 3.19)	1.12 (-0.82, 3.06)

Number of cars in household	-0.41 (-0.99, 0.18)	-0.29 (-0.82, 0.25)	-0.51 (-1.17, 0.14)	-0.27 (-0.89, 0.34)	-0.91 (-1.69, -0.14)*	-0.70 (-1.52, 0.12)	0.42 (-0.58, 1.43)	0.28 (-0.71, 1.26)
Limiting illness or disability	3.10 (1.29, 4.92)**	2.56 (0.90, 4.22)**	2.56 (0.38, 4.74)*	2.77 (0.80, 4.75)	2.78 (0.95, 4.60)**	2.31 (0.45, 4.17)*	2.86 (-1.02, 6.74)	2.01 (-1.34, 5.36)
Month of interview	-0.16 (-0.29, -0.03)	-0.12 (-0.25, 0.01)	0.10 (-0.13, 0.33)	0.13 (-0.06, 0.32)	-0.13 (-0.32, 0.06)	-0.21 (-0.42, 0.00)	-0.35 (-0.56, -0.13)**	-0.19 (-0.39, 0.02)
Neighbourhood income deprivation	-0.32 (-1.26, 0.62)	-0.20 (-1.04, 0.65)	-1.49 (-2.76, -0.22)*	-0.89 (-2.03, 0.24)	1.38 (-0.19, 2.95)	1.09 (-0.46, 2.64)	-0.07 (-1.32, 1.18)	-0.09 (-1.35, 1.17)
Neighbourhood employment deprivation	0.27 (-0.76, 1.30)	0.18 (-0.78, 1.13)	1.68 (0.36, 3.00)*	1.30 (0.15, 2.45)*	-1.11 (-2.34, 0.12)	-1.01 (-2.33, 0.32)	-0.12 (-1.26, 1.03)	-0.14 (-1.39, 1.10)
Neighbourhood education deprivation	0.52 (-0.07, 1.11)	0.50 (-0.05, 1.05)	0.83 (-0.07, 1.72)	0.69 (-0.08, 1.46)	0.33 (-0.34, 1.00)	0.35 (-0.32, 1.02)	0.03 (-0.97, 1.03)	0.08 (-0.81, 0.96)
Neighbourhood crime rate deprivation	-0.22 (-0.82, 0.39)	-0.30 (-0.85, 0.26)	-0.44 (-1.12, 0.25)	-0.48 (-1.11, 0.15)	-0.43 (-1.32, 0.46)	-0.51 (-1.35, 0.32)	-0.02 (-0.83, 0.78)	-0.09 (-0.91, 0.73)
Neighbourhood environment deprivation	0.01 (-0.59, 0.62)	0.16 (-0.36, 0.69)	0.55 (-0.22, 1.32)	0.57 (-0.14, 1.28)	-0.05 (-1.04, 0.94)	0.50 (-0.50, 1.50)	-0.21 (-1.04, 0.61)	-0.05 (-0.84, 0.74)
Neighbourhood percentage of green space	0.01 (-0.03, 0.06)	0.02 (-0.02, 0.06)	0.02 (-0.04, 0.08)	0.04 (-0.02, 0.10)	-0.03 (-0.08, 0.01)	-0.03 (-0.08, 0.02)	0.02 (-0.03, 0.07)	0.00 (-0.04, 0.05)
Life satisfaction		-1.61 (-2.01, -1.20)***		-1.46 (-2.07, -0.84)***		-1.46 (-1.91, -1.00)***		-1.84 (-2.57, -1.12)***

Notes:

 *   Indicates statistical significance at the $p < 0.05$ level.

 **   Indicates statistical significance at the $p < 0.01$ level.

 ***   Indicates statistical significance at the $p < 0.001$ level.

Changes in *n* are due to missing values in the following variables: commute distance, location relative to congestion zone, population density, educational attainment, OECD equivalised gross household income indexed by the consumer price index, number of children, the presence of limiting illness or disability, neighbourhood income deprivation, neighbourhood employment deprivation, neighbourhood education deprivation, neighbourhood crime rate deprivation, neighbourhood environment deprivation and neighbourhood percentage of green space.

[b] Changes in *n* are due to missing values in the life satisfaction variable.

Supplementary files for Chapter 4

The following pages present the supplementary files for Chapter 4: Driving in London and Singapore; A cross-cultural, qualitative comparison of city transportation experiences.

Appendix 4.A. Introduction to Singapore

This document presents a brief introduction to the background of the transport demand management system in Singapore. More detailed information about the different systems and policies can be accessed from the references within this document.

Singapore, an island city-state in Southeast Asia, has a population of 5.61 million in 2016 in an area of 719.1 square kilometres, has a population density of 7,797 per square kilometre (Department of Statistics, 2016). In tandem with its rapid economic and population growth after independence in 1965, its vehicle population rapidly increased in the 1970s leading to traffic congestion that was exacerbated by its limited land space and high population density (Lew & Leong, 2009). The Land Transport Authority (LTA) then introduced a variety of vehicle population control strategies discouraging private car ownership since 1975 (Menon & Loh, 2015). The following three major traffic demand control policies that were adopted and still implemented today are presented below. Further information can be found in Meng, Lu, and Ohtman (2015) and Pow (2014).

Electronic Road Pricing Scheme
The first traffic congestion management strategy was the Area Licensing Scheme introduced in 1975 which required vehicles entering or leaving the central business district vicinity during peak period to purchase and display an area licence (Menon & Loh, 2015). This scheme has since been superseded by the fully automated Electronic Road Pricing (ERP) system that deducts charges electronically whenever vehicles pass through a gantry.

High Additional Registration Fee for vehicles
In 1975, a high tax, the Additional Registration Fee (ARF), was also imposed upon the registration of a vehicle (Meng et al., 2015). The ARF is calculated based on a percentage of the vehicle's open market value. In the mid-1990, a car with an open market value of S$10,000 would have been subjected to a 45% custom duty and an ARF of 175%, resulting in a new car price of S$32,000. However, this price was net of the car distributer's margin. Thus, a Toyota Starlet XL with an open market value of S$11,351 in May 1990 would eventually retail at S$42,630. According to the LTA's current policy, a car with an open market value of S$30,000 today will have an ARF of 140% (S$42,000).

Despite the ARF and ERP scheme from 1975, the vehicle population continued rising rapidly and almost doubled in 1989 with 257,371 vehicles. Land scarcity made it impossible to continually increase road supply to meet the growing demand, except at high marginal cost. The LTA then adopted a more direct approach towards regulating the car population (Menon & Loh, 2015).

Vehicle Quota System and the Certificate of Entitlement

The Vehicle Quota System (VQS) was introduced in 1990 to control the vehicle population by limiting new vehicle purchases (Lew & Leong, 2009). Potential buyers must now obtain a Certificate of Entitlement (COE) prior to purchasing a new vehicle. A set quota of COEs will be issued monthly for potential buyers to bid and the final price of a COE for that bidding round is set at the lowest accepted bid. The LTA determines the quota of COEs issued based on a prescribed rate of vehicle population growth has been revised down from 3% in 2008 to 0.25% per annum currently (LTA, 2017b).

Vehicles due to be purchased are grouped into 5 categories depending on the engine size and nature of the purchase as shown in Table 1. Private vehicles, the focus of the study here, are purchased across three categories (Category A, B and C). Because the COE premium is determined by market force through bidding rounds that are currently held twice a month the COE premiums have been noted to dramatically change over periods of time. Historical figures of COE prices from LTA (2017a) are summarised and illustrated in Table 1 and Figure 1.

Table 4.A.1. COE categorisation and historical price range

Current category[1]	Old category[2]	Highest price[3]		Lowest price[3]	
		SGD[4]	Period	SGD	Period
Cat A	Cat 1 (≤1000cc) Cat 2 (1001-1600cc & taxi)	92,100	Jan 2013	2	Nov 2008
Cat B	Cat 3 (1601-2000cc) Cat 4 (≥2001cc)	96,210	Jan 2013	200	Jan 2009
Cat C	Cat 5 (Goods vehicle & bus)	76,310	Oct 2013	1	Dec 2006
Cat D	Cat 6 (Motorcycle)	6,889	Jan 2016	1	Nov 2002
Cat E	Cat 7 (Open)	97,889	Jan 2013	3,000	Feb 2009
Nil	Cat 8 (Weekend car)				

Note: [1]From April 1999; [2]Before April 1999; [3]Based on current COE categories; [4]SGD refers to Singapore Dollars

COE Prices (May 1990 to April 1999)

COE Prices (April 1999 to January 2017)
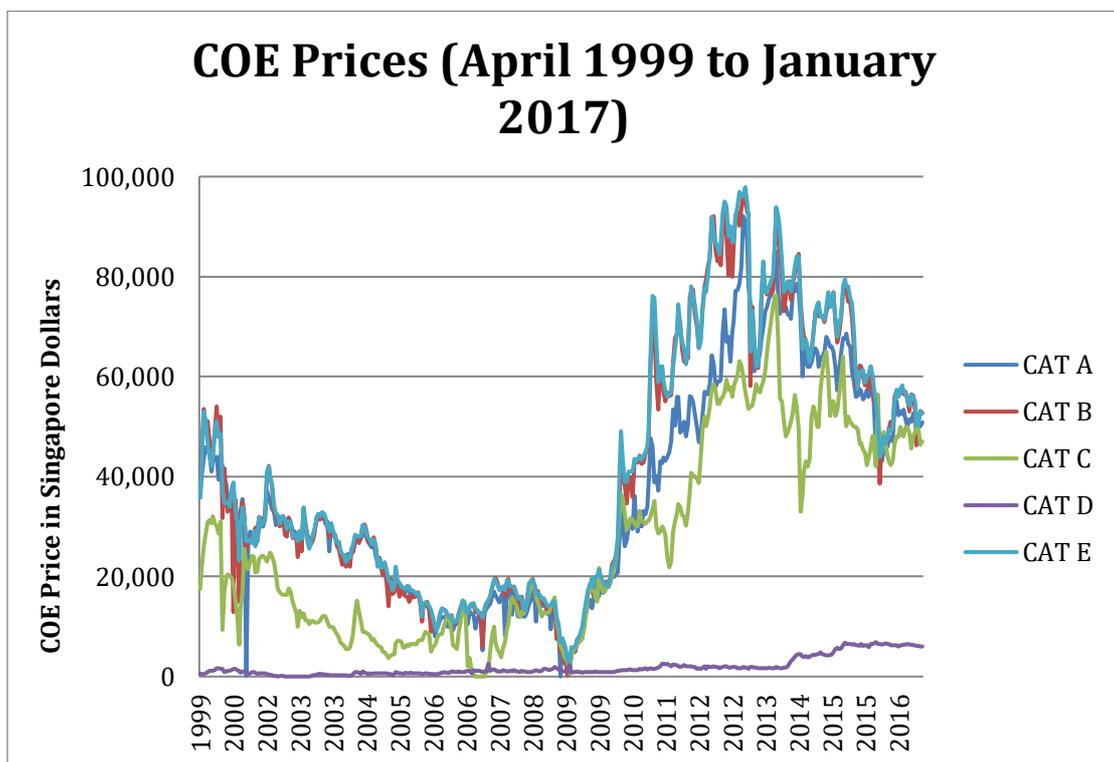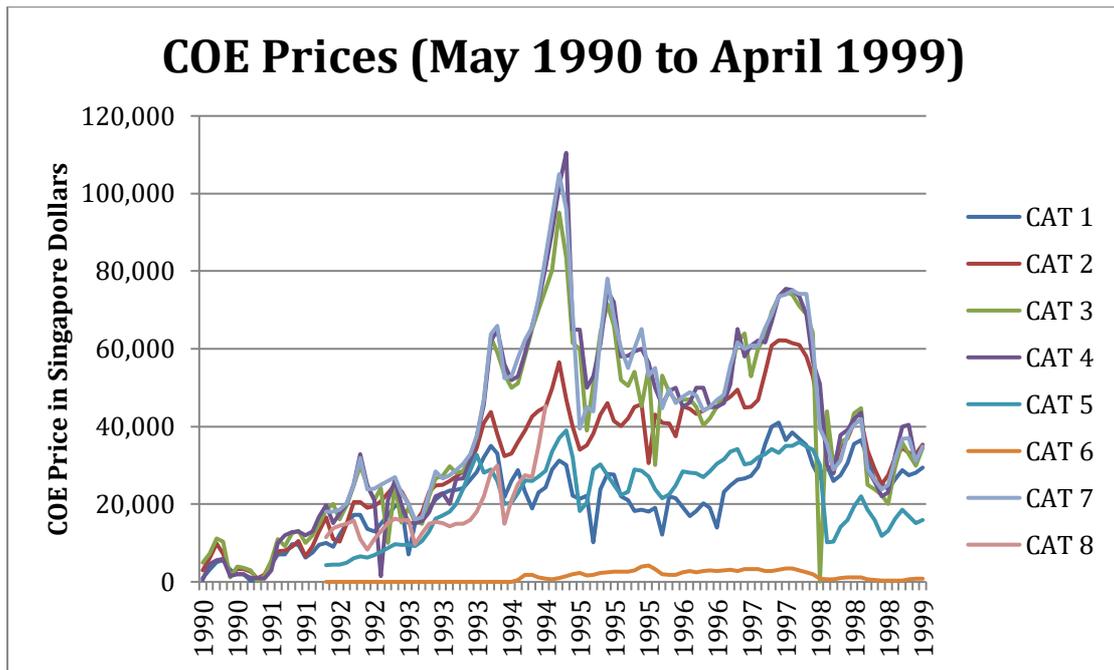
Figure 1. COE prices from May 1990 to January 2016

With these policies, Singapore's car population in 2016 stood at 602,311 (11 cars per 100 persons) (LTA, 2016a). The public transport system network managed by LTA consists of buses, the Mass Rapid Transit (MRT) and Light Rapid Transit (LRT) (more information for each service can be found on www.lta.gov.sg). To continue its effort to manage the demand for transportation the government has also committed S$36 billion over five years in 2016 to create a car-lite society with the aim of promoting a lifestyle where

people will happily choose to walk, cycle and take public transport (LTA, 2016b).

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Appendix 4.B. Interview Discussion Guide

Duration: approx. 45 mins

Thank you for consenting to be part of this interview study. In this interview we will be exploring some of your experiences and thoughts about your daily travels, there are no right or wrong answers as we are interested in your opinions on this topic. However, if you feel uncomfortable with answering or elaborating any questions please do not feel obliged to do so. Lastly, the session will be audio recorded and used for the purpose of this study only. If you do not have any questions we can begin.

Role of travel in personal life

Can you tell me about the most frequent journey you make?
(different scenarios: work commute, leisure (going out with friend/family), routine trips (grocery shopping))

- *Is this journey for work or leisure?*
- *What mode of transport do you use to for this journey?*
    - *Why do you choose to use this mode of transport for this journey?*
    - *How do you feel making this journey with this mode of transport?*
    - *Does it limit what you can do within the day?*
- *Can you visualise this journey and describe what this journey is like for you?*
    - *Why do you feel this way?*
    - *Are there any specific experiences you have during this journey that you can share?*
    - *What can we change about this journey to make it better?*
- *Is it possible to make the journey with a different mode of transport? Why?*
    - *Are you willing to use this mode of transport your suggested? Why?*
- *Do you think how you travel for these journeys reflect you as a person?*
    - *Does it reflect your personality?*
    - *Does it reflect your beliefs and values? What other options of transport available to you?*

In general when it comes to choosing the type of transport to use, what is important when you make that decision?

- *What factors influence your decision?*
- *Why is this important?*
- *Any other considerations?*

<u>Opinion about transportation in London (or Singapore)</u>

What do you think about the transport system in England (or Singapore)?

- *How would you rate the road infrastructure?*
  - *What do you think about driving here?*
    - *What are the road conditions for driving in your opinion?*
      - *To what extent do you think these conditions are a result of car use? Why?*
    - *Do you think there are too many cars on the road currently?*
  - *What do you think about car ownership?*
    - *Is it affordable?*
    - *Do you think it should be made more or less affordable?*
    - *What would you consider as affordable?*
    - *How do you think of the policies that relate to car ownership?*
  - *What do you think about the improving the road infrastructure to accommodate more cars on the road?*
    - *Do you think it is necessary?*
- *How would you rate the public transport infrastructure?*
  - *What do you think about taking the public transport?*
    - *In your opinion how would you rate the public transport system?*
      - *How accessible (or convenient) would you say the public transport is?*
      - *How affordable would you say the public transport is?*
  - *What do you think can be done to improve the public transport system infrastructure?*
    - *What do you think the current initiatives to make the public transport system more accessible, comfortable and reliable?*
  - *(If not currently using public transport) Will you consider using public transport? Why?*
    - *If not willing to consider currently, what can be done to change this?*
- *How would you rate using active transport (cycling or walking)?*
  - *What do you think about walking/cycling when possible?*
    - *In your opinion how would you rate the active transport infrastructure?*
      - *How accessible (or convenient) would you say the public transport is?*
    - *What do you think is the biggest barrier to walking/cycling?*
  - *Will this be something you will consider doing on a regular basis? Why so/not?*
    - *If not willing to consider currently, what can be done to change this?*
- *If it were up to you, what would you do different to the existing transportation system? Why would you propose these?*

<u>For car owners</u>

At what age did you first get your driving licence?

- *What made you get the driving licence?*

Car ownership: When did you own your first car?

- *How soon after you got your driving licence did you consider getting a car?*
    - *What motivated you towards getting a car?*
- *What was the car?*
    - *Why did you choose that particular car?*
- *What car do you drive now?*
    - *Why did you choose this car?*
- *In general? What do you consider when purchasing a car?*
    - *Amongst them, which is most important? Why?*
- *After this car and in a few years, will you consider getting another car?*

Accessibility of car ownership

- *What are your opinions on the affordability of cars in England (or Singapore)?*
    - *Do you think it's reasonable?*
    - *Do you think it should be made more affordability so that cars are accessible to more people?*
- *Do you think the current system for car ownership needs tweaking?*
    - *In your opinion what should be tweaked and how?*

For interviewees in England

What do you think about additional taxation on car ownership?

- *What do you think about it as a means of easing congestion?*
- *What do you think might be some reactions to increasing taxation on car ownership?*

"In Singapore, a country in Southeast Asia, prior to purchasing a car, a certificate of entitlement (valid for 10 years) is required, and it currently costs S$57,089 (approximately £26,064) for the small car category, comparable to a Honda Jazz, Toyato Yaris or Ford Ka. In addition, car buyers will have to pay a registration tax of 100% of the car value. These are in addition to the cost of car."

- *What are your thoughts about this?*

Whilst cars are expensive in Singapore, public transport is actually very affordable, being only a quarter of the cost of an equivalent trip in London.

- *What are your thoughts about this?*
- *Do you think a similar system is possible in London?*

COE scheme

- *What do you think about removing the COE on car ownership?*
- *What do you think about lowering car prices?*
- *What do you think about the COE as a means of easing congestion?*

"The COE is a system unique to Singapore. It doesn't exist in other countries, and consequently, cars are much cheaper elsewhere. In England, for example, cars are sold at what would be the price of the car initially in Singapore, without the COE and registration tax (amounting to 100% of the car value)."

- *What are your thoughts about this?*
- *Do you think this will make cars more accessible to people?*
- *Do you think this will have an impact on how we use cars in Singapore?*
- *What effects do you think it might have on the environment in Singapore?*
  - *Congestion, air pollution, noise pollution*

"The public transport in England is also comparatively more expensive than in Singapore. An equivalent trip in London would cost 4 times than in Singapore."

- *What are your thoughts about this?*
- *Why do you think that public transport more affordable in Singapore?*
  - *What do you think about the government's role in stabilising the prices of public transportation?*
- *Should we keep public transport at the same cost as currently or follow London's lead in increasing the prices and using the profits to be reinvested in the infrastructure?*

Do you think a system similar to the one in London is possible in Singapore?

Appendix 4.C. Supplementary document of quotes supporting identified themes.

The quotes supporting the themes identified in the interviews and reported in the result section is presented below. The quotes are presented first for interviews conducted in London and then for those in Singapore. There are five overarching themes that consist of 26 further sub-themes (in bold and italics). Some quotes may be repeated as they are relevant to more than one theme. Sub-sub-themes (in italics) are also used in this document when appropriate to further distinguish between transport modes or different aspects of the sub-themes.

<u>**Supporting quotes from interviews in London**</u>

Theme 1: Purpose and Nature of the Journey

Work versus social travelling

> It's very very expensive to travel by Rail. Personally, on a business trip it doesn't matter because the company is footing the bill but on a personal basis I hardly travel by Rail. Whenever possible, I always use the bus. [LDN02_Male]

> I tend to drive out of London and for most reasons it's social driving or to garden centres which tend to be on the periphery, because I have a garden. So if you want to transport things, visit friends, or visit stately homes (I'm a member of the National Trust and they have properties all over the place) so that's the sort of reasons why I really use my car. … most people would drive with a purpose in mind. [LDN14_Male]

Challenging trips by public transport

> But if I'm also going to other places on the way, stop along the way, then I will take the car. [LDN05_Male]

> A lot of my shopping would be done on foot because I tend to buy comparatively small amounts of food and carry them in a rucksack. So I don't use any form of transport, well, walking is a form of transport, of course. [LDN12_Male]

> If you're going somewhere and you have things to take like heavy bags then I would use the car. Otherwise, if it's just me and a handbag then I would just use the public transport. … Like today, I just came back from shopping and I used the car because it would just be too much to grapple with the buses. [LDN13_Female]

> But I don't think that people do much leisure driving anymore, i.e. in days gone by, people would go out on the weekend and have a leisure drive simply for the sake of going out and driving in the country. I don't think anyone does that anymore because the cost of petrol has rocketed over the years and income hasn't kept pace, particularly in Europe in the past number of years. But on the other hand, if you want to go buy something in the shopping mall I guess you're going to drive there anyway, particularly if you have large purchases or bulk items to carry. That's the only downside of public transport, transporting bags of whatever you need to buy. [LDN14_Male]

> I would keep the car, not that I use it often. It is very useful. I was helping a relative, who lives close to me, and the journey time as far as I was concern, there was no question on whether to go on public transport because it was just way too slow. I'm aware of pollution and all that but sometimes it's the best of choice. … Sometimes

when I visit my relatives, it's not too far away but by public transport it is exceedingly awkward so I'll drive. [LDN14_Male]

My car is used when it's raining very heavily. When I've to go for an appointment that I've to be sure that I get there on time then I'll use my car. Or when dropping my husband off for his appointment or his club. … When I do not want to rely on public transport, like when it is for a very important appointment then I will drive. Sometimes it's also if I have someone disabled with me then I'll drive. [LDN16_Female]

The last time I went into London it was outside the congestion hour and it was going to a wedding, and that one I had no choice because my husband was in the car and he's not able to walk much, so we've to go by car. [LDN16_Female]

If I have to transport heavy things – I go for a big shop once a week – I take the car. If I'm buying plants for the garden, I take the car. When I'm going to the recycling depot, I take the car. [LDN17_Female]

Theme 2: Transport Access and Feasibility

Availability of infrastructure

Public transport in general

You know people here complain and complain but I'm so used to the rest of the world I think London is very accessible, compared you know. I really love London. [LDN01_Female]

Generally accessible, especially with the Tube I think it's a great help. Even the rail network here is very extensive and it's quite easy to get from place to place in London just that it depends on how long it would take that's all. But in terms of accessibility, I would say it's quite accessible and well-connected. [LDN02_Male]

In London you have these Circle lines and horizontal and all these different lines, but because we live in the West and his office is in the North West. So when he wants to go to the office, he has to travel to the centre and then travel back. There's no way for him to travel from the West to the North West and it takes a long time. And if he gets a bus, he has to change two or three times and it's very very difficult to go to work and it takes a long time to go to work. So there is no option really, he has to drive. [LDN03_Female]

Hong Kong is much better. The transportation in Hong Kong is much better. There are lots of options, like for us, for me, I took the Tube to work, for my husband he took the bus to work because there is a bus from our flat to the office, a direct bus, quick one. [LDN03_Female]

I'm not really…if the train is not available I won't go in the first place, especially when it's far. Again, it depends on the distance. So if I'm going to somewhere that can be accessed by bus in like 30 minutes, I can do that. But if I'm going to work or go somewhere as far as my workplace is, I wouldn't go there by the bus, it's just too long, it'll take about 2.5 to 3 hours. [LDN04_Male]

I'm not really…if the train is not available I won't go in the first place, especially when its far. Again, it depends on the distance. So if I'm going to somewhere that can be accessed by bus in like 30 minutes, I can do that. But if I'm going to walk or go somewhere as far as my workplace is, I wouldn't go there by the bus, its just too long, it'll take about 2.5 to 3 hours. [LDN04_Male]

Because there is no Tube station there and the train takes more time. It is faster. … I've to take another train and change to go there, so it's more practical to drive. And I'm driving away from Central London, not into Central London. [LDN05_Male]

Simply, there would be various numbers of people using the public transport. … I don't think it would be an exaggeration to say that at times it's overloaded and that includes overland rail, Tube and bus, which are all available here. [LDN07_Male]

It's a combination I think because I think sometimes it's the capacity issue somewhere further down along the line because when they get here it's already full. And there has also been quite a substantial increase in the population within the immediate area with lots of new blocks of flats and new development of houses. Probably also because of the drop in the prices of the flats as well. So it's more people I guess. [LDN07_Male]

If the public transport is really good then that would be the best way to solve the problem. [LDN08_Female]

I think it's really good. The amount of connections that there are is amazing, you've lots of options and you can get anywhere, which I think is great. You don't have to worry about whether there will be a bus because everything is connected. The only problem is that there is often delays, cancellations or problems with the train lines, especially in where we live. So, in theory it's great when it is all running smoothly but that's not very often. [LDN08_Female]

We live near a train station so we mostly get a train into Central London on the Southeastern, which is quite good because from where we live they go to quite a few of the central stations and then from there I will either walk or get the Tube usually. I use buses for more local things like going to the shops or to the doctor's. [LDN08_Female]

If I need a car to get to work, like in some places you need a car because the public transport isn't good enough to get to wherever. [LDN09_Male]

I don't think it has much to do with it. It's more about the expensive public transport and you've a lot of people complaining about the trains. And for us, there is no way to get to the train station by public transport as the bus comes every hour and I've to walk a mile out to the main road and that will probably take me 15 to 20 minutes. I would love to be able to cycle to work in a cross-country path, that would be amazing. But unfortunately, there isn't one. So I think many people don't have a choice, certainly in this area that we live, which is rural. The nearest pub or village shop is four miles away. … It's so rural and there are no infrastructures at all. [LDN10_Female]

…because I live remotely so I do have to drive to the station for example, and again, Rail tickets are so expensive and journeys are so long, it's not a viable option…. Buswise, the infrastructure is already there in place and the UK has a very good Rail system but the cost is exorbitant. [LDN11_Male]

Yes, and I don't know whether you've noticed but the Transport for London system is gradually getting bigger and taking in some of what you would call the commuter routes. … Certainly that will make a contribution but I'm thinking about the adoption of what were considered to be railway lines before. For example, the Overground services were what used to be British Rail Systems, which are now incorporated into the Transport for London system. I believe the same thing is now happening with the commuter routes in Outer London, we're talking about 15 to 20 miles outside of Central London, so it's getting quite big. … Yes, it does. Originally I think there were six travel zones, with Heathrow the furthest out but now I think there are zones seven and eight, which are further out. [LDN12_Male]

Well, I was in London last Thursday and the Piccadilly line had something like three quarters or less number trains because there were problems with the wheels. So I was forced to walk quite a long way because the buses were so incredibly slow and I couldn't get into the Tube station, even then, the pavements were crowded as well. [LDN12_Male]

I think because you live in London there are so many different routes that you can take. So if you know one route is particularly bad and you need to get to a certain place at a certain time, I think there are so many different routes that you can take. You can get on

the buses, Tubes, Overground and all kinds of things, and they are good when they all work well. [LDN13_Female]

I do think that the transport system that we have in London, on the whole, is very good. I do think that now we have more, with the Night Tube which is something else that is advantageous instead of cutting off at 11.30pm or midnight. I just feel that the London transport system itself, overall, is just very good because I have friends living in the countryside and they've got just one bus an hour so when I think of how I can just walk to the end of the road, get on one bus that will get me to an area that has a dozen of buses to all sorts of areas and the longest you wait for a bus is five minutes. So on the whole, I just think that our London transport system is extremely good. Yes you do have your hiccups with things happening, like in the last few weeks with the cycle lanes being put in but on the whole it is quite a good system. [LDN13_Female]

There's quite a good structure going on with the running of the buses and the trains. They don't have trams inside of London, it's only in Croydon that we have trams. [LDN16_Female]

Buses

Secondly, I don't see much construction going on with the roads, so it's always…I like to analyse the problem using demand and supply, so demand for usage is always there, or in fact increasing over time but supply is not keeping up with the demand…Not only more bus lanes, but more bus routes as well. You have to help people living in the outer areas and make it convenient. Because for me to go into town there aren't so many buses that go into town. Maybe there are just like one or two routes that pass by my area. So maybe expanding that with more bus routes in areas like mine might help as well. [LDN02_Male]

More frequency and bigger buses as well. Because I see the buses running are quite small. They have double deckers but it's only essentially one and ahalf floors, one and a half storeys in the bus. So it's also improving the frequency and the quantity of seats, the number of seats in each bus that will help. [LDN02_Male]

There isn't a bus with a direct journey. You have to catch at least two buses to get to work. With the rush hour traffic, I don't think that would be a good option. [LDN06_Female]

No I wouldn't even attempt to catch the bus. For one thing, there isn't one bus that will take me all the way there. [LDN06_Female]

It's more about the expensive public transport and you have a lot of people complaining about the trains. And for us, there is no way to get to the train station by public transport as the bus comes every hour and I've to walk a mile out to the main road and that will probably take me 15-20 minutes. I would love to be able to cycle to work in a cross-country path, that would be amazing. But unfortunately, there isn't one. So I think many people don't have a choice, certainly in this area that we live, which is rural. The nearest pub or village shop is four miles away. [LDN10_Female]

I'm within a 10-minute walk of a Tube station and where I actually live I'm actually well serviced by buses but I tend to only use them for very short journeys or when I'm carrying more or heavier stuff. So I would only use a bus for a short journey. [LDN14_Male]

Even though there is the bus lane at certain times of the day for the buses but still there are vans that are allowed to load and unload and that can block the buses. [LDN15_Male]

I would use the bus sometimes to visit friends and so on but it would depend on the bus route because sometimes I go to visit friends where there isn't a bus route. [LDN17_Female]

Tubes (Underground)

I would. London is quite good, the Tube system. If you drive, half the time you're parking in a traffic jam. [LDN01_Female]

The Crossrail project, which you might have heard of, will link Heathrow to Canary Wharf and beyond. This is the first Tube construction undertaken in 40 years and the population has doubled or tripled or however many, it has increased substantially in the 40 years but investment in infrastructure has not kept up with that. So I think there's that question as well about whether supply is keeping up with the population demand. [LDN02_Male]

So I mean, in terms of sharing with more people, true, but there has to be more regular investment when you have more passengers. The Tube here breaks down a lot you must admit. Some lines are notorious for being unreliable. [LDN02_Male]

The reason we chose to have a car is because, for me, it is very easy to get to work on the Tube and go to work, but for my husband it is very difficult and it's the problem of the Tube. … In London you have these Circle lines and horizontal and all these different lines, but because we live in the West and his office is in the North West. So when he wants to go to the office he has to travel to the centre and then travel back. There's no way for him to travel from the West to the North West and it takes a long time. And if he gets a bus, he has to change two or three times and it's very very difficult to go to work and it takes a long time to go to work. So there is no option really, he has to drive. … Not well-connected. It's well-connected for people who live in the city centre or want to go across the city but not for people who want to go to the West or the outskirts, traveling around is difficult. … If I want to see a friend in Ealing from here, I have to travel to the centre and come back, it's not very convenient. Distance is very close but the traveling makes a round like that. [LDN03_Female]

Yes, definitely. It could do with more trains. Now the service gap is four minutes for the trains at London Bridge. That means that I have to squeeze onto the train that comes or wait for the next train to be able to board. [LDN06_Female]

If I'm traveling in to work, it can get pretty uncomfortable once I'm on the train; the station is fine. But when I'm getting on at London Bridge in the evening, the platform can be very overcrowded, especially if there are any delays on the train or the line is suspended for some reason and I don't know if I'm able to get on the Tube or the train again because there are so many people ahead of me sometimes. [LDN06_Female]

I used the public transport system to get into town last week but there were so many people around that the station was overcrowded and the trains were absolutely packed that you can't move on the Tube. But I don't see how you can make any difference with that because you can only have so many trains that can come along and one can only come along after the other. It's already really good. Therefore, if you encourage more people to use public transport in London, in the centre, what do you do? You can't have more trains because you can only have one going through a tunnel at a time. So I don't know, but there must be something that can be done. … The new trains that we've got which you can move from one end to the other end, that must have made a massive improvement rather than those single carriages. … Like the trains that you've got on the Overground where you can just get on and walk all the way through. With that you can get more people. [LDN13_Female]

Twenty years ago I wouldn't have dreamt of taking the Tube because the traffic wasn't that bad and there weren't that many cars on the road and you could park anywhere. … Because more people use the Underground, there are now more trains in the Underground. Now you have trains every two minutes. … And more efficient too. Now

they've brought in all-night Underground during the weekends. On Friday, Saturday and Sunday nights it's all 24-hours Tube. [LDN15_Male]

It will be nice to see the Tube being joined into the outskirts of London. … Yes, they did talk about it at one point but it has been shelved. … Well, all the expansion that they've done is not in where I live and doesn't affect me. … Yes, it's on the other side so to me that's no good. I'm only interested in what accessibility I get and the things that I can use. The things that I can't use I'm not too bothered about it because it's not to my benefit but to others, maybe. [LDN16_Female]

Trains

I use the Tube for sure. Fortunately, my house is quite close to the Overground station so I can just walk to the train station. From the train station I need to take the Tube to get to wherever it is that I need to go. On train sometimes, if outside of London. [LDN02_Male]

No, because I live remotely so I do have to drive to the station for example, and again, Rail tickets are so expensive and journeys are so long. It's not a viable option. [LDN11_Male]

Yes and we have the London Overground which actually does a circle around London almost. So from where I live, if I want to get from North West London to South West London that's convenient. I would use the Overground because it's the newish, it has the new stock on the line so it's pleasant to use. In summer and winter, it's either air-conditioned or heated. That's another major consideration too. [LDN14_Male]

Where I am, I am just on the outside of Croydon, in Shirley. We're okay in that we have the train stations Elmers End and East Croydon nearby. Where I am, we also have the tram. The only thing is that it would be nice if Woodside station can be opened again but I doubt if they can open Woodside station, because for me to walk to Elmers End, even though I can walk, it's still quite a distance and to Croydon I've to hop on a bus or a tram. For Woodside, if they can open up the station again, which I doubt they can because they would have to buy up some of the houses because a lot of the area of old railway tracks has already been used to build houses when they did away with the station. We have a tram that is running from Woodside now but it would be nice if a train can be connected as well being that Croydon is going to be the second London. So it would be nice if they can link us all, using some new land or whatever to give us a near station in Shirley. That would be great but I doubt they would do it. … They need to do that but remember on the same token, if they want to make Croydon the second London. Say if London is flooded, they will move everything to Croydon, that's what Croydon is for. They're gearing up for that, should London get flooded, for Croydon to be the base for all the businesses. So they can upgrade it and put more train links around the surrounding area of Croydon, in Shirley and so forth. I mean there are good links but on Shirley's side, they did away with Woodside train station. Should Woodside train station been there, it would be very convenient for us because we can just walk there and go to London or Elmers End. I don't know how they're going to link it but that's just a thought anyway because the chances of it happening is very slim. [LDN16_Female]

Outside the congestion charge area that's fine, I'm quite happy to drive there if I have to drive around, that I'm okay. … LDN16 Driving is fine; the motorway is brilliant. The motorway is fine and it saves you time. [LDN16_Female]

Availability of infrastructure for private vehicles

Maybe because roads in London are mainly constructed during the Victorian era, so in the Victorian era, people transport using horses and a lot more people were walking…So change has happened over two centuries, but unfortunately the

infrastructure in this country was constructed during the Industrial Revolution in the Victorian era. [LDN02_Male]

In London, I think the roads are completely overused. It wouldn't be so bad if it wasn't so busy. The biggest issue I had was that I live south of the river in South East London and to get to North London, which I've to do more often than not, I've to go through the Blackwall tunnel because in the South East you don't have much option to get across the river. You either drive very far East to get over the Dartford crossing, which is a bridge, or the Blackwall tunnel, or you go through Central London but that's not really an option because it's too busy. So this Blackwall tunnel you have to use it everyday. Basically, they need another crossing really, more roads built but they should not be one-way. [LDN08_Female]

Yes, because it's an old city it wasn't designed for this many cars and a lot of the streets are very narrow and things like that. [LDN08_Female]

Generally okay but when you get up to the rural sections, they're narrow country lanes and they certainly can be improved. [LDN11_Male]

I wouldn't drive in Central London. Firstly, driving is horrendous and the one-way system is no good, and I'll get lost there. … But to the outskirts of London, yes. I would drive if I were to go into the country because parking isn't as expensive and you even have free parking. [LDN16_Female]

Clearly there is a problem with the roads. I think the central congestion charge has improved that a bit but I think there is an ongoing problem with the roads. It's really difficult to see how that might be improved because the population is so dense, the roads are not wide and I think in Central London, apart from reducing the number of cars I don't see what else they can do really. … Yeah, most of the time the roads are pretty busy. [LDN17_Female]

Availability of infrastructure for bicycles

I just think that London is probably not a great city to cycle around because it is old and the roads are not wide enough to accommodate loads and loads of cycling as well as cars. I just think there is not enough room for everyone. [LDN06_Female]

It would be possible to cycle certainly but I don't do that for safety reasons, it's too dangerous to cycle on the road with the cars. There are probably roads in London that have safer routes but definitely from here to central London it's tricky. … The lack of cycle lanes and definitely the lack of segregated cycle lanes. The blue paint on the road doesn't seem to be quite enough. [LDN07_Male]

To be honest, I think the cycle routes are not really fit for purpose in London. We should look at other countries like Holland where people can cycle. I would love to cycle to the station from where we live but the roads are very narrow and not wide enough for two cars and a bicycle. [LDN10_Female]

But you have to be more careful with cycling. I haven't been out, I was working so I think you have to be careful cycling in the rain and in the dark and look properly… If you have a cycle lane that wasn't on the road then all these problems would go away. … And I think that if we've got that then many more people would cycle. It'll still have its dangers though. And it will be difficult to introduce a new mode of transport in a city that has been built basically for horses and carts isn't it? [LDN10_Female]

What you really want is a bicycle route and path, and then for other transports like buses and taxis and so on. But there just isn't a room in London. [LDN12_Male]

I think cycle lanes are important especially in the centre of town, but the amount of cyclists that we see locally here I don't think that it's worth the money and effort to be quite honest. We've got quite wide roads. It's a mayor of London thing because I don't

think it needs to be here. I think it needs to be where you've got busy junctions and in the centre of town like the West End and the City but I don't think you don't need it in the edges of London. Some sections, yes I think you do need a cycle lane but in our immediate sections I don't think we do. [LDN13_Female]

I think the bike system within Central London is really good and people have been using it. It has been beneficial and has helped kept cars out of the centre of London. In that way, I think it is good and I think tourists tend to use them a lot, and that's all for good. But I don't think that they've really thought about the whole thing because many areas outside centre of London, six to seven miles out, I don't think you really need a cycle lane unless it's an extremely busy road then a cycle lane might be a good idea. You don't really need them in smaller sections. [LDN13_Female]

Compared to cars

We had a car when we first moved to London, me and my partner took one with us from Durham then it broke and rather than getting it fixed we got rid of it because it was more of a hassle than anything good. … Most places are faster on public transport than driving and you save a lot of money not having a car…it was completely different in Durham. I would say it was the complete opposite in Durham as public transport is there but it's not good, takes a long time and is more expensive. And because it is not as busy, there were more parking and things were spread out so I would definitely use the car in Durham than use the public transport. [LDN08_Female]

Disable-friendly infrastructure

Except for me it's not so much, because it's mostly the Jubilee line that is accessible. Okay, there's some like the Hammersmith one, but not all of them are accessible, not all the stations are accessible. Bond Street for example, that's not accessible. So every time, I have to check and often the lifts don't work either. Even if they're accessible, some times the lifts don't work. [LDN01_Female]

For example, if I want to go to, I don't know, somewhere where…it's not level access, I can tell them and they will call ahead so that they will wait for me with a folding ramp for me to get off. [LDN01_Female]

It might be more money in London because it is older, the retrofitting. But for the Crossrail, they haven't built it yet, so they might as well build it. Because if you consider the demographics, it's going to be a lot more older people and people with push chairs and all that and it's not for people with wheelchairs necessarily, it's for anybody, you know. If you go for a skiing holiday and, you know, break a leg, you will need it. [LDN01_Female]

I think for a business model, it makes sense. People always say it is going to cost a lot more money, how? You know, instead of putting some steps, you make it level access, how is it going to make it more expensive? You know, it's going to make it more expensive when you put in a load of steps and then you decide where you're going to put the ramp, then yes, but not if you did it from the start. [LDN01_Female]

I mean it would be great if we don't have cars but then, you see, even when it's disabled people, a lot of them need the car because they can't use public transport …[LDN01_Female]

I don't like taxis. I don't like because… you know the ramp is quite high up. London taxis are quite good but I'm always stressed that they might not find a correct height for the pavement and it will be quite steep to go up or go down. [LDN01_Female]

I do think that things have gotten much better for people who are disabled but there are still lots of places that you can't get to if you're a disabled person. Victoria, I think, I'm

not sure what they're doing with the improvements, whether they're doing something for the disabled, because a disabled person in a wheelchair can't get to Victoria because there are no access to the lifts. But there are other sections that have, over the years, been improved massively but there is still a lot of work to be done with regards to the disabled. … But Victoria you would think that something could be done. It might be space or something but Victoria is such a hub you would think that disabled people would need to get to stations outside of Victoria and then come back on the National Rail rather than using the Tube. … Like I said, they have massively improved over the years but there is still that corridor of improvement to be made. [LDN13_Female]

Improvements have been made but they tend to be provided when spaces are available, for example, elevators to take you from the deeper depths. On that point also, they also can't really do much about improving the area because there just isn't the space to do it. Of course, most have escalators but they take you from point A to point B but you may still have to negotiate steps to leave or enter stations. [LDN14_Male]

The Underground is very quick, very convenient and fast as well but getting into the Underground with the steps and everything is not handicapped or disabled-friendly. [LDN16_Female]

Yes for a few stations, like Crystal Palace where they've got the lift and everything but I think more has to be done. Because if I'm disabled, my chances of using the Underground is very slim because the walk is such a long walk and some stations don't have escalators so you have the steps and it's a long walk. … I don't know how they can make it disabled-friendly because of space and I don't think they can just close down the station because many people use them, especially the station I use and Victoria station. They've renovated Victoria and that has put us out quite a bit but if they were to renovate to make it disabled-friendly I don't know how they can do it for the Tube line and so on. It will require a lot of money to do it but it will be nice if it can be done. … Because it's dated so it's difficult that way. [LDN16_Female]

Ease of Travel

Generally across all public transport modes

Yes, because if the Tube is not working, for example occasionally it might be suspended for a long time, the alternatives for me to get home would take a very long time. So my options are bounded by catching the Tube from work. I can catch other alternative transport but it will take a lot longer. I wouldn't even try catching the bus because when the Tube is down, everyone is trying to get on the bus and you can't get on the bus because they are all full so you'll feel a little stranded in Central London or can't get to work. … When there are disruptions I usually wait for however long it takes for that line to be working again. [LDN06_Female]

I live in a street in South West London, about five miles out of the centre, about a hundred yards out of the large commons, about a mile from one Tube station in one direction and a train station in the other direction. I've lived in this place for 25 years. … Yes I say it's convenient. It's probably more convenient now then it was when we first moved here. [LDN07_Male]

After a long day and a physically exhausting job (because sometimes you have to stand outside in the cold for hours in the winter waiting for something to happen) it used to stress me out because at the end of the day I have to take the work car and my kit back to the depot in Acton, pick up my car then go. Sometimes I have shifts where it can be quiet but usually I get quite stressed because I'm like, 'Why aren't they sending me home because the traffic is building up and I've to get all the way to Acton'. If they let me off early I'll have a quicker journey. But now, when I finish my shift I'll just skippily hop to the Tube station and get on the Tube which is normally very quick. 10 minutes on the Tube and then the trains, which go every half an hour. Occasionally they'll cancel but it's pretty good service really. And once I get on the train I'm very relaxed, I've got my water, I've got my book and I'm quite happy. [LDN10_Female]

And I've to phone up the night before to see what time they want me in the next day. They might say 'you've a really early job and have to be on site by 6am'. That would be that I've to be in by 5am and that means that I've to get a taxi. [LDN10_Female]

I think because you live in London there are so many different routes that you can take. So if you know one route is particularly bad and you need to get to a certain place at a certain time, I think there are so many different routes that you can take. You can get on the buses, Tubes, Overground and all kinds of things, and they are good when they all work well. [LDN13_Female]

Buses

I can take the Tube or I can take the bus. Sometimes what I do is I take the Tube and go home by bus. Because, even though the bus takes more than half an hour, it's just so stress-free. I just get on the bus, read or whatever, it just takes me straight to my house, bus stop, right outside my house. Whereas, if I take the Tube, even though it's only like 10 minutes, I still then have to get off and get a bus to get home. Even though I can just walk it, but I'm not walking if it's late. [LDN01_Female]

But for the buses you can't find just one bus that goes to your office. Maybe some people have to change two or three, or one or two times, then you've to add up the cost as well. So if I have a bus that goes straight to my work without delay, then yeah, I will choose the bus. [LDN03_Female]

I can give you one example of one day when I was in university. Because we have two different campuses, I went from one campus from another one, it's in a small town, Thamley on Thames. After 7.30 there was no bus, I couldn't get home, I had to call my husband to pick me up and drive me back. So imagine for people living here without a car, they can't go anywhere. Especially if you go to smaller areas, smaller towns, you must have a car. [LDN03_Female]

There isn't a bus with a direct journey. You've to catch at least two buses to get to work. With the rush hour traffic I don't think that would be a good option. [LDN06_Female]

No I wouldn't even attempt to catch the bus. For one thing, there isn't one bus that will take me all the way there. [LDN06_Female]

Yes, if it's a fairly short distance within Central London I might well use the bus because whereas the Tube is more convenient for longer journeys, it would also mean that you've to go down, wait for the train and then go up again and that adds significantly to the time. Whereas, on the bus, it is at the same level as where you are and you basically hop on the bus and off again. There are no requirements to get down to the railway lines. [LDN12_Male]

Some bus services operate at night, which is good for people working shifts and all that and on weekends that is also offered on the Tube. [LDN14_Male]

From where I'm living, the only thing I think is not convenient for me or has room for improvement is the bus 367 that is a little too infrequent. [LDN16_Female]

Tubes

Certainly, if it's very far from the Overground, it makes it difficult to actually get around and the main mode of transportation in London is the Tube or the train. So, accessibility to the Tube is very very important, to me at least, I'm sure to many other people as well. [LDN02_Male]

Stressful? Yes. There is a lot of demand. Especially during the peak hours, eight to nine, it's very difficult to get a seat first of all. Secondly, it's even difficult to get on the train. I travel every day via Canada Water, a station called Canada Water, usually it's very common to wait for three or four trains before I can get onto the train. There are just so many people who want to commute. [LDN02_Male]

We rented a flat there so it's quite convenient. The flat was just five minutes from the station. So my husband, he's driving, for me, I take the Tube to the work, it takes about 40 to 45 minutes door to door. [LDN03_Female]

Some bus services operate at night, which is good for people working shifts and all that and on weekends that is also offered on the Tube. [LDN14_Male]

No doubt, it's less stressful and much faster because you don't have stoppages. I can work out, for example, I want to go from where we are now to Leicester Square, if there is no hold up, which is unlikely, I'll be there in 40 minutes. I can make an appointment to be there in 40 minutes and I can be on time. … Exactly. Sometimes there might be some hold up in the tunnels because of signals but we're talking about seconds and minutes if that happens, that's all. If I were to go to my dentist in Leicester Square, which is about between 10 and 15 stations from here, I give myself 45 minutes and I'll be there before time. If I take the car, it will take me two hours because of the rush hour. [LDN15_Male]

Other than that, the train services from East Croydon is brilliant, apart from the strikes. The other inconvenience on the trains is that on weekends, which can't be helped I guess, they've got too much disruption due to repair works and a lot of cancellations at Elmers End station, which is the station very close to me. … They've to do the maintenance job so it can't be helped but it is an inconvenience that the maintenance work has to be done on the weekend. If they want to do the maintenance work, perhaps they should do it later in the night rather than at weekends during daytime as the impact of cancellations can be quite great. I'm not too happy about it because it's an inconvenience to us because other alternatives like going on the bus or whatever takes too long in the rush hour. [LDN16_Female]

Trains

I use the Tube for sure. Fortunately, my house is quite close to the Overground station so I can just walk to the train station. From the train station I need to take the Tube to get to wherever it is that I need to go. On the train sometimes, if outside of London. [LDN02_Male]

If I'm going longer distances I will often use trains. As you probably know, there are different types of travel passes for people and I've one of them so I get a discount on the trains. I just find it nice to just be able to sit down and not worry about the driving. [LDN12_Male]

I use that relatively infrequently. I might do an occasional long car journey. In fact, as I'm getting older I'm more tempted to do the longer journeys by rail. I think I use the railway more for the longer journeys just for the convenience and less stress; let the trains deal with the problems. [LDN17_Female]

Ease of using private vehicles

…that's also…something you have to think about before you drive or not. If we are going to the centre, we wouldn't drive because of the road, traffic, and also there is no place to park. Even if there is a place to park, it's very expensive as well. So there are a lot of things that I've to think about it. [LDN03_Female]

Because there is no Tube station there and the train takes more time. It is faster. … I've to take another train and change to go there, so it's more practical to drive. And I'm driving away from Central London not into Central London. [LDN05_Male]

I think it's that I'm used to stepping out, getting into the car, and not having to go to the station, wait for the train and then change another train and then get there and then walk. It's not very practical. … I want to be in the apartment, take an elevator, or lift, into the basement, get into my air-conditioned car and go from there. [LDN05_Male]

Yes, like how the traffic situation might be. Whether I would need to carry things. Whether there is more than one person in the car. Whether I'm going for a period of time for holiday or to visit people. Just whatever is more convenient. Well I suppose, whether there is a reliable public transport route. …there are a lot of factors and living in Greater London, one of the factors is that to drive, sometimes it takes longer to get out of a busy city. Sometimes public transport is quicker. [LDN07_Male]

In London, I think the roads are completely overused. It wouldn't be so bad if it wasn't so busy. The biggest issue I had was that I live south of the river in South East London and to get to North London, which I've to do more often than not, I've to go through the Blackwall tunnel because in the South East you don't have much option to get across the river. You either drive very far East to get over the Dartford crossing, which is a bridge, or the Blackwall tunnel, or you go through Central London but that's not really an option because it's too busy. So this Blackwall tunnel you've to use it everyday. Basically, they need another crossing really, more roads built but they should not be one-way. [LDN08_Female]

Yes I guess so. You've just got to plan better, you got to know how long it takes for you to get home and things like that. You've got to plan when you're leaving work, when you're going in, as opposed to just jumping into the car where obviously you've a lot more flexibility because you don't have to take the trains and choose the trains to get on. [LDN09_Male]

I prefer to use public transport when I can. … I find driving into London is congested and worrying. It seems like a mini battle with people pushing in and trying to get to somewhere quickly and it's not a long-term solution. Electric cars might be different. I don't like driving in London. [LDN12_Male]

I very rarely drive to the centre of town as there is no point, because you can't park. If I'm going into the centre of town, into London itself, or to the West End, I would always use public transport. I use the car locally and when I go to Kent and Surrey. But I have used the transport system for both of them too. [LDN13_Female]

It's difficult to say. If you're going somewhere and you've things to take like heavy bags then I would use the car. Otherwise, if it's just me and a handbag then I would just use the public transport. … I walk and use local transport like the buses and trains and I use the car. Like today, I just came back from shopping and I used the car because it would just be too much to grapple with the buses. [LDN13_Female]

Yeah, if I were to drive to Leicester Square, for example, when I go to see my dentist, who moved from Edgware Road to Leicester Square and I moved with him, it would take me an hour and a half to get there and there would be nowhere to park. I couldn't find any free parking there and it's very difficult to park at the West End. [LDN15_Male]

I wouldn't drive in Central London. Firstly, driving is horrendous and the one-way system is no good, and I'll get lost there. [LDN16_Female]

The amount of traffic is so great even out in Northern London that even when there's a minor roadwork or an accident it can get very difficult. I mean, one still has to go with it because that's the only choice you have at that time. … Of course when I drive I try to go at a time that is better if I have the option, you know, avoid the rush hour that sort of thing. … Well, that's life isn't it? I travelled in the rush hour in London throughout my working life so I'm resigned to my fate. [LDN17_Female]

Ease of using private-hire vehicles

I can always take taxis, why do I need a car? If I can just call up a taxi. [LDN01_Female]

Sometimes it's not convenient. For instance, when we go to the railway station when we are going further or to take a relative, we would take the taxi because it's more convenient than to drive because you have the congestion charges and the traffic situation. [LDN07_Male]

The other day we were trying to get somewhere and there was a Black Taxi strike so we basically sat in a taxi, we were in a taxi as well, for an hour and three quarters. I saw that happen again in Waterloo the other day where they just blocked the road deliberately. That is stressful when you're trying to get somewhere and there's a 10-minute delay here and there. You've to leave time and plan your journey to get somewhere but sometimes things just go absolutely pear shape and you've got no way around it. [LDN10_Female]

Ease of cycling/walking

Yes, it's about half an hour walk that I take everyday… It feels really good actually. I think I'm very lucky as I'm one of the only people that I know who walks as almost no one walks to work and that's a really good thing. …and because of where I live, if I were to get a bus I would have to walk to the bus stop and then walk from the bus, so it's the fastest way anyway to get there. …I think it will be the quickest way anyway. [LDN08_Female]

I would love to cycle to the station from where we live but the roads are very narrow and not wide enough for two cars and a bicycle. [LDN10_Female]

Oh yes, because I've a flat in quite Central London and I used to cycle to Shepherd's Bush where I used to be based and then to Oxford Circus as well. … I would cycle to Paddington and go along the canal for most of the way. It has its own challenges but at least you were not on the road so that's nice. I found a very good route. [LDN10_Female]

I just don't think that it is practical for me in Central London. I wouldn't know where to leave my bicycle. I use the bicycle for more recreational purposes because I live on the outskirts of London and can get to parks and quieter roads fairly easily. [LDN12_Male]

Financial Cost

Financial cost of public transport

I think transport in London is expensive. [LDN01_Female]

The trains are expensive. And I mean, the Tubes are expensive as well…This doesn't make sense. Because it's so expensive, it would make business sense to have better public transport so that, you know, it makes sense to people to not have a car if they can get from A to B easily isn't it? [LDN01_Female]

You see the thing is…the trains and everything are quite expensive, so for example, I knew somebody who lived in West Midlands and they drive in because the train ticket is so expensive. [LDN01_Female]

With regards to buses, yes, cheaper means of transport but you can never predict the traffic here. Sometimes it can be busy, sometimes it can be quiet, so if you're taking the bus, you're taking the risk there whether you can get there in time. You cannot be absolutely sure if you can get there in time. [LDN02_Male]

Affordabilitywise, I think it's a bit on the high side. Because for me, everyday, if I were to use the Oyster and not buy the travel card, I'll probably spend £7.50, where as if I get the travel card it's £35 a week, so about £5 a day. Affordabilitywise, I think it's on the high side compared to other cities. I was in Edinburgh before and it cost me £50, £50 to purchase a one-month ticket, trams and buses, and I could use the express service, the direct service to get to the airport with that ticket. In London, that is unthinkable. To go to Heathrow, it's at least £11. [LDN02_Male]

It's very very expensive to travel by Rail. Personally, on a business trip it doesn't matter because the company is footing the bill but on a personal basis I hardly travel by Rail. Whenever possible, I always use the bus. [LDN02_Male]

Actually the price is quite expensive in London. If you take from Zone 1 to across many different zones, it's very expensive. But because my office and the home is in one zone, it's very cheap for me, like £1.50 or something. So it's quite alright for me. But I think the transportation cost in London is very expensive for normal people. … The buses are alright actually. Buses, it's one journey, I think you only pay £1.50 for one journey, yeah. … Maybe some people have to change two or three, or one or two times, then you have to add up the cost as well. [LDN03_Female]

I can give you an example. For three people, going in to London for dinner probably costs £10 going there and coming back. For two people, £20 and some people think it's cheaper to drive. Like for us, going to Newbury to see my relatives, it's much cheaper to drive because it's just petrol. But if we take public transport, like Tube then trains, it's like double the price. So I think if it is cheaper, more economic, we would consider public transport. [LDN03_Female]

Yes, exactly and it's also cheaper to drive as well, except the Tube. The train is just so expensive. … I think it's overpriced. I think recently somebody wrote an article about it, it's cheaper to fly to another city than taking the train. [LDN03_Female]

Well, not particularly, well obviously it would be nice if they can reduce the price of transport, the price of the fare, if it can be reduced. I appreciate that it is a business and they require funding but if it is more affordable, it will be easier for me to use it. Right now I still have to use it but it is costly expense for me every month. … Yes I believe it can be made more affordable. Whether it is too expensive I try not to think that because I can't compare the price, I'm not that familiar with other transport systems, and what I mean by other transport systems is those in other countries. So I won't have an idea if it is expensive or not but I know it can be more affordable. Because, to move from Zone 1 to Zone 6 on a monthly ticket, you're looking to spend £250 every month. That is quite expensive. Because for most people living on the outskirts that is what you have to pay. [LDN04_Male]

The cost doesn't really matter because you want to get to work right? How much difference is it going to make? £20-30? I don't think anybody would think about cost when they are thinking about ways to get to work. [LDN05_Male]

I buy a monthly pass and I use the bus and Overground train and the Tube everyday. I guess I make a lot of my journey on public transport. I think it is expensive but because of the number of journeys I make everyday I guess it's not that bad. … Yeah, I think it's good value for money for me. But for me, I think the prices will continue to rise and rise and rise. [LDN06_Female]

I think it's very important to have the incentive to do that. One area that I've noticed is the pricing of relatively medium to long railway journeys where there seems to be a huge range of fare prices depending on whether you bought it long time in advance or

last minute and the price would change enormously. Sometimes the price would be prohibitive to travel by Rail. There doesn't seem to be a logical scale. [LDN07_Male]

Yes. I know it's cheaper in other countries but I don't think it's too bad. I don't feel angry or anything about it, I'm quite happy to pay whatever I pay to get it. As long as it doesn't go up anymore it's okay. [LDN08_Female]

But if public transport would be even better that will be brilliant and I'll probably use it more. I have friends who live on the other side of the city that is difficult to get to at the minute so I suppose if public transport were cheaper and better it would allow me more freedom because it's quite expensive to get to where my friends live on the other side as I've to take two different trains, the Tube and the bus. So by the time I take these different transports, it can get quite expensive. [LDN08_Female]

Seems okay for what you get. It costs more if you do longer journeys but if you stay on one form of transport I think it's fine. The minute you do bus, Tube and then train it gets more expensive. [LDN09_Male]

Getting to Oxford Circus by train and Tube is quite easy. Obviously there's a big financial aspect involved in the traveling but interestingly, we recently worked it out and it actually costs about the same whether you drive to work or get the train. They're both expensive but it's because we choose to live in the countryside instead of the city, so we're really the ultimate commuters. [LDN10_Female]

It's more about the expensive public transport and you've a lot of people complaining about the trains. [LDN10_Female]

I can't see a viable and economical alternative unfortunately because of where I live. …because of the cost implications. Rail tickets are exceptionally expensive in this country. [LDN11_Male]

…because I live remotely so I do have to drive to the station for example, and again, Rail tickets are so expensive and journeys are so long, it's not a viable option…. Buswise, the infrastructure is already there in place and the UK has a very good Rail system but the cost is exorbitant. [LDN11_Male]

Because I tend to travel off-peak, it's usually quite reasonable. For example, a journey into Central London is less than £2 off-peak. I find that price slightly strange in a way because that's roughly the price of a single fare on the buses. But that has changed very recently because you can now take 2 journeys for £1.50 on the buses. So I find that the pricing is a little odd. I would expect the pricing to be slightly higher given the speed of its service into London compared to buses. … I would say that it's not reflective of the convenience of using the Tube. £2, or £1.85 that it usually is, doesn't seem, to me, a lot of money to ask for to get to Central London quickly, compared with the price of a bus. … While, if you make several journeys a day then it can begin to add up. But there are price caps. But very seldom do I get up to the price caps. [LDN12_Male]

I think for buses, it seems illogical that each sector of the bus route should be charged the same amount. That has changed slightly recently where now you can travel twice on the bus. I'm not sure how you would do that in London if you use a time or distance based charging because London is quite large and it can take hours to travel from one transport system point to another transport system point. So I don't know how you can organise that. [LDN12_Male]

I think that they are still slightly high but they are better than what they used to be. If you have an Oyster card it can be something like £1.50. I don't really think that it's an astronomical price to pay? [LDN13_Female]

If you want to get anywhere within a reasonable time within the city then I just use the public transport. … For me, because I've a good public transportation, it actually saves me time and money quite honestly. [LDN14_Male]

Buses I think tend to be cheaper than the Underground system. … So, transport is expensive here. London is an expensive city, period, as most of the major cities in Europe are. [LDN14_Male]

I think the business with the Rail fares is unnecessarily complex. There are so many options and differences. You used to just go to the ticket office and say that I would like a return ticket to so and so and if it was past the rush hour you got a cheaper fare and if it was in the rush hour you got a more expensive ticket and everybody understood it. It's much more difficult to understand it now with all the options. I think it needs to be simplified and made clearer. [LDN17_Female]

Financial cost of public transport with a Freedom Pass

Exactly and that has been made easier since I turned 60. Because some routes cost more than others. But since being 60 and with the Freedom Pass now transport within London now is free so I can use whichever options. … This means I could use either an all-bus route or a Tube and a bus whereas before the cost of that would have to be considered. [LDN07_Male]

I do travel around London, I absolutely adore London. I use all forms of transport. I'm fortunate to have a pass and this is such a privilege to have. I use all forms of transport and I do travel absolutely everywhere. I go to Kent where I can use the buses, Tubes and the Network Rail, which is still within the confines of the M25. I go to my friends in Surrey. So I use it massively. I do have shopping places that I go to but I don't have a set kind of routine with it. … I can use the buses, Tubes, and the Overground and I can use the pass on the Network Rail within the M25 radius. If I go beyond the M25 then I pay the fare from the last station to the destination where I want to go. Let's say I want to go further into Kent or Surrey, I would have the pass free to a certain level and then pay the extra. … It's invaluable. The Freedom Pass because I'm past a certain age is invaluable to have because it enables you to do so much. You don't have to think about how much travel would be costing you although travel has come down in price over the years. The Network Railways haven't but within London area there are lots of deals that you can have and even if I have to pay towards my Pass I think I will do.
[LDN13_Female]

I'm at the age where I've free transport, that's one of the gems of being older, all people in London boroughs would get free transport on the Tubes and the buses. If I'm here as a tourist or visitor from outside London and they are seniors they should pay rates for seniors. But anyway, transport is quite expensive. But then, it's also expensive to run. The cost of transport is quite high but I think that they are still subsidised, as they are in most countries. But people operate different systems. The big advantage of transport here is that there are endless methods of paying, from using a Smartcard, an Oyster system that you can preload, which has made it much easier. You pay by zones and that's predetermined and you get a point where there's a daily cap. Whereas in Paris, you'll have these tickets that you can buy ten of these and use them at a discounted price, that works quite well too. [LDN14_Male]

Well, at present I drive very infrequently and mainly use the public transport because I have my Freedom Pass. I travel free everywhere so I use the buses, trains and trams often. … Because of my Freedom Pass, it's free, I don't have to pay. The only time I have to pay is only when I'm using it during peak hours and that is only in the morning. From 4.30am to 9.30am I will have to pay if I use the public transport so I try to avoid it. Of course, occasionally I have to pay it because I've to go at a certain time to my appointment or something. Pricewise, the trains are expensive and the buses are reasonable. But the buses and trams are free for 24 hours for us pensioners with our Freedom Pass. So it's only the train that we get our concession if we use it outside the peak hours if not we have to pay like everybody else. [LDN16_Female]

I'm very happy with the transport in London. When I go into Central London, I'm very happy with my Freedom Pass, so it doesn't bother me much. But if the train fare is cheaper out to the country, that would be great because then we would have the choice. Because outside, in the country, buses are free for us but not the trains. So sometimes it would be nice to have the option of being able to hop on the trains or buses if I choose to, outside of London. [LDN16_Female]

Even with the Railcard, you only have a third off. You've got to remember that pensioners do not get a lot from our pension. I know we can travel free outside, in the country, on any buses but the trains we've got to pay when it's outside London. … It could be more affordable for older people, the trains and everything. Because you've got to remember that when we want a reduction in our travel fare for the elderly, we have to subscribe to it. We have to pay so much to the subscription in order to get the discount otherwise, you don't get it. … I don't think we need to subscribe to it to get a discount. That would only work if you travel a lot outside and on long train journeys then you subscribe to it to get a third off your fare. That would only work if you travel a lot. If you travel only once in a while, you might as well pay the fare without the discount card because the subscription itself is too much. [LDN16_Female]

I think it's a great thing but I think when money is so short, people who could afford to pay for their transport should be paying for their transport and only people who couldn't afford should be getting the Freedom Pass. I think applying it to everyone it's very nice, but it may not be the best use of the money. … I know if I say that, I might end up having to pay something and I might not enjoy that but it might be better for people in general if we paid something. [LDN17_Female]

There's a thing called the seniors Railcard and you can get a reduction on the fares; I've one of those. With the card you have to travel at certain times after the rush hour, but you get a third's reduction on the fares. It costs a bit but it's not expensive. … You get a one-third discount and if you book in advance you can get a better deal too. So if I know I'm going I'll try to book in advance. [LDN17_Female]

Financial cost of private hire vehicles

Well, I've got a taxi card. In London, because I'm disabled, for every £10 I only pay £2. So to a certain extent, it is affordable. But when I look at it, it's still more affordable than buying your own car and then having to park it and I'm paranoid. When I had a car, I would send it to the garage every three months to check that it is still going okay because what do I do when I get stuck? [LDN01_Female]

Taxis, first of all, are out of the question because it's too expensive, and taxis you can call anywhere, and now there's Uber as well. Maybe now with Uber it might be cheaper, but still not an affordable means of transport to be taken everyday. [LDN02_Male]

I don't use it very often but I did use the Uber once when I got stuck when I took the last train home and I fell asleep so the train went all the way to the end of the line which is quite far out from where I live so I got an Uber home, which would have been really expensive in a regular taxi, so it saved me a lot of money. But I don't use them very often. [LDN08_Female]

Financial cost when using bicycles/walking

Yes, it's often slower walking and would also save you money if I walk instead of taking the Tube. I do that quite often and save a bit of money as well. [LDN08_Female]

Financial cost of using the car

I have a licence, I wouldn't drive. First of all, I have got a terrible sense of direction. Secondly, there is no parking and it costs so much to go into the congestion zone. Why would you want to drive? [LDN01_Female]

And I think here in London, I don't see myself driving here, maybe until I reach a certain income level. … It's just the congestion charge and the parking charges, which are killing. [LDN 02_Male]

Yeah, it's affordable because the two of us are working. The insurance, the petrol, yeah it's affordable. … Parking, of course, is expensive and it depends on where as well. Petrol is quite expensive, but that's quite common everywhere, you have no choice. Apart from that, insurance is alright. [LDN03_Female]

…that's also…something you have to think about before you drive or not. If we are going to the centre, we wouldn't drive because of the road, traffic, and also there is no place to park. Even if there is a place to park, it's very expensive as well. So there are a lot of things that I've to think about. [LDN03_Female]

…one has to consider the congestion charges as well, it's a deterrent as well…The cost of parking. Sometimes I would go to the theatre or some other occasions when it's more convenient to drive, but I've to take into consideration the convenience and the cost of parking. [LDN07_Male]

…it depends on what the true cost of traveling by car is as well, not just the fuel. [LDN07_Male]

Where we live we have free parking…but I would say that it is very expensive because of all the parking that you have to pay wherever you go and it's difficult to get parking that is free. [LDN08_Female]

So that's a bit of the first part of the journey, driving to the station and paying £6.50 a day for parking at the station and that's a huge part of the cost. [LDN10_Female]

INT What do you think about the cost of driving to work everyday?
LDN11 It's cheaper than Rail.
[LDN11_Male]

From that aspect they now have the congestion charging. Parking is also very expensive. [LDN14_Male]

London also has the congestion charge and then if you have to park your car it will cost you another £10-£20. I don't know of anybody, unless they are covered by the company, who will take the car. [LDN15_Male]

I wouldn't drive in Central London. … Then you have the congestion charges during Monday to Friday and parking is also expensive so I wouldn't drive into London. So public transport is my only option into London. But to the outskirts of London, yes. I would drive if I were to go into the country because parking isn't as expensive and you even have free parking. … We have to think about the cost but in Central London there is no way one can drive there. Unless we drive in the evening and if you're lucky you can get some free parking, and in the evenings after 6pm there is no congestion charge. … Going outside of London it's cheaper to drive than taking the train because if you have more than one person it will work out cheaper. … That driving is actually cheaper than taking the train. Driving can be cheaper than the train if it is outside and you're going far away, it is cheaper. [LDN16_Female]

I've not driven much in the past few years. I stopped when the congestion charge came about. The last time I went into London it was outside the congestion hour and it was going to a wedding, and that one I had no choice because my husband was in the car and he's not able to walk much, so we have to go by car. [LDN16_Female]

Financial cost of purchasing and maintaining the car

Yeah, once you have a car, you got to feed it, you got to buy insurance, you got to park it. Even if you don't do anything about it, you still got to pay for it. … Cars are not that affordable. [LDN01_Female]

Yeah, it's affordable because the two of us are working. The insurance, the petrol, yeah it's affordable. … Parking, of course, is expensive and it depends on where as well. Petrol is quite expensive, but that's quite common everywhere, you have no choice. Apart from that, insurance is alright. [LDN03_Female]

Here we bought a secondhand car, it's only £3000, it's very easy to buy a car in London, like my colleagues who are very new and they got a job and after a few months they can buy a car. [LDN03_Female]

I think they are expensive. But it would depend on the kind of car you want. I think the cost of owning and maintaining a car is quite expensive. [LDN04_Male]

Prices of cars in the UK. It's very easy to buy a car, especially used cars also, but the taxes for cars are very high. Compared to other countries I grew up in, the prices of cars there are double priced. … In India, Nepal, Sri Lanka, even in Asia cars are more expensive. Over here cars are very cheap. Even used cars are also very cheap. But the maintenance of the car is more expensive here. … Yeah. I'm just saying generally cars are much cheaper here. The cars in Europe are very cheap because the governments don't charge tax on the cars and all that. [LDN05_Male]

Well, I'm going to start my lessons for driving this year. But this does not mean I will end up getting a car because of the expense of running a car when in reality I wouldn't use it because it will probably be more stressful driving around London than catching the Tube. And probably it might be slower as well. [LDN06_Female]

Expensive. It's expensive both to buy and maintain and insure. It's an indulgence really. [LDN07_Male]

I think we should put our finances into electric cars and self-drive cars because people will always want to leave and come back when they want to and people will always want cars. Like cigarettes, even if you put the price up people will still want to buy them and they will find the money. People like the freedom of having a car and the safety. Self-drive and electric cars in cities is where we have to go. [LDN10_Female]

Prices of cars? I think there are some remarkably reasonable cars around. I think that it is amazing what you get for your money these days. … The new cars have so many facilities in them that fifteen years ago would be considered a luxury, like heated steering wheels. So I think cars are relatively affordable even though it is annoying that you have to keep paying for things like parking but that is the way life is. [LDN12_Male]

I think if I lived in the centre of London I'm not sure if I would own a car. Because if you were to take a long journey you could always hire one and money wise, it wouldn't be worthwhile to own a car if I lived in the centre of London. But everybody is different and everybody has cars for a different reason. But I know for a fact that I wouldn't bother. You have to pay for parking permit, congestion charge when you move the car. They are just all added costs and pollution in the centre. [LDN13_Female]

Well, we have to bear it. If you've got the car, you've got the expenses, the service, the petrol, the road tax, the insurance and the MOT. It's very expensive to keep the car. … Yes, because you need a car. But if you can't afford it you can't afford it and you have the option of the public transport. [LDN15_Male]

Having a car is quite expensive but for certain things I rely on it. I don't do a high mileage and that does make it more expensive but the convenience is such that I still want to have a car. … I decide that I can afford it because it is a priority for me for the

convenience of living. But yes, the road tax, insurance, servicing, MOT etc adds up over the year. [LDN17_Female]

Journey Time and Distance

By public transport in general across different modes

People choose to ride bicycles, for example, to get to places faster than they can or take the Tube. The Tube is the best option for most people. [LDN03_Female]

I'm not really…if the train is not available I won't go in the first place, especially when it's far. Again, it depends on the distance. So if I'm going to somewhere that can be accessed by bus in like 30 minutes, I can do that. But if I'm going to walk or go somewhere as far as my workplace is, I wouldn't go there by the bus, it's just too long, it'll take about 2.5 to 3 hours. [LDN04_Male]

I just tend to leave earlier so if there is any delay I won't get to work so late. I factor the potential delay into my commute in the morning. [LDN04_Male]

I'm not really…if the train is not available I won't go in the first place, especially when it's far. Again, it depends on the distance. So if I'm going to somewhere that can be accessed by bus in like 30 minutes, I can do that. But if I'm going to walk or go somewhere as far as my workplace is, I wouldn't go there by the bus, it's just too long, it'll take about 2.5 to 3 hours. [LDN04_Male]

This means I've to allow more time to travel where I'm going. My usual commute to work is, I take different routes depending on what time I have to be there for the meeting, I would take the route that is more reliable. If that takes longer, I would have to leave earlier. [LDN07_Male]

It affects the time. If you're going out to meet somebody, normally it might take 30 to 45 minutes, I think you're having to double that amount of time, 1 to 1.5 hours. You're having to compensate for time, that's one of the massive things. [LDN13_Female]

If you want to get anywhere within a reasonable time within the city then I just use the public transport. … For me, because I've a good public transportation, it actually saves me time and money quite honestly. Because if I go anywhere, for instance if I leave tomorrow, Saturday, to drive out of London, I tend to leave early to avoid the shopping people and get out of the city quite early in the morning. But generally everyday the line of traffic outside my house, people commuting to work or whatever they are doing, I really don't have the patience to sit in the traffic for untold hours. So you can get to your destination much faster by public transport quite frankly. [LDN14_Male]

Buses

Buses, the problem is that it can be slow and the only option left, is either the train or the Tube. [LDN02_Male]

With regards to buses, yes, cheaper means of transport but you can never predict the traffic here. Sometimes it can be busy, sometimes it can be quiet, so if you're taking the bus, you're taking the risk there whether you can get there in time. You cannot be absolutely sure if you can get there in time. [LDN02_Male]

That's a good question that you raised there. It's very very expensive to travel by Rail. Personally, on a business trip it doesn't matter because the company is footing the bill but on a personal basis I hardly travel by Rail. Whenever possible, I always use the bus. [LDN02_Male]

Depends, I think it depends on the distance. I'm not saying that the bus transport is entirely bad, it depends on the situation as well. Sometimes it's not feasible to travel by Tube, because of the distance, because of the convenience. Bus stops can be so close to your destinations so it makes more sense to take a bus. So it depends on a few factors of course. So it depends on your situation I would say. [LDN02_Male]

Commute by bus? I wouldn't do it. Bus is just one of the backups, for example if there is a Tube strike and there is no other way to commute but bus. But I wouldn't commute by bus in London for work. But if I'm going out for other things and don't need to be in a rush or don't have to be there on time, then I will consider bus, yeah. [LDN03_Female]

But for the buses you can't find just one bus that goes to your office. Maybe some people have to change two or three, or one or two time, then you've to add up the cost as well. So if I have a bus that goes straight to my work without delay, then yeah, I will choose the bus. [LDN03_Female]

I wouldn't even attempt to catch the bus. For one thing, there isn't one bus that will take me all the way there. I just think the traffic going into Central London and the route I would take is just too busy, there is too much traffic that I would just sit on the bus for ages. [LDN06_Female]

I'm not totally certain about the buses because when I work I very rarely use the buses, and again it's for speed. … I tend to only use them for very short journeys or when I'm carrying more or heavier stuff. So I would only use a bus for a short journey. [LDN14_Male]

If I'm in a hurry I won't take the bus. If I have an appointment and I want to get there on time I'll never dream of taking the bus, I'll take the Tube because that's the most reliable way to get there and the quickest way. [LDN15_Male]

I tend to only use them for very short journeys or when I'm carrying more or heavier stuff. So I would only use a bus for a short journey. [LDN17_Female]

I do the bus a lot. I do not use the bus into Central London; that would be my last resort because it's so much slower. If I'm going into Central London I take the Tube, which is a much quicker way of getting to places. … My default mode is the Tube. Sometimes I would use the bus but my default mode is the Tube. [LDN17_Female]

Tubes

I would say, for anybody, it would be the Tube. You, know, even for me, if it is accessible, yeah, it would be the Tube, because it's faster. You know, from North Greenwich to Waterloo, maximum 20 minutes. If you take a bus, 90 minutes. … You know, the bus stops, and you have the traffic and it's slower. The train is faster. [LDN01_Female]

Because it would take far far longer to travel to work by buses and I don't cycle. The Overground trains either take too long or they are not frequent enough. I really have to catch the Tube, it is the quickest option. [LDN06_Female]

If I'm going into Central London I would almost exclusively use the Underground system, the Tube. …surface transport is quite slow; buses, because I'm 65, I have a bus pass for free transport for buses anyway. But the buses are very slow because London is fairly congested. So if you need to get to Central London it might be 30 minutes on the Tube but might take you an hour on the bus. …it's faster, though it's a little bit more expensive because I've to pay for that and I don't get that for free. But the Tube doesn't get you as close to places because buses have more frequent stops than Tube lines. But having said that I don't mind walking, I get as close as I can by the Tube and then walk. [LDN12_Male]

I'm a major user of the Tube. I tend to use the Tube for all aspects of my life mainly because it provides the level of speed compared to bus transportation. The traffic congestion is a major issue in this city so the Tube offers rapid transport regardless. The time can influence it (congestion), whether it's a working day or week for instance. Sitting on a bus, if you're contemplating a longer journey is a no-no for me because it just takes too long. So those influence and sitting in polluted traffic isn't my idea of a good time either. So all aspects of my life, shopping and necessary visits to the dentist, doctor's and anything else I would use the Tube system. [LDN14_Male]

Going by Tube to town than driving, because driving, you have the traffic and all that. You're more relaxed by the Tube and it's faster. You can get from A to B in less than half the time. And I wouldn't dream going by car to the West End. I would take the Tube because it's faster and less stressful. If you're in a hurry and want to get from A to B by a certain time, you don't want to be held up in traffic because you get stressed and the blood pressure rises, you're not relaxed. Someone driving awkwardly may also cause delays. There are many factors that will cause delays and holdups in traffic. The bus is even worse, because if you go by bus, the distance between each bus stop is very short in this country, sometimes it's not more than a hundred yards. This doesn't happen everywhere but next to us, we live in the city centre in London, there is one station one hundred yards from here and another one hundred yards from here. So imagine how do you get to the office. [LDN15_Male]

If I'm in a hurry I won't take the bus. If I have an appointment and I want to get there on time, I'll never dream of taking the bus. I'll take the Tube because that's the most reliable way to get there and the quickest way. [LDN15_Male]

I do the bus a lot. I do not use the bus into Central London; that would be my last resort because it's so much slower. If I'm going into Central London I take the Tube, which is a much quicker way of getting to places. … My default mode is the Tube. Sometimes I would use the bus but my default mode is the Tube. [LDN17_Female]

Trains

Sometimes, especially with the train it can be delayed due to signalling issues, so that can means that we are on the track for longer than normal. [LDN04_Male]

Yes, the train is quicker, the bus can take an hour. [LDN09_Male]

INT If you're taking the Rail, what would the journey be like?
LDN11 Longer, 30 minutes to an hour longer minimum, that's typical. … It's more time consuming and in my opinion there is more chance of delay happening by Rail. [LDN11_Male]

Private vehicle

Long distance and traffic in the morning. I think I will likely spend more time driving than I would with public transport. [LDN04_Male]

Because there is no Tube station there and the train takes more time. [Driving] is faster. [LDN05_Male]

Yes, like how the traffic situation might be. Whether I would need to carry things. Whether there is more than one person in the car. Whether I'm going for a period of time for holiday or to visit people. Just whatever is more convenient. Well I suppose, whether there is a reliable public transport route. …there are a lot of factors and living in Greater London, one of the factors is that to drive, sometimes it takes longer to get out of a busy city. Sometimes public transport is quicker. [LDN07_Male]

The other day I drove into Acton and it took me an hour and three quarters to get in because there was a drive of about 45 minutes at virtually walking pace. An hour and forty-five minutes of just sitting in the car is just a waste of time and that for me is the worst thing really. [LDN10_Female]

If I want to visit a stately home, public transport isn't great to certain locations because you may go to a place and change to another bus ride and it may take an hour or more. So, no, I would keep the car, not that I use it often. It is very useful. I was helping a relative, who lives close to me, and the journey time as far as I was concern, there was no question on whether to go on public transport because it was just way too slow. … Sometimes when I visit my relatives it's not too far away but by public transport it is exceedingly awkward so I'll drive. [LDN14_Male]

No doubt, it's less stressful and much faster because you don't have stoppages. I can work out, for example, I want to go from where we are now to Leicester Square, if there is no hold up, which is unlikely, I'll be there in 40 minutes. I can make an appointment to be there in 40 minutes and I can be on time. … Exactly. Sometimes there might be some hold up in the tunnels because of signals but we're talking about seconds and minutes if that happens, that's all. If I were to go to my dentist in Leicester Square, which is about between 10 and 15 stations from here, I give myself 45 minutes and I'll be there before time. If I take the car, it will take me two hours because of the rush hour. [LDN15_Male]

I tend to only use them for very short journeys or when I'm carrying more or heavier stuff. So I would only use a bus for a short journey. [LDN17_Female]

By bicycle or walking

You can take a bus, but there is no need to. It's only a four minute walk, four to five minutes' walk. [LDN02_Male]

Yes, it's about half an hour walk that I take everyday… It feels really good actually. I think I'm very lucky as I'm one of the only people that I know who walks as almost no one walks to work and that's a really good thing. …and because of where I live, if I were to get a bus I would have to walk to the bus stop and then walk from the bus, so it's the fastest way anyway to get there. …I think it will be the quickest way anyway. [LDN08_Female]

I could but I don't have a bike, sadly. If I have a bike I definitely would because that would only take me five to ten minutes and it's really quick. [LDN08_Female]

Yes, it's often slower walking and would also save you money if I walk instead of taking the Tube. I do that quite often and save a bit of money as well. [LDN08_Female]

When it's shorter distances, I walk. I try not to drive. I don't drive as much now unless I'm pushed for time then I'll drive. But most of the time I'll just walk or hop on the bus. If it's a short distance, about seven to ten minutes' walk then I'll walk and treat it as an exercise. [LDN16_Female]

Reliability

Public transport in general across different modes

…whether I can get there on time or not, punctuality is absolutely of importance. If I miss a meeting, or if I'm late for a meeting, I think it doesn't speak well of me so I've to get from point A to point B in time and within the schedule that the transportation company has provided. Otherwise, it is not good for the productivity level and also, on myself as well, of the impression of me. [LDN02_Male]

The reason I choose mine is …reliable, it has to be reliable and it has to…have no delays for work, yeah. If it says it comes at this time, it has to be at this time. If it takes 20 minutes, I want to know it will take 20 minutes, yeah. [LDN03_Female]

I just tend to leave earlier so if there is any delay, I won't get to work so late. I factor the potential delay into my commute in the morning. [LDN04_Male]

It is very reliable. I would say it's 99% of the time reliable, I get to work, I get home. There are times when you don't, it's chaos, and you remember those. [LDN06_Female]

I would take the route that is more reliable. If that takes longer I would have to leave earlier. [LDN07_Male]

This means I've to allow more time to travel where I'm going. My usual commute to work is, I take different routes depending on what time I've to be there for the meeting, I would take the route that is more reliable. If that takes longer I would have to leave earlier. [LDN07_Male]

Yes, like how the traffic situation might be. Whether I would need to carry things. Whether there is more than one person in the car. Whether I'm going for a period of time for holiday or to visit people. Just whatever is more convenient. Well I suppose, whether there is a reliable public transport route. …there are a lot of factors and living in Greater London, one of the factors is that to drive, sometimes it takes longer to get out of a busy city. Sometimes public transport is quicker. [LDN07_Male]

Buses

Commute by bus? I wouldn't do it. Bus is just one of the backups, for example if there is a Tube strike and there is no other way to commute but bus. But I wouldn't commute by bus in London for work. But if I'm going out for other things and don't need to be in a rush or don't have to be there on time, then I will consider bus, yeah. [LDN03_Female]

…there are buses, but buses are not reliable. Sometimes the bus is delayed or there's traffic, the bus doesn't come on time because it gets stuck in traffic. If there is no traffic, actually the bus takes about less time than the Tube. It's more convenient actually because I don't have to change, I just take one bus to go to work. But the thing is that there is so much traffic in London. [LDN03_Female]

Buses are quite good actually, mostly reliable but they don't come at the time you think they will but I don't think many people aim to get a bus at a certain time because of that. You'll just go to the bus stop and wait till they arrive. But they're fairly reliable in London, I would say that they are quite good. They don't often have cancellations or things like that, they are pretty much always the same. So the buses are quite good, it's just the traffic problem but then the buses have got lots of bus lanes so that does help. [LDN08_Female]

Tubes

The Tube here breaks down a lot you must admit. Some lines are notorious for being unreliable. [LDN02_Male]

Breakdowns. Breakdowns happen fairly often on some lines. That causes stress because you need to plan alternative routes to your destination. [LDN02_Male]

The Tube is more, it's just like, it comes at the right time and you know exactly how long it's going to take and you'll not be late. [LDN03_Female]

If I'm in a hurry I won't take the bus. If I have an appointment and I want to get there on time I'll never dream of taking the bus, I'll take the Tube because that's the most reliable way to get there and the quickest way. [LDN15_Male]

My default mode is the Tube. Sometimes I would use the bus but my default mode is the Tube. … The Tube works well most of the time. It has its own problems, signal failure, problems on the line or whatever, but most of the time it's efficient. [LDN17_Female]

Trains

It's generally quite good. Again, it depends on the rail company. Some of them are really notorious, especially in inner London: Southern Rail. Southern Rail is the one that goes from London Bridge to my place but it's not reliable at all. So it depends on the rail company. But in general, the services that go out of London are quite reliable. [LDN02_Male]

The Tube system works well so long as they don't go on strike like the rail people at the moment then you're totally snookered. That's probably more on the railway strikes but strikes are usually a major problem for a lot of people. [LDN04_Male]

Sometimes, especially with the train it can be delayed due to signalling issues, so that can mean that we are on the track for longer than normal. [LDN04_Male]

So the major stress is getting to the station as the trains are very punctual these days and tend to come a minute early so you have to be there. [LDN10_Female]

INT If you're taking the Rail, what would the journey be like?
LDN11 Longer, 30 minutes to an hour longer minimum, that's typical. … It's more time consuming and in my opinion there is more chance of delay happening by Rail. [LDN11_Male]

The only problem is that there is often delay, cancellations or problems with the train lines, especially in where we live. So, in theory it's great when it is all running smoothly but that's not very often. … Not the Southern but the South Eastern Rail. But it isn't quite as bad as the Southern Rail but I would say it's the next worst one because our trains are almost never on time. They are always at least a few minutes late. [LDN08_Female]

Private vehicle

When I do not want to rely on public transport, like when it is for a very important appointment then I will drive. [LDN16_Female]

Cycling and walking

I try to walk as much as possible even if it's quite far because I enjoy it more and you don't have to worry about anything being late. [LDN08_Female]

INT You would like to be able to walk to work and you mention that this is because of the sense of control?
LDN07 Yeah and the simplicity too. But mainly because I can be completely independent.
INT So you wouldn't be dependent on the reliability of the network?
LDN07 Yes.
[LDN07_Male]

Weather

…what the weather is like, and you know, if it is a nice day, I wouldn't mind just walking over and, you know, taking the…I don't even mind getting lost because I can wander around. I like wandering around. But if it's cold, if it's raining… Weather is a huge thing…I think taxis are good for when it's raining. [LDN01_Female]

I think it plays a big part but people get used to it. You see people cycle even when it's raining or something. People are quite good here dealing with weather. For me, I wouldn't want to cycle on a rainy day because it's quite miserable to cycle on a rainy day. [LDN03_Female]

My car is used when it's raining very heavily. [LDN16_Female]

Using journey planning application or tools

You know, I can check my Google Maps which will tell me you've got to change two buses here and one train here, then one more bus here, it's okay, fine, I'll reach. [LDN05_Male]

So, it was the journey in the evening that made me so fed up despite my best attempts with various applications on my phone trying to get me around traffic but the traffic between Surrey and London is just incredible. [LDN10_Female]

I look at applications on the phone, look at whether there are any disruptions. Yes, I do try and plan the route. … It is fairly easy. There are fairly many Tube lines, fifteen I suppose, but it's fairly easy to look through those and see if there are any disruptions. What is more difficult is on buses where you want to use the bus because there is no Tube lines nearby and that is sometimes more difficult to do and you'll need an application to do it as there are hundreds of bus routes. … There's one on the iPhone called 'Tube Map', that's one that I use. But if I'm planning to use the buses I would use TfL.gov.uk. … The TfL route planner is quite good because it tries to use real-time information. [LDN12_Male]

Sometimes when I don't want to use the Tube I can force the application to use buses only or not use river transport that sort of thing. [LDN12_Male]

This would make so much of a difference to people. If you can find a more efficient way to be able to use the system then you would be able to increase its capacity without having to build more infrastructure. I think you can see that happening in things like road travel where intelligent systems know what the traffic flow is like, for example Waze, which knows what traffic flow rates are and can optimise on the fly so you don't necessarily end up with the same route that you started out with as they can change it for you. So I'm sure that things like that will soon come into travel apps as well. [LDN12_Male]

Perhaps there is a two-stage process here. First, you use your tablet or laptop to investigate different routes. Then you transfer this information to your smartphone and then implement them using this small device. … I think that would be practical on a bigger screen because you can look at dozens of options, use the network maps, compare it with typical breakdown and congestion information to optimise your own individual travel route that way. These things are probably quite complicated to do but I imagine that they will come out in the next 10 to 15 years. [LDN12_Male]

Because I've lived here for a long time and I know how it is most of the time. I might check if there's any holdup on the Tube, going on my computer to look up on the Transport for London page if I have an important appointment. But most of the time I just walk to the Tube station and see what happens. … If I were just using the car in the local area then I wouldn't look up what's going on. If I was doing a longer journey, say in

South London, I would take a longer route round the periphery of London and would check the roads then using a computer on whether there is a traffic jam etc. …when you do check and find that there's a problem and had time to plan for it then it's less troublesome than sitting in traffic and not being able to do anything about it. [LDN17_Female]

Theme 3: Perception and Beliefs of Different Transport Modes

Perception of the transport

Perception of public transport

Commute by bus? I wouldn't do it. Bus is just one of the backups, for example if there is a Tube strike and there is no other way to commute but bus. But I wouldn't commute by bus in London for work. But if I'm going out for other things and don't need to be in a rush or don't have to be there on time, then I will consider bus, yeah. [LDN03_Female]

You can't expect everyone to travel by public transport, I don't think it's a good way to travel for everybody. For some people it is okay but for some people it's not okay. [LDN05_Male]

Traveling by public transport in London can be quite brutal sometimes and it can definitely have a negative impact on your state of mind. It can be horrible where you start your day with a terrible journey and then you still got the rest of the day ahead of you – it's not a great journey. [LDN06_Female]

Public transport is a better choice than driving in London in my opinion. [LDN06_Female]

Yeah, I mean catching the Tube is not fun but it's kind of like a necessary evil really. You just got to get on with it! [LDN06_Female]

I think it's really good. The amount of connections that there are is amazing, you have lots of options and you can get anywhere, which I think is great. [LDN08_Female]

In fact, the Northern line has another line that runs underneath it that was started in the 1930s and would do just that, an express route from Outer London into Central London. It was started but was stopped during the war and it never restarted. So there are a lot of lines in Outer London that were started but were then abandoned. I think this is because we were moving to an era of cars and people thought that public transport weren't important as they can use their cars. But now, we are reversing that process. [LDN12_Male]

Perception of private vehicle

If they have cars, they don't work in central London. They work in the outskirts of London where the traffic is less busy and there's no Tube basically, no Tube lines. [LDN06_Female]

They think they can control their own car but then you don't really control your own car because you are limited by the congestion and other things. I think that it is a perception issue. [LDN12_Male]

Yes, kind of like a status symbol. I think people do but that's not everybody and that has always been the case. I suppose if you have lots of money and you want a sporty type of car and want to be seen then yes, you know, it's up to you to be quite honest, but a car just gets me from A to B and as long as it's reliable that's all I care about. [LDN13_Female]

Perception of cycling and walking

Yes, it's about half an hour walk that I take everyday… It feels really good actually. I think I'm very lucky as I'm one of the only people that I know who walks as almost no one walks to work and that's a really good thing. …and because of where I live, if I were to get a bus I would have to walk to the bus stop and then walk from the bus, so it's the fastest way anyway to get there. …I think it will be the quickest way anyway. [LDN08_Female]

No, I don't. I think you've got cyclists and non-cyclists. I think we have been brought up in a different culture unlike somewhere like Holland where everybody cycles, we never really had that. So I don't think having cycle lanes would encourage people at all. [LDN13_Female]

If we go to the GP we walk there because it's not far to the GP. If we go shopping it's also walking distance to go to Tesco. In the beginning, when there is change, when you change from one mode to another, it's hard but then you'll get used to it. You'll always get used to it…[LDN15_Male]

When it's shorter distances I walk. I try not to drive. I don't drive as much now unless I'm pushed for time then I'll drive. But most of the time I'll just walk or hop on the bus. If it's a short distance, about seven to 10 minutes' walk then I'll walk and treat it as an exercise. [LDN16_Female]

Perception of private-hire vehicles

I don't use it very often but I did use the Uber once…I think it's also encouraging more car travel. I think if you can, you should travel by public transport during the day. It is okay for late night travel because the roads are quiet anyway and it's getting people around safely. But I would say not in the daytime. [LDN08_Female]

I don't, and the reason again is security. I have a firm that is local who vet their drivers. If you take Uber, you just call someone and you do not know who they are. Most of the time it is okay but you do hear instances when it's not okay. … I understand that I may be missing a good price but the main reason for me using these vehicles is the security. Therefore I want to have this company that is local and I can rely on. [LDN17_Female]

Desire for having a car

I think I can be happy [driving]. I think I'm doing something physical, I like to drive; it's a fun activity because I like to drive so it's no problem. [LDN05_Male]

I'll never buy my own car, not in London because I don't enjoy driving in the busy traffic so I won't do that out of choice. [LDN08_Female]

I think we should put our finances into electric cars and self-drive cars because people will always want to leave and come back when they want to and people will always want cars. Like cigarettes, even if you put the price up people will still want to buy them and they will find the money. People like the freedom of having a car and the safety. Self-drive and electric cars in cities is where we have to go. [LDN10_Female]

If you really ask me about cars, a car just gets me from A to B. I had a really ancient car until three years ago and I used it for over 20 years and it was fine till it went wrong. I don't know… It takes me from A to B and that's all I'm interested in, I'm not really a car person. [LDN13_Female]

Yes, kind of like a status symbol. I think people do but that's not everybody and that has always been the case. I suppose if you have lots of money and you want a sporty type of car and want to be seen then yes, you know, it's up to you to be quite honest, but a car just gets me from A to B and as long as it's reliable that's all I care about. [LDN13_Female]

I would consider giving up the car if my health wasn't good enough for me to do it. If I'm no longer able to do it or not in full command of the vehicle. But that is difficult to recognise when that happens to you and one hopes one will recognise when that happens. … I guess I would have to use the taxis or public transport more. But when I'm not strong enough to drive a car I don't think I'll be moving around much. [LDN17_Female]

Need for a car

I mean it would be great if we don't have cars but then, you see, even when it's disabled people, a lot of them need the car because they can't use public transport…[LDN01_Female]

I think it's because they want to think that if they want to get out they can. I don't even think that they need. Because you can't even drink and drive in this country. So, that's the other thing, you can't drink and drive, you still need to take a taxi, even if you can drive, unless you don't plan to drink when you go out partying. I don't know, habit? Maybe they like going out of London? [LDN01_Female]

I can always take taxis, why do I need a car? If I can just call up a taxi. [LDN01_Female]

Yup. It could be and again it's the perception of what people deem a car to be. People deem it as a necessity in this country, apart from London of course. [LDN02_Male]

It's like in Hong Kong, public transport is so convenient and it's reasonably priced, plus you have taxis as well. If you need you can get a taxi, so I wouldn't think about buying a car. [LDN03_Female]

…coming here we really feel the need to have a car. I can give you one example of one day when I was in university. Because we have two different campuses, I went from one campus from another one, it's in a small town, Thamley on Thames. After 7.30 there was no bus, I couldn't get home, I had to call my husband to pick me up and drive me back. So imagine for people living here without a car, they can't go anywhere. Especially if you go to smaller areas, smaller towns, you must have a car. [LDN03_Female]

Because I lived in London for eight years and I've not really needed to drive in London so therefore I've never got round to getting it. But now that I'm considering moving out of London I'm going to get my driving licence because other cities wouldn't have just as good public transport. … I probably wouldn't get a car even after I learn to drive in London because of the expense and you don't need it. Public transport is a better choice than driving in London in my opinion. [LDN06_Female]

Definitely. I have to drive for my job really, there's no choice, and other occupations like electricians also need to drive so I often look at other people driving when I'm driving and think 'do you really need to drive?' I think if you have no need to you should use public transport. [LDN08_Female]

If we didn't then a car becomes necessary. But when you have options then it isn't. [LDN09_Male]

If I need a car to get to work, like in some places you need a car because the public transport isn't good enough to get to wherever. [LDN09_Male]

My previous car failed so I needed a replacement vehicle as we live very remotely and don't have any access to public transport nearby where I live, that's why I need a vehicle. [LDN11_Male]

Less and less, and I tend to drive out of London and for most reasons it's social driving or to garden centres which tend to be on the periphery, because I have a garden. So if you want to transport things, visit friends, or visit stately homes (I'm a member of the National Trust and they've properties all over the place) so that's the sort of reasons why I really use my car. [LDN14_Male]

When I deem myself to be gaga! It's one of those things that means freedom and if I want to, on a Sunday morning, decide to go to wherever today and I've to carry something then the car is there. You want to make a decision quickly for those moments. It is freedom. If I want to visit a stately home, public transport isn't great to certain locations because you may go to a place and change to another bus ride and it may take an hour or more. So, no, I would keep the car, not that I use it often. It is very useful. I was helping a relative, who lives close to me, and the journey time as far as I was concern, there was no question on whether to go on public transport because it was just way too slow. I'm aware of pollution and all that but sometimes it's the best of choice. … Sometimes when I visit my relatives it's not too far away but by public transport it is exceedingly awkward so I'll drive. [LDN14_Male]

Yes, you need a car in London because the distances are quite far. I think in area, London is the largest city in the world. … I think the population is not but the area is definitely largest in the world. To drive from the North to the South, from one end to the other, you're talking about a few hours, two to three hours I think with all the traffic and traffic jams. … As long as we are healthy and able to drive we'll have it because it's essential to have a car. … Without the car you're immobile. You can only go as far as where your feet can take you. … The older you are, the more difficult it is for you to walk and with the rain and what have you. [LDN15_Male]

Having a car is quite expensive but for certain things I rely on it. I don't do a high mileage and that does make it more expensive but the convenience is such that I still want to have a car. … I decide that I can afford it because it is a priority for me for the convenience of living. But yes the road tax, insurance, servicing, MOT etc. adds up over the year. [LDN17_Female]

Cycling as recreation

I think it'll be okay mostly. It's quite good where we live because I go through a green hearth and then a park so it's all quite green, quite lucky where I live. I wouldn't cycle anywhere else but I think that particular route would be okay. … I would do short distances but I wouldn't feel comfortable cycling in the city because I feel that it's too dangerous and I'm not confident enough. … I think there isn't a good relationship between drivers and bikes, and there are a lot of shouting that goes on so I wouldn't want to do it. [LDN08_Female]

I use the bicycle for more recreational purposes because I live on the outskirts of London and can get to parks and quieter roads fairly easily. [LDN12_Male]

I think the bike system within Central London is really good and people have been using it. It has been beneficial and has helped kept cars out of the centre of London. [LDN13_Female]

A form of exercise

And I also find that if I go by Tube and by train, I'm walking up and down all the stairs and it has helped me with the problem with my knees and I've lost weight because I

always walk up all the elevators and often walking fast while carrying quite heavy bags. I just find that that is really good for my health rather than being sat in the car, probably fidgeting out of boredom because I'm sitting in a traffic jam for 40 minutes. You know fitnesswise, that is not great. Some parts of my job can be very static even though it can be an active job, sometimes I have to sit in the car all day or stand still in the cold all day so it's not necessarily making your aerobic fitness very good. That's why going on the Tube and the train is a little better for your health I think because you walk more and move more. On certain days I'm even getting out of breath so you know that this is good for you. … Recently in London, on the escalators everybody stands on the right and if you want to walk you go to the left, and they're thinking about changing that, making people stand together on both sides. Londoners are up in arms because they say that that's the only exercise they get in their day and that's true because for most Londoners that's the only exercise that they really get. [LDN10_Female]

I think there is a lot of pressure on the country to clean up and get their pollution levels down, and cycling is one way. And it's healthy for people, especially in this age where there is a lot of obesity, it is important to have exercise. [LDN10_Female]

LDN12 The local shops for food are about 0.5 miles away.
INT So you'll be happy to walk half a mile?
LDN12 Yes, totally happy. …I'm reasonably healthy and fit so I don't find it a problem. I'm a believer that exercise is good for you so I consider it as part of one's health regime.
[LDN12_Male]

When it's shorter distances I walk. I try not to drive. I don't drive as much now unless I'm pushed for time then I'll drive. But most of the time I'll just walk or hop on the bus. If it's a short distance, about seven to ten minutes walk then I'll walk and treat it as an exercise. [LDN16_Female]

Linking transportation to the environment

I hate flying for all sorts of reasons, and also for the carbon footprint and all that sort of stuff…if I can, I take the train. [LDN01_Female]

But I think even if I don't have a mobility problem, I still don't like taxis. I think, politically, I always prefer public transport. … I think because you use up less, you know, it's better for the environment, you don't have to spend so much. [LDN01_Female]

I guess you read a lot about pollution levels and how polluted London is and how that's so bad for your health. … I do a lot of running outside and I do wonder if, because the roads are so busy and I run along the roads with all the fumes coming out of the cars and stuff, are negatively affecting me. That does cross my mind. In addition, the pollution levels on the Tube are quite worrying as well. But it's just something you kind of expect that living in a city, it's going to be kind of polluted and probably the air that we are breathing in is very dirty. [LDN06_Female]

I think in any city that [public transport] is the best way to get people around and with less pollution because that's what I think when I'm in the van for so long surrounded by the other vehicles with fumes everywhere. [LDN08_Female]

I think there are a lot of pressures on the country to clean up and get their pollution levels down and cycling is one way. [LDN10_Female]

I think the environment is much more important and irreplaceable and priceless, so we have to find a way of transporting ourselves without killing the planet at the same time. [LDN10_Female]

LDN11 In my opinion I consider a diesel to be more reliable, durable and longer lasting.
INT What about the environmental impact of a diesel compared to a petrol car?
LDN11 I don't consider that.

INT So the emissions from the vehicle is not important to you?
LDN11 No.
[LDN11_Male]

Not in London but I've [cycled] on a couple of vacations, but I don't think I would because there are too many fumes. [LDN12_Male]

I think if I live in the centre of London I'm not sure if I would own a car. Because if you were to take a long journey you could always hire one and money wise, it wouldn't be worthwhile to own a car if I lived in the centre of London. But everybody is different and everybody has cars for a different reason. But I know for a fact that I wouldn't bother. You have to pay for parking permit, congestion charge when you move the car. They are just all added costs and pollution in the centre. [LDN13_Female]

Yes, it's the congestion, pollution and time of the travel. I'm afraid that the traffic grows exponentially so if you have more roads, you'll soon have more cars as well and there will be more traffic. I don't know how you solve the problem. [LDN14_Male]

Theme 4: Anticipated Travel Experience

Stress

Stress when using public transport

Least stressful? The bus. [LDN01_Female]

…it's always stressful going on the Tube as well because there's always more people and you know. [LDN01_Female]

Breakdowns. Breakdowns happen fairly often on some lines. That causes stress because you need to plan alternative routes to your destination. [LDN02_Male]

Stressful? Yes. There is a lot of demand. Especially during the peak hours, eight to nine, it's very difficult to get a seat first of all. Secondly, it's even difficult to get on the train. I travel every day via Canada Water, a station called Canada Water, usually it's very common to wait for three or four trains before I can get onto the train. There are just so many people who want to commute. [LDN02_Male]

Yeah, definitely it is stressful and I remember I went to London after work once, during rush hour, it's just like…I got a headache because I couldn't breathe in the Tube and you get so many people around you. It's very tiring, especially after a day at work and then you stand there with so many people and you just cannot get on because you have to wait for the next one, next one. It's just very stressful. [LDN03_Female]

This is tricky. I wouldn't say it is stressful. I wouldn't say it is stressful partly because I have gotten used to it. [LDN04_Male]

Traveling by public transport in London can be quite brutal sometimes and it can definitely have a negative impact on your state of mind. It can be horrible where you start your day with a terrible journey and then you still got the rest of the day ahead of you – it's not a great journey. [LDN06_Female]

To be honest, not with my job. I think it's, in some cases, I can just switch off in the train but you can't when you're driving. It is stressful when it doesn't work when the trains are cancelled and whatever, but it's not too bad. [LDN09_Male]

…it used to stress me out because at the end of the day, I have to take the work car and my kit back to the depot in Acton, pick up my car then go. Sometimes I have shifts where it can be quiet but usually I get quite stressed because I'm like, 'Why aren't they

sending me home because the traffic is building up and I've to get all the way to Acton'. If they let me off early, I'll have a quicker journey. But now, when I finish my shift I'll just skippily hop to the Tube station and get on the Tube, which is normally very quick. 10 minutes on the Tube and then the trains, which go every half an hour. Occasionally they'll cancel but it's pretty good service really. And once I get on the train I'm very relaxed, I've got my water, I've got my book and I'm quite happy. [LDN10_Female]

I tend to travel during off-peak times when it's not too crowded. At least it's not too crowded when I first get onto the train as it's in the outer parts of London. Again, if the lines are busy, which often is the case for many of the lines in Central London, you've got to stand occasionally. But, you see, Central London is fairly compact and the places that I go to are usually within a four-mile radius of Central London and that's maybe three or four stops on the Underground. … But there have been times when I had to travel during peak times and yes it is uncomfortable and very crowded. Stressful? I guess that it tells me to travel at a different time and try to plan things. But the thing I'm thinking about is traveling to and from the airport when you have to travel at a certain time and this can be particularly stressful when you have a suitcase. [LDN12_Male]

Going by Tube to town than driving, because driving, you have the traffic and all that. You're more relaxed by the Tube and it's faster. You can get from A to B in less than half the time. And I wouldn't dream going by car to the West End. I would take the Tube because it's faster and less stressful. If you're in a hurry and want to get from A to B by a certain time, you don't want to be held up in traffic because you get stressed and the blood pressure rises, you're not relaxed. [LDN15_Male]

I suppose if I were working it would cause me a lot of stress. But because I'm a pensioner and not working, my time is quite free. If I'm held up on the buses, for example, it doesn't bother me because I do enjoy the view. But on the train, of course, you do not have a view to look at, or the Tube, then it's very inconvenient and annoying. [LDN16_Female]

Stress when using private vehicle

I have the radio on and sometimes I've got a hot drink with me, I smoke so I've a cigarette, so I feel equipped for the day. Unless sometimes there's an accident or something early in the morning then that's a bit of stress, otherwise it's fine for me. [LDN10_Female]

…it used to stress me out because at the end of the day I've to take the work car and my kit back to the depot in Acton, pick up my car then go. Sometimes I have shifts where it can be quiet but usually I get quite stressed because I'm like, 'Why aren't they sending me home because the traffic is building up and I've to get all the way to Acton'. If they let me off early I'll have a quicker journey. [LDN10_Female]

I've been doing it for years and years and have become just like a cab driver. I don't get stressed about it at all because I think after years and years that's what it does to you. You realise that there is no point getting fed up and stressed about it. … I've driven under quite a lot of pressure in London and I quite like the challenge of that but there's no point stressing. The way I drive, let's say we've got a deadline like a footage for the one o'clock news and it's ten past twelve and we've got half an hour's journey then I'll drive in quite an aggressive way, as fast as I can safely (I'm quite a safe driver and an experienced driver). But if I'm not in a rush I would just cruise along. So there are two ways of driving. [LDN10_Female]

Being able to do something during the journey

I'll do reading. If I'm over the ground, I can check my phone, read the news, or check emails. Yes, ideally, I wouldn't want to sit there and stare at the wall, I would like to do something with the time, absolutely. … maybe not full productivity level but it occupies

me for some time. And it's good to catch up with the news and what is happening around the world – that's very important. [LDN02_Male]

On the Tube? Mainly reading news, on the phone or listening to music, yeah. …or read the news while I'm waiting. So it's kind of wasting my time if I just stand there and don't do anything so it's better to do something. [LDN03_Female]

I just use the opportunity to watch movies, so that also helps me to pass the time and take my mind off. … Sometimes I watch a movie, read the newspaper, and some occasions I read a novel. Well, sometimes I watch a movie, read a novel, most of the time I watch a movie, sometimes I read the newspaper, read a novel, few times I also work…well I wouldn't say work…I would like to say I have done some work on the train but it's not that much to classify as work. It is hard to do your work on the train you get what I mean. … I wouldn't say it's the best use of my time but it is a good distraction. … Well, personally, I have never liked long journeys in the first place and it's exactly an hour and a half of doing nothing and I get restless easily so I need to be doing something and movie is the most interesting thing I can do. Besides that I get to watch it on my phone, it also helps. [LDN04_Male]

INT How would you describe your daily commute on the public transport?
LDN07 I would say uncomfortable and unproductive.
[LDN07_Male]

I think it's important; the time wasted. I prefer to travel by the train as I can read, whereas on the crowded Tube I can't do anything but stare at the posters so that feels like time wasted. If the Tube was more reasonably occupied I'll be able to read or do something. So I think the quality of travel is quite important as well. [LDN07_Male]

I think it's, in some cases, I can just switch off in the train but you can't when you're driving. [LDN09_Male]

Not really because in the car I can listen to the radio, make phone calls without having anyone listen to me and having a cigarette which I can't do on the train really. But I guess that it's just a different experience because I started reading books, something I couldn't do when I was driving, and that's something I haven't done in like five years. [LDN10_Female]

And once I get on the train I'm very relaxed, I've got my water, I've got my book and I'm quite happy. … It's more relaxing sitting in the train than the car and it's about time really isn't it? Both journeys are quite long. [LDN10_Female]

My experiences are that some people who travel on buses…The nightmare thing is people using their cell phones. You'll have endless people talking and playing games. If you want to read something, it can be quite disturbing. [LDN14_Male]

Comfort

Physical comfort

Maybe like have better facilities: like the Tube has air-conditioning, has better ventilation so the Tube has more fresh air in the Tube and inside the Tube station. …especially in summer, London is terrible. [LDN03_Female]

I think driving is quite comfortable because you just get into the car, it doesn't matter if it rains or if it snows or whatever, you can get to your place and find a place to park …it's more comfortable of course, driving. [LDN03_Female]

In addition, the pollution levels on the Tube are quite worrying as well. But it's just something you kind of expect that living in a city, it's going to be kind of polluted and probably the air that we are breathing in is very dirty. [LDN06_Female]

But once I get onto the train, before that it's cold on the platform, it's reasonably warm and I can read a book and that's very relaxing. [LDN10_Female]

I think they're not bad but I do criticise the trains because I think they're expensive, dirty, and often overcrowded, so definitely unpleasant. I've just got over a "flu-ey" cold where I've been to the doctor and been ill for over two and the half weeks and I'm sure that was due to sitting next to people sniffing, sneezing and coughing, and the trains are not cleaned properly so I'm sure you catch a lot of things on the train and the Tube. …and it's dirty, you know all that air that is pouring through the tunnel with soot and whatever. [LDN10_Female]

Although I do accept that they do a lot of upgrading work regularly on the different lines. On the Victoria line trains I've noticed a lot of nicer new trains. … the fact that the new trains are cleaner. [LDN16_Female]

I would use the Overground because it's the newish, it has the new stock on the line so it's pleasant to use. In summer and winter, it's either air-conditioned or heated. That's another major consideration too. [LDN14_Male]

My experiences are that some people who travel on buses consume food, which in an un-air-conditioned bus leaves much to be desired. So it's not a very pleasant travel experience. So that I find is totally objectionable. Whereas in other cities food is banned, they've not done it over here and I think it's a big mistake. [LDN14_Male]

I had it particularly on the Underground where it's not air-conditioned and it's almost impossible to provide on some lines air-conditioning because there are no outlets. Unlike New York or some degree in Paris where the platforms take the residual heat distributed from the air-conditioning equipment. London's is not air-conditioned though there are a few lines that are more open and they have introduced air-conditioning in them, and personally they aren't convenient for access and thus of no use to me. I live on one of the lines that is the oldest and even though they've new rolling stock but then you've got continuous days of heat so the comfort can be quite stifling, quite honestly. … It's less of a problem in the outer areas where it is more open and actually above ground, but once you come into the centre areas you're actually very limited as to what you can do, I think. I do think the planning has been brilliant for the newish lines compared to the older ones where no provisions were made for improving or having outlets built into the system to take some of the heat out. I guess all governments are short of money these days so it's probably unlikely to happen. [LDN14_Male]

I find that the Underground in England is very nice, very clean. In Paris, there is a problem there of pickpockets and you've signs all over the place asking you to beware of pickpockets. … Generally speaking, it is safer I'm sure. It's more organised here. … Clean and no graffiti, unlike in Paris. [LDN15_Male]

Aesthetic (environmental) comfort

Because, even though the bus takes more than half an hour, it's just so stress-free. I just get on the bus, read or whatever, it just takes me straight to my house, bus stop, right outside my house. [LDN01_Female]

I try to walk as much as possible even if it's quite far because I enjoy it more and you don't have to worry about anything being late. … I think I like walking anyway, I guess living in Durham I grew up walking everywhere so I'm used to walking lots and it's not unusual for me to walk half an hour – that's totally normal. And it's nice because you can see sights in London, you can walk past the famous places whereas if you're on the Tube you're stuck underground. [LDN08_Female]

Oh yes, because I've a flat in quite Central London and I used to cycle to Shepherd's Bush where I used to be based and then to Oxford Circus as well. … I would cycle to Paddington and go along the canal for most of the way. It has its own challenges but at

least you were not on the road so that's nice. I found a very good route. [LDN10_Female]

I'm happy to walk to the nearest shopping mall, which is probably about two and a half miles away. …because it's a nice walk along a stream and there's not too much traffic most of the time. [LDN12_Male]

I find that driving into London is congested and worrying. It seems like a mini battle with people pushing in and trying to get to somewhere quickly… I don't like driving in London. [LDN12_Male]

Sitting on a bus, if you're contemplating a longer journey is a no-no for me because it just takes too long. So those influence, and sitting in polluted traffic isn't my idea of a good time either. So all aspects of my life, shopping and necessary visits to the dentist, doctor's and anything else I would use the Tube system. [LDN14_Male]

I suppose if I were working it would cause me a lot of stress. But because I'm a pensioner and not working, my time is quite free. If I'm held up on the buses, for example, it doesn't bother me because I do enjoy the view. But on the train, of course, you do not have a view to look at, or the Tube, then it's very inconvenient and annoying. [LDN16_Female]

Social proximity and interaction

Comfort of course, but comfort is difficult to get during peak hours. [LDN02_Male]

Yeah, definitely it is stressful and I remember I went to London after work once, during rush hour, it just like…I got a headache because I couldn't breathe in the Tube and you get so many people around you. It's very tiring, especially after a day at work and then you stand there with so many people and you just cannot get on because you have to wait for the next one, next one. It's just very stressful. … In Hong Kong it was quite stressful as well, because there were so many people going to work but the good thing about Hong Kong is that even though there are so many people, everything is organised. [LDN03_Female]

…sometimes you have situations where it is a bit crowded so everybody is bumping into each other. Even if you get a seat, the person by your right or left is trying to hoard more than their seat so there is this kind of crowdedness going on. In the grand scheme of things, it is comfortable once you can get a seat anyway. … If it is crowded it wouldn't be comfortable for me because of the lack of space. [LDN04_Male]

Well, it's one of the busiest branches on the whole Tube, so even without any changes involved it can be pretty uncomfortable. [LDN05_Male]

If I'm traveling in to work it can get pretty uncomfortable once I'm on the train, but the station is fine. But when I'm getting on at London Bridge in the evening, the platform can be very overcrowded, especially if there are any delays on the train or the line is suspended for some reason and I don't know if I'm able to get on the Tube or the train again because there are so many people ahead of me sometimes. [LDN06_Female]

I know people personally who won't use the Tube because they are scared because it's too crowded. I think there is a point that the public space has become too frightening for some people. Overcrowding affects people in different ways. [LDN07_Male]

…in the car I can listen to the radio, make phone calls without having anyone listen to me and have a cigarette, which I can't do on the train really. [LDN10_Female]

I think people see public transport as being not for them. You have to mix with people and maybe that's what people don't like; sitting in the same seat as someone they don't know and they don't know what will happen. They think they can control their own car

but then you don't really control your own car because you are limited by the congestion and other things. I think that it is a perception issue. [LDN12_Male]

I used the public transport system to get into town last week but there were so many people around that the station was overcrowded and the trains were absolutely packed that you can't move on the Tube. [LDN13_Female]

My experiences are that some people who travel on buses…Then of course, the other thing is that people have these days, which is interesting, with untold languages and you try and work out what the language is. The nightmare thing is people using their cell phones. You'll have endless people talking and playing games. If you want to read something it can be quite disturbing. [LDN14_Male]

I prefer the train. I'm not fond of the Underground because I find the Underground too hectic during rush hour. [LDN16_Female]

Security

Security on public transport

I always feel nervous when I'm in London Underground because of terrorism. I think I'm not the only person that thinks 'oh god' I've to get a train underground during the rush hour and get shoved up close to the door, which sometimes I am, and that's pretty horrible really. [LDN10_Female]

I think security is a good thing. I think most public transport now have cameras in it and so when someone is aggressive on it they tend to follow that up. I think it is the assurance that when there is an issue someone will take notice of it and correct it. I mean you can't stop bad things from happening but you can try and catch the people that do it and make sure that they will find what they do unacceptable. So I think that it is the accountability of public transport issues - the security. [LDN12_Male]

I think the social behaviour has changed quite a lot and not necessarily for the better. Some people, especially traveling at night, may not feel totally comfortable, to some degree. [LDN14_Male]

I find the Underground in England very nice, very clean. In Paris, there is a problem there of pickpockets and you have signs all over the place asking you to beware of pickpockets. … Generally speaking, it is safer I'm sure. It's more organised here. … Clean and no graffiti, unlike in Paris. [LDN15_Male]

I don't feel insecure on the Tube because there are usually a lot of people on the Tube. But once I get off the Tube, I have to walk from the station to my home and that's when I would feel insecure. … If I was not doing that, sometimes, for example late at night after a function in Central London, I would have a taxi to bring me home if I did not wish to be walking on the streets that late. [LDN17_Female]

Security on private-hire vehicles

I think it is very convenient but I don't necessarily think it is a good thing. But it can be a good thing, I've quite a lot of my female friends who will use it to get home from like the Tube station to home when it's late at night. It's quite a safe way to travel if you're young or not comfortable walking late at night. [LDN08_Female]

I don't, and the reason again is security. I have a firm that is local who vet their drivers. If you take Uber, you just call someone and you do not know who they are. Most of the time it is okay but you do hear instances when it's not okay. … I understand that I may be missing a good price but the main reason for me using these vehicles is the security. Therefore I want to have this company that is local and I can rely on. [LDN17_Female]

Security when using private vehicle or driving

> I got myself a really nice car about five years ago because I thought that if I'm going to drive to work everyday I will want it to be safe, fast, comfortable and reliable. So I bought a brand new car, something that I've not done before. So, that helped a lot because I could do the journey of about 42 miles in about an hour or even less sometimes. [LDN10_Female]

> I think we should put our finances into electric cars and self-drive cars because people will always want to leave and come back when they want to and people will always want cars. Like cigarettes, even if you put the price up people will still want to buy them and they will find the money. People like the freedom of having a car and the safety. Self-drive and electric cars in cities is where we have to go. [LDN10_Female]

> Freedom, convenience and also security, if I would add, because if I'm traveling at night, for example, I'll feel safer in North London in my car than on the street waiting for a bus. [LDN17_Female]

Physical safety when cycling

> No I don't cycle because I think it is very dangerous to cycle in London. There is no cycle path so sometimes you see cyclists and drivers racing each other and they get angry at each other. So I wouldn't say it's safe to cycle in London. It's convenient and I think it's a very good idea for people who are more confident about cycling on the road and it helps them to get to places quicker. But not me, I wouldn't do it because I will be lost if there are so many cars with me on the road, I will not feel comfortable. Just by having cycling paths really. Have separated lanes for cyclists so you don't have to mix with buses, cars and other things. [LDN03_Female]

> I would never consider cycling to work because it's way too dangerous. A lot of cyclists I know have all had accidents and also the worst thing about cyclists that I think I don't like is that they are quite disregarding of pedestrians. I've been nearly run over by cyclists so many times because they just don't want to stop for you. And I think they are also a danger to themselves as well... I think they are quite peculiar as well with their expensive bikes that they rule the road really. [LDN06_Male]

> It would be possible to cycle certainly but I don't do that for safety reasons, it's too dangerous to cycle on the road with the cars. There are probably roads in London that have safer routes but definitely from here to central London it's tricky… The lack of cycle lanes and definitely the lack of segregated cycle lanes. The blue paint on the road doesn't seem to be quite enough. [LDN07_Male]

> I think it'll be okay mostly. It's quite good where we live because I go through a green hearth and then a park so it's all quite green, quite lucky where I live. I wouldn't cycle anywhere else but I think that particular route would be okay. … I would do short distances but I wouldn't feel comfortable cycling in the city because I feel that it's too dangerous and I'm not confident enough. … I think there isn't a good relationship between drivers and bikes, and there is a lot of shouting that goes on so I wouldn't want to do it. [LDN08_Female]

> I used to live in London and used to cycle to work every day for four or five years. I think it has changed a little in London but I don't think they've quite got that sorted out, you always hear about cyclists getting killed. To be honest, I think the cycle routes are not really fit for purpose in London. We should look at other countries like Holland where people can cycle. I would love to cycle to the station from where we live but the roads are very narrow and not wide enough for two cars and a bicycle. The route that we go along is very narrow, very hilly, full of potholes at the side of the road and it goes through an area that is quite high up so you get fog and lots of animals because it goes

right through the forest. Often you've a wide van coming towards you at 50mph and that's what you're up against and I think they're mad. There are steep bends all along the road and you've nowhere to go with these blind corners. [LDN10_Female]

But I did get knocked off my bike one night and that rather put me off. [LDN10_Female]

Very good. I would cycle to Paddington and go along the canal for most of the way. It has its own challenges but at least you were not on the road so that's nice. I found a very good route. But I did get knocked off my bike one night and that rather put me off. I was doing a late shift at Shepherd's Bush and I was cycling back at about 11 o'clock at night. Looking back at it, it was quite foolish because it was raining, obviously dark and I was coming out of the side road and the guy was coming towards me very slowly. I pulled out but he didn't see me at all even though I had a load of lights and reflective stuff on. He knocked me off my bike in the middle of the road and he paused but didn't stop. Some people helped me, got my bike and we got his number plates. But it was a bit of a hit and run, and it was pretty scary being in the middle of the road on a Friday night at 11 o'clock in the rain. I felt really vulnerable. [LDN10_Female]

But you've to be more careful with cycling. I haven't been out, I was working so I think you have to be careful cycling in the rain and in the dark and look properly, anyone… If you have a cycle lane that wasn't on the road then all these problems would go away. … And I think that if we've got that then many more people would cycle. It'll still have its dangers though. And it will be difficult to introduce a new mode of transport in a city that has been built basically for horses and carts isn't it? [LDN10_Female]

Autonomy

Because you'll have the feeling of control. My ideal would be that I would be able to walk to work. … Yeah and the simplicity too. But mainly because I can be completely independent. [LDN07_Male]

I try to walk as much as possible even if it's quite far because I enjoy it more and you don't have to worry about anything being late. [LDN08_Female]

INT So there's still a need for a car because certain activities cannot be carried out by public transport easily?
LDN07 Exactly, and one can be more spontaneous.
[LDN08_Male]

You've just got to plan better, you got to know how long it takes for you to get home and things like that. You've got to plan when you're leaving work, when you're going in, as opposed to just jumping into the car where obviously you've got a lot more flexibility because you don't have to take the trains and choose the trains to get on.
[LDN08_Male]

I think we should put our finances into electric cars and self-drive cars because people will always want to leave and come back when they want to and people will always want cars. Like cigarettes, even if you put the price up people will still want to buy them and they will find the money. People like the freedom of having a car and the safety. Self-drive and electric cars in cities is where we have to go. [LDN10_Female]

They think they can control their own car but then you don't really control your own car because you are limited by the congestion and other things. I think that it is a perception issue. [LDN12_Male]

When I deem myself to be gaga! It's one of those things that means freedom and if I want to, on a Sunday morning, decide to go to wherever today and I've to carry something then the car is there. You want to make a decision quickly for those moments. It is freedom. … So, no, I would keep the car, not that I use it often. It is very

useful. … I'm aware of pollution and all that but sometimes it's the best of choice. [LDN14_Male]

Without the car you're immobile. You can only go as far as where your feet can take you. … It also depends on how old you are. The older you are the more difficult it is for you to walk and with the rain and what have you. [LDN15_Male]

Freedom, convenience and also security, if I would add, because if I'm traveling at night, for example, I'll feel safer in North London in my car than on the street waiting for a bus. [LDN17_Female]

Road Congestion

I would. London is quite good, the Tube system. If you drive, half the time you're parking in a traffic jam. You know, London is so crazy, you just need one car to break down and the whole of South London will be blocked. … It's just not meant for so many cars. It's not meant for so many people. [LDN01_Female]

…you can see a buildup of cars every morning. I would say my place is like a commuter town actually, within London. We're still within London but we're on the outskirts already. A lot of people live there but work in the city so there are a lot of people commuting into the city every day. So even that, it's already crowded, so I can only imagine what more the areas nearer to the city. They will be definitely more crowded than mine. [LDN02_Male]

…there are buses, but buses are not reliable. Sometimes the bus is delayed or there's traffic, the bus doesn't come on time because it gets stuck in traffic. If there is no traffic, actually the bus takes about less time than the Tube. It's more convenient actually because I don't have to change, I just take one bus to go to work. But the thing is that there is so much traffic in London. [LDN03_Female]

I wouldn't consider driving because the traffic is so bad. [LDN03_Female]

He has to drive through the North Circular in the morning or in the afternoon and it's just a disaster, there's so much traffic. Without traffic he can get to office within 15 minutes. With traffic, it takes up to an hour. [LDN03_Female]

I just think the traffic going into Central London and the route I would take is just too busy, there is too much traffic that I would just sit on the bus for ages. [LDN06_Female]

I did this job previously for 6 months already and going back to it now. It's pretty bad. You have to wake up early and give yourself at least three hours to where you are going even if you are going only five to six miles away as it can take three hours because the traffic is really horrendous and sometimes it barely moves. It's quite bad. …the morning is the worst time because you want to get to school before the morning performance, so by eight o'clock, so you'll be traveling in the rush hour and that's what makes it so bad. It's a little better in the afternoon because you leave at school time, more like three o'clock, so there's usually not much traffic on the way home, which cuts down the journey time by quite a lot. [LDN08_Female]

In London I think the roads are completely overused. It wouldn't be so bad if it wasn't so busy. The biggest issue I had was that I live south of the river in South East London and to get to North London, which I have to do more often than not, I have to go through the Blackwall tunnel because in the South East, you don't have many options to get across the river. You either drive very far East to get over the Dartford crossing, which is a bridge, or the Blackwall tunnel, or you go through Central London but that's not really an option because it's too busy. So this Blackwall tunnel you have to use it everyday. Basically, they need another crossing really, more roads built but they should not be one-way. [LDN08_Female]

I love getting out early in the morning. There's something about creeping out of the house before anyone else. Because if you leave at, once you hit the A3 or the M25 by 6.30am you're going to be sitting in traffic. [LDN10_Female]

I find driving in to London congested and worrying. It seems like a mini battle with people pushing in and trying to get to somewhere quickly… I don't like driving in London. [LDN12_Male]

Because if I go anywhere, for instance if I leave tomorrow, Saturday, to drive out of London, I tend to leave early to avoid the shopping people and get out of the city quite early in the morning. But generally everyday the line of traffic outside my house, people commuting to work or whatever they are doing, I really don't have the patience to sit in the traffic for untold hours. So you can get to your destination much faster by public transport quite frankly. … Yes, it's the congestion, pollution and time of the travel. I'm afraid that the traffic grows exponentially so if you have more roads, you'll soon have more cars as well and there will be more traffic. I don't know how you solve the problem. [LDN14_Male]

If you have a camera and could see the main streets, Regent Street, Oxford Street, Euston Road, there are just lines and lines of crawling traffic… [LDN14_Male]

Because the population is increasing all the time. When I first came here 20 years ago, every family had one car, not two or three cars like now. So, the number of cars has exceeded way above what the roads can absorb. That's why there is the congestion charge. The reason they brought in the congestion charge was because the traffic jams were so often and it's so difficult to get into the city or the West End for work. So they put this charge in place to force people to take the Tube or public transport and not to take their cars and park there. … To discourage people from taking their cars, that's the purpose of the congestion charge. And also to make money out of it. … Definitely it has worked and that is why since about ten years ago, nobody takes their car to work. Even the people who are not near a Tube station would park their cars near a Tube station and then take the Tube. [LDN15_Male]

20 years ago, I wouldn't have dreamt of taking the Tube because the traffic wasn't that bad and there weren't that many cars on the road and you could park anywhere. [LDN15_Male]

The amount of traffic is so great even out in Northern London that even when there's a minor roadwork or an accident it can get very difficult. I mean, one still has to go with it because that's the only option you have at that time. … Of course when I drive I try to go at a time that is better if I have the option, you know, avoid the rush hour that sort of thing. … Well, that's life isn't it? I travelled in the rush hour in London throughout my working life so I'm resigned to my fate. [LDN17_Female]

Clearly there is a problem with the roads. I think the central congestion charge has improved that a bit but I think there is an ongoing problem with the roads. It's really difficult to see how that might be improved because the population is so dense. The roads are not wide and I think in Central London, apart from reducing the number of cars I don't see what else they can do really. … Yeah, most of the time the roads are pretty busy. [LDN17_Female]

Theme 5: Thoughts about Transport Policies

Subjectivity surrounding the affordability of cars

Quotes are similar to those in 'Financial cost of private vehicles'.

Vehicle Quota System in Singapore: The necessary evil

Reaction to the Vehicle Quota System in Singapore

Ridiculously expensive. The price of the car itself is already ridiculously expensive and the price to maintain and own a car is ridiculously expensive. I'm not sure what the original price of the car would normally be, but something would tell me it's nothing close to £60,000. [LDN04_Male]

Personally, I wouldn't like the system, but if I live there, a citizen of the country I wouldn't have any choice, but if I have a choice in the matter I wouldn't like the system. I rather love the freedom of choice on whether I want to use the public transport or not because… …the argument I want to make is that, you know, maybe the country wants its citizens to have a good transport network and be able to use the public transport and be good enough for people to use, which is a good thing. However, I want to have the freedom to decide if I want to use the public transport system or to use my car. [LDN04_Male]

That is £10,000 in the UK and £14,000 in India, and £18,000 in Nepal. Because Nepal has no roads and they want to take the money. But if you are telling me it's £30,000 that's not tax, that's a barrier to entry. Because they don't want you to have a car so they put £30,000. And £30,000 is ridiculous. You can get a brand new Mercedes C-class for £30,000. [LDN05_Male]

I think it's a great idea in terms of how it makes the city run because it's good to have less cars on the road and have everybody using the public transport. It is also much better for the environment. [LDN08_Female]

Really? They're trying to deter people from buying cars. I wouldn't have any money. … I can understand it really because Singapore is a really small place. Public transport and things like cycling should be promoted, shouldn't they? … Places like Singapore that is a city-state they should run without cars. If it can run without cars it will be the most amazing city in the world, I would bet. It would, because it's the cars that kill a city, really. [LDN10_Female]

Goodness. … Sounds like a totalitarian state almost. I doubt people in the…I assume that the country is set in the East rather than the West. I would rather think that the European viewpoint wouldn't find that acceptable as a method of control. It almost invites corruption and are you then discriminating between the people who have more money than those who don't. … I thought you would say Singapore. … I think Singapore is quite unique in that way. You're very much more law abiding in Singapore than other places possibly. I think that you'll have riots here if something started like that. [LDN14_Male]

It's ridiculous isn't it, you tell me. I can buy a house here with the prices of the car. [LDN16_Female]

What you've got to remember is that you cannot say that the prices in Singapore are not reasonable or whatever because each country is an individual and it's suited to the government and the people. Because Singapore is only a small island you cannot have too many cars because of pollution and everything. So the restrictions that the government imposed through the taxes are quite fair because it is suited to the people. And even when the car is abolished after ten years I think you get some rebate back from the government, isn't it? …and the scrap value is quite reasonable. Whereas in London when we say scrap we mean that it comes to £10 or £50 at most when you scrap a car but in Singapore your scrap still comes to quite a few thousands. So that in itself is quite reasonable and because with that you're going to get newer cars, cleaner air and less pollution. [LDN16_Female]

Unique transport policies for each city

It might not work because I think people here, they value having a car, whereas in Singapore, the COE system was implemented very long ago when Singapore was still developing. But now, of course, Singapore is a rich country. But here, people value their car. Second of all, this is a big country, so people staying in Edinburgh or Glasgow or other smaller cities, there might not be as much congestion as there is here in London. So maybe implementing a COE system, it might only be here for London? But how do you control then, people who buy cars from elsewhere in the UK when you can still come in to London? They are probably some outside London as well. [LDN02_Male]

I think it could but it would have to stem from something that we already have. We have the congestion charge in the centre of London…So perhaps, if you make that more expensive and make the area bigger that might help. … I'm quite keen on these environmental factors and interested in how we can be more environmentally-friendly so I think it is really a good idea to introduce that to get people to think more. That's because cost is the best way to make people change their choices. Like in England we have the plastic bags that used to be free but now they cost 5p, though 5p is nothing people don't like to pay for things so instantly it solves that problem. So I think cost is the most effective way to get people to change their choices. It's a good idea. [LDN08_Female]

I think we should put our finances into electric cars and self-drive cars because people will always want to leave and come back when they want to and people will always want cars. Like cigarettes, even if you put the price up people will still want to buy them and they will find the money. People like the freedom of having a car and the safety. Self-drive and electric cars in cities is where we have to go. … As long as they don't do it permanently and it's just temporary, I think people will accept that the car is on its way out. [LDN10_Female]

I think Singapore is quite unique in that way. You're very much more law abiding in Singapore than other places possibly. I think that you'll have riots here if something started like that. [LDN14_Male]

That's right. Certain policies will work for certain countries. It certainly won't work here because you've got to remember that Singaporeans are more obedient as well. … No, it won't work here. You can only encourage people. [LDN16_Female]

Necessity of road usage charging

We have the congestion charge in the centre of London where it's like £11.50, I think, for the day to drive within that radius. But I think the radius is so small, in the Central bit of London, and the traffic can be just as bad further afield. So perhaps, if you make that more expensive and make the area bigger that might help. But I think that it would be difficult because London is so sprawling and surrounded by other towns it would be difficult to create a barrier to determine who would have to pay and who wouldn't. Parts of London further out are less congested. [LDN08_Female]

I'm afraid that the traffic grows exponentially so if you have more roads you'll soon have more cars as well and there will be more traffic. I don't know how you solve the problem. From that aspect they now have the congestion charging. …I think it's an income source for the local authorities. And I suppose if you're working and don't have any other form of transport available to you, like service vehicles that do deliveries or collections, and individuals sitting in the car, do they have any other options? Perhaps they have but maybe not. From that viewpoint, people however reluctant in any event, despite the cost of using your own transport, if out of necessity, will use it. [LDN14_Male]

That's why there is the congestion charge. The reason they brought in the congestion charge was because the traffic jams were so often and it's so difficult to get into the city or the West End for work. So they put this charge in place to force people to take the

Tube or public transport and not to take their cars and park there. … To discourage people from taking their cars, that's the purpose of the congestion charge. And also to make money out of it. … Definitely it has worked and that is why since about 10 years ago nobody takes their car to work. [LDN15_Male]

I've not driven much in the past few years. I stopped when the congestion charge came about. … It's not so much about the congestion charge making me think twice about driving into London. I won't drive into London whether there is a congestion charge or not because the traffic is too chock-a-block. [LDN16_Female]

Clearly there is a problem with the roads. I think the central congestion charge has improved that a bit but I think there is an ongoing problem with the roads. It's really difficult to see how that might be improved because the population is so dense, the roads are not wide and I think in Central London, apart from reducing the number of cars I don't see what else they can do really. [LDN17_Female]

Supporting quotes from interviews in Singapore

Theme 1: Purpose and Nature of the Journey

Work versus social travelling

It depends on whether I'm drinking that day. If I'm drinking heavily with my friends then I will probably take the public transport. [SGP03_Male]

I do have to meet up with my customers once in a while and I might have to drive to pick them up. [SGP05_Male]

INT Are there any instances where you will drive?
SGP08 Yes, say when I'm feeling lazy to take public transport or say I'm picking people up and it makes sense to go in a big group, things like that. … Recently I went to East Coast with a bunch of friends and I picked everybody up. We had a meeting point and then we drove to the East Coast because I think that it's further and less accessible than somewhere in comparison like in town or Orchard.
[SGP08_Female]

…because I might need to drive my clients…my job requires a car. But if it's for leisure, like going for shopping, then there is no need for a car. [SGP11_Male]

Only if I'm rushing or going for, let's say, a fancy dinner. One time that I took a cab for social purposes was when I was going for a graduation dinner because when you dress up nice you won't want to take the train so you take the cab instead. Otherwise, usually if I can help it I won't want to take a cab. … because I want to save cost. [SGP14_Male]

Two conditions have to be met. One, whether I'm taking alcohol that day. Second, where am I going. If it's too far then it makes more sense to drive. If it's town or Orchard where parking is costly and it's near enough to go there then I'll just take public transport. [SGP16_Male]

Challenging trips by public transport

That said, a car would be useful when going shopping or when visiting the expo where you'll be buying a lot of things. For people like us who don't drive, we would rarely go to the expo because even if the items are cheap, when we buy it we have no means to bring it home. [SGP02_Female]

INT Are there any instances where you will drive?
SGP08 Yes, say when I'm feeling lazy to take public transport or say I'm picking people up and it makes sense to go in a big group, things like that. … Recently I went to East Coast with a bunch of friends and I picked everybody up. We had a meeting point and then we drove to the East Coast because I think that it's further and less accessible than somewhere in comparison like in town or Orchard.
[SGP08_Female]

Because we have an elderly living at home so we use the car to send her around.
[SGP08_Female]

To work not really, unless for isolated instances I'll use an Uber if the place is very far away or if I'm carrying very heavy stuff. [SGP09_Female]

The other reason is that sometimes it's still more convenient to drive than to take public transport, especially if you are carrying bulky items or going multiple places or if the places you're going are less accessible via public transport. In these cases you would still prefer to drive if you could. [SGP14_Male]

Theme 2: Transport Access and Feasibility

Availability of infrastructure

Public transport in general

For me I think the transport system is good. Because Singapore's land area is small, with just the MRT and buses you can get to places easily even if you don't drive. And for taxis, they tend to always be more available in certain areas while there will be lesser of them in other areas. I think it is still okay to get around Singapore without driving. Taking trains and buses to places is convenient and fast. … Overall, I think the transport system here is okay even if you cannot afford to travel by car unlike other countries like Malaysia. [SGP01_Female]

I feel the transport system here in Singapore is good and convenient to places like the shopping centres. Regardless of buses, trains or taxis, it's very accessible and convenient. … The public transport infrastructure in Singapore is also constantly being upgraded regardless of the area you are living in, private or public housing. I believe even those who live in private housing are now less likely to drive, especially those above 65 years old. This is because the Downtown line and Circle line are now operational making it even more convenient. [SGP02_Female]

If you do not have a robust public transport infrastructure then I think it will piss off a lot of Singaporeans or the expatriates working here. Because if it's going to be so inconvenient then we would might as well buy a car and get stuck in the jam together even though there is public transport. [SGP03_Male]

Not as mature as some other countries, for example Japan where the system is really fantastic. … but the government is actually building many MRT stations in different locations. There is a lot of construction going on in Singapore right now. So in 5 to 10 years' time it would be more stabilised. … So I think it's a good thing. [SGP04_Female]

But obviously the public transport must be good for everyone to have the option to have a private or not have a private car. [SGP05_Male]

One scenario is when I go to school at NTU when it's way more convenient for me to drive. Because if I take the public transport, I will have to take a bus from my house to the interchange then I'll have to take a train from Bishan to Buona Vista and then change to the Circle line from Buona Vista to Pioneer and then from Pioneer, take another shuttle bus into NTU. So that's a total of three to four changes for me and it's inconvenient even though it is cheaper. So in this scenario I will drive because it takes me only 40 minutes by car, even though I have to pay more for it I'm fine with that. [SGP06_Female]

I think recently in Singapore there have been problems with the train sometimes where the train just stops and you wonder what's going on. But I think, compared to other countries, our public transport in Singapore is actually very safe and efficient. … I think in Singapore it is very accessible as we have the MRT, buses and shuttle buses. [SGP08_Female]

I think it is pretty good in terms of infrastructure. Of course, in terms of reliability it definitely can be improved. Pricing wise, I feel it's fine and is not an issue. … The main thing that is a letdown is reliability. For places that do not have a train station it's generally fine because they are usually covered by buses. So in terms of transport network, I think it is pretty okay. [SGP10_Male]

The main thing is the parking, because it is expensive in town. And in Singapore, the public transport is quite good and well connected, I can just go on the bus and reach Shenton Way or on the MRT, so there is no need to drive. … At the same time,

because the town itself is very well connected with buses and MRT so it is easy to get into town but if you're going to some place not connected by the MRT then it will be much more difficult. [SGP11_Male]

I would always take public transport, mainly because my family doesn't own a car. Public transport is very efficient in Singapore so I'll always choose the public transport. [SGP13_Female]

I guess it's very integrated when you compare it to a larger country but this is possible because Singapore is so small that you can actually plan your transportation system throughout the whole island well enough. I'm from Malaysia, so if you compare Malaysia to Singapore, it's a lot less convenient to travel by public transport because the places you commute between is a lot further. But in Singapore, the distance from East to West is like 40km, so it doesn't actually take so much time for driving to be necessary as if you were to stay in another country. So I guess how I see transportation here in Singapore is that it is very well developed although I feel that there are still certain parts that are not so accessible by public transport. But as a whole, I do feel that it is very well connected, even with the bus system because my experience tells me that. Few years ago when I first came to Singapore, the MRT system was not as established as it is right now and we could still travel between places quite easily with the bus. Now that the MRT system is up and covers so much more of the island than it used to, I feel that the bus system has become less important, at least for me. I don't take buses as much as MRT nowadays. … There are so many more lines and you can go almost anywhere using the MRT. [SGP14_Male]

Buses

For my case, especially when I take the bus, it's more comfortable now because they've increased the frequency of the buses and it's a new route that the town council has put in. This new route drives by my house, otherwise I would have to walk five minutes to another bus stop, compared to now where it's right beside my building so I can get to it easily. [SGP03_Male]

For feeder bus, unfortunately there's not much decision because that's the only thing you can take to go to the MRT station, unlike long distance buses where you can decide to take the trains. For feeder buses it's very localised and you've no other choice, you're always stuck with the feeder bus. Again, the government has increased the number of buses in Singapore but the sad thing is that they've not increased the size of the depot. A lot of the time you have a major traffic jam within the bus terminal. Buses cannot get out and incoming buses cannot find a parking lot and vice versa. … So during major hours, peak hours, you should see the traffic jam in there, it's hilarious I tell you. I've seen, even at Jurong East, 10 to 15 buses just waiting to turn into the bus terminal because the infrastructure was not meant for that many buses. For every bus service you increase by one or two buses, and each terminal has like 30 services, you multiply it and imagine the number of new buses coming in. [SGP07_Male]

They have increased the frequency of the bus but sometimes the infrastructure cannot handle, especially during peak hours…the infrastructure at the bus terminal to handle the buses, like I said, they cannot cater for that many buses to come into the terminal at the same time. [SGP07_Male]

Trains

I think they're moving towards that direction like in 2020 they'll have more lines available that will enhance the capacity and reliability of the infrastructure. So it'll definitely be more complicated then. But then again, that would offer you more convenience too. [SGP03_Male]

I think it is good now but I find that, the trains for example, they have to pay more attention to the maintenance because the trains keep breaking down because of the stress, overusage or that the maintenance is not properly done. A lot of people are sick of the train system but I think we do have a system in place and it is just that the company that is running the train must have a good and proper maintenance programme. [SGP03_Male]

The MRT system, I think they're fairly good. They are very efficient. The way the connections are I think they are very very good. … It is very easy because the bus stop is located quite near to the station, like 100 metres away, not more than that. [SGP07_Male]

Definitely, improvements can be made to the quality. … For trains, I think the frequency of the breakdowns is due to the ageing of the infrastructure so I think they will have to invest to overhaul this infrastructure to improve the overall experience. But I think one key problem is that to overhaul this infrastructure, renewing the tracks for example, it would definitely impact everyday transportation. Let's say they want to renew the Circle line, and it'll take a couple of months because it's not possible to do it in a couple of weeks, with parts of it not being accessible I think that will be a very big problem. I think the problem is that there is definitely a need to make improvements but it is also very hard to go about that right now. [SGP15_Male]

Availability of infrastructure for private vehicles

Driving is one problem, parking is another in Singapore. Finding a parking space in Singapore is a big problem because the parking in here is limited and very expensive. Imagine paying $18 for five hours of parking, that would be equivalent to a taxi ride. Parking is an issue, not only driving. Coming here today, for instance, if this were a central area I would have to go many rounds or even further away in order to find a parking space. [SGP01_Female]

We've such a great transport system and have limited landmass, yet everyday we're trying to build even more things so I don't think having more cars on the road is going to help with our traffic. We don't have very bad traffic right now but I think that will happen if you let more cars on the road. [SGP09_Female]

Road wise, I feel that there are quite a number of cars on the road but when I go to neighbouring countries I feel that Singapore has quite a reasonable number of cars relative to everyone around us. Even the quality of the road in Singapore is hands down top five in the world compared to anyone else in the world. [SGP10_Male]

I think that because of all these, our roads are so well maintained and you can hardly find a pothole in Singapore because of the whole tax and registration system. It's all part of a whole ecosystem of costs and benefits. [SGP10_Male]

Availability of infrastructure for environmentally-friendly private vehicles

Actually, I quite look forward to electronic cars. … Actually it doesn't matter as long as it is well-developed. But at the moment it is really not convenient. The charging station is very limited. So to me it's not convenient at the moment. But in the future, if it is easier for people to use, I don't mind changing my current car to an electric car. [SGP04_Female]

Even the hybrid thing, I mean even if you own an electric car, I was told that it's very hard to find a place to charge it. So on one hand we say we want to, but we do not see our government actively promoting it. [SGP07_Male]

Availability of infrastructure for bicycles/walking

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Yes, I've thought about cycling, but you have to first think whether there is provision for cycling infrastructure. Unlike overseas, or in England, there is provision for dedicated cycling paths but there isn't one in Singapore. When I'm cycling in Singapore, I have to cycle on the road, competing for road space with other vehicles and I'm constantly worrying if the lorry will hit me. There are many cyclists that have been hit on the road here. There isn't a proper road for the cyclists. If you want to encourage your citizens to cycle, you have to first provide the proper infrastructure for them. I've noticed that there are now more people cycling in Singapore to work but it's dangerous for them. When I drive and I see a cyclist on the road I will give way to them because I'm a cyclist myself and I know when it's dangerous for cyclists and I would give way to them. So if you want Singaporeans to cycle or walk you have to first provide the infrastructure. …if the infrastructure is in place I wouldn't mind cycling to work. [SGP01_Female]

But you've to still consider where these bikes can be parked and locked because it's not possible to keep it in your office especially if everyone starts cycling to work. This is a big headache. … Like how they upgraded the walkway shelters so that people do not have to use the umbrella even on rainy days. Likewise they have to plan cycling infrastructure properly to let people run or cycle. It would be great if they can just concentrate on developing this infrastructure within the towns first. If not, there would be a lot of accidents. [SGP02_Female]

And also, in Singapore, it's not a cycle-friendly country unlike Europe where long time ago, they've developed the infrastructure including cycle tracks, unlike Singapore where it is very dangerous for cyclists to cycle on the road, especially during the busy hours. It is very dangerous, it is not a cyclist friendly country. [SGP04_Female]

They already have the plan in Tengah, in the West of Singapore where they're trying to have the concept of having the whole location car-free. There wouldn't be a car in the suburb. People going back to their home by walking or cycling. They would still have cars going through but it's all underground. So on top it is car-free and I think it's a very good concept. … Yes, to be more active and help the environment as well. I really fully support this project, I don't mind moving there. [SGP04_Female]

I've seen my colleague do it before, cycle to work, but the thing is that in an office environment in a tropical country like Singapore, which is so hot, the office itself must have a place for people to shower after they arrive at work. We must have the infrastructure for that to happen. …if you're cycling within the town area it's okay because ultimately when you go home you shower. But when you cycle to the office and work eight hours in the office, you cannot be sweaty right? So there has to be a place to shower and clean up. …also I think because Singapore, as a land-scarce country, the road itself is quite dangerous for people to cycle to work unless we make a cycling track throughout the entire country, which I think is quite impossible. The roads do not have enough space and I think there are too many winding roads in Singapore itself. …I'm not a road planner or LTA, but from a layman view I don't think it's possible because the roads are just too heavily utilised and quite impossible to create a lane for bicycle users and draw a parallel between car users and bicycle users, then what happens? [SGP05_Male]

But our roads are not cyclist friendly yet. [SGP07_Male]

Then I think the next thing you need to do is to have more parking areas for the bicycles, because at the moment there are not many. There are some but they are not enough. The roads are also not very cyclist friendly. So what you're talking about is about joining all the parks and cycle ways, yes they are okay. But if you're talking about, let's say cycling from here, Choa Chu Kang to Bukit Panjang, it's a very unfriendly road to cycle. [SGP07_Male]

One thing is that there is no proper, dedicated lane for cyclists. [SGP11_Male]

The infrastructure in Singapore is not ready yet. You can bike, but unlike in the US where there are bike lanes at the side where you can bike safely, in Singapore, a lot of the times you have to bike on the pavement. If you bike on the road it is very unsafe.

So, no. I think the infrastructure will have to improve by leaps and bounds before I personally would consider that. [SGP12_Male]

I tried it before because I have bikes and do bike around if I'm free. I do find that the park connectors that go to and connect the parks from the last time that I biked around half the island, I noticed that park connectors are basically pavements, so they're probably not done yet. If I bike for fun, that's okay but if I bike to work or do things I don't think that's possible. Two, the weather here is too hot. If you really bike to work you'll need a place to shower and change before you go to the office. So the facilities are not there as well. Because if you compare us to Europe, to Amsterdam or Holland, people bike everywhere probably because the weather is so nice to bike and they have the infrastructure to encourage biking. But over here, you don't have these two factors. [SGP12_Male]

In Holland, I heard that they've shared bike systems where you can get bikes from anywhere with a bike stop, bike to a place and then put it back there, you don't really need to own a bike. I think that's a good idea as it'll encourage people to bike more because for me, one of my biggest deterrents is that I have foldable bikes and being foldable it means that things can be detached so it's very hard for me to lock my bike. It's not safe because I've got my seat stolen before in a condo because it can be detached and taken away. So, for me to use this, like I've said, provided I'll see my bike again when I return. [SGP12_Male]

I think that is a big problem because the infrastructure doesn't support the increase in cyclists in the recent few years so they had to take up cycling on the sidewalks. People started to complain so it ended up with the pedestrians complaining and also the drivers complaining. … I think you need to build the right lanes, roads and signals for the cyclists first and educate people to let them know that this is a real mode of transport and we have to give them some right of way and also rules to cyclists before I'll consider, because right now if I have to cycle on the road I'll be quite scared. [SGP13_Female]

I guess the other thing would be bicycle storage. Because I'm renting a place in Pioneer, storing a bicycle could be a problem that I may face if I decide to buy a bicycle. [SGP14_Male]

For cycling, I think one key problem is that Singapore doesn't have the proper infrastructure in place. We only have a single lane or pathway for pedestrians mostly and we're not allowed to cycle on the road because it's also very dangerous. Cycling would be a good way to encourage the use of public transportation. Cycling is not very good in Singapore because it is inconvenient. I think if the number of cyclists increases significantly, I think it will be quite cumbersome for many pedestrians who are not cycling as well. [SGP15_Male]

The only thing that I figure, that may not be possible, is having cycling lanes. I think Melbourne and Paris have them. But we can't do this in our context because we don't have the luxury of space. [SGP16_Male]

I mean there are other Singaporeans or expats who try cycling or other alternative forms of transport but in our weather, sometimes it rains sometimes it gets too hot, it may not be feasible. For one trip you have to bring a lot of things, change of clothes etc. [SGP16_Male]

Ease of Travel

Generally across all public transport modes

Because Singapore's land area is small, with just the MRT and buses you can get to places easily even if you don't drive. And for taxis, they tend to always be more available in certain areas while there will be lesser of them in other areas. I think it is

still okay to get around Singapore without driving. Taking trains and buses to places is convenient and fast. … Overall, I think the transport system here is okay even if you cannot afford to travel by car unlike other countries like Malaysia. [SGP01_Female]

If you really want people to not buy a car you have to provide an excellent public transport infrastructure such that you wouldn't have to change too many times to get to a place. [SGP01_Female]

Of course having a car can offer you convenience though at times it can also be inconvenient to have a car, especially with parking challenges especially when it's the holidays or peak periods. Even though I don't have a car I find that it's very convenient for me to take the public transport as it is also very quick, unless there are breakdowns. Even if you drive you'll also be subjected to traffic jams on the road. Especially on my way to work on a rainy day, if you drive you'll definitely be stuck in a traffic jam. It's faster to take the train. [SGP02_Female]

I feel at ease and have freedom because it's something I do everyday. There isn't really a choice because I've to use it to get to work. … I can't do anything about it, I have to wait for the next one or just squeeze in. There's nothing much to complain about because the frequency of service is a lot higher now after they improved the service. Unless it's during the weekend, when you have to wait slightly longer. But if it's the peak hour, it's usually very fast. [SGP02_Female]

It also depends on whether the particular destination I'm travelling to is accessible. If I have to walk 15 minutes after alighting from the bus there I think it makes more sense for me to drive down. [SGP03_Male]

I don't travel during the peak hours much, but I understand from people who travel during the peak hours to work that the MRT situation is horrendous, meaning it's packed like sardines. So that's another reason I hear that people rather drive because the waiting time is ridiculous and the queue in there is really packed like sardines. So, I guess some people would rather drive. [SGP07_Male]

In fact, for most of my colleagues who are not from Singapore, they only travel by train. I feel that for foreigners they'll not travel by buses because it's too confusing and they'll end up in places with no idea where they are, so they'll stick to travelling by trains. I have colleagues who would purely know places by train stations. [SGP10_Male]

One key feature of the London's Tube is that there are a lot of ways to reach the same place. So if the District line doesn't work I can always change to another line, the Northern line or the Circle line, to get to the same place. In Singapore, it will be more of a challenge because to most destinations via the train we have only a single line there. And the problem with buses is that there isn't always an efficient bus route from each station to get to where you want. So, it's much harder in Singapore. [SGP15_Male]

Buses

I think based on my…I've been working for a year now and I would say that about 85% of the time it's smooth traffic. It's only on some days when it rains then there's a massive jam because people don't really know how to drive in wet weather. [SGP03_Male]

For my case, especially when I take the bus it's more comfortable now because they have increased the frequency of the buses and it's a new route that the town council has put in. This new route drives by my house, otherwise I would have to walk five minutes to another bus stop, compared to now where it's right beside my building so I can get to it easily. [SGP03_Male]

Trains

I guess it's about the same as the bus, but it's just that the frequency, though it's high, the amount of people taking the train is also high so it's natural for you to always be standing and squeezing with other passengers. But as long as it gets me to my destination without having to wait for a few trains before being able to get on the train, it wouldn't be an issue. … As long as I can get to my destination on time I wouldn't mind squeezing on the train. I wouldn't say squeeze, but rather having to stand during the train ride. [SGP03_Male]

If the train is easier, like there's a direct line to Orchard or something then I will take the train. [SGP06_Female]

I will also do buses once in a while but I rather stick to trains if I can. … Firstly, because it is more convenient and it's sheltered. Secondly, on the bus you might miss your stop because, unlike some countries that have a location thing that tells you where you are, buses in Singapore do not have that feature and you'll have to rely on Google Maps and it can be a very stressful experience and you might miss the stop. I would rather take the train. … And in Singapore, there are traffic jams and it can get quite congested as well. Trains, generally if they don't break down, are quite fast. [SGP10_Male]

…on the train there is a very low chance that you will get lost. So for me I don't have to think too much on the train because I just need to get off at a certain station. But for a bus, especially if I'm getting to a new place, I'll be constantly checking the GPS to make sure that I'm not getting off at the wrong stop. [SGP13_Female]

Ease of using private vehicles

Driving is one problem, parking is another in Singapore. Finding a parking space in Singapore is a big problem because the parking in here is limited and very expensive. … Coming here today, for instance, if this were a central area I would have to go many rounds or even further away in order to find a parking space. [SGP01_Female]

This is in addition to driving and owning a car being a burden to older people and not to mention the challenge of parking. That said, a car would be useful when going shopping or when visiting the expo where you'll be buying a lot of things. For people like us who don't drive, we would rarely go to the expo because even if the items are cheap, when we buy it we have no means to bring it home. [SGP02_Female]

It's also because some people want to avoid the crowd. It depends on the time of your travel as during rush hour it's really packed with people and you have to squeeze with others. So having a car gives you more freedom. Especially during mornings when you do not have enough sleep and you have to squeeze with people on the packed train or have to wait for the next train. …it depends on the convenience it offers and also the person's financial ability. [SGP02_Female]

But there are also others who insist on getting a car, it depends on the individual. There are also people who are rich who do not get a car, they would rather take a taxi because they don't have to stress about driving the car, parking and even topping up the CashCard for the ERP. [SGP02_Female]

I think it offers me another mode of transport. It allows me to have the backup option of driving because my family owns a car so I have this option available to drive at my own convenience if I really want to. For example, if I'm late when I'm meeting my friends I'll just borrow the car and drive it out, instead of hailing a cab, because it's more convenient. …it offers you more ways to travel around in Singapore. [SGP03_Male]

I also have to work pretty late and I want to get home as soon as possible and I don't want to queue for a taxi or take a bus, I want to go straight to my car and drive home. [SGP05_Male]

If we are in, for example Orchard Road, we might park the car in certain areas and then take the train or walk around and then go back because you can't go carpark-hunting all the time right? … For me, I like to know where I can park my car as in if I go to certain areas I make sure that there is ample parking so that I don't have to look for carparks. Some people do consider parking price but, I'm not being proud or arrogant, I don't. I just like convenience and because my wife is a member of Hyatt Hotel where she is entitled to free parking and it's quite centralised, so to speak, we always park there. [SGP05_Male]

Usually I will take the train, or I will drive if it's very convenient for me to drive then I'll take the car. [SGP06_Female]

Yes. I think having a car at my disposal is more convenient, for example, if I'm taking the public transport and I've to meet people earlier or later, or something happens, if I have a car at my disposal then I can just go ahead and drive and don't have to wait or spend more time traveling. So, having a car is easier and more convenient for me. [SGP06_Female]

Yes, I think so as parking is one of the main factors. If you make it very expensive and make it scarce in town then you might actually discourage people from driving in to town. Because even if I can drive up to town, if I know that it'll be very hard for me to find parking I won't be bothered to do so. [SGP12_Male]

Ease of using private-hire vehicles

Taxis wise I would go with Comfort taxis, meaning the normal taxis, not Uber or Grab, and book it via a phone call and that will cost me $3 plus in booking fees already. Recently, I've been using Grab a bit more frequently because it's a bit cheaper but then I'm not guaranteed a car on the spot so it can get quite unreliable in this sense so I will just go ahead and go back and call a Comfort cab. … Yeah, I would use Uber or Grab if I can get a car almost immediately otherwise I will just stick to Comfort cabs. [SGP06_Female]

Nowadays I prefer to take Uber, I hardly take taxis. …I think it's cheaper, I'm not sure how much cheaper it is because recently Uber raised their prices, but previously, based on personal experience, traveling to and fro some of the places that I go to appears that Uber is cheaper by a few dollars. Recently with Uberpool it's even cheaper, so if I'm not in a hurry I'll take Uberpool. … And also the convenience because I can book it to come to wherever I am. If I call for a taxi, I have to pay extra and if I'm outside I would have to go to a taxi stand. For Uber, it's much easier. [SGP09_Female]

For me I don't take the regular cab anymore, I stick to Uber. When there is anything I will just take the Uber, for example if it is raining or the train breaks down or I need to get somewhere fast. … Basically, it's the price as well as the service. I feel, in terms of the service I got from taxis in the past, I do not feel that I'm rewarded for taking their service. I felt like I was trying to find a taxi driver who was going the same direction as me. Thus, I decided that I'm not going to take a taxi unless I'm really desperate and in need to travel to somewhere. …and in terms of apps and all, like GPS, it's much better than what taxis can offer. … it's all about convenience and the best option is Uber for me. [SGP10_Male]

Quite convenient actually because I don't need to walk out under the sun to look for a taxi and then whenever it comes I'll just walk out. So I think Uber has given me a good option other than taxis and public transport. My overall experience is positive, let's put it this way. [SGP12_Male]

I do think that they need to improve on the public transport system here because the taxis are so hard to get. When you go on the road, it is so hard to get a taxi during peak hours and that pisses people off as well. Like me, I drink and it's very hard for me to go to a pub to drink and then come out and get a taxi, but my wife is from Hong Kong and when I'm in Hong Kong I can get a taxi from anywhere easily. I think something is not

right with our public transport as well – it is not as efficient as it should be. [SGP12_Male]

Uber certainly helps in terms of the convenience of getting a car to pick you up at your house or at your place, but using Uber you will still need to wait and sometimes you get 1.2, 1.5, 2 or 3 times the price, so there are downsides to Uber as well because during peak hours you may be paying twice the amount. Plus, being an Uber driver, they may not be able to find you all the time so you might have to go through all the trouble of getting them to the place that you want them to go. So, there are plus and minuses. I certainly enjoy the convenience of Uber but there are also things here and there, the Uber not being able to find you, during peak hour times two the price and things like that, means it's not there yet. [SGP12_Male]

…anywhere that requires me to make more than two to three transfers I might take the cab instead. [SGP13_Female]

It has definitely increased the choice and I think it has made it much more convenient because you can book your Uber or Grab even before you get to the roadside. So, it is now more convenient and people have more options. Moreover, Uber has all these options like Uberpool. It has given us a lot more choices. [SGP13_Female]

If I can get one by the roadside I'll always try to get one. If it's peak hours I would try to get GrabCar because the prices are fixed. Let's say the taxi stand has a lot of people I would then try to get another kind of taxi using Uber or Grab. Generally if I can get one by the roadside I will get one, if not I will use the app. … If you use the apps you have to wait for the driver to be assigned to you. Sometimes it is just a lot faster to go to the roadside and grab one. … But I don't think that the prices are that much different to warrant me choosing one over the other, unless it's during peak hour. [SGP14_Male]

But the problem is that these ride-sharing schemes can be quite inflexible also. Because the frequency is lower and you have to wait for people to be going in the same direction, it doesn't really suit the reason why I take a taxi, which is when I'm in a rush for time or have no choice. [SGP15_Male]

Ease of cycling/walking

Cycling to work? It's way too far for me because if I were to take the public transport it's going to take me 50 minutes already. If I cycle down to work it's probably going to take me 1.5 hours. And the weather in Singapore is quite hot, not like those overseas where in summer you probably get cold air blowing in your face. So when I get in to work through cycling, I think it's going to cause me to have a very uneasy day at work because I'll be drenched. [SGP03_Male]

INT So for yourself, in the near future will you consider cycling to work?
SGP10 It's something I was thinking about but weighing the pros and the cons I didn't opt for it and looking at how the situation is I don't think that will change any time soon, so I will not do it.
[SGP10_Male]

I would do it more for the convenience because I can just take the bike and go, and not have to wait for the bus. Probably it has nothing to do with money. Maybe some to do with the health. As long as I'll see my bike again, then yes. [SGP12_Male]

Financial Cost

Financial cost of public transport

In Singapore, I think it is okay if you're going to increase the fares by 10 cents. In other developing and poorer countries the transportation should be more affordable for the people but in Singapore I think it's okay. What I think should be done further in Singapore is lowering or removing the fares for the elderly and those in the lower income bracket. This is the group of people who are neglected in our society and I think this group of people still exists in Singapore and they should receive assistance with transport. It should not be about earning and collecting money all the time in Singapore. [SGP01_Female]

I think the price is okay because a huge cost is involved when developing a good infrastructure and because the country has invested a lot into developing it I think it's only right for the citizens to also be supporting this. With the current price or increasing it by 10 cents, I'm alright with it because with the rise they're also improving the system and this will cut down your travel time, saving you time. In addition, it's comfortable, fast and with little unreliability issues. So even if they increase the fares by 10 cents I don't think that is an unreasonable request. It's not easy being the leader in Singapore. [SGP02_Female]

INT So you were saying if you take the LRT then change to the MRT it's going to take about the same time.
SGP03 Yeah, but it's going to be more costly.
INT So the decision of choosing the bus and train over the LRT then MRT is because of the cost.
SGP03 Yeah, primarily because of the cost.
[SGP03_Male]

To be honest with you, I've not taken a bus in a long time in Singapore. I still feel that the bus is quite affordable to many. [SGP05_Male]

Partly, and also because our buses are very cheap. …I think people will rather take the feeder bus because we do have a very efficient feeder bus and it's very affordable because they do not charge you by per trip but included in one trip. [SGP07_Male]

Actually, it is very affordable. For students you have student prices, for the elderly they give discounts so it's very affordable. In fact, thinking of MRTs and buses they are really affordable [SGP08_Female]

Price wise, I really can't complain because Singapore's transportation is, I feel, not that expensive compared to other places that I've been to. So pricewise, I'm definitely okay with the price. [SGP10_Male]

I actually think that it is very affordable because a bus ride can be less than a dollar and an MRT ride usually are a maximum of $1.60 or $1.70 but when I go overseas one bus ride, no matter how many stops you go, is at least two or three Singapore dollars when you convert from the local currency, so I feel that it is very affordable in Singapore. Even taxis also, compared to other countries, taxis in Singapore are a lot cheaper. [SGP13_Female]

I think that Singapore's public transport is generally affordable compared to places like the UK. In the UK, a single bus trip can be £4 regardless of distance. So when I was in Singapore I averaged about S$100 a month on transport to my workplace and also to go on weekends. Singapore has concession plans for students and people who are not working so in that regard, it is quite affordable. If you're a working adult and you spend S$100 a month on public transport it's actually not that expensive. [SGP15_Male]

Financial cost of private hire vehicles

Probably the toll charges when you travel on certain roads. For example, when you're driving in a car or taking an Uber or taxi ride, you probably have to pay for the toll charges when you enter the city. I mean when you take the public transport or MRT you don't have to pay all these charges so it's also about cost. If I'm not in a rush I'll take the

bus or the MRT. But if I'm absolutely in a rush, like if I'm traveling late at night, I'll probably just take a cab. [SGP03_Male]

I can take the Uber. But it doesn't make sense to take a cab or Uber in the morning because of the cost. [SGP03_Male]

…but thinking about taxis, it isn't really that affordable. I don't know what the taxi rates are in other countries but in Singapore it feels quite pricey. …I think with the introduction of Uber and Grab it has become more competitive so I think Uber is easier and cheaper sometimes than normal cabs, but at peak hours it can be more. So I still think that it is quite pricey. [SGP08_Female]

Nowadays I prefer to take Uber, I hardly take taxis. …I think it's cheaper, I'm not sure how much cheaper it is because recently Uber raised their prices, but previously, based on personal experience, traveling to and fro some of the places that I go to appears that Uber is cheaper by a few dollars. Recently with Uberpool it's even cheaper, so I'm not in a hurry I'll take Uberpool. … And also the convenience because I can book it to come to wherever I am. If I call for a taxi I've to pay extra and if I'm outside I would have to go to a taxi stand. For Uber, it's much easier. [SGP09_Female]

For me I don't take the regular cab anymore, I stick to Uber. When there is anything I will just take the Uber, for example if it is raining or the train breaks down or I need to get somewhere fast. … Basically, it's the price as well as the service. I feel, in terms of the service I got from taxis in the past, I do not feel that I'm rewarded for taking their service. I felt like I was trying to find a taxi driver who was going the same direction as me. Thus, I decided that I'm not going to take a taxi unless I'm really desperate and in need to travel to somewhere. …and in terms of apps and all, like GPS, it's much better than what taxis can offer. … it's all about convenience and the best option is Uber for me. [SGP10_Male]

I don't actually take taxis, Uber or Grab. If I don't drive, I'll take public transport because taxis are too expensive for me as even if I drive it'll probably not cost as much. Taxis would probably cost five times as much as it would cost me to drive, but I'm not talking about the cost of the car, just petrol alone. So because I have a car I would drive, instead of taking the taxi. [SGP11_Male]

Uber certainly helps in terms of the convenience of getting a car to pick you up at your house or at your place, but using Uber you will still need to wait and sometimes you get 1.2, 1.5, 2 or 3 times the price, so there are downsides to Uber as well because during peak hours you may be paying twice the amount. Plus, being an Uber driver, they may not be able to find you all the time so you might have to go through all the trouble of getting them to the place that you want them to go. So, there are plus and minuses. I certainly enjoy the convenience of Uber but there are also things here and there, the Uber not being able to find you, during peak hour double the price and things like that, means it's not there yet. [SGP12_Male]

Even taxis also, compared to other countries, taxis in Singapore are a lot cheaper. [SGP13_Female]

Actually I prefer the conventional taxi, like the one that you flag down at the roadside. But sometimes at my house there really isn't any taxi so I have to use Uber. … I would prefer the conventional taxi because sometimes Uber has double charges and extra stuff so I feel that it's not that cheap sometimes. [SGP13_Female]

If I can get one by the roadside I'll always try to get one. If it's peak hours I would try to get GrabCar because the prices are fixed. Let's say the taxi stand has a lot of people I would then try to get another kind of taxi using Uber or Grab. Generally if I can get one by the roadside I will get one, if not I will use the app. … If you use the apps you have to wait for the driver to be assigned to you. Sometimes it is just a lot faster to go to the roadside and grab one. … But I don't think that the prices are that much different to warrant me choosing one over the other, unless it's during the peak hours. [SGP14_Male]

I still try to keep to public transport because even with these ride-sharing apps, the costs are still relatively high compared to taking the bus or train. …So for Uber and Grab they have the ride-sharing scheme and if you're part of the ride-sharing it's definitely much cheaper than when you take the taxi. [SGP15_Male]

Financial cost of using the car

Driving is one problem, parking is another in Singapore. Finding a parking space in Singapore is a big problem because the parking in here is limited and very expensive. Imagine paying $18 for five hours of parking, that would be equivalent to a taxi ride. Parking is an issue, not only driving. Coming here today, for instance, if this were a central area I would have to go many rounds or even further away in order to find a parking space. [SGP01_Female]

I would say not because the parking charges at my office is quite crazy so it doesn't make sense for me to drive down and the cost of petrol and probability of getting into an accident is quite high. I rather pay $3 instead. Even though it is more convenient for me to drive the car down, it just doesn't make sense for me to park in the office. … Once you hit a higher income bracket I guess it doesn't matter anymore. But for now I think it's more cost-efficient to use public transport instead of driving. [SGP_03_Male]

To me, to be honest, if I drive a private car, it's not my concern. If I want to go to, for example, Orchard Road, I would have to go through ERP and all these, I don't really think of it. … You have a choice right? You have a choice not to go in during that hour but if you're working, then you should take the public transport if you don't want to pay for the ERP. [SGP04_Female]

If the parking is not expensive then I will drive. … For example, if I want to drive I will decide if I have to pay for ERP and parking when I reach my destination and then how long I will take to get there, by car versus by public transport. If I find that it's more convenient and economically friendly to drive then I'll drive. Otherwise, I will just go ahead with the train if it's nearer, there's a direct train and it's cheaper. …I go to town almost every day, except weekends. But anyway, I'm prepared to pay for it because this is the system, this is how it works. If you're not happy about it, then don't drive. [SGP06_Female]

I think the occasion as well. For instance, if I'm attending a wedding and am all dressed up for the wedding then I'll drive because I also know that they will validate parking. … When parking is free! [SGP08_Female]

I have a car so I drive, but I do take the public transport if I'm going in to the town area because parking is expensive there. … The main thing is the parking, because it is expensive in town. And in Singapore, the public transport is quite good and well connected, I can just go on the bus and reach Shenton Way or on the MRT, so there is no need to drive. [SGP11_Male]

But these days I tend to take public transport because the parking fee has increased by two times at JTC so I would have to spend $16-$20 a day if I were to drive. So these days I tend to take public transport. [SGP16_Male]

Financial cost of purchasing and maintaining the car

…the cars in Singapore are expensive, they aren't $1,000-$2,000 only. … They're too expensive. Imagine your COE can buy a car plus you have to pay for the car. [SGP01_Male]

I think car ownership in Singapore is for the rich or the upper middle class because in Singapore I would say that the public transport, even though there have been some

recent hiccups, is reliable to get you to places. So a car, to me, is more like a luxury item on my checklist. [SGP03_Male]

I find it so silly to spend so much money on a car. The cars are so expensive here, really. Just my opinion, but I find it very strange that people spend $100,000 to buy a car, drive to work, park it there, drive it out again at 6 o'clock in the evening. To me, I don't find the rationale behind it because, like I said, I find our public transport fairly good. [SGP07_Male]

Well I didn't really purchase the car and it was already around hence I use it. But I'm not sure if I had my own family or stayed by myself I would have a car. Firstly, because I don't have the financial power to buy a car. Secondly, I feel like there is no need, especially with cabs. …if you don't feel like taking public transport you can take a cab. …financially speaking, the car is a burden, and even if you take a cab three to four times a week I don't think it will be as expensive as a car. [SGP08_Female]

Hypothetically speaking, if I were to stay in Singapore it will depend on my financial situation. Based on what I know now, probably not in the next ten years. …I wouldn't be able to afford the upkeep and it may not be worth it because we have many alternatives. [SGP09_Female]

Not in Singapore, maybe if I'm overseas. Even if I'm in Singapore it'll probably be when I have children, but right now, no. … Number one, it is so expensive to get a car. Number two, people tend to road rage quite a bit here in Singapore. And I feel that the public transport here is affordable and accessible enough, and if there is somewhere that you need to get to where public transport is a bit more inconvenient then just pay for a cab, it's definitely cheaper than owning a car anyway. … Yes. If next time, when I have children and need to get to somewhere I might just take a cab because the most you need to do it is like two to three times a week and the bill will probably add to $200 or $300 a month but if you own a car you're going to pay at least $500 or $600 a month just on fuel, instalment, and all that. [SGP13_Female]

Journey Time and Distance

Public transport in general across different modes

I can't do anything about it, I've to wait for the next one or just squeeze in. There's nothing much to complain about because the frequency of service is a lot higher now after they improved the service. Unless it's during the weekend when you've to wait slightly longer. But if it's the peak hour it's usually very fast. [SGP02_Female]

One scenario is when I go to school at NTU when it's way more convenient for me to drive. Because if I take the public transport I will have to take a bus from my house to the interchange then I'll have to take a train from Bishan to Buona Vista and then change to the Circle line from Buona Vista to Pioneer and then from Pioneer, take another shuttle bus into NTU. So that's a total of three to four changes for me and it's inconvenient even though it is cheaper. So in this scenario I will drive because it takes me only 40 minutes by car, even though I have to pay more for it I'm fine with that. [SGP06_Female]

Because I work in the afternoon and the traffic isn't that bad so I don't take traffic jams into consideration at that hour. I will choose between the bus and MRT based on which has the fastest route because when I work in the afternoon there isn't really any traffic issues with buses, so I'll see which one gets me there faster. [SGP09_Female]

I could take the bus if I wanted to but it would be a lot slower. … I guess cost isn't such a big factor since it's so near. For me, the major thing is the amount of time that I spend traveling. [SGP14_Male]

I guess it's complacency given that my ride in the morning is quite fast and not too crowded so I don't really see the need to take the bike. [SGP14_Male]

Yes, I would definitely choose the bus over other options. If there is a bus to my destination and the difference in time is between ten to 20 minutes I would most likely prefer the bus. [SGP15_Male]

In Singapore's context, now with the Downtown line it makes it more convenient. Driving takes about 30 minutes, the Downtown line takes about 40 minutes so the difference is not much to compare with. [SGP16_Male]

Buses

In Singapore, for some reason, whenever it rains there will be a massive traffic jam along anywhere on the roads in the morning during the rush hour. I don't know why, but it happens. When that happens it's usually caused by road accidents where drivers are not careful and this jams up the whole road. This probably costs me about an additional 20 minutes on the bus. [SGP03_Male]

Buses? I feel like sometimes if it's more than one hour it gets a little irritating because the bus journey is too long but if it's under half an hour on the bus it is okay. However, one good thing about buses is that you will probably get a seat. But it's so slow with all the traffic congestion and traffic lights. [SGP13_Female]

Trains

Especially on my way to work on a rainy day, if you drive you'll definitely be stuck in a traffic jam. It's faster to take the train. [SGP02_Female]

As long as I can get to my destination on time I wouldn't mind squeezing on the train. I wouldn't say squeeze, but rather having to stand during the train ride. [SGP03_Male]

I usually take the train to the hospital because it's faster and I'll avoid the jam and also it's very expensive to park. [SGP08_Female]

…in Singapore there are so many train lines and it is interesting and is really hard to optimise. You can take the faster route but because of the crowd and all you might miss the train and end up taking more time to get to where you want to go. [SGP10_Male]

I always feel that the train is faster. [SGP13_Female]

In Singapore's context, now with the Downtown line it makes it more convenient. Driving takes about 30 minutes, the Downtown line takes about 40 minutes so the difference is not much to compare with. [SGP16_Male]

Journey time and distance by private vehicle

Having a car for me though is for the convenience as I visit many different places often so if I don't drive I'll have to spend a lot of time waiting for the buses or taxis. It's not that the transport system here isn't good but it's my personal preference that I prefer the freedom that the car offers me. For example, I took about 30 minutes to arrive here today because I drove, but if I were to take public transport I would have had to leave 1 or 1.5 hours earlier. [SGP01_Female]

I would say it's for convenience in future. … I mean, even though you're going to take the public transport it's going to cost waiting time. Even though they've developed apps to tell you what time the bus is arriving at your bus stop, it is still dependent on the bus

driver and the speed limit of the bus as compared to driving your own car and travelling around Singapore, I think it will be much more efficient. That is if I have the means to get a car. [SGP03_Male]

If the parking is not expensive then I will drive. … For example, if I want to drive I will decide if I have to pay for ERP and parking when I reach my destination and then how long I will take to get there, by car versus by public transport. If I find that it's more convenient and economically friendly to drive then I'll drive. Otherwise, I will just go ahead with the train if it's nearer, there's a direct train and it's cheaper. [SGP06_Female]

In Singapore's context, now with the Downtown line it makes it more convenient. Driving takes about 30 minutes, the Downtown line takes about 40 minutes so the difference is not much to compare with. [SGP16_Male]

Journey time and distance by private-hire vehicle

Whenever I find that I want to reach a destination faster or when I'm running late and I don't want to have to bother about having to find a parking lot, I will take a cab or an Uber instead. [SCP06_Female]

To work, not really unless for isolated instances I'll use an Uber if the place is very far away or if I'm carrying very heavy stuff. [SGP09_Female]

I don't usually do unless the place I want to go is very inconvenient, it is very late at night or I'm rushing to a certain place then I'll consider taking a cab. [SGP14_Male]

Because sometimes the place can be quite near to where I am now but the way that the buses and MRT routes it's like I've to go one big round or make many transfers. In this case I would rather take the cab if it is under half an hour or something. [SGP13_Female]

Journey time distance by bicycle or walking

Cycling to work? It's way too far for me because if I were to take the public transport it's going to take me 50 minutes already. If I cycle down to work it's probably going to take me 1.5 hours. And the weather in Singapore is quite hot, not like those overseas where in summer you probably get cold air blowing in your face. So when I get into work through cycling I think it's going to cause me to have a very uneasy day at work because I'll be drenched. [SGP03_Male]

I would walk if the place is within walking distance, like within 15 minutes, but I don't think that exists in my current schedule. …if I'm meeting someone in my neighbourhood, like within five to ten minutes, or sometimes even 20 minutes, I don't mind walking because these meetings usually take place in the evenings anyway, when it is less warm. [SGP09_Female]

If within the town if you can plan it properly with biking lanes that can direct people to bike to an MRT station, for example, park their bike there safely and go on the MRT to go to work, that will work. Within the town and neighbourhood, within two to three kilometres of cycling, as anything more than that would probably be an issue. [SGP12_Male]

I did try walking back once from Boon Lay to Pioneer but I wouldn't use that as a mode of transport everyday. … At least in the morning because it will increase my traveling time quite significantly and that means I would have to wake up earlier in the morning to get ready. But as for the commute back from work to home I guess there isn't much reason for me not to walk home. But somehow I guess it's more like in my mind I just

want to get home sooner rather than later so I'll just take the MRT for convenience. [SGP14_Male]

I wouldn't even mind walking even as long as it's reasonable. … It really depends. For example, Seng Kang to Hougang, it's quite a reasonable distance, to a certain extent, up to an hour's walk, maybe 45 minutes, is reasonable to me. … three kilometres or slightly more. … I would consider doing it. If I had a 50-minute walk to office everyday I wouldn't mind it. To me it's also another form of exercise so I will definitely do it if it's viable. [SGP15_Male]

Reliability

Public transport in general across different modes

You've just got to hope that there isn't a train or bus breakdown, with that you'll definitely feel stressed because you need to get to work. Other than that it's okay. [SGP01_Female]

I think it's quite reliable and you can also count on the bus to come pretty much on time, for trains as well. I haven't really experienced much train breakdowns like other people may have so to me it's still okay. …I think generally it's quite reliable. …if I decide to take the public transport I will just go ahead as it doesn't bother me whether or not it may break down. [SGP06_Female]

I think it is pretty good in terms of infrastructure. Of course, in terms of reliability it definitely can be improved. Pricing wise, I feel it's fine and is not an issue. …The main thing that is a letdown is reliability. For places that do not have a train station it's generally fine because they are usually covered by buses. So in terms of transport network I think it is pretty okay. [SGP10_Male]

Plus, the public transport system in Singapore seems to be ageing and the confidence level for public transport in Singapore is not that high at the moment with the breakdowns happening often, therefore that might be generating more interest for private transport as well. [SGP12_Male]

My first choice is always to take the train; buses are like my backup option if the train doesn't bring me there because I feel that buses are more unreliable. With trains, you can also predict when it will arrive and you know for certain that you'll reach there in 20 minutes, so you don't have to wait 20 minutes for the bus and not having the bus show up. So for me, I would always prefer the train to the bus. [SGP13_Female]

Buses

I think one of the benefits of taking the buses now are that every bus stop is equipped with the system that tells you what time the buses will arrive, so if you know roughly what time the bus will arrive you just need to get down slightly earlier to catch the bus. This bus timetable provides more convenience unlike in the past when we do not know what time the bus will come and we might miss the bus. [SGP01_Female]

Definitely, improvements can be made to the quality. Firstly, waiting times can be more consistent, especially for buses. Recently I was taking the bus and ended up having to take a cab because the expected waiting time for the next bus was about an hour, which does not make sense. The gap being an hour is far too large. [SGP15_Male]

Trains

For me I think the transport system is good. Because Singapore's land area is small, with just the MRT and buses you can get to places easily even if you don't drive. However, there's an issue of the MRT breaking down frequently. [SGP01_Female]

As for the MRT, recently there has been more frequent train breakdowns. It is unreliable to a certain extent. There might be delays of five to 10 minutes. These additional jams, if I'm really unlucky, would delay my usual train time about half an hour. [SGP03_Male]

I think in Singapore, I'm not sure, but I've heard about all the major train disruptions in Singapore over the past few years. But I've not really encountered any of the major ones. The ones that I've encountered are more of five to 10-minute delays and the train operator would broadcast and tell you that the train will be delayed for a few minutes and apologise for the inconvenience caused. So I can't say for sure, but if you were to compare our train system with overseas I would say that our train system is much more reliable than overseas. [SGP03_Male]

You know in Hong Kong their MRT system is really well-developed, very punctual, and the breakdowns are less frequent than in Singapore. So the Singapore government needs to do something about it to improve the efficiency of the trains. I think it's quite fair for Singaporeans to be making noise now because the breakdowns have become more frequent than before and I think it's not so much about expectations but about the government needing to improve on that. [SGP04_Female]

I think it is good now but I find that, the trains for example, they have to pay more attention to the maintenance because the trains keep breaking down because of the stress, overusage or that the maintenance is not properly done. A lot of people are sick of the train system but I think we do have a system in place and it is just that the company that is running the train must have a good and proper maintenance programme. [SGP05_Male]

Especially the trains, I think every week there's some kind of delay or breakdown. Although in reality it is not as bad as it sounds but because of this publicity and with everyone saying 'oh god, the train broke down again, oh no', then you tell yourselves this is why you don't want to take public transport, because it's not reliable. [SGP07_Male]

I haven't had the misfortune of having to stroll in the tunnel so I've no experience to relate to. …I think the system we have in place is good enough. I don't expect the system to be 100% perfect or operational. [SGP16_Male]

Weather

Especially on my way to work on a rainy day, if you drive you'll definitely be stuck in a traffic jam. It's faster to take the train. [SGP02_Female]

In Singapore, for some reason, whenever it rains there will be a massive traffic jam along anywhere on the roads in the morning during the rush hour. I don't know why, but it happens. When that happens, it's usually caused by road accidents where drivers are not careful and this jams up the whole road. This probably costs me about an additional 20 minutes on the bus. [SGP03_Male]

I think based on my…I've been working for a year now and I would say that about 85% of the time it's smooth traffic. It's only on some days when it rains then there's a massive jam because people don't really know how to drive in wet weather. [SGP03_Male]

And the weather in Singapore is quite hot, not like those overseas where in summer you probably get cold air blowing in your face. So when I get in to work through cycling I think it's going to cause me to have a very uneasy day at work because I'll be drenched. [SGP03_Male]

I think it's the weather. How do you expect people to walk an hour to their office under the sun? It's so hot here. [SGP04_Female]

I've seen my colleague do it before, cycle to work, but the thing is that in an office environment in a tropical country like Singapore which is so hot… Weather is a big factor obviously to cycle to work. [SGP05_Male]

I find that it will not really work well in Singapore because of our weather. Let's say you're going to work and all dressed up, will you want to cycle to the train station 25 minutes away and when you reach there you're sweaty? [SGP07_Male]

…it actually feels good to walk, especially when the weather is not hot. [SGP08_Female]

It's too hot and I don't think that it is very wise. From prior experience, I don't think that there's anywhere I need to go that is within such close proximity that if I cycle there I would not feel like I'm not dying. I think it's physically too taxing and it's not about the exercise but it's just the heat itself that makes it so uncomfortable with the perspiration and everything. I mean, you can't really turn up at home drenched in your own perspiration. [SGP09_Female]

I would walk if the place is within walking distance, like within 15 minutes, but I don't think that exists in my current schedule. …if I'm meeting someone in my neighbourhood, like within five to ten minutes, or sometimes even 20 minutes, I don't mind walking because these meetings usually take place in the evenings anyway, when it is less warm. [SGP09_Female]

And the Singapore weather is really too hot to really cycle. That boils down to the office also. You must have a place for them to shower, lockers in the office building, before people can cycle to work but that is not happening now. [SGP11_Male]

…the weather here is too hot. If you really bike to work you'll need a place to shower and change before you go to the office. So the facilities are not there as well. Because if you compare us to Europe, to Amsterdam or Holland, people bike everywhere probably because the weather is so nice to bike and they have the infrastructure to encourage biking. [SGP12_Male]

Yes, because Singapore is so hot, no matter where the person cycles to the person will have to be able to shower. Right now, I feel that companies are quite supportive in the sense that they provide showers in the offices or allow for flexible work hours so I don't have to reach at 8.30am but at 9am so I can start cycling at 8 plus. But the thing is that if I can't even get to my office safely then I wouldn't even bother trying. So I think the weather and mindset can be overcome if I really really want to cycle, but if the physical infrastructure doesn't support it, then there's no point. [SGP13_Female]

In Singapore it's generally not feasible for walking because the weather is not great. Most people in Singapore wouldn't want to walk also. Walking is only suitable for short distances. Even Seng Kang to Hougang, which is considerably short, I think no one wants to walk that as well. [SGP15_Male]

Depending on the weather. If it rains, I'll drive. If it doesn't, I'll take public transport. [SGP16_Male]

In Singapore's context, now with the Downtown line it makes it more convenient. Driving takes about 30 minutes, the Downtown line takes about 40 minutes so the difference is not much to compare with. The only crux is that if it is raining then it's a bit more inconvenient. That's why the weather plays a part. … Not really. Most of the time the weather is reasonably good if we don't talk about the rainy season. [SGP16_Male]

I mean there are other Singaporeans or expats who try cycling or other alternative forms of transport but in our weather, sometimes it rains sometimes it gets too hot, it may not be feasible. For one trip you've to bring a lot of things, change of clothes etc. [SGP16_Male]

Using Journey Planning Application Or Tools

The thing is I usually plan my trips based on whatever is reflected on Google Maps. If I travel to a place I'm unsure of I will rely on Google Maps as it will provide me with the directions and the estimated time that I will get there. … It's helpful to a certain extent. If you're familiar with the places you're going to, sometimes the apps give you a longer direction if they don't have a shortcut but sometimes if you know the place well enough you'll know that there are certain public transports that you leverage on for a faster way. When I use these apps it's more that I'm unsure of a place. … It depends on what time I have to reach the destination. If I'm in a rush or am late, I'll base it on Google Maps to compare the time like for taxis. Basically, I'll be using the app to determine and plan my mode of transport. [SGP03_Male]

Firstly, before I make my decision on which kind of transport I want to use I will see whether driving or taking public transport is easier. I will use Google Maps to check the route for my driving and use, basically Google, to check out which lines and how long it will take for me on the trains…how long I've to spend on the train and how many changes I've to make if any. [SGP06_Female]

If I decide to go ahead with driving then I will also use the Google Maps when driving as a GPS…it just basically directs me when I'm driving because I use it as a navigation tool. [SGP06_Female]

No, not at all. But maybe because I'm used to the system. Having said that, our bus guide online, the app, is quite useful also. … That's mainly for the longer distance bus rides. But having said that, the accuracy is questionable also sometimes. [SGP07_Male]

Theme 3: Perception and Beliefs of Different Transport Modes

Perception of the transport

Perception of public transport

For me I think the transport system is good. Because Singapore's land area is small, with just the MRT and buses you can get to places easily even if you don't drive. However, there's an issue of the MRT breaking down frequently. [SGP01_Female]

Overall, I think even without a car I think it's alright because the government has learnt from the experiences and transport systems in other countries like the UK and Japan and then implement the best workable system in Singapore. [SGP02_Female]

We have a great public transport system, really. But, unfortunately, it needs a lot of fine-tuning. [SGP07_Male]

… with the system itself, I think I'm quite happy with it. [SGP09_Female]

I've always had this feeling that public transport in Singapore is more functional than trying to have good quality compared to transportation in Japan or Taiwan where everything runs like clockwork. In Singapore, it is clean and it's also more functional, for getting you from one place to another but service wise, I see a lack of focus in wanting to provide a service at all. I think that's the main reason why when the train breaks down, they just give you a bus that goes from one station to another station to bridge

the breakdown and that's fine because they feel that at the end of the day you get to go where you want to go. But it doesn't just work like this. But that's their supposed logic with such a policy. [SGP10_Male]

Most people are not happy with the public transport, but for me, I'm very happy. But maybe it's because I don't take it during peak hours. And the transport here, buses and MRTs, are not that expensive and I'm quite happy with that. And now, if you don't want to take taxis there are Ubers or Grab, you have a lot of choice. [SGP11_Male]

…the public transport system in Singapore seems to be ageing and the confidence level for public transport in Singapore is not that high at the moment with the breakdowns happening often. [SGP12_Male]

Perception of private vehicle

I really think that there are too many cars. For such a small country, there are really a lot of cars. [SGP13_Female]

Perception of private-hire vehicles

The taxis, itself, is okay. My dad was a taxi driver before so I know how being a taxi driver is like. I just find that taxi drivers sometimes they ask for it, like in Singapore as you know, when it rains you can't find a taxi and at certain hours they don't like to go into the city, into Shenton Way because it's congested and they have to change shifts where they only go a certain direction. They don't give the consumers a lot of options. Then came Uber and Grab, which is good because it gives a bit of competition for the taxi companies to fine-tune their concept. And I believe in competition, competition is good. … I'm seeing that some of these taxi companies are trying to educate their drivers a little bit more and they can't really monopolise the so-called private public transport, if there's such a word. [SGP05_Male]

I think it came out at the right time because I think our taxi drivers were getting a bit arrogant, especially during the peak hours. …and make the taxi drivers more hard working because now they know if they don't drive there's Uber and Grab. [SGP07_Male]

Perception of cycling and walking

Cycling for me would be an exercise, something that I would have to actually plan to do instead of using it as a transport system. [SGP06_Female]

Cycling to work is not our culture yet. For leisure, maybe. [SGP07_Male]

First the mindset, start with the younger generation. Cycling must be promoted as they grow up, just like in China where people cycle because they are brought up to cycle. Look at Vietnam, look at every kid, before they can run they can ride a motorbike because that's the way they travel from one village to another, it's the norm. For us, no, it's not our lifestyle. Unless we change our lifestyle I would honestly think that people wouldn't ride a bicycle unless for leisure and pleasure. [SGP07_Male]

Singapore has never branded itself as a cycling place. [SGP10_Male]

I would also say the behaviour because we don't exactly have a very good impression of cyclists in Singapore. Currently, the cyclists when they cycle on the pavement would usually ring the bell or ask people to move out of their way and sometimes they don't have a very good cycling attitude so people have a bad impression of cyclists. So it's

going to take a while for people to change and to accept cycling as a mode of transport. [SGP13_Female]

Singapore today is not cyclist friendly, it's not even two-wheel friendly in a very general sense. Accidents happen, but whether it is the cyclist's, motorcyclist's driver's fault, I don't see any improvements. Cyclists die, motorcyclists die, even skate-scooters also die. [SGP16_Male]

Desire for having a car

It's the same logic as what's your expectation of having the car. Whether it's just for convenience and getting to places without having to take the bus or rush for time and having more time or whether you enjoy taking the bus and MRT. I think it depends on the individual. You may enjoy taking the bus and MRT while I enjoy being able to drive because of the convenience and shorter travel time. So even if you make the transportation system excellent, there will still be people who would want to drive. [SGP01_Female]

I would say it's for convenience in future. …driving your own car and traveling around Singapore, I think it will be much more efficient. That is if I have the means to get a car. [SGP03_Male]

Yes, because we have two cars at home. If I give up my car we'll still have one more car at home. … That's right, again, it's for convenience. Financially if we can afford we will have a car in the household till the time we feel that we cannot drive anymore, one, or financially we cannot afford, then we will stop owning a car. [SGP05_Male]

Because by and large in Singapore, everyone wants to own a car, so as a fresh graduate or anyone who comes out to work for two or three years will say that they want to own a car. So everybody will try every ways and means to own a car. Even if they can't own a car, they will drive their parents' cars. [SGP05_Male]

Right now I don't think it's very affordable but I would hope to be able to afford it in future.
…I think it is very expensive. However, for now, even though I think it is expensive I will still want to try and set aside some finances for a car, even if I'm on my own or have a family in future, as I think it's more convenient for everybody as well. … I wouldn't say it is very important but it wouldn't be very convenient. [SGP06_Female]

I find it so silly to spend so much money on a car. The cars are so expensive here, really. Just my opinion, but I find it very strange that people spend $100,000 to buy a car, drive to work, park it there, drive it out again at six o'clock in the evening. To me, I don't find the rationale behind it because, like I said, I find our public transport fairly good. [SGP07_Male]

The younger people, I noticed that a lot of them, when they're in pre-U, JC, or university they start to get their driver's licence because that's their immediate aspiration. Once they work and they get their credit cards and car then that's it. … I think the mindset to own a car has been ingrained in you, like you want to have a car or a house kind of thing. [SGP07_Male]

I think I was 22 or 23, around that time… Because my family already had a car so it made sense to get a licence…so that I can drive the family car. [SGP08_Female]

Hypothetically speaking, if I were to stay in Singapore it will depend on my financial situation. Based on what I know now, probably not in the next ten years. But if I'm based overseas where cars are a lot cheaper I will probably get a car as it'll be more convenient that way. [SGP09_Female]

INT And do you think you will consider getting a car?
SGP10 I feel that Uber is very convenient in terms of pricing and I really do not feel the need to do so.
[SGP10_Male]

Yes, most people dream to have a car because you can't beat the convenience of having a car. It's just that if the prices are too high then you might want to turn to Uber, Grab or taxis instead of owning a car. I mean, for those who are just going to work and not doing sales, and just drive the car to office 9am to 5am, then there is no need to have a car. [SGP11_Male]

Probably owning a car has some sort of prestige there. Because if you own a car that means you must be doing relatively well compared to those taking the bus, I think. But then, cars itself, is something negative and not something that you earn from it, it's not an asset. It is a liability and burden. … You can see all the cars in Singapore look so new because they wash, polish and clean it up, unlike in other countries whereby the car is just a transport. Here, it is a luxury item. [SGP11_Male]

For me, I speak personally, I got used to the lifestyle of having a car. First of all, when I came to Singapore to study I didn't have a car, but when I went to the States to work for seven or eight years, I drove all the time and I got used to that lifestyle. So, when I came back I just bought a car because it's so hard to go around not having a car. So for me, personally, I think I got used to the lifestyle of having a car and find it hard to entertain the notion of not having a car to go around. [SGP12_Male]

It's something like every Singaporean working towards owning a private house as well then they upgrade themselves from HDB. Similarly, they would strive to own a car if they can afford it. I hate to use the word 'status symbol' but it's probably that, to tell people that 'I've made it'. But personally, that's not mine, it's more for the convenience. [SGP12_Male]

Not in Singapore, maybe if I'm overseas. Even if I'm in Singapore it'll probably be when I have children, but right now, no. … Number one, it is so expensive to get a car. Number two, people tend to road rage quite a bit here in Singapore. And I feel that the public transport here is affordable and accessible enough, and if there is somewhere that you need to get to where public transport is a bit more inconvenient then just pay for a cab, it's definitely cheaper than owning a car anyway. [SGP13_Female]

A lot of people prefer to drive. I think, myself included, it's just that a car to a person could be a status thing. You want to own a car because it feels good to own a car. That's one of it. If you give me the option of driving or taking the MRT I would drive if I could. One of the reasons I think is the status and pride of being able to own a car if we want to own a car. The other reason is that sometimes it's still more convenient to drive than to take public transport, especially if you are carrying bulky items or going multiple places or if the places you're going are less accessible via public transport. In these cases you would still prefer to drive if you could. [SGP14_Male]

INT You were saying that in future you would want to buy a car?
SGP15 I would consider it but of course there are other factors that may come into play. But it's definitely one of my highest or most prioritised considerations. …I definitely think it is quite useful and it gets me around. To a certain extent, the car is great for efficiency but the cost in Singapore is inevitable and you won't expect it to get lower so it's a trade-off. I guess it's for the fact that I like to drive that I put the car that high on my priority list.
[SGP15_Male]

But actually, if I could, I would prefer to drive. … Firstly, I like to drive, that's one aspect. Secondly, I feel that driving allows more control and flexibility as I get to choose the route and I have a better estimate of the time also. Because I'm the one driving I feel more in control of my journey. [SGP15_Male]

I have rented a car before but those are usually not in circumstances where I need to get stuff done. Mostly I rent a car for the purpose of renting a car. … Basically, the one

time I rented a car was to just explore the island of Singapore and not so much of getting to somewhere. It was more about renting a car to get to drive and, since I've a car, to make full use of it. … Definitely it was a great feeling. Like I said, I enjoy the level of control it offers me compared to taking the public transport and I also liked the feeling of driving. So, I definitely prefer to drive because it's more convenient. [SGP15_Male]

Need for a car

I think it is still okay to get around Singapore without driving. Taking trains and buses to places is convenient and fast. … Overall, I think the transport system here is okay even if you cannot afford to travel by car unlike other countries like Malaysia. [SGP01_Female]

Compared to other countries like the US, UK and Australia where the land area is big they don't have many buses or public transport available so they need to have a car. In my opinion, in Singapore you do not need to have a car. … Overall, I think even without a car I think it's alright because the government has learnt from the experiences and transport systems in other countries like the UK and Japan and then implement the best workable system in Singapore. [SGP02_Female]

I mean it becomes more of a necessity if my family members have inconveniences, like my parents having difficulty walking distances, then I will consider getting a car. So it's very much dependent on whether you can afford it and whether you have the need to drive in Singapore. [SGP03_Male]

Primarily because I have a car. If I don't use the car then the car is sitting at home then there's no point for me to have a car, that's one. [SGP05_Male]

The reason why I choose to travel by public transport: now that I'm retired I don't really need the car, like I said our public transport is fairly good and I'm never in a rush so it brings me to places I want to go. [SGP07_Male]

It's very easy to get around and you don't really need a car in Singapore. In bigger countries like in China, UK or US you probably need a car. [SGP08_Female]

Well I didn't really purchase the car and it was already around hence I use it. But I'm not sure if I had my own family or stayed by myself I would have a car. Firstly, because I don't have the financial power to buy a car. Secondly, I feel like there is no need, especially with cabs. …if you don't feel like taking public transport you can take a cab. [SGP08_Female]

I think that in Singapore, if you can't drive, don't have a licence or don't have a car I don't think it's going to impact your life in a very large way because I think our public transport system is very efficient and taxis and Ubers are not exorbitant. But I think it is a good skill to learn because in case of emergencies or when you have family or elderly, it makes things easier when ferrying these dependents around. But as an independent adult, I don't think not having a licence has a big impact on your life. [SGP09_Female]

I believe that they have their value in our daily lives. When I was younger my parents had cars and it was really convenient but it's not an essential item because we are not like in other countries where bus services are limited or they come every half an hour. We have a lot of options and also alternatives to these options. I think living without a car in Singapore is pretty okay. [SGP09_Female]

Yes, most people dream to have a car because you can't beat the convenience of having a car. It's just that if the prices are too high then you might want to turn to Uber, Grab or taxis instead of owning a car. I mean, for those who are just going to work and not doing sales, and just drive the car to office 9am to 5am, then there is no need to have a car. [SGP11_Male]

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…because I might need to drive my clients…my job requires a car. But if it's for leisure, like going for shopping, then there is no need for a car. [SGP11_Male]

If I don't have to send her to work anymore, if she stops working, then the pressure to own a car is much less because I'll not have any timing issues because for me I'm on flexible work hours and I can plan my client meetings ahead of time and I don't really need a car to be honest. [SGP12_Male]

I'm from Malaysia, so if you compare Malaysia to Singapore, it's a lot less convenient to travel by public transport because the places you commute between is a lot further. But in Singapore, the distance from East to West is like 40km, so it doesn't actually take so much time for driving to be necessary as if you were to stay in another country. [SGP14_Male]

And Singapore is a really small island and for most distances you can reach within an hour or so with public transportation so there's no real need for a car beyond wanting to drive or for luxury reasons. [SGP15_Male]

A lot of people deem the car as a necessity but in fact it's not a necessity and it's just a want. You don't even need it in the Singapore context because you don't travel interstate, you don't drive a few hundred kilometres a day to get from point A to point B so it's less of a need than a want. [SGP16_Male]

Cycling as Recreation

Cycling for me would be an exercise, something that I would have to actually plan to do instead of using it as a transport system. [SGP06_Female]

For leisure it is different. Like on weekends you want to cycle from the park to adjoining parks yes, but if it's for day-to-day to work I think very few people will do that. …cycling to work is not part of our culture yet. For leisure, maybe. [SGP07_Male]

Singapore has never branded itself as a cycling place. If people want to cycle they can go to the park connector and so on, but the roads are not safe for cycling. [SGP10_Male]

I tried the bicycle but it's really dangerous to ride in Singapore because the drivers are very inconsiderate when it comes to giving way to bicycles. So I think I won't do that on the main road, but in parks it is okay. [SGP11_Male]

…seriously, on the road, I'm not confident enough to cycle but in the park I'm okay, but not on the road. [SGP11_Male]

I tried it before because I've bikes and do bike around if I'm free. I do find that the park connectors that go to and connect the parks from the last time that I biked around half the island I noticed that park connectors are basically pavements, so they're probably not done yet. If I bike for fun, that's okay but if I bike to work or do things I don't think that's possible. [SGP12_Male]

A Form of Exercise

Obviously cycling is good for health and walking is also good for health and if the constituencies and areas allow for such a thing then I think it is a very good idea. [SGP05_Male]

I would do it more for the convenience because I can just take the bike and go, and not have to wait for the bus. Probably it has nothing to do with money. Maybe some to do with the health. As long as I'll see my bike again, then yes. [SGP12_Male]

Actually LTA is promoting the 'Walk, Cycle, Ride' across the whole of Singapore but I think it is a bit hard to implement because the weather is too hot. When you try to get to wherever you're getting to you're all sweaty and so it's not exactly feasible. …I feel like the priority is on easing the current public transport infrastructure load, but then they decided to throw in the active lifestyle to encourage people to change. [SGP13_Female]

If I had a 50-minute walk to office everyday I wouldn't mind it. To me it's also another form of exercise so I will definitely do it if it's viable. [SGP15_Male]

Linking transportation to the environment

They already have the plan in Tengah, in the West of Singapore where they're trying to have the concept of having the whole location car-free. There wouldn't be a car in the suburb. People going back to their home by walking or cycling. They would still have cars going through but it's all underground. So on top it is car-free and I think it's a very good concept. … Yes, to be more active and help the environment as well. I really fully support this project, I don't mind moving there. [SGP04_Female]

Firstly, I thought I can help the environment by driving a hybrid car. Secondly, the quietness of the car. And of course, the affordability of the car that I'm having. …I know it's a bit contradictory because I drive. But because I like the convenience of having a car and I already have my carbon footprint so I thought I reduce it by a little bit, at least 30% of it by driving a hybrid car. [SGP05_Male]

Nope, I've never heard of anybody being environmentally friendly or they should not own a car because they want to be friendly to the environment. I think we have not evolved to that level yet as Singaporeans. …I'm sure there are some very environmentally friendly people in Singapore, I don't doubt it, but, unfortunately, the percentage of it is very low. When they buy a car that is not the top consideration. The looks, the engine, etc. I don't think being environmentally friendly is top of the list there, or even on that list. So when you go and buy a car and the company tells you that 'by the way, this car is also environmentally-friendly' you'll say 'okay' because it's not like I came here, top of my list, for a car that is environmentally friendly. No, probably you'll look for the looks, the horsepower, the engine, the leather seats, etc. [SGP07_Male]

To be honest, I'm less concerned about the environment. … Yeah, it's like a secondary consideration. Primarily, I will consider the finances, whether there are children in the family, if there is a need for it, whether I have elderly at home. These things play more into consideration compared to the environment, unfortunately. [SGP08_Female]

This is a personal opinion and I don't think many locals share it, but I don't think it is a good idea to make cars more affordable in Singapore because of the environmental issue and the space issue. I'm not saying this as an expert but as a personal opinion I just think that we have such a great transport system so we do not have a need for more cars on the road, which will contribute to more pollution even though we are no way as polluted as big cities like Shanghai and Beijing but every little bit counts. We have such a great transport system and have limited landmass, yet everyday we're trying to build even more things so I don't think having more cars on the road is going to help with our traffic. We don't have very bad traffic right now but I think that will happen if you let more cars on the road. [SGP09_Female]

Not really. I've never heard someone saying that 'I'll not take a car because it's too environmentally unfriendly', they're usually saying they don't get a car because it's too expensive. [SGP13_Female]

…environmental factors are out of my control. If I have a chance to contribute to it I definitely would but when I make the decision between taking the train or the bus, whichever decision I make, both transports are going to run. To me, I cannot have a direct impact on whether this mode of transportation has some sort of environmental impact so generally this notion doesn't cross my mind. [SGP15_Male]

In my consideration of whether I should get the car I don't think I factor in the environment into account. On a deeper basis, I would be concerned about it if it's causing issues. Let's say if it's causing genuine issues I would be concerned about it but at this point in time I'm not sure of it. Personally, I've not seen much of this information in the news or statistics that there is a level of pollution in Singapore from the cars and to what extent are these cars causing environmental impact on Singapore. But in these few years leading up to being able to afford a car, my decision may or may not be affected if more of this information is available. But at this point in time, it is not a concern and no one really talks about this in Singapore. … We cannot really see pollution and, like I said, the news doesn't really report this type of things. Basically there is a lack of awareness in Singapore regarding these environmental issues. … I think that we definitely should be raising awareness, especially with the recent news about the number of deaths in Beijing that resulted from the pollution levels there. [SGP15_Male]

Theme 4: Anticipated Travel Experience

Stress

Stress when using public transport

I do take the public transport too and I don't think it's stressful. … You've just got to hope that there isn't a train or bus breakdown, with that you'll definitely feel stressed because you need to get to work. Other than that it's okay. [SGP01_Female]

It's not about a smoother train ride or the faster time but because it is less stressful. Because the train is so crowded, I try not to get onto a train unless I know that it will not be crowded. [SGP10_Male]

Sometimes if the train arrives as you reach the platform then there's some kind of a mad rush of everyone trying to get on the train. … I guess I just have to get used to it. The way I see it is that it is just the morning rush hour, given the time that I go to work at 7.50am so it doesn't really affect me much as to me, it's just the rush hour. [SGP14_Male]

Usually I don't feel stressed because I think I tend to lose myself in my own world on the train listening to something or reading something. I tend to isolate myself from the crowd so the crowdedness doesn't really affect me. [SGP15_Male]

Stress when using private vehicle

I'm used to it already for so many years so it's not so stressful to me in that sense unless there's an accident on the expressway then I'll be rushing for time and that would add a little bit to the stress level. [SGP05_Male]

Working from home I save the money and because I don't drive or take the public transport and it makes it less stressful not having to bother about the traffic and human congestion. [SGP16_Male]

In the morning I usually travel after the peak hour so I'm not affected by the congestion. But it's a higher level of stress, if you ask me, during the evening congestion because everybody gets off work at the same time but start work at different times. … When I first started driving and drove enough, I feel my temper gets shorter, my stress levels go up and I feel a bit more frustrated and everything, but now I'm okay. … You need some getting used to. … I can't recall how long I took but it took a certain self-realisation that

my temper was frustrated and only then I began to make changes to how I drive and get to work. [SGP16_Male]

Being able to do something during the journey

…in the past when they did not increase the frequency I had to stand as compared to now I have available seats for me to rest. … It gives me time when I'm sitting down to use my phone to read newspapers or surf social media though when I'm standing I can still use my phone. …it enables me to do more things on the bus. [SGP03_Male]

During peak hours it is actually quite squeezy and that's the only part that I don't like, but it's the peak hour. Other than that, the train journey is quite smooth so you can do things like read or use your phone whereas on the bus I actually will get motion sickness if I try to read and all that. So, the train is more comfortable for me. [SGP13_Female]

…usually I'll be doing something on the train, doing or reading something on my phone or listening to music…I guess that to a certain extent I'm inclined to doing something on the journey but it's not so much about the crowdedness but I believe in making my time on the train more productive as well. [SGP15_Male]

It's almost the same. The only thing about driving is that you cannot do other stuff and have to be focused on the road. When you take public transport you can do literally everything, reading the news, checking emails, chatting with friends. But when you're driving you have to concentrate on the road and nothing else more. [SGP16_Male]

Comfort

Physical comfort

…in the past when they did not increase the frequency I had to stand as compared to now I have available seats for me to rest. [SGP03_Male]

If I cycle down to work it's probably going to take me 1.5 hours. And the weather in Singapore is quite hot, not like those overseas where in summer you probably get cold air blowing in your face. So when I get into work through cycling, I think it's going to cause me to have a very uneasy day at work because I'll be drenched. [SGP03_Male]

Because I will sweat and I don't want to feel sweaty when I reach a destination, like if I were to go for a job interview for example or to go meet my friends for dinner. I want to feel clean and good so I don't want to bother spending a little bit more time walking or cycling. [SGP06_Female]

Partly, and also because our buses are very cheap. I find that it will not really work well in Singapore because of our weather. Let's say you're going to work and all dressed up, will you want to cycle to the train station 25 minutes away and when you reach there you're sweaty? It doesn't make sense when you can just take a feeder bus and with this transfer the journey continues and it's not really that expensive. … Because on the feeder bus you have the air-condition and you then get off and walk to the train, half an hour later you reach the office without a drop of sweat. If you have to sweat like a mad man when you reach your destination and then have to find a parking for your bicycle, and at the end of the day it's even worse when you're really tired and have to cycle back to your house, how many people would? [SGP07_Male]

It's too hot and I don't think that it is very wise. From prior experience, I don't think that there's anywhere I need to go that is within such close proximity that if I cycle there I would not feel like I'm not dying. I think it's physically too taxing and it's not about the exercise but it's just the heat itself that makes it so uncomfortable with the perspiration

and everything. I mean, you can't really turn up at home drenched in your own perspiration. [SGP09_Female]

But I do personally prefer to take the bus, if possible… Because I feel like the seats are more comfortable. I think it's mostly for comfort because on trains you're sitting on hard chairs and facing a whole row of people. I don't think the train is uncomfortable but the bus is more comfortable and you can get a seat and scenery outside. [SGP09_Female]

The bus is definitely more comfortable and not only is it less crowded, there's always a chance to get a seat. [SGP10_Male]

Very comfortable in fact. You know the arrival times of the buses and trains and all the buses and trains are air-conditioned and you hardly need to walk more than a 100 metres to reach an MRT station or bus stop. So I think it is very convenient, plus it's sheltered all the way. … it does encourage me to take public transport when I go in to town. [SGP11_Male]

Actually I've thought of riding a bicycle to work before, except that I never really got down to trying it out because, even though the distance is not that far, by the time you ride from my place to the workplace you would start to sweat and that would affect my morning because you start feeling sticky and uncomfortable so I guess that is one of the major obstacles that I have not overcome yet to start riding a bicycle. … I guess there are actually showers in the toilet but I've not really explored or tried to use the showers in the morning when I get to work. [SGP14_Male]

Most of the time it is also easier to get a seat on the bus if I go at the right timing. … It feels more comfortable to me. [SGP15_Male]

It's on par, no real difference. But maybe driving is more comfortable given that you're in an air-conditioned environment. There's air-conditioning on the public transport but sometimes it can be pretty bad and not consistent so there are times that you're faced with a humid carriage without air-condition. If you go on that point, the comfort level with air-conditioning makes a difference. [SGP16_Male]

Aesthetic (environmental) comfort

I don't think the train is uncomfortable but the bus is more comfortable and you can get a seat and scenery outside. [SGP09_Female]

I guess it's because I'm moving on the road where there is more scenery outside and because the Purple and Circle lines are both underground so it feels better to me. Generally I prefer the feel of the bus, the way it moves. [SGP15_Male]

Social proximity and interaction

It's good in Singapore because we have to use it everyday and people now are more time-conscious in a way that they know that it's the peak hour so they'll automatically move further into the buses to allow more people to get on board. Even the bus drivers will help by urging people to move in. Even on the MRTs there are people that will help with boarding. Because everyone uses it for their daily commute they would automatically adapt their behaviour. [SGP02_Female]

As long as I can get to my destination on time I wouldn't mind squeezing on the train. I wouldn't say squeeze, but rather having to stand during the train ride. [SGP03_Male]

I think it's comfortable except on the trains during peak hours when it may get very squeezy when people push around and I get quite irritated in the morning. [SGP06_Female]

I don't travel at peak hour much but I understand from people who travel at peak hour to work that the MRT situation is horrendous, meaning it's packed like sardines. So that's another reason I hear that people rather drive because the waiting time is ridiculous and the queue in there is really packed like sardines. So, I guess some people would rather drive. [SGP07_Male]

The thing for me is that I can technically walk to the train station and take the train but because it's in the morning and with the morning rush I tend not to do that. That's because everyone tends to head to the station. So I would rather take a bus to another station that is less crowded and then take the train. [SGP10_Male]

It's not about a smoother train ride or the faster time but because it is less stressful because the train is so crowded. I try not to get onto a train unless I know that it will not be crowded. … It tends to be quite bad from 8am to 9.30am because that's when most people get to work. … Where I live is quite near the city and main areas so I can't even get onto the train and may have to wait for two or three trains before I can get on. And even when I do get on, it's right at the door so it's very uncomfortable and really bad. That's for trying to get onto the train. No matter which door I go to, the end or the middle, I'll still have to wait for a second train so I might as well just take the bus and go somewhere else to get on the train. …it is much better trying to get on at a station that is less crowded. What some of my friends do is that they take the other direction from where they want to go and then go down but I feel that that's too much effort for me to do so. [SGP10_Male]

The bus is definitely more comfortable and not only is it less crowded, there's always a chance to get a seat. Even though the frequency of the bus is not ideal, maybe like once every ten, 15 minutes, it's much better than trains because there're always fewer people on the bus compared to trains. [SGP10_Male]

During peak hours it is actually quite squeezy and that's the only part that I don't like, but it's the peak hour. Other than that, the train journey is quite smooth so you can do things like read or use your phone whereas on the bus I actually will get motion sickness if I try to read and all that. So, the train is more comfortable for me. … And also it has a lot more space as the bus has so much more finite space compared to a train. [SGP13_Female]

…the quality of conventional taxis; to me they're just normal. … The Uber drivers are more chatty, polite. … It's as if they know that they are the private vehicles so they're very polite. They're all just very chatty and polite. [SGP13_Female]

The train ride itself is pretty alright, I wouldn't say it's comfortable because I don't usually take a seat. But I guess what I can comment more on is that when I pass through the gantry to the platform, that can be a bit crowded especially in the morning. Some times if the train arrives as you reach the platform then there's some kind of a mad rush of everyone trying to get on the train. … I guess I just have to get used to it. The way I see it is that it is just the morning rush hour, given the time that I go to work at 7.50am so it doesn't really affect me much, as to me, it's just the rush hour. [SGP14_Male]

Most of the time it's surprisingly crowded. Because most people taking the Purple line get out in the town area at Dhoby Ghaut so for the first leg of the journey it's quite crowded and I don't get to sit. For me, I would prefer to sit due to the long journey but most of the time I don't get to sit. Even after I change over to the Circle line I don't really get to sit. Apart from that, the journey is quite smooth apart from having a lot of people on the train. The trains have broken down quite a few times so there were a number of times that I had to squeeze in and there were very long queues all the way up the escalators. When I transfer to the Circle line there's one long travellator and near the end of the travellator stretch you can start to see people crowding there. When there is a slight delay you can see a lot of people being stranded there because the platform is a small area and there are a lot of people waiting at the same time. Most of the time I get to board the train immediately but during these times I've to wait for one to two

trains to pass before I get to board the train. Generally I wouldn't really complain since I tend to get to office on time as I tend to leave early to give a bit of buffer. So generally, it's not too bad. … Yeah, usually it's quite crowded. For the Purple line, because most people are taking it to Dhoby Ghaut. For the Circle line, the crowd only begins to clear at Bouna Vista. There is a stark difference as before Bouna Vista I'm basically sandwiched and after Bouna Vista I've a lot of space to myself. [SGP15_Male]

Usually I don't feel stressed because I think I tend to lose myself in my own world on the train listening to something or reading something. I tend to isolate myself from the crowd so the crowdedness doesn't really affect me. It definitely helps me to kill time during the journey and make the journey feel faster. Since there is something to focus on, it makes it harder to feel like you're trying to move from one place to another. …it's some kind of a distraction. [SGP15_Male]

Security

I think, compared to other countries, our public transport in Singapore is actually very safe and efficient. … Like in Australia, when you take the trains at night you have to be very careful. They have these boxes to avoid being attacked or raped, a box that is under CCTV. Whereas in Singapore, we don't have that concern and our public transport is actually quite clean and fast. I think it's because Singapore is smaller as well so it is easier to ensure that people can access various parts of the island via public transport. [SGP08_Female]

…one of my biggest deterrents is that I have foldable bikes and being foldable it means that things can be detached so it's very hard for me to lock my bike. It's not safe because I've got my seat stolen before in a condo because it can be detached and taken away. So, for me to use this, like I've said, provided I'll see my bike again when I return. [SGP12_Male]

Physical safety when cycling

When I'm cycling in Singapore I have to cycle on the road, competing for road space with other vehicles and I'm constantly worrying if the lorry will hit me. There are a lot of cyclists that have been hit on the road here. There isn't a proper road for the cyclists. If you want to encourage your citizens to cycle you have to first provide the proper infrastructure for them. I've noticed that there are now more people cycling in Singapore to work but it's dangerous for them. When I drive and I see a cyclist on the road I will give way to them because I'm a cyclist myself and I know when it's dangerous for cyclists and I would give way to them. So if you want Singaporeans to cycle or walk you've to first provide the infrastructure. [SGP01_Female]

And also, in Singapore, it's not a cycle-friendly country unlike Europe where long time ago, they've developed the infrastructure including cycle tracks, unlike Singapore where it is very dangerous for cyclists to cycle on the road, especially during the busy hours. It is very dangerous, it is not a cyclist-friendly country. [SGP04_Female]

…also I think because Singapore, as a land-scarce country, the road itself is quite dangerous for people to cycle to work unless we make a cycle track in the entire country, which I think is quite impossible. [SGP05_Male]

I would, definitely, if it is safe enough and the roads are okay I definitely would want to and am thinking about it. … The traffic in Singapore - the drivers are not exactly very safety-conscious. So I feel the whole aspect of being on the road and being a fellow road user is not good in Singapore compared to like in Japan or Taiwan in terms of cycling. … Singapore has never branded itself as a cycling place. If people want to cycle they can go to the park connector and so on, but the roads are not safe for cycling. [SGP10_Male]

I tried the bicycle but it's really dangerous to ride in Singapore because the drivers are very inconsiderate when it comes to giving way to bicycles. So I think I won't do that on the main road, but in parks it is okay. [SGP11_Male]

It is unsafe, definitely. Two things: One, you bike on the pavement and there are also a lot of people walking as well so it is not safe because you can knock into people or fall into the drains. Two, if you bike on the road, because the roads have no bike lanes you have to share the road with other cars and drivers in Singapore are not good at sharing so I don't want to risk my life for this. But there are certain places where you can bike, you can bike in East Coast Park, no issues. I would like to be able to bike into town. If it's safe and I have my own biking lanes then definitely. [SGP12_Male]

I went cycling in Netherlands once and the cycling lanes were just very well-connected and everyone gave way to cyclists. The cyclists had the most right of way on the road and this would encourage people to cycle because you know that it is safe. But in Singapore when you cycle you don't know if someone will run you over. …I feel that it is not that safe yet. …I think you need to build the right lanes, roads and signals for the cyclists first and educate people to let them know that this is a real mode of transport and we have to give them some right of way and also rules to cyclists before I'll consider, because right now if I have to cycle on the road I'll be quite scared. [SGP13_Female]

Right now, I feel that companies are quite supportive in the sense that they provide showers in the offices or allow for flexible work hours so I don't have to reach at 8.30am but at 9am so I can start cycling at 8 plus. But the thing is that if I can't even get to my office safely then I wouldn't even bother trying. So I think the weather and mindset can be overcome if I really really want to cycle, but if the physical infrastructure doesn't support it, then there's no point. [SGP13_Female]

Singapore today is not cyclist-friendly, it's not even two-wheel friendly in a very general sense. Accidents happen, but whether it is the cyclist's, motorcyclist's driver's fault, I don't see any improvements. Cyclists die, motorcyclists die, even skate-scooters also die. [SGP16_Male]

Autonomy

Having a car for me though, is for the convenience as I visit many different places often so if I don't drive I'll have to spend a lot of time waiting for the buses or taxis. It's not that the transport system here isn't good but it's my personal preference that I prefer the freedom that the car offers me. For example, I took about 30 minutes to arrive here today because I drove, but if I were to take public transport I would have had to leave 1 or 1.5 hours earlier. [SGP01_Female]

Having a car would offer the individual freedom and convenience. … Having a car offers convenience, especially for me as I've been used to having a car unlike those who do not drive as they're used to having to work their schedule around the travel time required of taking public transport. [SGP01_Female]

It's also because some people want to avoid the crowd. It depends on the time of your travel as during rush hour it's really packed with people and you have to squeeze with others. So having a car gives you more freedom. [SGP02_Female]

I mean, even though you're going to take the public transport it's going to cost waiting time. Even though they've developed apps to tell you what time the bus is arriving at your bus stop, it is still dependent on the bus driver and the speed limit of the bus as compared to driving your own car and traveling around Singapore, I think it will be much more efficient. …I think it offers me another mode of transport. It allows me to have the backup option of driving because my family owns a car so I have this option available to drive at my own convenience if I really want to. [SGP03_Male]

I would do it more for the convenience because I can just take the bike and go, and not have to wait for the bus. [SGP12_Male]

I feel that driving allows more control and flexibility as I get to choose the route and I have a better estimate of the time also. Because I'm the one driving, I feel more in control of my journey. [SGP15_Male]

I think the issue of control, you can still have control in choosing when to leave and when not to leave. It's just that certain public transport have time limits where after 12.30am everything stops and before 6am nothing has started. So driving, yes, gives you the flexibility because you can leave and start at those odd hours. [SGP16_Male]

Road congestion

Even if you drive you'll also be subjected to traffic jams on the road. Especially on my way to work on a rainy day, if you drive you'll definitely be stuck in a traffic jam. It's faster to take the train. [SGP02_Female]

I think based on my…I've been working for a year now and I would say that about 85% of the time it's smooth traffic. It's only on some days when it rains then there's a massive jam because people don't really know how to drive in wet weather. [SGP03_Male]

I think Singapore's road transport infrastructure… There is not much of traffic jam apart from the morning and evening during peak hours, but it's not that bad because the traffic is still moving. When you compare it to Bangkok or Taiwan, it's so much better. [SGP04_Female]

I usually take the train to the hospital because it's faster and I'll avoid the jam and also it's very expensive to park. Because taking the train helps avoid jams. [SGP08_Female]

Because I work in the afternoon and the traffic isn't that bad so I don't take traffic jams into consideration at that hour. [SGP09_Female]

We've such a great transport system and have limited landmass, yet everyday we're trying to build even more things so I don't think having more cars on the road is going to help with our traffic. We don't have very bad traffic right now but I think that will happen if you let more cars on the road. [SGP09_Female]

Car pricing, it's good in the sense that we have less congested streets as not everybody will own a car because of the high prices. Even for me, because of the car price, I may just give up on the car. If it's too cheap then everybody will buy cars and the roads will be congested and you may be stuck for an hour or two in a traffic jam. …together with the ERPs and all that. But the ERP charges are still relatively low because you're talking about $2 or $3. It's the car price that is definitely the killer coupled with the COE, which controls the amount of cars allowed on the road. [SGP11_Male]

Correct, people own cars but choose to use public transport because parking is expensive and the traffic jam will cause you to think twice. You'll think 'if I use the MRT, it's reliable and I can get to where I want to go in a specific time because there are no jams on the MRT, whereas if I drive I may get stuck in traffic jams and spend a lot of time trying to find parking'. So that may turn people off from driving in their cars to town. [SGP12_Male]

Theme 5: Thoughts about transport policies

Subjectivity surrounding the affordability of cars

Quotes are similar to those in 'Financial cost of private vehicles'.

Vehicle Quota System in Singapore: The necessary evil

Of course I understand because Singapore's land area is small that's why they encourage you not to buy a car because if everyone drives there would be traffic jams. I can understand the rationale. [SGP01_Female]

I think this is actually, even though it may sound like it is very expensive to own a car in Singapore, I feel that it is a good system in place because Singapore is a small country and our transport infrastructure is quite robust in the sense that you can get to any place you want. Because of the high cost of cars, on the road you don't get frequent jams. We do get jams, but compared to like Malaysia, Kuala Lumpur, if you drive to the city centre you're probably going to get stuck in a jam there for like much longer, and I think it's because they do not control the number of vehicles on the road. So even though it is at a high cost in Singapore and we still think that it is more convenient in the sense that there aren't that many cars on the road that cost the congestion. So it's a pretty good system in place. [SGP03_Male]

Actually to be honest with you, I'm not so familiar with the system but when I want to change cars I would then go and monitor the system and ask why it is so high and why it is so low. I don't really understand how it works. Previously I got a really cheap COE when I drove the Porsche – it was only $7,000. Now when I drive this BMW, the COE is almost $70,000. …but I don't really know how it works but I know the Singapore government does it to control the quantity of cars on the road and it's a demand and supply system, I guess. … I believe that the government should control the population of our cars in Singapore but what kind of system would be more effective, I'm not sure. But at the moment, I think the COE is the best. [SGP04_Female]

To me, not that I'm very pro-government, I think it is a very good system to have. It is about affordability. First, you've to have good public transport so that people can have the luxury of not using cars. Now, for a country like Singapore, which is so small, a land-scarce space, controlling the population of cars is very important and I think we have the best system in the world to control the population of the cars and that is the COE. If you can afford, you pay. If you cannot afford then you don't pay – you don't have to have. But obviously the public transport must be good for everyone to have the option to have a private or not have a private car. [SGP05_Male]

The COE and the ERP helps to generate income for the LTA to help them to better the road conditions. I hope I'm correct. In one way it acts as a deterrent. Two, it acts as an income to finance the infrastructure. So I think it works in all counters. … As far as the ERP and COE are concerned, I'm okay with it, I think we have the best system. [SGP05_Male]

I think right now because I'm not the one paying for it I don't have any strong feelings towards it but I do understand that it is very expensive and I also hear people say that it is ridiculous to pay so much for the COE when the car itself only costs a little bit of that. But I also understand what the government is trying to do with the COE prices and everything. So, I guess it's just how people want to see the issue. [SGP06_Female]

I think it is to control the number of cars on the road and I think it is also time-wise as people getting stuck in traffic is also inconvenient, and we also have to reduce the amount of gas emissions in the atmosphere, I guess. Yes, there are a lot of pros to this high COE prices I guess, but for car owners it is not good. [SGP06_Female]

The COE. I mean if the reason is to limit the number of cars, there are so many ways to do it for free. Like maybe a quota system, or whatever, there are many ways of doing it I'm sure. Once they had the COE system and they see the kind of money that they are getting every year, I'm sure it's somewhere in the seven digits if not in the high six digit.

…I'm sure you can still control the car population without having people to bid for the COE? You can issue a quota and people apply for it or whatever it is. You can have a system you can apply for it and once you get it you're not eligible to get it again for X number of years, or whatever. There are many other ways beside money, I think. But money is easiest to think and easiest. …the COE is one of the easiest ways for the government to make money, a no-brainer, they have to do nothing, you introduce a licence and everybody has to pay for it. I honestly don't think that the government will ever want to get rid of the COE because it's like a cash cow. [SGP07_Male]

…if I were to put it crudely I would say that the prices are so high because that's the easiest way that the government can make money from Singaporeans. It's the no-brainer way of making money. Literally you don't have to do anything and you get so much money. [SGP07_Male]

I think that is a well talked about topic. The prices of cars here are quite high and I think one of the highest in the world, or maybe the highest, because of the COE. It is really expensive. I think that the government will want to increase the prices of cars because they want to encourage people to use public transport. It is surprising that there are so many cars in Singapore despite their high prices. [SGP08_Female]

I think it's probably about the land, we are a tiny country and heavily populated, so we've to regulate the number of cars on the road. I suppose it's effective because in Singapore we have a number of rich people, so if you were to tax the rich that would make more sense in terms of cars because cars are luxury items. [SGP08_Female]

INT Do you think this is necessary?
SGP08 Given that we have a lot of people and a very small island, high density, it probably is. …I would have more objections if public transport were not as safe and efficient but the government has made it very safe and very efficient, I can see that it is a good alternative.
[SGP08_Female]

What do I think about the car prices? Because I never had the need or plan to buy a car in the next few years I don't personally know how much it costs exactly but based on hearing what other people say I think it's exorbitant and quite a heavy burden, especially for a young person. …I think it is insane. …I guess it is relative. If you're really rich you wouldn't think that it is insane but I do think that it's exorbitant for the average young person who has just started working for 5 to 8 years. [SGP09_Female]

In the broad sense, for the environment and controlling the number of cars it works. But for a lot of people they will not see it this way. They will just think that the standard of living is too high. But personally it doesn't affect me, I feel. …If I were to be looking to get a car then I'll probably be very upset about it. [SGP09_Female]

I feel that there are quite many cars on the road but when I go to neighbouring countries I feel that Singapore has quite a reasonable number of cars relative to everyone around us. Even the quality of the roads in Singapore is hands down top 5 in the world compared to anyone else in the world. …and I think that because of all these our roads are so well maintained and you can hardly find a pothole in Singapore because of the whole tax and registration system. It's all part of a whole ecosystem of costs and benefits? [SGP10_Male]

INT What do you think about the cost of owning a car in Singapore then?
SGP10 It's definitely prohibitive and really high, something that everyone admits.
INT Do you think that there is a need to keep the car prices in Singapore high?
SGP10 Definitely because Singapore's landmass is really small and I think if the number of cars increase by 50% that'll be far too many in terms of getting to places conveniently. So I'm really okay with the registration and prices of cars in Singapore because looking at alternatives, there are really no other alternatives.
[SGP10_Male]

Definitely because Singapore's landmass is really small and I think if the number of cars increase by 50% that'll be far too many in terms of getting to places conveniently. So I'm really ok with the registration and prices of cars in Singapore because looking at alternatives, there are really no other alternatives. [SGP10_Male]

I would feel that the entire environmental agenda, if any, is very small or something that is convenient (like, by the way), but it's definitely not what the policy was for. So I don't think they should champion this environmental angle because it just happened that this system does help it but this doesn't mean that the environment was considered at any point in time. …I think the whole eco-friendliness of Singapore is a tourism thing that they use to boost tourism. [SGP10_Male]

It's the price of the car that is definitely the killer coupled with the COE, which controls the amount of cars allowed on the road. [SGP11_Male]

Car pricing, it's good in the sense that we have less congested streets as not everybody will own a car because of the high prices. Even for me, because of the car price, I may just give up on the car. If it's too cheap then everybody will buy cars and the roads will be congested and you may be stuck for an hour or two in a traffic jam. [SGP11_Male]

I think cars are way too expensive and while I understand the reason why the government does it, I think the way that it is done, the COE and all, probably is not the best method, to me. …it worked but it failed some ten years ago and then the car population grew very quickly at that time. Then they clamped down on the COE licences in the last few years and caused the COE, going from $50,000 plus to something like $12,000 and then it went up to…the fluctuation is ridiculous and not logical. So, the system is there but the execution is flawed. … The COE actually went to $70,000 plus. When I bought my car three years ago I paid $74,000 for my COE and now it hovers around $50,000 plus. My car before that I only paid $14,000. …that's why the system that is being used is somewhat flawed because I don't think that it should fluctuate that much. [SGP12_Male]

I think the most important thing if you want to control the traffic on the road, any charges you make should be based on usage and parking. … What I'm saying is that there are many ways to control the car population and COE might not be the best way. [SGP12_Male]

I think it is a necessary evil. Honestly, I think that there are too many cars in Singapore. Even with the COE there are still so many cars and there are traffic jams every single day. Sometimes in the shopping mall the parking lots are always full. I don't know whether it's a matter of land constraints or that there are too many cars. But it's probably a bit of both. And a lot of Singaporeans tend to see the car as a prestige symbol, they think that if they own a car that means they're rich. So while I think the COE is a bit irritating I think it is necessary to prevent people from buying cars. [SGP13_Female]

If we compare in terms of absolute price I think it's pretty absurd the amount of money that we have to pay for a car. But if you look at the bigger picture it has been somewhat effective in reducing the number of cars on the road. I wouldn't say that I totally agree with the way the government has imposed the tax you have to pay and hence the price of the car. Then again, I don't see a better way of achieving the objective of trying to reduce the number of cars on the road. [SGP14_Male]

I think cars are expensive in Singapore, especially considering the fact that now I'm currently in the UK where cars are less than ten times the price in Singapore. But the thing is that I can understand the rationale for the cost of the car in Singapore. I feel that it's expensive but there's nothing I can complain about as well. … Most of the initial car cost comes from the Certificate of Entitlement, which restricts the number of cars in Singapore. We don't have enough land space to have a lot of cars so this is one way. Even if we have a lot of cars, I don't think the cars will be able to move on the road as well. Look at the UK or even China, they have certain restrictions in place so even if everyone can buy a car it doesn't always mean that you can drive it inside the city.

Even London has certain ways to curb the number of cars. So Singapore, being considerably smaller, the COE is a good way to deter people from getting cars unnecessarily because the public transport system is also quite efficient. … And Singapore is a really small island and for most distances you can reach within an hour or so with public transportation so there's no real need for a car beyond wanting to drive or for luxury reasons. … It's efficient enough at this current point in time. Of course, if everyone takes the public transport and no one drives then it wouldn't be efficient because there isn't space for everyone. This COE, segregating car owners and non-car owners, is a very good way to ensure that transportation in Singapore, in general, is rather smooth. [SGP15_Male]

I think in the process of limiting the number of cars on the road, it has achieved limiting the pollution but I'm not sure whether that was the initial objective of having the COE in the first place. To a certain extent, it certainly helps that. … I'm not sure if they took into consideration the environment at that point in time. It feels more to me that they wanted to control the number of cars on the road due to road constraints. [SGP15_Male]

INT …what do you think about the COE system?
SGP16 Good. Very good.
INT Can you elaborate on that?
SGP16 Number one, Singapore doesn't have a lot of land space and that means that we do not have a lot of roads so if every household has two or three cars, that will mean that there will be congestions on our roads. So the COE system is good because it's a legalised system to limit the number of cars a household can have given now that they go by the tier where the first car is cheaper and the second car is more expensive, and so on. I mean we cannot deny rich people who want to own more than one car, that we have no choice, because they have the money that a big portion of the people don't have. So the COE system is for controlling the amount of cars. For a small country with that little roads I think there is a need for the COE for the benefit of the country. … Yes, the COE paper is about half the price of one car or maybe slightly more. That in a way deters people from buying cars. A lot of people deem the car as a necessity but in fact it's not a necessity and it's just a want. You don't even need it in the Singapore context because you don't travel interstate. You don't drive a few hundred kilometres a day to get from point A to point B so it's less of a need than a want. [SGP16_Male]

…the main objective of the COE is to limit the number of cars on the road and not really to control the carbon level. Now with the Tesla car coming in and the reduction in levies on the road tax or part of the COE but not many people are using environmentally-friendly cars in Singapore, not that I see any yet. [SGP16_Male]

Unique transport policies for each city

It depends, because we are talking about a country bigger than Singapore where they have more land and area so driving a car wouldn't be as congested. Whereas in Singapore you have 6 million people squeezing in one tiny island and it's probably about 43km in length. … I think in Singapore it will not work because of the culture here. Because for most Singaporeans, it has been ingrained in us that being able to drive a car you would need a lot of money so the moment you reduce the pricing of cars in Singapore people would rush to purchase a car of their own and then roads will get congested especially within the city areas. Even with this high pricing system we have now, sometimes traveling to the city centre is still a chore. So I don't think making cars any cheaper is going to resolve this issue. [SGP03_Male]

I think the system is okay to me as I think if the car is made more affordable to others then the number of cars would increase very fast, which Singapore, being a very small country, I don't think we can afford to have so many cars on the road. … A lot of people will rush in to buy cars. Then we'll have a lot of problems with parking. You see in Hong Kong and Macau, people have to pay to buy a parking lot, even in their own apartments. So if Singapore removes the COE system and cars become affordable for most of the people then we will have another problem with the parking. Again,

Singapore is a very small country, how are you going to plan your infrastructure to cater for all these cars when most people can afford a car? So when you buy a car, there are so many things to consider, the parking, the daily costs, petrol, insurance and tax, there are so many things. When cars become cheaper then a lot of people will go and buy cars. …so it's a very big thing. And I don't believe they will withdraw the COE system. If they withdraw the COE system I believe that they will have another system in place to tackle this problem. [SGP04_Female]

There have been calls and issues raised by the public but I still feel there's no other system that can actually be better than this. Like my household I've two cars, other households probably three, other households none, other households one car. Again it's willing buyer willing seller, if I can afford to have three cars why can't I have three cars? … The thing is that in London, they do not control the car population. Because they do not control the car population, driving into London is a massive jam hence they take the train and tube. When there is a strike, which happens quite often in London, then it creates a lot of problems. Similarly in Singapore, when the trains break down it creates a lot of problems. Now I deal a lot with London as well and know all of them, they don't drive to work but have one, two or three cars at home. But they live on the outskirts of London and use the cars on the weekends. The thing is this, you can afford to buy a car that is cheap but you can't use it, so it defeats the purpose. By the same token, the cars in Singapore are expensive; if you can afford to buy then you can afford to use it. So it's a chicken and an egg question. You want the car to be cheap and can't use it or have an expensive car and can use it? … I think there would also be people who cannot own a car who will be unhappy and if the policy changes and people can afford to own a car they will still be unhappy because they cannot drive it. So I think Singapore's system is the better of two evils. [SGP05_Male]

Honestly, because this is such an easy cash cow for the government I think no matter how you tweak it, it will always be there. They will always use the reason that they want to control the car population. So I don't think they will really change it because they will lose a huge amount of income. …I guess this generation of people maybe don't realise the difference already because they are brought up in the COE environment already. … Because Singaporeans are brought up here and are so used to it, that's the base price for them and to them that's normal…it is the mindset of 'take it or leave it' because they've never seen a cheaper version of the same car. [SGP07_Male]

I haven't given much thought to that. I think there will be overcrowding though, if COE prices were to be reduced. We will be stuck in horrible jams. [SGP08_Female]

This is a personal opinion and I don't think many locals share it, but I don't think it is a good idea to make cars more affordable in Singapore because of the environmental issue and the space issue. I'm not saying this as an expert but as a personal opinion I just think that we have such a great transport system so we do not have a need for more cars on the road as they will contribute to more pollution even though we are no way as polluted as big cities like Shanghai and Beijing. But every little bit counts. We've such a great transport system and have limited landmass, yet everyday we're trying to build even more things so I don't think having more cars on the road is going to help with our traffic. We don't have very bad traffic right now but I think that will happen if you allow more cars on the road. [SGP09_Female]

INT So you think that there needs to be control on the number of cars on the road?
SGP09 Yes definitely, I think worldwide.
[SGP09_Female]

Generally no, I don't feel that it is a right that somebody is entitled to a car and I feel that the policymaking is a really good policy. So I don't understand why just because someone feels like they are entitled to own something they should able to do so. It's just my opinion that just because people feel that they are entitled to own something it makes it their right. [SGP10_Male]

In Singapore there is actually a weekend and off-peak hour car scheme that seems to work pretty well because the registration fee is much less than the usual amount. For

people who are interested in having cars for social benefits like family outings, they tend to go for that scheme. But in terms of London, I don't think that we should make cars that lowly priced because I don't see the point of it. …and there are also externalities just like if everyone has cars, there will be traffic and everyone takes longer to get to their destinations. It will just lead to more negative outcomes. [SGP10_Male]

I think car prices do not have to be high, just that because you've a control on the COE and the number of cars released to the market by the government, so it doesn't mean that COE or car prices have to be high. But it is because they're controlling the COE and more people are buying it that's why they push up the price. The COE can be $1 and doesn't need to be $60,000 now. …because they control the number of COE and it is all done by the government, and then you have Uber and Grab coming in to bid so it'll never go down. [SGP11_Male]

No. I believe in not having cheap cars in Singapore because I don't want Singapore to end up like Jakarta, Bangkok or KL where people spend two, three hours getting to work. When cars are cheap, people would just buy it and drive all the time, and when the infrastructure is not there to support the volume of cars we'll end up with the ECP as a giant car park. So I don't believe that that's the way to go by lowering the price and letting people own cars easily. That said, to lower the prices of cars, the infrastructure in Singapore needs to be ahead of the population of cars. I think the MCE is a good start but that's only one highway. Everyday, if I live in the North, the CTE is a giant car park. So, that doesn't work because even with the control on car population now, the CTE going north is jammed everyday. [SGP12_Male]

I think that wouldn't work in Singapore. Because I once heard something like, how a government should work is that you enforce a hard and fast rule even if they don't like it because over time they will grow to accept and adapt and live with it. So if you make cars cheaper I think people will just swap to cars and nobody will take public transport no matter how much you promote because people will always think that the car is more convenient. [SGP13_Female]

If cars were to be made cheaper in Singapore, a lot more people will start buying cars. But when everyone starts buying cars and congestion starts increasing then people will start realising that taking public transport is a lot faster and more convenient, and then maybe, just maybe, our mindset will also start to change so that people will start appreciating the public transport that we have and start driving less if we can. But I think this will come at the cost that traffic conditions in Singapore will worsen and because it worsens it would deter people who want to drive and switch to public transport instead. … That's quite hard to decide. I would say there needs to be a balance in terms of how high the car prices are and how many cars you actually allow to be on the road because you don't want to go to the extent where the traffic congestion is so bad because there are so many cheap cars that people can buy. So there has to be a balance and I don't know what would be the best solution, whether to continue keeping car prices high or to reduce it. From a practical standpoint, I think some analysis should be done before deciding what is the best way. [SGP14_Male]

I think that there is definitely some room for making cars cheaper in Singapore. Firstly, almost everyone has a car in the UK from what I can see and that's because it's very cheap and easily attainable. I think a lot of the people in the UK have driving licences too. It's a very useful tool in time of need. In Singapore, there are currently a lot of people who don't drive if their offices are in the town area or due to the cost of parking and whatnot, but these people have cars that they can use to go out on the weekends. I think that due to some circumstances in Singapore, there is already a sort of inherent control on car use. So to a certain extent, I think that the car prices in Singapore can be lowered so that more people could have a car that could be used for other purposes like going out with their family. I think the weekend car is a very good scheme that Singapore has but even then, comparatively, is still quite unaffordable if you look at other countries. … Maybe there could be other policies in place to limit the driving during peak hours. [SGP15_Male]

Necessity of road usage charging

The ERP does help a little bit to ease the traffic a little because some people would try to avoid going into the ERP area or make a longer route to get in. Yeah, I think it helps a little bit to divert the traffic. … I do pass through every day because I go to town almost every day, except weekends. But anyway, I'm prepared to pay for it because this is the system, this is how it works. If you're not happy about it, then don't drive. … Of course, because no country in the world…I think Singapore is really the first one to have this ERP system and I think a lot of countries want to follow. This means that the ERP system really did help to ease the traffic, especially during the peak hour. [SGP04_Female]

The COE and the ERP helps to generate income for the LTA to help them to better the road conditions. I hope I'm correct. In one way it acts as a deterrent. Two, it acts as an income to finance the infrastructure. So I think it works in all counters. … As far as the ERP and COE are concerned, I'm okay with it. I think we have the best system. [SGP05_Male]

ERP charges are still relatively low because you're talking about $2 or $3. [SGP11_Male]

Supplementary files for Chapter 5

The following pages present the supplementary files for Chapter 5: "Nice car, but what about the CO^2 emissions?": Who considers environmental factors during car purchase decisions?

Table 5.A.1.
Correlations of factors considered during car purchase.

	Comfort	Cost - purchase/running/resale value/tax/insurance	Small engine	Large engine	Environmentally-friendly/low CO_2 emissions	Electric - one that's plugged directly into an electricity supply
Comfort	1					
Cost	0.026	1				
Small engine	-0.056	0.124	1			
Large engine	0.307	-0.157	-0.488	1		
Environmentally-friendly	0.218	0.275	0.280	-0.061	1	
Electric	0.168	0.058	0.214	0.152	0.380	1
Style/design	0.316	0.106	-0.153	0.315	0.071	0.040
Functionality	0.405	0.222	-0.162	0.231	0.227	0.111
Reliability	0.318	0.293	0.097	0.085	0.319	0.090
Safety	0.420	0.248	0.143	0.081	0.400	0.219
Speed/Performance	0.364	0.058	-0.217	0.544	0.074	0.100
Features (e.g., sat nav)	0.414	0.140	-0.144	0.351	0.194	0.165

Note: $N = 21,992$

Style/design/image of brand/model	Functionality/nterior space/boot size	Reliability	Safety	Speed/Performance	Features (e.g., sat nav)
1					
0.318	1				
0.149	0.371	1			
0.171	0.364	0.593	1		
0.561	0.321	0.186	0.194	1	
0.542	0.403	0.254	0.283	0.549	1

Table 5.A.2.
Results of Principal Component Analysis of factors considered during car purchase.

	Unrotated			Varimax rotated		
	Component 1	Component 2	Component 3	Component 1	Component 2	Component 3
Eigenvalue	3.64	2.19	1.14	2.99	2.42	1.56
Variance explained	0.30	0.18	0.10	0.25	0.20	0.13
Comfort	0.673			**0.523**	0.356	
Cost		0.444	-0.447		**0.668**	
Small engine		0.709		-0.521		**0.505**
Large engine	0.508	-0.593		**0.798**		
Environmentally-friendly	0.411	0.603			0.462	**0.621**
Electric	0.306	0.317	0.749			**0.858**
Style/design	0.628	-0.307		**0.663**		
Functionality	0.665			0.443	**0.556**	
Reliability	0.570	0.412			**0.763**	
Safety	0.618	0.462			**0.705**	
Speed/Performance	0.692	-0.397		**0.789**		
Features (e.g., sat nav)	0.740			**0.680**	0.319	

Note: N = 21,992. Only results with factor loading < .3 are displayed. Following the rotated factor solution, the components are renamed as follow: 1 - Image; 2 - Utilitarian; 3 - Environmental.

Table 5.A.3.

Correlations of component items in climate change engagement variables.

	A) Behaviour contributes to climate change	B) Pay more for environmentally-friendly products	C) Soon experience major environmental disaster	D) Environmental crisis has been exaggerated	E) Climate change is beyond control	F) Climate change too far in future to worry	G) Changes to help environment need to fit with lifestyle	H) Not worth making changes if others don't	I) Not worth UK making changes
A	1								
B	0.370	1							
C	0.396	0.440	1						
D	-0.244	-0.249	-0.436	1					
E	-0.089	-0.098	-0.033	0.279	1				
F	-0.226	-0.214	-0.274	0.463	0.474	1			
G	-0.039	-0.146	-0.106	0.282	0.217	0.397	1		
H	-0.156	-0.230	-0.194	0.340	0.362	0.478	0.361	1	
I	-0.213	-0.273	-0.236	0.408	0.400	0.514	0.320	0.695	1

Note: N = 21,870

Table 5.A.4.

Results of Principal Component Analysis of component items in climate change engagement variables.

	Unrotated		Direct oblimin rotated	
	Component 1	Component 2	Component 1	Component 2
Eigenvalue	3.47	1.49	3.02	1.93
Variance explained	0.39	0.17	0.34	0.21
A) Behaviour contributes to climate change	-0.438	0.585	-	**0.723**
B) Pay more for env-friendly products	-0.501	0.537	-	**0.711**
C) We'll soon experience major env disaster	-0.526	0.627	-	**0.801**
D) Environmental crisis has been exaggerated	0.680		**0.543**	-0.426
E) Climate change is beyond control	0.545	0.417	**0.678**	
F) Climate change too far in future to worry	0.762		**0.770**	
G) Changes to help env need to fit with lifestyle	0.516	0.309	**0.601**	
H) Not worth making changes if others don't	0.732		**0.783**	
I) Not worth UK making changes	0.777		**0.791**	

Note: N = 21,992. Only results with factor loading < .3 are displayed. Following the rotated factor solution, the components are renamed as follow: 1- Climate change detachment; 2-Climate change engagement.

Table 5.A.5. Results of logistic regression models investigating the association between environmental and sociodemographic variables and the consideration of at least one environmental feature during car purchase considerations.

	Model 1a[a] (n = 21,758)		Model 1b[b] (n = 12,895)		Model 1c (n = 12,895)	
	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald	Odds ratio (95% CI)	Wald
Environmental Variables						
Climate change concern					1.12 (1.04, 1.21)**	
Climate change engagement					1.09 (1.07, 1.11)***	
Climate change detachment					0.96 (0.95, 0.98)***	
Pro-environmental behaviour (higher scores = higher frequency)						
Turn TV off standby					1.04 (1.01, 1.06)**	
Switch off lights					1.09 (1.04, 1.15)***	
Water conservation					1.07 (1.04, 1.10)***	
Use less heating					0.99 (0.96, 1.03)	
Buy less packaging					1.09 (1.04, 1.15)**	
Buy recycled paper products					1.08 (1.04, 1.12)***	
Bring own shopping bags					1.08 (1.05, 1.12)***	
Use public transport than car					1.04 (0.99, 1.09)	
Walk/cycle short journeys					1.02 (0.98, 1.06)	
Car share					1.07 (1.03, 1.12)**	
Fewer flights					1.07 (1.02, 1.12)**	
Sociodemographic Variables						
Sex		189.47***		96.94***		52.47***
Male	1		1		1	
Female	1.58 (1.48, 1.69)***		1.55 (1.42, 1.69)***		1.40 (1.28, 1.53)***	

Age	17.49***	11.80***	6.22***
16-25	1	1	1
26-35	1.21 (1.02, 1.43)*	1.27 (1.02, 1.58)*	1.12 (0.90, 1.40)
36-45	1.48 (1.27, 1.74)***	1.53 (1.23, 1.89)***	1.26 (1.01, 1.56)*
46-55	1.83 (1.56, 2.14)***	1.95 (1.59, 2.40)***	1.58 (1.28, 1.95)***
56-65	1.89 (1.60, 2.24)***	2.03 (1.62, 2.53)***	1.58 (1.26, 1.98)***
66-75	1.94 (1.59, 2.37)***	1.97 (1.50, 2.57)***	1.60 (1.21, 2.11)**
over 75	2.18 (1.73, 2.74)***	2.00 (1.46, 2.74)***	1.72 (1.25, 2.37)**
Ethnic group	28.87***	19.85***	14.46***
White	1	1	1
White Mixed or Black/African/Caribbean/Black British	1.81 (1.45, 2.25)***	1.88 (1.39, 2.53)***	1.86 (1.37, 2.53)***
Asia/Asian British	1.88 (1.61, 2.18)***	1.98 (1.63, 2.41)***	1.77 (1.45, 2.16)***
Arab or Any other ethnic group	1.61 (1.08, 2.40)*	1.56 (0.96, 2.52)	1.44 (0.89, 2.34)
Equivalised household income (5ths)	0.21	0.70	1.88
1 Lowest	1	1	1
2	0.93 (0.83, 1.05)	0.93 (0.78, 1.11)	0.93 (0.78, 1.11)
3	1.02 (0.91, 1.14)	1.01 (0.85, 1.18)	0.99 (0.84, 1.17)
4	0.95 (0.85, 1.06)	0.95 (0.81, 1.11)	0.92 (0.78, 1.08)
5 Highest	0.92 (0.82, 1.03)	0.92 (0.78, 1.08)	0.84 (0.72, 0.99)*
Labour market status	1.35	1.46	0.65
Employed	1	1	1
Unemployed	1.04 (0.88, 1.21)	1.03 (0.82, 1.29)	1.04 (0.83, 1.30)
Retired	1.08 (0.96, 1.22)	1.15 (0.97, 1.35)	1.08 (0.91, 1.27)
In education	1.24 (0.94, 1.64)	1.31 (0.89, 1.93)	1.11 (0.75, 1.64)
Family carer	0.92 (0.78, 1.08)	0.90 (0.72, 1.11)	0.88 (0.70, 1.09)

	Model 1	Model 2	Model 3
Highest qualification	7.80***	6.82***	1.09
No qualification	1	1	1
other	0.99 (0.86, 1.14)	0.96 (0.79, 1.18)	0.94 (0.77, 1.16)
GCSE etc.	0.97 (0.85, 1.10)	0.87 (0.73, 1.04)	0.83 (0.69, 0.99)*
A levels	1.01 (0.89, 1.15)	0.98 (0.83, 1.17)	0.89 (0.75, 1.06)
Other higher cert	1.12 (0.98, 1.28)	1.05 (0.87, 1.27)	0.87 (0.72, 1.06)
Degree	1.27 (1.12, 1.45)***	1.27 (1.06, 1.51)**	0.90 (0.75, 1.08)
Longstanding illness or disability	0.21	0.01	0.01
Yes	1	1	1
No	0.96 (0.89, 1.03)	1.01 (0.91, 1.11)	1.00 (0.91, 1.09)
Number of cars in household	18.80***	12.00***	5.44**
1	1	1	1
2	0.85 (0.79, 0.91)***	0.84 (0,74, 0.93)***	0.89 (0.81, 0.99)*
3 or more	0.73 (0.65, 0.82)***	0.71 (0.61, 0.83)***	0.79 (0.68, 0.92)**
Children under 14 in household	18.31***	7.20***	6.12***
0	1	1	1
1	0.85 (0.75, 0.97)*	0.86 (0.72, 1.02)	0.86 (0.72, 1.02)
2	0.80 (0.70, 0.91)**	0.85 (0.71, 1.02)	0.86 (0.71, 1.03)
3 or more	0.43 (0.34, 0.54)***	0.48 (0.34, 0.66)***	0.49 (0.35, 0.69)***
Locality	12.94***	10.06**	12.60***
Rural	1	1	1
Urban	1.15 (1.07, 1.24)***	1.17 (1.06, 1.30)**	1.20 (1.08, 1.32)***
Region	3.10***	1.74	1.83*
London	1	1	1
North East	1.10 (0.88, 1.38)	1.15 (0.86, 1.53)	1.45 (1.09, 1.93)*
North West	1.10 (0.94, 1.29)	1.08 (0.88, 1.33)	1.27 (1.03, 1.57)*
Yorkshire and the Humber	1.31 (1.10, 1.57)**	1.22 (0.97, 1.52)	1.33 (1.06, 1.67)*
East Midlands	1.28 (1.07, 1.53)**	1.16 (0.93, 1.44)	1.35 (1.08, 1.69)**

West Midlands	1.04 (0.87, 1.24)	0.99 (0.79, 1.23)	1.22 (0.98, 1.51)
East of England	1.18 (1.00, 1.40)	1.17 (0.95, 1.44)	1.32 (1.06, 1.63)*
South East	1.22 (1.04, 1.43)*	1.20 (0.99, 1.47)	1.30 (1.07, 1.59)*
South West	1.21 (1.02, 1.43)*	1.20 (1.20, 0.98)	1.31 (1.06, 1.62)*
Wales	1.00 (0.83, 1.20)	1.00 (0.80, 1.26)	1.10 (0.87, 1.39)
Scotland	1.30 (1.09, 1.55)**	1.32 (1.06, 1.66)*	1.51 (1.21, 1.88)***
Northern Ireland	1.02 (0.84, 1.23)	0.98 (0.77, 1.25)	1.22 (0.96, 1.56)

Note:

*   Indicates statistical significance at the $p < 0.05$ level.

**   Indicates statistical significance at the $p < 0.01$ level.

***   Indicates statistical significance at the $p < 0.001$ level.

[a]   Sample consists only of those who responded to all sociodemographic variables

[b]   Sample consists only of those who responded to all environmental and sociodemographic variables

Table 5.A.6. Results of linear regression models investigating the association between environmental and sociodemographic variables and consideration of environment-related factors during car purchases. Values are differences (95% confidence interval) in scores in each scale (higher score = more consideration).

	Model 2a[a] (n = 21,758)	Model 2b[a] (n = 12,895)	Model 2c (n = 12,895)
	B	*B*	*B*
Environmental Variables			
Climate change concern			0.03 (0.01, 0.06)**
Climate change engagement			0.03 (0.02, 0.04)***
Climate change detachment			-0.01 (-0.01, -0.01)***
Pro-environmental behaviour (higher scores = higher frequency)			
Turn TV off standby			0.01 (0.00, 0.02)**
Switch off lights			0.03 (0.01, 0.04) ***
Water conservation			0.02 (0.01, 0.03)***
Use less heating			0.00 (-0.01, 0.01)
Buy less packaging			0.03 (0.01, 0.05)***
Buy recycled paper products			0.03 (0.02, 0.04)***
Bring own shopping bags			0.02 (0.01, 0.03)***
Use public transport than car			0.01 (-0.01, 0.03)
Walk/cycle short journeys			0.00 (-0.01, 0.01)
Car share			0.02 (0.01, 0.04)***
Fewer flights			0.02 (0.01, 0.04)**
Sociodemographic Variables			
Sex			
Male	0	0	0
Female	0.17 (0.15, 0.20)***	0.16 (0.13, 0.19)***	0.12 (0.09, 0.15)***

Age			
16-25	0	0	0
26-35	0.08 (0.03, 0.13)**	0.08 (0.01, 0.15)*	0.04 (-0.02, 0.11)
36-45	0.15 (0.11, 0.20)***	0.15 (0.08, 0.22)***	0.08 (0.02, 0.15)*
46-55	0.23 (0.18, 0.27)***	0.23 (0.17, 0.29)***	0.15 (0.09, 0.22)***
56-65	0.25 (0.20, 0.31)***	0.26 (0.19, 0.33)***	0.17 (0.10, 0.24)***
66-75	0.26 (0.20, 0.33)***	0.24 (0.15, 0.33)***	0.17 (0.08, 0.25)***
over 75	0.30 (0.22, 0.38)***	0.28 (0.17, 0.40)***	0.23 (0.12, 0.33)***
Ethnic group			
White	0	0	0
White Mixed or Black/African/Caribbean/Black British	0.22 (0.14, 0.30)***	0.22 (0.13, 0.32)***	0.21 (0.11, 0.30)***
Asia/Asian British	0.27 (0.21, 0.32)***	0.30 (0.23, 0.38)***	0.25 (0.17, 0.32)***
Arab or Any other ethnic group	0.21 (0.07, 0.35)**	0.23 (0.05, 0.41)*	0.19 (0.01, 0.37)*
Equivalised household income (5ths)			
1 Lowest	0	0	0
2	-0.03 (-0.08, 0.01)	-0.03 (-0.09, 0.03)	-0.03 (-0.08, 0.03)
3	-0.01 (-0.05, 0.03)	-0.02 (-0.08, 0.04)	-0.03 (-0.08, 0.03)
4	-0.03 (-0.07, 0.01)	-0.04 (-0.10, 0.02)	-0.05 (-0.10, 0.01)
5 Highest	-0.06 (-0.10, -0.01)**	-0.06 (-0.11, 0.00)	-0.08 (-0.13, -0.02)**
Labour market status			
Employed	0	0	0
Unemployed	0.01 (-0.05, 0.06)	0.01 (-0.07, 0.10)	0.01 (-0.06, 0.09)
Retired	0.02 (-0.03, 0.06)	0.05 (-0.02, 0.11)	0.03 (-0.03, 0.08)
In education	0.09 (-0.01, 0.19)	0.08 (-0.05, 0.20)	0.02 (-0.10, 0.14)
Family carer	-0.05 (-0.11, 0.00)	-0.07 (-0.14, 0.01)	-0.07 (-0.14, -0.00)*

Highest qualification			
No qualification	0	0	0
other	0.03 (-0.02, 0.08)	0.00 (-0.07, 0.08)	0.00 (-0.07, 0.07)
GCSE etc.	0.01 (-0.04, 0.05)	-0.03 (-0.10, 0.03)	-0.05 (-0.11, 0.01)
A levels	0.02 (-0.03, 0.06)	0.01 (-0.06, 0.07)	-0.02 (-0.08, 0.04)
Other higher cert	0.05 (0.00, 0.10)	0.03 (-0.04, 0.10)	-0.03 (-0.10, 0.03)
Degree	0.08 (0.03, 0.12)**	0.07 (0.01, 0.14)*	-0.04 (-0.10, 0.02)
Longstanding illness or disability			
Yes	0	0	0
No	-0.02 (-0.05, 0.00)	-0.01 (-0.05, 0.02)	-0.01 (-0.05, 0.02)
Number of cars in household			
1	0	0	0
2	-0.07 (-0.10, -0.05)***	0.07 (-0.11, -0.04)***	-0.05 (-0.08, -0.02)**
3 or more	-0.11 (-0.15, -0.08)***	-0.11 (-0.16, -0.06)***	-0.07 (-0.12,-0.02)**
Children under 14 in household			
0	0	0	0
1	-0.07 (-0.11, -0.02)**	0.06 (-0.12, -0.01)*	-0.06 (-0.12, -0.01)*
2	-0.09 (-0.14, -0.05)***	-0.07 (-0.13, -0.00)*	-0.06 (-0.12, 0.00)
3 or more	-0.27 (-0.34, -0.20)***	-0.25 (-0.35, -0.15)***	-0.22 (-0.32, -0.13)***
Locality			
Rural	0	0	0
Urban	0.05 (0.02, 0.08)***	0.06 (0.02, 0.09)**	0.06 (0.03, 0.10)***
Region			
London	0	0	0
North East	0.01 (-0.06, 0.08)	0.03 (-0.06, 0.13)	0.10 (0.01, 0.19)*
North West	0.04 (-0.01, 0.10)	0.03 (-0.04, 0.11)	0.08 (0.01, 0.15)*
Yorkshire and the Humber	0.10 (0.04, 0.16)**	0.07 (-0.00, 0.15)	0.09 (0.02, 0.17)**
East Midlands	0.10 (0.03, 0.16)**	0.07 (-0.01, 0.15)	0.11 (0.03, 0.18)**

West Midlands	0.02 (-0.05, 0.08)	0.01 (-0,07, 0.09)	0.07 (0.00, 0.15)
East of England	0.06 (0.01, 0.12)*	0.06 (-0.01, 0.13)	0.09 (0.02, 0.16)**
South East	0.08 (0.02, 0.13)**	0.08 (0.01, 0.15)*	0.10 (0.03, 0.16)**
South West	0.07 (0.02, 0.13)*	0.06 (-0.01, 0.13)	0.08 (0.01, 0.15)*
Wales	0.01 (-0.05, 0.07)	0.00 (-0.08, 0.08)	0.02 (-0.05, 0.10)
Scotland	0.11 (0.05, 0.17)***	0.12 (0.04, 0.19)**	0.15 (0.08, 0.22)***
Northern Ireland	0.02 (-0.05, 0.08)	0.00 (-0.08, 0.09)	0.07 (-0.01, 0.15)

Note:

* Indicates statistical significance at the p < 0.05 level.

** Indicates statistical significance at the p < 0.01 level.

*** Indicates statistical significance at the p < 0.001 level.

a Sample consists only of those who responded to all sociodemographic variables

b Sample consists only of those who responded to all environmental and sociodemographic variables

Table 5.A.7.
Results of linear regression models investigating the association between environmental and sociodemographic variables and consideration of environment-related factors (expressed as a ratio of total considerations) during car purchases. Values are differences (95% confidence interval) in scores in each scale (higher score = greater proportion of pro-environmental consideration).

	Model 3a[a] (n = 21,758)	Model 3b[a] (n = 12,895)	Model 3c (n = 12,895)
	B	*B*	*B*
Environmental Variables			
Climate change concern			0.01 (0.00, 0.01)*
Climate change engagement			0.01 (0.01, 0.01)***
Climate change detachment			-0.00 (-0.00, -0.00)***
Pro-environmental behaviour (higher scores = higher frequency)			
Turn TV off standby			0.00 (0.00, 0.00)**
Switch off lights			0.01 (0.00, 0.01)**
Water conservation			0.01 (0.00, 0.01)***
Use less heating			0.00 (-0.00, 0.00)
Buy less packaging			0.01 (0.00, 0.01)***
Buy recycled paper products			0.01 (0.00, 0.01)**
Bring own shopping bags			0.00 (0.00, 0.01)**
Use public transport than car			0.00 (-0.00, 0.01)
Walk/cycle short journeys			0.00 (-0.00, 0.01)
Car share			0.00 (0.00, 0.01)*
Fewer flights			0.00 (0.00, 0.01)**
Sociodemographic Variables			
Sex			
Male	0	0	0
Female	0.4 (0.04, 0.05)***	0.4 (0.03, 0.05)***	0.03 (0.02, 0.04)***

Age			
16-25	0	0	0
26-35	0.01 (-0.00, 0.02)	0.01 (-0.01, 0.03)	0.00 (-0.01, 0.02)
36-45	0.03 (0.01, 0.04)***	0.03 (0.01, 0.04)**	0.01 (-0.00, 0.03)
46-55	0.05 (0.03, 0.06)***	0.05 (0.03, 0.06)***	0.03 (0.01, 0.05)***
56-65	0.05 (0.4, 0.07)***	0.05 (0.4, 0.07)***	0.03 (0.02, 0.05)***
66-75	0.06 (0.04, 0.08)***	0.06 (0.03, 0.08)***	0.04 (0.02, 0.06)***
over 75	0.08 (0.06, 0.10)***	0.07 (0.04, 0.10)***	0.06 (0.03, 0.09)***
Ethnic group			
White	0	0	0
White Mixed or Black/African/Caribbean/Black British	0.05 (0.03, 0.07)***	0.05 (0.02, 0.07)***	0.04 (0.02, 0.07)***
Asia/Asian British	0.06 (0.05, 0.08)***	0.07 (0.05, 0.09)***	0.06 (0.04, 0.08)***
Arab or Any other ethnic group	0.06 (0.02, 0.10)**	0.06 (0.01, 0.11)*	0.05 (0.00, 0.10)*
Equivalised household income (5ths)			
1 Lowest	0	0	0
2	-0.01 (-0.02, -0.00)*	-0.01 (-0.02, 0.00)	-0.01 (-0.02, 0.01)
3	-0.01 (-0.02, -0.00)*	-0.01 (-0.02, 0.01)	-0.01 (-0.02, 0.01)
4	-0.02 (-0.03, -0.01)***	-0.02 (-0.03, -0.00)*	-0.02 (-0.03, -0.00)*
5 Highest	-0.02 (-0.03, -0.01)***	-0.02 (-0.03, -0.01)**	-0.02 (-0.04, -0.01)***
Labour market status			
Employed	0	0	0
Unemployed	0.00 (-0.01, 0.01)	0.00 (-0.02, 0.02)	0.00 (-0.01, 0.02)
Retired	0.00 (-0.01, 0.01)	0.01 (-0.01, 0.02)	0.00 (-0.01, 0.02)
In education	0.01 (-0.01, 0.03)	0.02 (-0.01, 0.05)	0.01 (-0.03, 0.04)
Family carer	-0.01 (-0.03, -0.00)*	-0.01 (-0.03, 0.00)	-0.02 (-0.03, 0.00)

Highest qualification			
No qualification	0	0	0
other	-0.01 (-0.02, 0.00)	-0.01 (-0.03, 0.01)	-0.01 (-0.03, 0.00)
GCSE etc.	-0.02 (-0.03, -0.01)**	-0.03 (-0.04, -0.01)**	-0.03 (-0.05, -0.01)***
A levels	-0.02 (-0.03, -0.01)**	-0.02 (-0.04, -0.00)*	-0.03 (-0.04, -0.01)**
Other higher cert	-0.01 (-0.02, 0.00)	-0.02 (-0.03, 0.00)	-0.03 (-0.05, -0.01)**
Degree	-0.01 (-0.02, 0.00)	-0.01 (-0.02, 0.01)	-0.03 (-0.05, -0.02)***
Longstanding illness or disability			
Yes	0	0	0
No	-0.00 (-0.01, 0.00)	-0.00 (-0.01, 0.01)	-0.00 (-0.01, 0.01)
Number of cars in household			
1	0	0	0
2	-0.02 (-0.02, -0.01)***	-0.02 (-0.03, -0.01)***	-0.01 (-0.02, -0.00)**
3 or more	-0.03 (-0.04, -0.02)***	-0.03 (-0.04, -0.01)***	-0.02 (-0.03, -0.01)**
Children under 14 in household			
0	0	0	0
1	-0.01 (-0.03, -0.00)**	-0.01 (-0.03, -0.00)*	-0.01 (-0.03, -0.00)*
2	-0.02 (-0.03, -0.01)***	-0.02 (-0.03, -0.00)*	-0.02 (-0.03, -0.00)*
3 or more	-0.06 (-0.08, -0.05)***	-0.06 (-0.08, -0.03)***	-0.05 (-0.07, -0.02)***
Locality			
Rural	0	0	0
Urban	0.01 (0.01, 0.02)***	0.01 (0.01, 0.02)***	0.02 (0.01, 0.02)***
Region			
London	0	0	0
North East	-0.00 (-0.02, 0.02)	0.00 (-0.02, 0.03)	0.02 (-0.00, 0.04)
North West	0.00 (-0.01, 0.02)	-0.00 (-0.02, 0.02)	0.01 (-0.01, 0.03)
Yorkshire and the Humber	0.02 (0.00, 0.03)*	0.01 (-0.01, 0.03)	0.02 (-0.00, 0.04)
East Midlands	0.01 (-0.01, 0.02)	-0.00 (-0.02, 0.02)	0.01 (-0.01, 0.03)

West Midlands	-0.00 (-0.02, 0.01)	-0.01 (-0.03, 0.01)	0.01 (-0.01, 0.03)
East of England	0.01 (-0.01, 0.02)	0.01 (-0.01, 0.03)	0.02 (-0.00, 0.03)
South East	0.01 (-0.01, 0.02)	0.01 (-0.01, 0.02)	0.01 (-0.00, 0.03)
South West	0.00 (-0.01, 0.02)	0.00 (-0.02, 0.02)	0.01 (-0.01, 0.02)
Wales	-0.00 (-0.02, 0.01)	-0.00 (-0.02, 0.02)	0.01 (-0.01, 0.03)
Scotland	0.02 (0.00, 0.03)*	0.02 (-0.00, 0.04)	0.03 (0.01, 0.04)**
Northern Ireland	0.00 (-0.02, 0.02)	-0.01 (-0.03, 0.02)	0.01 (-0.01, 0.03)

Note:

* Indicates statistical significance at the $p < 0.05$ level.

** Indicates statistical significance at the $p < 0.01$ level.

*** Indicates statistical significance at the $p < 0.001$ level.

[a] Sample consists only of those who responded to all sociodemographic variables

[b] Sample consists only of those who responded to all environmental and sociodemographic variables

Table 5.A.8.

Results of linear regression models investigating the association between environmental and sociodemographic variables and consideration of utility-related features during car purchases. Values are differences (95% confidence interval) in scores in each scale (higher score = more consideration).

	Model 4a[a] (n = 21,758)	Model 4b[b] (n = 12,895)	Model 4c (n = 12,895)
	B	*B*	*B*
Environmental Variables			
Climate change concern			0.06 (0.03, 0.10)**
Climate change engagement			-0.02 (-0.03, -0.01)**
Climate change detachment			-0.02 (-0.02, -0.01)***
Pro-environmental behaviour (higher scores = higher frequency)			
Turn TV off standby			0.01 (-0.01, 0.02)
Switch off lights			0.03 (0.00, 0.05)*
Water conservation			0.01 (0.00, 0.02)
Use less heating			0.00 (-0.01, 0.02)
Buy less packaging			-0.01 (-0.03, 0.02)
Buy recycled paper products			0.01 (-0.01, 0.02)
Bring own shopping bags			0.04 (0.02, 0.05)***
Use public transport than car			-0.01 (-0.03, 0.01)
Walk/cycle short journeys			0.00 (-0.02, 0.01)
Car share			0.03 (0.01, 0.05)**
Fewer flights			0.01 (-0.01, 0.03)
Sociodemographic Variables			
Sex			
Male	0	0	0
Female	0.01 (-0.03, 0.04)	0.02 (-0.03, 0.06)	-0.02 (-0.06, 0.02)

Age			
16-25	0	0	0
26-35	0.26 (0.17, 0.35)***	0.25 (0.14, 0.36)***	0.22 (0.11, 0.32)***
36-45	0.24 (0.15, 0.33)***	0.24 (0.13, 0.35)***	0.19 (0.09, 0.30)***
46-55	0.23 (0.14, 0.31)***	0.26 (0.15, 0.36)***	0.20 (0.09, 0.30)***
56-65	0.19 (0.10, 0.29)***	0.23 (0.11, 0.35)***	0.17 (0.05, 0.28)**
66-75	0.09 (-0.01, 0.20)	0.10 (-0.04, 0.23)	0.05 (-0.09, 0.18)
over 75	-0.04 (-0.17, 0.08)	-0.04 (-0.21, 0.13)	-0.08 (-0.25, 0.08)
Ethnic group			
White	0	0	0
White Mixed or Black/African/Caribbean/Black British	-0.10 (-0.22, 0.01)	-0.11 (-0.25, 0.04)	-0.10 (-0.24, 0.05)
Asia/Asian British	-0.24 (-0.32, -0.15)***	-0.24 (-0.35, -0.13)***	-0.21 (-0.32, -0.10)***
Arab or Any other ethnic group	-0.29 (-0.49, -0.09)**	-0.30 (-0.58, -0.02)*	-0.29 (-0.57, -0.02)*
Equivalised household income (5ths)			
1 Lowest	0	0	0
2	0.02 (-0.04, 0.08)	0.02 (-0.06, 0.10)	0.02 (-0.06, 0.10)
3	0.12 (0.06, 0.17)***	0.08 (-0.00, 0.16)	0.07 (-0.01, 0.15)
4	0.14 (0.08, 0.20)***	0.12 (0.03, 0.20)**	0.10 (0.02, 0.18)*
5 Highest	0.13 (0.07, 0.19)***	0.09 (0.01, 0.18)*	0.08 (-0.01, 0.16)
Labour market status			
Employed	0	0	0
Unemployed	-0.10 (-0.18, -0.02)*	-0.13 (-0.24, -0.01)*	-0.13 (-0.24, -0.01)*
Retired	0.09 (0.03, 0.15)*	0.10 (0.02, 0.18)*	0.08 (0.00, 0.16)*
In education	0.07 (-0.07, 0.21)	0.03 (-0.15, 0.22)	0.02 (-0.16, 0.20)
Family carer	0.02 (-0.06, 0.10)	0.00 (-0.11, 0.11)	0.01 (-0.10, 0.11)

Highest qualification			
No qualification	0	0	0
other	0.22 (0.15, 0.30)***	0.20 (0.10, 0.31)***	0.20 (0.09, 0.30)***
GCSE etc.	0.37 (0.31, 0.44)***	0.39 (0.29, 0.48)***	0.37 (0.27, 0.46)***
A levels	0.42 (0.35, 0.48)***	0.41 (0.32, 0.51)***	0.38 (0.29, 0.47)***
Other higher cert	0.45 (0.38, 0.53)***	0.47 (0.37, 0.57)***	0.41 (0.32, 0.51)***
Degree	0.53 (0.46, 0.59)***	0.51 (0.42, 0.61)***	0.44 (0.35, 0.53)***
Longstanding illness or disability			
Yes	0	0	0
No	-0.05 (-0.08, -0.01)**	-0.02 (-0.07, 0.03)	-0.02 (-0.06, 0.03)
Number of cars in household			
1	0	0	0
2	0.02 (-0.02, 0.06)	0.02 (-0.03, 0.07)	0.03 (-0.02, 0.07)
3 or more	-0.08 (-0.14, -0.02)*	-0.08 (-0.15, -0.00)*	-0.06 (-0.14, 0.01)
Children under 14 in household			
0	0	0	0
1	0.10 (0.03, 0.16)**	0.11 (0.03, 0.18)**	0.11 (0.03, 0.18)**
2	0.21 (0.14, 0.27)***	0.23 (0.14, 0.32)***	0.23 (0.14, 0.32)***
3 or more	0.20 (0.09, 0.30)***	0.20 (0.06, 0.35)**	0.23 (0.08, 0.37)**
Locality			
Rural	0	0	0
Urban	-0.01 (-0.05, 0.03)	0.01 (-0.04, 0.06)	0.01 (-0.04, 0.06)
Region			
London	0	0	0
North East	0.08 (-0.04, 0.20)	0.15 (0.00, 0.30)	0.17 (0.02, 0.31)*
North West	0.07 (-0.03, 0.17)	0.07 (-0.06, 0.20)	0.09 (-0.04, 0.21)
Yorkshire and the Humber	0.09 (-0.02, 0.19)	0.11 (-0.02, 0.23)	0.11 (-0.02, 0.23)
East Midlands	0.17 (0.08, 0.27)***	0.19 (0.07, 0.31)**	0.19 (0.07, 0.31)**

West Midlands	0.08 (-0.02, 0.18)	0.12 (0.00, 0.23)*	0.13 (0.02, 0.24)*
East of England	0.07 (-0.02, 0.17)	0.11 (0.00, 0.23)	0.11 (0.00, 0.23)*
South East	0.17 (0.08, 0.26)***	0.17 (0.06, 0.23)**	0.16 (0.05, 0.26)**
South West	0.16 (0.06, 0.25)**	0.17 (0.05, 0.29)**	0.16 (0.05, 0.27)**
Wales	-0.01 (-0.11, 0.09)	-0.06 (-0.02, 0.07)	-0.09 (-0.22, 0.04)
Scotland	0.11 (0.02, 0.21)*	0.13 (0.02, 0.25)*	0.14 (0.02, 0.25)*
Northern Ireland	-0.11 (-0.22, 0.00)	-0.05 (-0.19, 0.09)	-0.02 (-0.16, 0.11)

Note:

* Indicates statistical significance at the $p < 0.05$ level.

** Indicates statistical significance at the $p < 0.01$ level.

*** Indicates statistical significance at the $p < 0.001$ level.

[a] Sample consists only of those who responded to all sociodemographic variables

[b] Sample consists only of those who responded to all environmental and sociodemographic variables

Environmental variables

In Model 4c, all three variables were significantly related with utility-related considerations. However, only climate change concern (B = 0.06, p < .01) was positively related to these considerations as both climate change engagement (B = -0.02, p < .01) and disengagement (B = -0.02, p < .001) were found inversely-related. Three pro-environmental behaviours were found significant in this model. Switching off lights (B = 0.03, p < .05), bringing your own shopping bags (B = 0.04, p < .001) and car sharing (B = 0.03, p < .01) behaviours were positively related with higher levels of utility-related considerations.

Sociodemographic variables

In Model 4a, participants between 26 and 65 years of age (B = 0.19 to 0.26), in the third to fifth income quintile (B = 0.12 to

0.14), who were retired (B = 0.09, p < .05) and had some form of educational attainment (B = 0.22 to 0.53) were found to report significantly higher levels of utility-related considerations during car purchases. Those whose household had at least one child before 14 years of age also reported significantly higher levels of considerations (B = 0.10 to 0.21). Participants who were Asian/Asian British (B = -0.24, p < .001) or Arab or from any other ethnic group (B = -0.29, p < .01) reported lower levels of considerations than White participants. Lower levels of considerations were also observed amongst those who were unemployed (B = -0.10, p < .05) or had three or more cars in the household (B = -0.08, p < .05). The gender (B = 0.01, p >. 05) and urban/rural locality (B = -0.01, p >. 05) of the participants were not significantly related to utility-related considerations. The above findings persisted even after accounting for the missing data from the environmental variables (Model 4b). However in the full model (Model 4c) when the environmental variables were added, being in the third (B = 0.07, p >. 05) and fifth (B = 0.08, p >. 05) income quintile and having three or more cars in the household (B = -0.06, p >. 05) were no longer significantly related to utility-related considerations. Closely similar to environmental-related considerations, in the full model, participants living elsewhere in the UK, compared to London, reported significantly higher levels of utility-related considerations (B = 0.11 to 0.19) apart from those in the North West (B = 0.09, p >. 05), Yorkshire and the Humber (B = 0.11, p >. 05), Wales (B = -0.09, p >. 05) and Northern Ireland (B = -0.02, p >. 05).

Table 5.A.9.
Results of linear regression models investigating the association between environmental and sociodemographic variables and consideration of image-related factors during car purchases. Values are differences (95% confidence interval) in scores in each scale (higher score = more consideration).

	Model 5a[a] (n = 21,758)	Model 5b[b] (n = 12,895)	Model 5c (n = 12,895)
	B	*B*	*B*
Environmental Variables			
Climate change concern			0.03 (-0.01, 0.07)
Climate change engagement			0.00 (-0.02, 0.01)
Climate change detachment			0.01 (-0.00, 0.01)
Pro-environmental behaviour (higher scores = higher frequency)			
Turn TV off standby			-0.03 (-0.04, -0.02)***
Switch off lights			0.00 (-0.02, 0.03)
Water conservation			0.00 (-0.02, 0.01)
Use less heating			-0.04 (-0.05, -0.02)***
Buy less packaging			-0.04 (-0.06, -0.01)**
Buy recycled paper products			-0.01 (-0.03, 0.01)
Bring own shopping bags			0.00 (-0.02, 0.02)
Use public transport than car			-0.04 (-0.07, -0.02)**
Walk/cycle short journeys			-0.04 (-0.06, 0.03)***
Car share			0.04 (0.01, 0.06)**
Fewer flights			0.00 (-0.02, 0.02)
Sociodemographic Variables			
Sex			
Male	0	0	0
Female	-0.22 (-0.26, -0.19)***	-0.24 (-0.28, -0.19)***	-0.23 (-0.28, -0.18)***
Age			

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16-25	0	0	0
26-35	-0.01 (-0.11, 0.09)	0.03 (-0.10, 0.15)	0.05 (-0.07, 0.17)
36-45	-0.16 (-0.26, -0.07)**	-0.13 (-0.24, -0.01)*	-0.08 (-0.20, 0.02)
46-55	-0.30 (-0.39, -0.20)***	-0.25 (-0.36, -0.13)***	-0.19 (-0.31, -0.08)**
56-65	-0.34 (-0.44, -0.25)***	-0.27 (-0.39, -0.15)***	-0.19 (-0.31, -0.07)**
66-75	-0.39 (-0.50, -0.28)***	-0.34 (-0.48, -0.20)***	-0.28 (-0.42, -0.14)***
over 75	-0.47 (-0.58, -0.35)***	-0.38 (-0.54, -0.22)***	-0.34 (-0.50, -0.18)***
Ethnic group			
White	0	0	0
White Mixed or Black/African/Caribbean/Black British	0.21 (0.08, 0.34)**	0.19 (0.02, 0.36)*	0.17 (0.00, 0.34)*
Asia/Asian British	0.16 (0.07, 0.24)***	0.17 (0.05, 0.28)**	0.17 (0.06, 0.28)**
Arab or Any other ethnic group	-0.08 (-0.30, 0.15)	0.02 (-0.03, 0.33)	0.01 (-0.30, 0.31)
Equivalised household income (5ths)			
1 Lowest	0	0	0
2	0.04 (-0.02, 0.10)	0.03 (-0.05, 0.12)	0.02 (-0.06, 0.10)
3	0.12 (0.07, 0.18)***	0.09 (0.01, 0.18)*	0.08 (0.00, 0.16)*
4	0.22 (0.16, 0.28)***	0.21 (0.13, 0.30)***	0.20 (0.12, 0.28)***
5 Highest	0.40 (0.33, 0.46)***	0.38 (0.29, 0.47)***	0.37 (0.29, 0.46)***
Labour market status			
Employed	0	0	0
Unemployed	-0.04 (-0.12, 0.03)	-0.03 (-0.15, 0.09)	-0.03 (-0.15, 0.08)
Retired	0.10 (0.04, 0.16)**	0.06 (-0.03, 0.14)	0.07 (-0.01, 0.16)
In education	-0.09 (-0.25, 0.06)	-0.18 (-0.38, 0.01)	-0.15 (-0.33, 0.04)
Family carer	0.03 (-0.06, 0.11)	-0.02 (-0.14, 0.10)	-0.01 (-0.13, 0.11)
Highest qualification			
No qualification	0	0	0
other	0.05 (-0.02, 0.12)	0.01 (-0.09, 0.11)	0.02 (-0.08, 0.12)
GCSE etc.	0.09 (0.03, 0.15)**	0.11 (0.02, 0.20)*	0.12 (0.04, 0.21)**

A levels	0.12 (0.05, 0.19)***	0.10 (0.01, 0.20)*	0.13 (0.04, 0.23)**
Other higher cert	0.15 (0.08, 0.22)***	0.13 (0.03, 0.22)*	0.17 (0.07, 0.27)**
Degree	0.09 (0.03, 0.16)**	0.07 (-0.02, 0.16)	0.16 (0.07, 0.25)**
Longstanding illness or disability			
Yes	0	0	0
No	-0.06 (-0.10, -0.03)**	-0.07 (-0.12, -0.02)**	-0.06 (-0.10, -0.01)*
Number of cars in household			
1	0	0	0
2	0.10 (0.06, 0.14)***	0.10 (0.04, 0.15)***	0.07 (0.02, 0.12)**
3 or more	0.13 (0.07, 0.19)***	0.12 (0.04, 0.21)**	0.08 (-0.01, 0.16)
Children under 14 in household			
0	0	0	0
1	-0.16 (-0.23, -0.09)***	-0.12 (-0.22, -0.03)*	-0.12 (-0.21, -0.03)**
2	-0.16 (-0.23, -0.09)***	-0.09 (-0.19, 0.01)	-0.10 (-0.20, -0.00)*
3 or more	-0.29 (-0.40, -0.19)***	-0.25 (-0.42, -0.09)**	-0.26 (-0.42, -0.11)**
Locality			
Rural	0	0	0
Urban	-0.02 (-0.06, 0.02)	-0.03 (-0.09, 0.02)	-0.03 (-0.09, 0.03)
Region			
London	0	0	0
North East	0.05 (-0.08, 0.18)	-0.01 (-0.15, 0.14)	-0.08 (-0.22, 0.06)
North West	0.03 (-0.07, 0.13)	0.03 (-0.11, 0.16)	-0.03 (-0.16, 0.10)
Yorkshire and the Humber	0.04 (-0.06, 0.14)	0.03 (-0.09, 0.16)	-0.02 (-0.14, 0.10)
East Midlands	0.15 (0.05, 0.25)**	0.13 (-0.00, 0.27)	0.07 (-0.06, 0.20)
West Midlands	0.05 (-0.05, 0.15)	0.05 (-0.08, 0.18)	-0.02 (-0.14, 0.11)
East of England	0.03 (-0.07, 0.13)	-0.00 (-0.13, 0.12)	-0.05 (-0.17, 0.07)
South East	0.06 (-0.03, 0.15)	0.05 (-0.07, 0.17)	0.01 (-0.10, 0.12)
South West	0.10 (-0.00, 0.20)	0.09 (-0.05, 0.22)	0.04 (-0.09, 0.16)

Wales	-0.06 (-0.16, 0.05)	-0.11 (-0.26, 0.04)	-0.18 (-0.32, -0.04)*
Scotland	0.00 (-0.10, 0.09)	-0.03 (-0.15, 0.10)	-0.08 (-0.20, 0.04)
Northern Ireland	-0.03 (-0.14, 0.07)	-0.04 (-0.19. 0.10)	-0.12 (-0.25, 0.02)

Note:

[*] Indicates statistical significance at the $p < 0.05$ level.

[**] Indicates statistical significance at the $p < 0.01$ level.

[***] Indicates statistical significance at the $p < 0.001$ level.

[a] Sample consists only of those who responded to all sociodemographic variables

[b] Sample consists only of those who responded to all environmental and sociodemographic variables

Environmental variables

The result in Model 5c indicates that all three climate change variables were not significantly related to the image-related considerations during car purchases. Car sharing was the only pro-environmental behaviour significantly related with higher levels of image-related considerations, $B = 0.04$, $p < .01$. In addition, five other pro-environmental behaviours (turning the TV off standby, using less heating, buying less packaging, using public transport than car and walking/cycling short journeys) were found significantly inversely related with these considerations with Bs ranging from -0.03 to -0.04.

Sociodemographic variables

In Model 5a, participants who belonged to either White mixed or Black British ($B = 0.21$, $p < .01$) or Asian/Asian British ($B = 0.16$, $p < .001$) ethnic groups, in the third to fifth income quintile ($B = 0.12$ to 0.40), attained an education of at least a GSCE level ($B = 0.09$ to 0.15) or had two or more cars in the household ($B = 0.10$ to 0.13) reported significantly higher levels of

image-related considerations. On the other hand, female participants (B = -0.22, p < .001) and those who did not have any longstanding illness or disability (B = -0.06, p < .01) reported significantly lower levels of considerations. Significantly lower levels were also observed with increasing age from 36 years (B = -0.16 to -0.47) and as the number of children under 14 years of age increased (B = -0.16 to -0.29). The participants' urban/rural locality was not found to be significantly related with image-related considerations (B = -0.02, p > .05). These findings remained unchanged in Model 5b that used a reduced sample which accounted for the missing data from the environmental variables. After adding the environmental variables in Model 5c, all the above findings persisted except participants in the 36-45 years age group (B = -0.08, p > .05). Finally, distinct from the environmental- and utility-related considerations, only participants in Wales reported significantly lower image-related considerations than participants in London (B = -0.18, p < .05).