

Investigating the Interactions of Travel Behaviour and Wellbeing: A

Mixed-methods Case Study of Penarth and Cardiff, Wales

Thesis presented by

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Abstract

Transport systems are essential to trade, globalisation, communication and other forms of interaction between people and societies (Banister, 2013). Yet they can also have negative impacts including decreased quality of life or health impacts arising from pollutants, environmental damage including climate change and a range of wider socio-economic effects (Glanz *et al.*, 1990). Given that most car journeys are short however (57% of UK trips are under five miles), there is particular potential for active travel (i.e. walking and cycling) to both reduce the environmental externalities of modern transport systems and stimulate improved quality of life and societal wellbeing (Banister, 2013; Martin *et al.*, 2014). Unfortunately, there is a paucity of robust evidence that examines how infrastructural interventions (i.e. those aimed at making the physical environment more conducive to active travel) actually impact on active travel levels in specific communities. In addition, there is very limited evidence of the wider effects that such interventions have on wellbeing and levels of happiness overtime.

This thesis details mixed-method research undertaken in Cardiff, UK, during 2011/2012, which examined the impacts of a new piece of infrastructure – the Pont-y-Werin walking and cycling bridge – on the local community’s levels of active travel and subjective wellbeing. It provides insights into the nature of constraints preventing travel behaviour change from taking place, and – through the use of the novel, ‘Day Reconstruction Method’ - into the consequences that different modes of travel can have for travel and wellbeing, including on

moment-to-moment moods and emotions. Overall by contextualising and measuring and evaluating wellbeing, the research suggests that people experience less pleasant emotions during travel than when undertaking everyday activities, and also that for certain modes there is a decrease in happiness before and after travel compared to everyday activities. Additionally greater monitoring, evaluation and promotion of combined hard and soft measures - focusing on travel behaviour change - is needed alongside providing travellers with accessible information on the wellbeing impacts of different modes (Elvik, 2009).



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Acronyms

AONB	Areas of Outstanding Natural Beauty
CO₂	Carbon Dioxide
CH₄	Methane
DfT	Department for Transport
DEFRA	Department for Environment and Rural Affairs
D.Phil.	Doctor of Philosophy
DRM	Day Reconstruction Method
EPSRC	Engineering and Physical Sciences Research Council
EMA	Ecological Momentary Assessment
ESM	Experience Sampling Method
EV	Electric Vehicle
GDP	Gross Domestic Product
GHG	Greenhouse Gas
iConnect	Impact of CO ₂ Constructing Non-motorised Networks and Evaluation of Changes in Travel
ISV	International Sports Village
k	Thousand
km	Kilometres
m	Million
MRC	Medical Research Council
N	Number
NCN	National Cycling Network
NO_x	Nitrogen Oxide
N₂O	Nitrous Oxide
OECD	Organisation for Economic Co-operation and Development
ONS	Office of National Statistics
PT	Public Transport
QoL	Quality of Life
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences

Sq	Squared
SWB	Subjective Wellbeing
TPB	Theory of Planned Behaviour
UK	United Kingdom
UNFCC	United Nations Framework Convention on Climate Change
UWAC	Understanding Walking and Cycling

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Chapter One - Motivation: Travel behaviour and wellbeing

Peoples' adaptability and resistance to change is astounding. People can and do cope with changing circumstances and conditions, they cope with "shocks" and "nudges", they are resilient and sometimes unpredictable. They do however value the comfort and the convenience of habits, practices and routines as they have typically expended some search effort in acquiring them (Stradling, 2011). Gauging and better understanding present travel behaviours alongside travel experiences can assist when moving towards a more sustainable transport system. Increasing awareness that travel behaviours generate positive and negative impacts on individual and collective happiness, satisfaction and wellbeing extends the application of travel behaviour research to a wider context. Complexities such as this are difficult to record, measure and evaluate, especially when different theories and methods are applied and tested on different populations across real life settings. It is increasingly important that these complexities are better understood, particularly in the realm of transport where more sustainable behaviour will be critical to mitigating greenhouse gas (GHG) emissions and other environmental externalities. Therefore the overarching aim of this thesis is to extend understandings on the interactions between travel behaviour and subjective wellbeing by employing mixed-methods to measure and evaluate the nature of travel behaviours alongside travel experiences. In addition, it also seeks to analyse the consequences of different travel modes on individual mood and subjective wellbeing¹ as well as to chart the nature of any "spill-over

¹ Current research on wellbeing has been derived from two general perspectives: the hedonic approach, which focuses on happiness and defines wellbeing in terms of pleasure attainment and pain avoidance; and

effects”. As Marco and Suls (1993) explain; spill-over effects occur when a problem arising from the preceding time period or its effects persist, because an individual has been unable to cope with an issue, or that it takes some time to cope with the issue successfully. The study therefore, also seeks to understand and measure emotions, moods and experiences before, during and after travel and to analyse whether any effects (i.e. positive and negative effects) persist. The thesis additionally argues the need for improvements in the measurement, evaluation and promotion of “hard” and “soft”² travel behaviour change measures, based on a more informed understanding of the consequences of travel on personal wellbeing (Bill *et al.*, 2015). The combined results of such improvements could empower individuals by creating more informed travel choices through providing information on the mental wellbeing consequences of different travel modes in addition to the consequences to physical health.

This Chapter begins by outlining the motivation for conducting this research and briefly discusses the challenges of measuring and evaluating travel behaviour and the consequences for wellbeing. It also outlines the “social practice” philosophy underpinning the study (Barr and Prillwitz, 2013; Cresswell, 2010; Urry, 2007). That is, examining how wellbeing and travel behaviour are shaped through social and historical processes and contexts over time and space, rather focusing solely on the here-and-now “habits” of individuals. The chapter highlights the study’s aims, objectives, research questions and key contributions of the research, and

the eudæmonic approach, which focuses on meaning and self-realisation and defines wellbeing in term of the degree to which a person is fully functioning or flourishing (Ryan and Deci, 2001). A more comprehensive explanation of the concept is found from Chapter Four onwards.

² “Hard” measures refer to regulatory measures (i.e. infrastructure provision and management changes), “Soft” measures refer to non-regulatory measures (i.e. information and personalised travel plans) (Bill *et al.*, 2015)

outlines how the study adds value to existing academic understandings of travel behaviour and subjective wellbeing. An overview of the structure of the thesis concludes Chapter One.

1.1 Social and travel practices, travel behaviour and wellbeing

Transport systems composed of infrastructures, modes and hubs are so embedded in the socio-economic life of individuals, institutions and corporations that they are often invisible. This is paradoxical as the perceived invisibility of transportation is derived from its efficiency (Rodrigue *et al.*, 2013). Consequently, we can divide the future view of transport (easy in prose, somewhat more difficult in reality) into one that can be seen as a “high technology future” (or technological system) and one that can be considered a “low technology future” (or social/economic system) (Banister, 2013). This thesis focuses on the low technology future scenario; examining travel behaviour and the affective experiences of travel and the resulting consequences and impacts on happiness, mood and emotions.

Measuring and evaluating travel behaviour and wellbeing is difficult. Consider the implications, the feelings and emotions experienced, and the practicalities involved when confronting the multiple differing techniques, practices, sources of information, technologies, fuel systems and the required societal adaptations which encompass travel behaviour and its effect on mental and emotional wellbeing (Rodrigue *et al.*, 2013). Change is being thrust upon societies in a fast paced, emotionally charged and almost guilt-inducing way (Hysing *et al.*, 2014). There are multiple issues and challenges involved when adapting to; reduced car

use, a new fleet of electric vehicles (EVs), cars fitted with driver assistance, vehicle control systems, new fuels, new technologies, congestion, fuel crises, tolls and road charging (among many, many others). These challenges are present before even considering the wellbeing consequences, the wider societal impacts, how we cope with and experience different modes and types of travel, experiences whilst travelling, and the future paths of shifting towards active and sustainable transport (Ettema *et al.*, 2013).

Travel practices – why, where, when and how we travel - are a function of the many choices that make up people's lives. In terms of changes in travel, travel experience, and our emotional response to travel, the motivations behind this thesis are that it seeks to explore and examine these elements both from an individual perspective but also implicitly from a societal perspective. As a result it examines some of the social practices that affect travel. This is an important element which needs greater unpacking within travel behaviour research. Bar and Prillwitz (2013) for example suggest that researchers need to broaden their analysis to consider the ways in which other social scientists have developed the notion of individual behaviour, into an understanding of social practice. This study's research into travel behaviour goes above and beyond many contemporary studies with the added focus and support of examining wellbeing and happiness whilst travelling, and the everyday practices that affect mood. Social practices are considered more broadly than habits for example, and explore collective assumptions and routines as a result of consumption settings,

infrastructures, technologies, materialities, and land-use environments (Barr and Prillwitz, 2013):

Social practices are conceived as being routine-driven, everyday activities situated in time and space and shared by groups of people as part of their everyday life... Social practices form the historically shaped, concrete interaction points between, on the one hand actors, with their lifestyles and routines, and on the other hand, modes of provision with their infrastructures of rules and resources, including norms and values” (Verbeek and Mommaas, 2008:634).

In this way, social practices place current individual routines and behaviours into both a social and a historical context. They assist in recognising how apparently individual choices are framed by contemporary trends and the development of such trends over time and space (Shove, 2010). There is a lack of empirical research on the links between travel practices, mobility and travel experiences (i.e. wellbeing). Therefore, this thesis examines a cohort’s³ travel and wellbeing over time and provides a greater degree of context and explanation behind findings than that provided by many alternative studies.

Urry (2002; 2007) states a greater recognition of the links between travel practices and the wider notion of mobility is needed. Mobility relates to the total amount of travel that is undertaken on all forms of transport and it includes the physical movement from one place to another and covers both the movement of people and goods (Givoni and Banister, 2013). Accordingly, travel helps to meet social and economic needs through not only the technology and infrastructure of transport from A to B (Banister, 2008), but the very act of moving and the ways in

³ Cohort (panel) studies identify a group of people and follow them over a period of time to understand how different exposures impact them.

which travel is performed also have significant value (Cresswell, 2010; 2011a). There is a need to recognise the meanings, emotions and implications on wellbeing associated with travel, the ways in which different scales of mobility connect, and the mechanisms through which mobility represents flows of ideas, objects, and humans. As mentioned, this thesis not only explicitly examines travel behaviour but also affective responses to, and experiences of, travel. Critically, Cresswell (2010; 2011b) also highlights the ways in which mobility is practised through movement and representation in space. This research therefore examines the ways in which “mobility practices” emerge and change (through) space and time and plots the contexts for these shifts as a way of examining the potential for achieving sustainable mobility (Barr and Prillwitz, 2013).

1.2 Aim and objectives

Through the use of a mixed-method case study approach this D.Phil. investigates the interactions between travel behaviour and wellbeing in Penarth and Cardiff, Wales. This research examines these interactions and takes as its focus a case study of a major walking and cycling infrastructure project promoting active travel. To improve understandings regarding the consequences travel behaviour has on the subjective experiences of travel and wellbeing, a combined mixed-method approach was undertaken. The aim of this research is not to assess the direct impacts of the physical infrastructure intervention per se, but rather to explore the broader linkages between travel behaviour and subjective wellbeing

in this case study area⁴. In order to establish a better understanding of behaviours and the resulting consequences of transport choices, the following objectives are addressed within the thesis;

1. *Explore the existing evidence base and identify gaps in research on the relationship and linkages between travel behaviour and wellbeing research.*
2. *Examine individual and household travel behaviour, in a case study context, to identify factors affecting travel choices.*
3. *Measure and evaluate participants' subjective experiences of travel and the effects that travel has on mood and emotions over time, and on overall subjective wellbeing, through an adapted methodology; the Day Reconstruction Method.*
4. *Develop a novel approach to identify and evaluate the case for "a greater understanding of context"; apply mixed-methods within a case study context in Cardiff and Penarth, Wales.*

Objective One forms the conceptual framework of the research and therefore following the review of existing theories and empirical investigations (Chapter Four), the thesis begins by formulating a structured answer to this objective in Chapter Five. Objective One is particularly covered in Chapters Four and Six through examining current literatures and theories, alongside measuring how modes impact moods and the experiential side of travelling. This objective also considers the significance of a combined empirical approach to better understand the importance of context; this enables a deeper level of enquiry. Objective Two seeks to provide a detailed overview of the discourse surrounding actual and perceived personal and practical constraints householders face when discussing and practicing active and sustainable travel behaviour. Particularly examined in

⁴ Even if the objectives of the research were to assess the impacts of the infrastructure intervention, the timescale of the research would not have enabled data to be collected prior to the intervention's installation.

Chapters Five and Seven, this objective is achieved following a critical analysis of household constraints to change. The first part of Objective Three is central to Chapter Six although it is further explored in the analysis carried out in Chapter Seven. Objective Three is tackled by examining the impacts travel has on moment-to-moment moods through a combination of time-use research, and through examining emotions, experiences, and hedonic and eudæmonic evaluations (Ryan and Deci, 2001). Lastly, Objective Four is addressed within each of the four empirical chapters presented within the thesis with the outcomes, potentials and pitfalls of conducting mixed-methods research examined in detail. This is explored in Chapters Six and Seven and uses the experiences and results of Chapter Five's qualitative explorations to support and provide depth to Chapter Six and Seven's quantitative analysis.

1.3 Key research questions

Research questions organise investigation, guide the methodology and situate the study within the social sciences discipline. The main research questions this thesis investigates are:

1. *What are the links between travel behaviour and wellbeing?*
2. *What are the perceived and actual constraints to walking and cycling among households and individuals?*
3. *How does transport mode impact on individual moment-to-moment moods and what are the spill-over effects from transport mode on everyday activities?*
4. *What lessons can be learned and what policy implications may arise from using a longitudinal, mixed-method approach when examining changes in travel behaviour and the subjective experiences of travel?*

1.4 Research contribution

This D.Phil. research positions itself within the fields of transport, mobilities studies and psychology. It used the iConnect (Impact of COnstructing Non-motorised Networks and Evaluation of Changes in Travel) consortium research programme (i.e. the research consortium created to measure and evaluate changes in travel, health and carbon at the field site) as a platform to conduct fieldwork, collect primary data and share access to secondary data (www.iconnect.ac.uk, 2011). The study is timely because it addresses pertinent questions on the links between the subjective experience of travelling and transport infrastructure aimed at increasing active travel at a time when issues such as obesity and wellbeing are high on the political agenda (Humphreys *et al.*, 2013). It seeks to investigate the changes and consequences in travel behaviour and wellbeing in response to a programme focusing on interventions for walking and cycling (i.e. active travel⁵). The study has the potential to make an important contribution to knowledge in the field of active travel and psychology given that there is a paucity of mixed-method evidence on the effects of travel behaviour on wellbeing. Linked to this, robust evidence within transport research lacks appropriate methods to measure and evaluate changes in wellbeing, emotions whilst travelling, and the experiential side of travel.

The study directly contributes to knowledge by revealing some of the specific contexts and circumstances under which interventions are more or less likely to bring about travel behaviour change. Subsequently, contributions from the

⁵ The terms “active travel” and “walking and cycling” are used interchangeably and refer to the same activities and modes incorporating both utility and leisure travel

study's empirical findings suggest that people experience less pleasant emotions during travel compared to everyday activities, and that for certain modes there is a decrease in happiness before and after travel compared to everyday activities. The study also highlights the importance of measuring and understanding contexts and experiences through mixed-method cohort studies, it therefore provides a useful opportunity to contribute new evidence in this field. Finally, this research is important as it adds to the findings of the wider iConnect study through its examination and measurement of wellbeing, as well as offering a more holistic comprehension on the intrinsic nature of mobilities research and transport geography.

Ultimately this D.Phil. study aims to reveal greater understandings of the degree to which the use of different travel modes is contextualised and measured, how measurements of wellbeing are understood and how constraints to travel behaviour change are overcome. Chapter One, has so far provided an overview of the main motivations for conducting the research, including a brief examination of the study's main contributions. It also examined how such contributions were established and conceptualised through the study's main aims, objectives and key research questions. This final section discusses the overall structure of the thesis.

1.5 Thesis structure

The sections of the thesis are structured as follows. Chapter Two outlines the research project and focuses on the approach undertaken for this study. The chapter discusses the approach undertaken and justifies the use of case studies following on to examine the empirical framework, and the role of Sustrans (i.e.

the UK-based charity charged with installing, monitoring and evaluating the intervention projects) and the ambition of Connect2 (i.e. the scheme used as a platform for research) and the research undertaken by iConnect. The chapter then reviews the travel provisions in the area and provides an analysis of the National- to Local-level policies and strategies for active travel focusing on how such policies are applied in and around Cardiff and Penarth.

Chapter Three examines the methodology adopted for this D.Phil. research. The chapter concentrates on justifying the selection of methodology, full details of the qualitative and quantitative methods applied, as well as the ethical implications and considerations for this study. The chapter includes a focus on how the core sample was established, including a brief discussion on some of the methods and findings from the wider iConnect research consortium project.

Chapters Four to Seven are based around four academic papers that have been submitted for peer review; here however they are presented as Chapters. As a result, inevitably there is a degree of repetition across these chapters (specifically relating to details of the case study, as well as of sampling, methodology and methods). Where text or diagrams are repeated from previous chapters, this is shown in italics.

Chapter Four conducts a review of relevant literature examining subjective wellbeing, behaviour change and travel. It aims to take stock of relevant literatures to date and delve deeper into the relationships and interconnections between travel behaviour and wellbeing. Chapter Four predominantly focuses on

tackling Research Question One; examining the linkages between travel behaviour and wellbeing and answering Objective One; exploring the evidence base and identifying gaps in research. It also broadly answers Objective Four; providing “a greater understanding of context”. It seeks to discuss the variety of empirical studies, methods, theories and applications presented inside and outside of academia. It additionally seeks to provide a discourse on why and how the relationship and interconnections between wellbeing and transport were established and have developed and advanced over the past few years. The purpose of Chapter Four is to provide the background contextualisation to these research disciplines and explain context and demonstrate how each interrelate for the purpose of this D.Phil. thesis. A multitude of studies, theories and methods are discussed from a wide set of disciplines and philosophies, complimented by a discussion on findings, recommendations for future research, and concluding remarks.

Following on from the literature review, Chapter Five scrutinises the notion of practical and personal constraints surrounding travel behaviour in and around the case study site. It uses data collected from householder interviews to understand some of the decisions behind travel, perceived and actual inhibitors to behaviour change or active travel in general, and some of the justifications behind this. Chapter Five largely seeks to answer Research Questions One and Two; understanding the perceived and actual constraints to active travel and the links between travel behaviour and wellbeing. Chapter Five additionally addresses Objective Two; examining individual and household travel behaviour,

in a case study context, to identify factors affecting travel choices. It also helps answer some of the fundamental questions underpinning Objective Four which seeks to provide “a greater understanding of context”.

Studying the impact travel has on individual moods, emotions and experiences over time provides a more in-depth examination of the travel scenario in this case study site. This led to a greater consideration of travel behaviours, perceived inhibitors to active travel uptake, and responses to everyday travel. From here onwards the thesis examines some of the more complex questions and outcomes which require a more in-depth and narrow research focus. Chapter Four and Five compliment Chapter Six which seeks to provide context and an in-depth insight into the wider nuances and complexities behind individual and household travel behaviours. Chapter Six examines this by exploring the impact travel modes have on moment-to-moment moods and emotions in an investigative study. Collecting exploratory data on moods and emotions, and experiential travel allows relationships to be identified such as *how* travel makes people feel, and *when* travel makes people unhappy. Examining the way travel affects wellbeing and its consequences is an important area to measure and understand as negative or unpleasant experiences have implications on our moment-to-moment moods and emotions which can “spill-over” and continue to impact everyday life. It can be seen that Chapter Six addresses Objective One, as well as Objective Three; by examining and measuring the subjective experience of travel and the effects on mood and emotions over time and on overall wellbeing. The Chapter also addresses Objective Four by discussing “a novel approach to transport research”.

Finally, Chapter Six also answers Research Question One, Three and Four; how mode impacts moment-to-moment moods and the resulting spill-over effects, as well as the policy implications of conducting such research and its practical application.

The data collected and the results produced so far lead into Chapter Seven which seeks to challenge and promote the strengths and considerations of employing mixed-methods to case study research, alongside recommendations for future studies within transportation and mobilities research. Chapter Seven uses the findings from Chapter Five and in particular from Chapter Six to provide a platform to explore the benefits of employing multiple data collection methods. It can be seen that combining methods ensures that the deeper nuances and contexts behind survey and interview responses are better recorded, analysed and explained. This Chapter seeks to understand the results of the longitudinal data set and interpret how noteworthy results are produced and reproduced in the initial and follow up data collection. Chapter Seven addresses each of the four research questions but increasingly focuses on Research Question Four; “what can be learned from using a mixed-methods approach”. In terms of objectives achieved, Chapter Seven predominantly examines Objectives Three and Four seeking to evaluate an applied research method and a mixed-method approach respectively.

Finally, Chapter Eight delivers the study’s overall conclusions, recommendations, limitations, and areas for future research. It provides a synthesis of processes, findings and contributions and critically analyses the entire D.Phil. process and

evaluates how the whole procedure would be improved, enhanced or redeveloped if repeated. Additionally, the Chapter demonstrates how each research question and objective was addressed and how in turn these answered the aims of the D.Phil. research. The final Chapter also reflects on the conception, development, and implementation of the theoretical framework and methodologies employed as well as the results and findings presented. It also examines how data were analysed and explained in the context of this thesis and case study research. In terms of future research, Chapter Eight provides an in-depth evaluation of the methods used to measure and evaluate travel behaviour and wellbeing in this context. Through applied, empirical research the Chapter demonstrates that to improve validity and robustness of research findings a combination of methods needs to be advocated and employed so that future studies are *sturdier* in terms of validity, robustness and impact.

This final Chapter openly addresses the study's limitations and the challenges faced throughout the research process identifying areas which required improvement, enhancement and/or more rigorous testing and validation. Finally, Chapter Eight outlines and reinterprets the findings of the thesis as well as acknowledging how the study adds to academic knowledge within human geography, transport and mobilities studies, and wellbeing research. The Chapter restates the knowledge gaps and explicitly outlines how this D.Phil. has contributed to the existing body of academic work. This includes discussing empirical evidence gathered; examining, evaluating and measuring travel behaviours, the use of a novel method to measure and examine wellbeing over

time, and finally advocating the use and importance of mixed-methods research to understand and interpret contexts. A clearer overview of the thesis structure is presented in Table 1.1 below. This mapping exercise depicts each of the four empirical/theoretical chapters (papers submitted for peer review) and illustrates how each chapter tackles the study's objectives and key research questions as well as the methods employed.

	Objective	Research question	Method employed
Chapter Four (Paper One)	One; Four	One	Literature Review
Chapter Five (Paper Two)	One; Two; Four	One; Two	Qualitative Interviewing
Chapter Six (Paper Three)	One; Three; Four	One; Three; Four	Quantitative Survey (DRM)
Chapter Seven (Paper Four)	One; Two; Three; Four	One; Two; Three; Four	Longitudinal Mixed-Methods Survey and Interview

Table 1.1: Overview of thesis structure

Chapter Two – Approach: Context and selection of case study

This research examines the contexts and interconnections between travel behaviour, wellbeing and travel experiences, not only in terms of the constraints surrounding actual and potential active travel, but also how travel impacts moods and emotions over time. This chapter begins by justifying the use of a case study approach followed by a brief outline on the background of the iConnect research consortium. This discussion examines the consortium's role, main findings, and explains the shift in this D.Phil. study's field sites from the original in Warwickshire, to the field site this research is based upon in Cardiff, Wales. To understand the political landscape and to address the discourse surrounding active travel in Cardiff, the chapter examines the national-, regional- and local-scale policies and provisions focusing on active and sustainable travel across Wales. Sustrans, the UK's leading sustainable transport charity, is consequently introduced and its role examined. The "Sustrans Connect2 Cardiff" scheme is then discussed, focusing on the project's ambition and aspiration as well as exploring why such schemes are considered important in terms of understanding travel behaviours and improving "community liveability". These discussions then link to general characteristics of the case study and focus on previous infrastructural interventions installed in the area, specifically the Cardiff Bay Barrage. Finally, the Chapter focuses on travel provision in and around the area examining how the Cardiff Connect2 scheme fits into the existing urban landscape.

2.1 Case study justification

“Qualitative case study methodology provides tools for researchers to study complex phenomena within their contexts” (Baxter and Jack, 2008:544)

Case study samples are small-scale, are studied intensively, and each case typically generates a large amount of information (Curtis *et al.*, 2000). According to Yin (2003) a case study design should be considered when a) the focus of the study is to answer “*how*” and “*why*” questions; b) you cannot manipulate the behaviour of those involved in the study; and/or c) you want to cover contextual conditions because you believe they are relevant to the phenomenon under study. This thesis considers all three elements. Case study research however, is simply not sampling research; cases are not studied primarily to understand other cases. The first obligation is to understand this one case in Cardiff and Penarth, Wales. Additionally a hallmark of case study research is the use of multiple data sources, a strategy which also enhances data credibility (Stake, 1995; Yin, 2003; 2013). This research primarily uses quantitative surveys and qualitative interviews, alongside direct observations, contextual fieldwork and the study of documentation and archival records (Baxter and Jack, 2008). A case study approach was chosen as Stake (2000) states “some of us emphasize the name *case study* because it draws attention to the question of what specifically can be learned from the single case”. The site examined should be considered at once to be *simple*; in that it presents a small, contextual insight into the way transport infrastructures and everyday travel impact the study’s cohort. As such, this may reflect experiences of others beyond the bounds of the case study.

Furthermore the site examined should be *complex*, in that the case study is made up of the intricate experiences of individuals and the interweaving of complicated transport policies and networks.

There is a need for specificity in the choice of case study site to allow completion of the research within the timescale, but this should not be seen as a weakness in the study's design. Indeed the benefits of a focused, case study approach have been alluded to by Stake (2000); "while we are studying the case study, our meagre resources are concentrated on trying to understand its complexities". So, it can be inferred that in employing a case study methodology, the researcher can gain greater insights into the very nature and context of the object being studied.

2.2 iConnect: Background and main findings

It is important to briefly introduce and provide an overview of the iConnect research consortium in establishing this D.Phil.'s research agenda. It is important to discuss iConnect's role as the consortium helped form the foundations of the research conducted within this thesis. iConnect (iConnect.ac.uk) involved eight academic institutions, began in May 2008 and ran for five years. The study's main aim was to measure and evaluate changes in travel, physical activity and carbon emissions relating to Sustrans' Connect2 scheme; transforming local travel in 79 communities across the UK (see Figure 2.1).

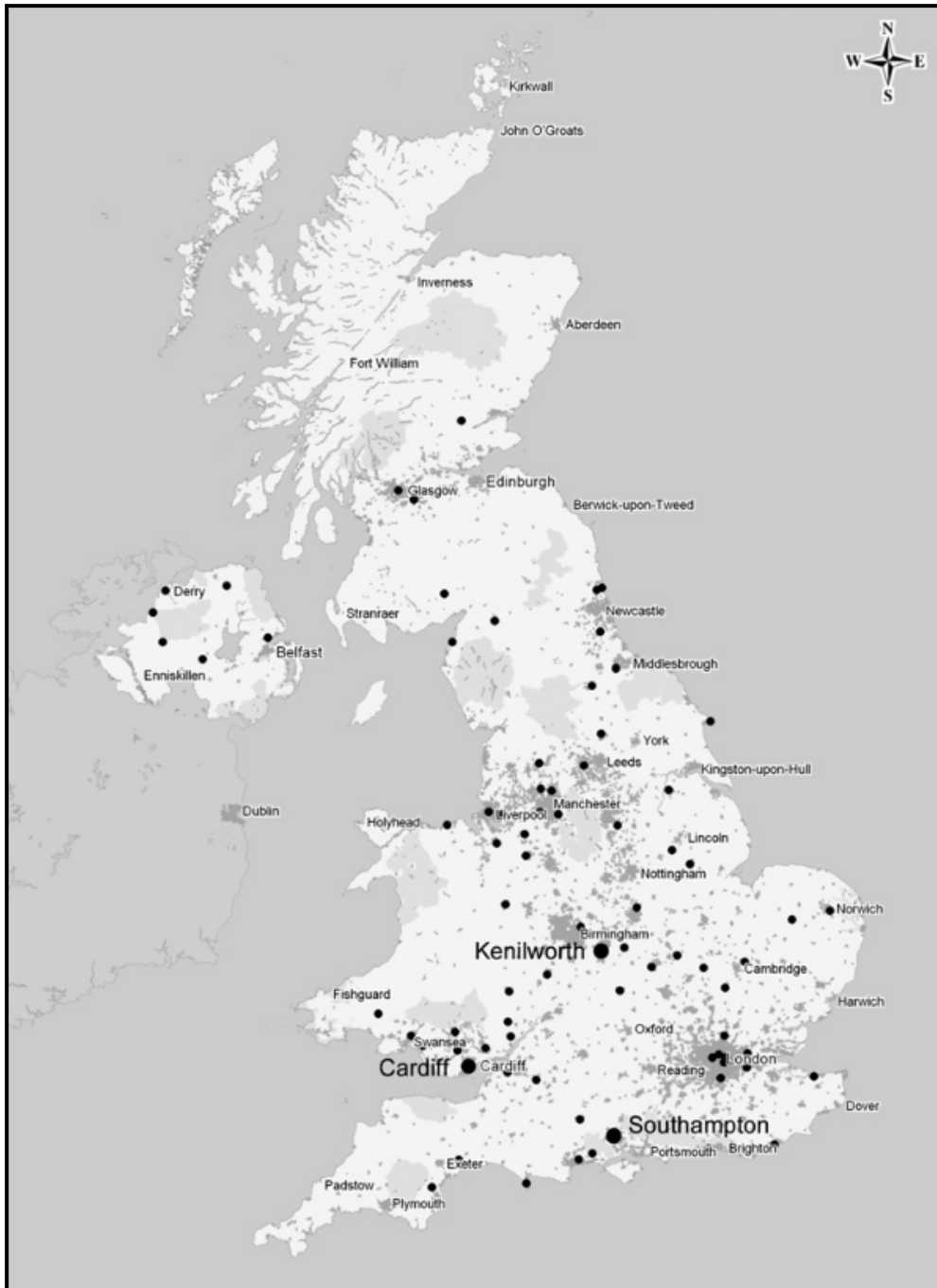


Figure 2.1: Locations of Connect2 case study sites

Source: Ogilvie *et al.* (2012)

The core engineering projects at the 79 Connect2 sites ranged widely in scale and setting, from major new bridges serving large urban populations to modest rural routes serving small local and tourist catchment populations (Ogilvie *et al.*, 2012). iConnect recognised that travel behaviour changes as a result of transport

interventions, were likely to be different across communities and locations and therefore sought to examine geographic and social variation in travel patterns and their impacts. Thus, iConnect conducted broad evaluations of the whole programme coupled with detailed investigations at five sites. This determined whether the new routes had helped people switch from using their cars to walking or cycling, helping them get more physically active and reduce their carbon footprint. Of the Connect2 communities, the five main case study sites were confirmed at the iConnect consortium meeting in London, January 2010 three of which; Cardiff, Kenilworth and Southampton were proposed as suitable sites for this D.Phil. research.

Originally the Sustrans Connect2 case study site of Kenilworth, Warwickshire was the preferred option for this thesis research (see Figure 2.2) with the Southampton, Hampshire site the alternate. In April 2010 participants from Kenilworth, Warwickshire were approached for a pilot study, and for wave two of a longitudinal research project to be conducted in July 2010; similar to the study outlined and conducted within this thesis. The Connect2 Kenilworth project however was severely delayed in 2010 and resulted in the cancellation of the fieldwork and data collection. This cancellation instigated a shift in case study sites from Connect2's Kenilworth site in England, to the Cardiff and Penarth site in Wales.

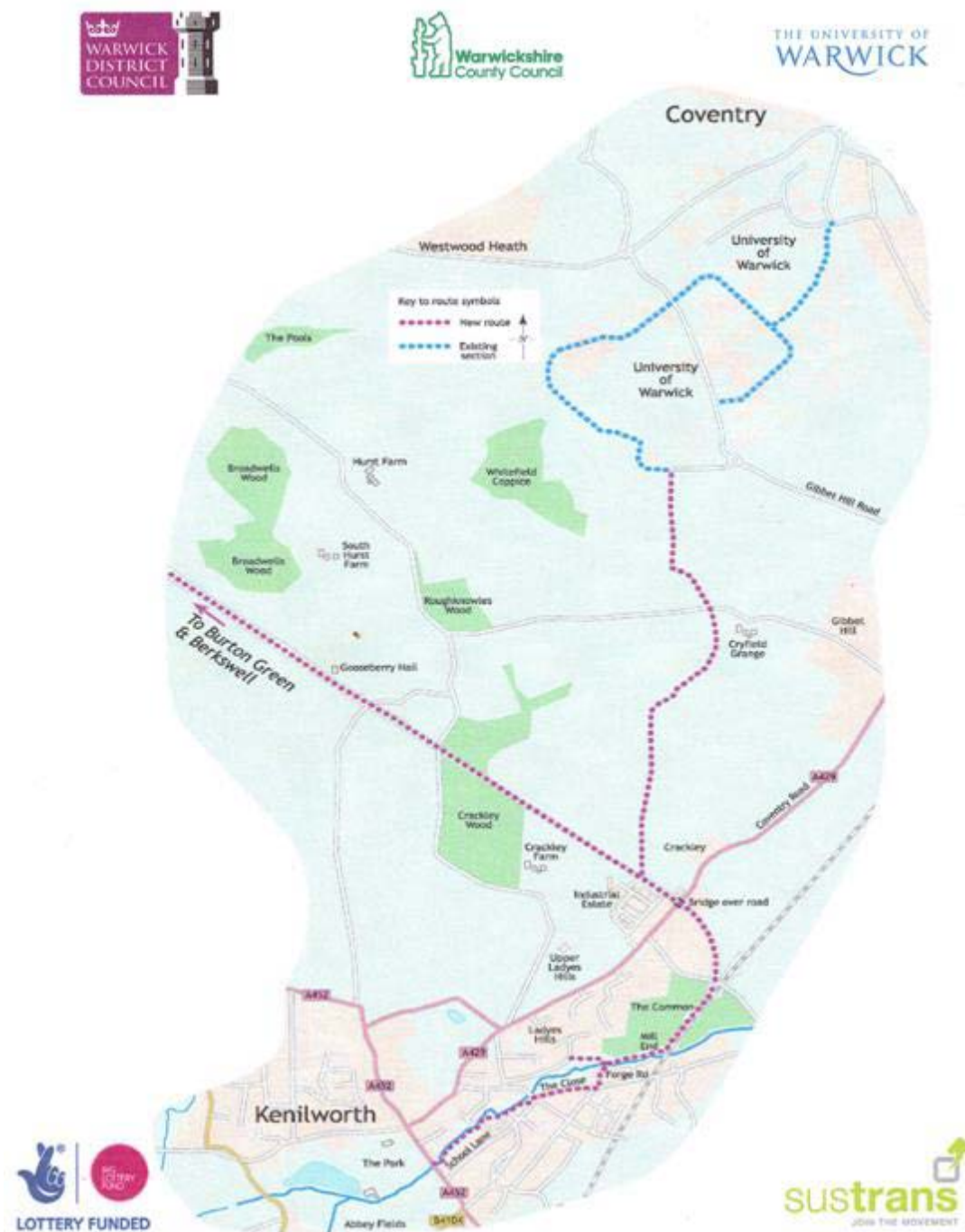


Figure 2.2: Connect2 Kenilworth, Warwickshire

Source: Sustrans (no date)

The delay in Kenilworth, Warwickshire was caused by an extremely overambitious timescale for completion where the transport intervention (i.e. a bridge over the A429) was drastically delayed, paired with a sudden lack of Local Authority support, meaning that at one point the project was almost entirely

cancelled (GoPetition.com, 2010). Completed just over a year later in September 2011 the scheme now links Kenilworth with the University of Warwick and the Berkswell Greenway. This delay caused too much risk to research and the timescale of this D.Phil. thesis. Therefore out of the remaining three sites chosen by iConnect, the most appropriate for this D.Phil.'s research (i.e. due to location, timing, project type, level of impact etc.) was the Cardiff Connect2 scheme.

The decision to focus on the Cardiff, Wales site was supported by visits to the University of Southampton's Department of Engineering and the Environment where the main iConnect consortium's administrative centre was located. A participant database review was undertaken to identify the characteristics of the Cardiff baseline respondents to ensure suitability and feasibility. The main pitfalls of this experience were the delays in setting up the Cardiff fieldwork and as a result the missing "before intervention" element of the research meaning that only two waves of data could be collected instead of three within the given time constraints of the D.Phil. process. In other respects, positive aspects of the experience allowed for a greater degree of confidence in the research agenda and protocol, prior experience in designing and recruiting research participants and a more appropriate case study site to examine and research.

Findings from the overall iConnect study indicate that a) the Connect2 schemes allow sustained usage of interventions but there is a dominance of recreational trips and b) that there is broad socio-demographic appeal, but there is higher usage in more advance and active groups (Goodman *et al.*, 2013; 2014). The findings and results which focus on the Cardiff Connect2 scheme within this

thesis agree with the findings of the iConnect study (i.e. a popular leisure route has been created and that there broad appeal but higher usage in more active and advanced groups); this D.Phil. research builds on and extends such results. Major benefits of collaborating with iConnect included access to shared data and access to expert academics from various disciplines and institutions. Data sharing meant that an existing cohort of willing respondents were available at the beginning of this D.Phil. study, saving time and wider recruitment costs.

2.3 Policy and provision: Wales, Cardiff and Penarth

This section discusses current and future transport policies and practices throughout Wales, Cardiff and the Vale of Glamorgan (i.e. one of the Local Authority's directly involved with the scheme). It is essential that an achievable, relevant, innovative and coherent transport plan and strategy is in place as transport plays a vital role in the lives of almost everyone. It is a necessity for most peoples' work and for social activities and those without transport can be isolated and lack the ability to participate in society (Lovelace *et al.*, 2011). The political discourse behind the provision of travel and transport infrastructure, funding and support is an important issue to focus on. Principally, due to the multiple funding agents involved in the Cardiff Connect2 project it is important to interpret how the differing strategies, plans and Local Authorities interrelate and divide control. Funding of £5 million was received from the Welsh Assembly Government (£1.645m), Cardiff Council (£1.3), Sustrans (£1.15m), Cardiff Harbour Authority (£250k) and the Vale of Glamorgan (£200k). It is therefore important to discuss the political agendas and the transport strategies of Wales, Cardiff City

Council and the Vale of Glamorgan, as well as identifying future plans and proposed schemes to assist understandings of how the Connect2 Cardiff scheme was conceptualised and how the project will be used as a benchmark across Wales.

National level

In 2008 the *Wales Transport Strategy* was published; a document superseding the Transport Framework for Wales. The Wales Transport Strategy established the “One Wales” policy documents focusing on the role transport plays in delivering the wider policy agendas of integrating transport with spatial planning, economic development, education, health, social services, environment and tourism (Wales Transport Strategy, 2008). The Strategy set out a number of longer term outcomes, grouped under three elements of sustainability as seen in Table 2.1.

The Wales Transport Strategy now includes the new, 2011 *National Transport Plan* which seeks to achieve the ongoing commitments stated previously, but also build on the previous plan, by adding and integrating public and community transport, and walking and cycling, with the intention of delivering and achieving “One Wales”. The transport plan has grouped the strategic longer term outcomes as seen in Table 2.1 into four strategic priorities from 2011 – 2016 (National Transport Plan, 2011);

- **Reducing** greenhouse gas emissions and other environmental impacts
- **Integrating** local transport
- **Improving** access between key settlements and sites
- **Increasing** safety and security

	Strategic Long Term Outcomes
Social	• Improve access to healthcare • Improve access to education, training and life-long learning • Improve access to shopping and leisure facilities • Encourage healthy lifestyles • Improve the actual and perceived safety of travel
Economic	• Improve access to employment opportunities • Improve connectivity within Wales and internationally • Improve the efficient, reliable and sustainable movement of people • Improve the efficient, reliable and sustainable movement of freight • Improve access to key visitor attractions
Environment	• Increase the use of more sustainable materials • Reduce the contribution of transport to greenhouse gas emissions • Adapt to the impacts of climate change • Reduce the contribution of transport to air pollution and other harmful emissions • Improve the impact of transport on the local environment • Improve the impact of transport on our heritage • Improve the impact of transport on biodiversity

Table 2.1: Longer term outcomes for the Wales Transport Strategy

Source: Wales Transport Strategy (2008:9)

In terms of sustainable travel, Wales overall has made £5m available over three years (2011-2014) to maximise investment into “Sustainable Travel Centres”. It aims to continue to improve the provision of travel information by prioritising investment in Personalised Travel Planning, plan strategic modal interchanges, and maintain its commitment to free concessionary travel on local bus services for elderly and disabled people. With regards to active travel, Wales’ National Transport Plan aims to; develop a larger number of traffic free active travel routes and segregated public transport routes; maintain the “Safe Routes in Communities” programme to develop safer active travel opportunities and deliver their “Walking and Cycling Action Plan”. Additionally, Wales plans to continue to increase the amount of funding available for walking and cycling schemes

(through the “Sustainable Travel Centres” and the “Safe Routes in Communities” programme) and integrate the development of cycle routes in southeast Wales that are supported under EU convergence funding.

In terms of future commitments for 2014-2015 and 2015 onwards, all proposals within the transport plan are largely focused on rail improvements, road improvements and finally bus improvements - no mention as yet of active travel improvements (National Transport Plan, 2011). Considering this however, the Active Travel (Wales) Act 2013 was passed which legislates for the provision of routes specifically designed for walking and cycling. The Act, which became law in Wales on the 4th November 2013, places a “requirement on Local Authorities to continuously improve facilities and routes and to prepare maps identifying current and potential future routes for their use. The Act also requires new road schemes to consider the needs of pedestrians and cyclists at the design stage” (National Assembly for Wales, 2014; Wales.gov.uk, no date).

Regional level

The National Transport Plan (2011) sits alongside the *Regional Transport Plans* (2010) in delivering the Wales Transport Strategy (see Figure 2.3). These plans aim to ensure consistency of service provision, support economic growth and promote social inclusion across the transport network. It is suggested that the national and regional plans together strengthen local service delivery and help to improve access to essential services such as health and education (National Transport Plan, 2011).

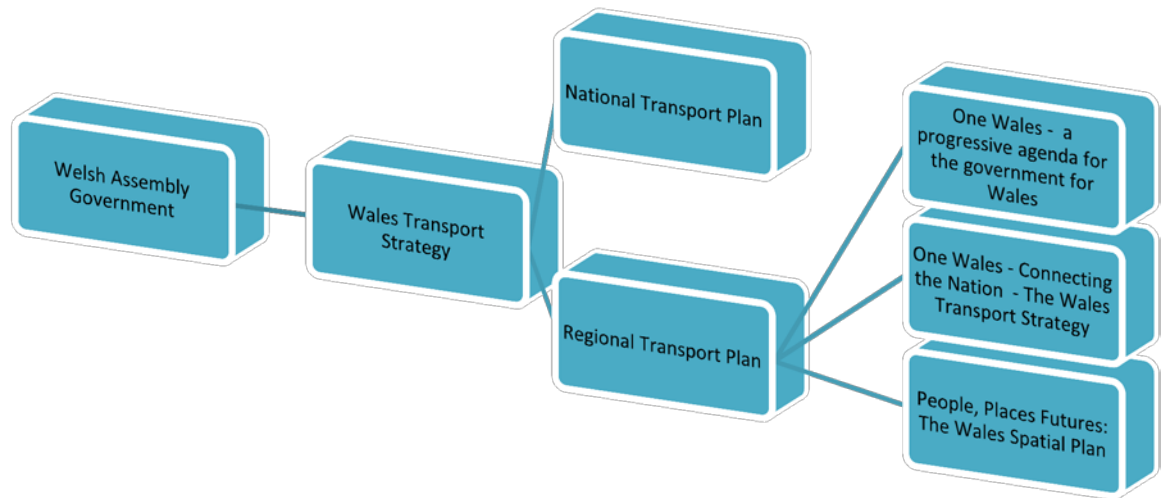


Figure 2.3: Policy documentation: Feed in to/out of Wales Transport Strategy

Source: Regional Transport Plan (2011)

The *South East Wales Regional Transport Plan* has been jointly developed by ten constituent authorities; of which Cardiff and the Vale of Glamorgan are included. From this a *Vision for Transport to 2021* has been developed as a way to provide;

“...a world class, integrated transport system that offers safe, efficient, and sustainable travel for all, and where public transport, walking and cycling provide real and desirable alternatives to car travel”

This vision and collaboration is essential as partnership between the different authorities would increase efficiency, help alleviate traffic and congestion, and create a genuine “network”. The Vale of Glamorgan and Penarth in particular, acts as a dormitory town for commuters in to Cardiff. There is heavy congestion and relatively high movement on the main highway links between the urban areas in the morning and evening peak periods as a high percentage of journeys to work are by car. Therefore, collaboration is crucial especially when comparing

regional commuter flow, for example in to and out of the Capital; Table 2.2 demonstrates the high commuter traffic volume levels when comparing Cardiff and the Vale of Glamorgan.

	Cardiff	Vale of Glamorgan (Penarth)
Out-Commuting	25900	27900
In-Commuting	72200	13400
Net Flow	46300	-14500
% working in own area	81	50

Table 2.2: In-commuting and out-commuting by Local Authority

Source: Regional Transport Plan (2010:16)

The Regional Transport Plan is shaped by three key Welsh Assembly Government policy documents which together provide the principle framework for the development and delivery of the plans across Wales.

2.4 Local-level policies in practice

Cardiff

Cardiff Council's transport and travel information is very prescriptive in nature and does not directly include independent and explicit policy documents. It does however highlight the *Cardiff Transport Strategy* which focuses on three main themes and aims to ease the pressure on the city's transport system by encouraging people to reduce car use and to walk, cycle, use public transport or to car share for as many journeys as possible. The three main strategy themes include (Cardiff.gov.uk, 2014);

- 1) *Widening travel choices - to ensure that a range of practical and attractive travel options are available for most trips and that people know about them.*
- 2) *Demand management – to introduce a range of measures to reduce the demand for travel overall and limit car use where appropriate.*
- 3) *Network management – to use a range of measures to make best use of the existing network and improve facilities and accessibility for all modes of travel and, in particular, for alternatives to the car.*

Further to the Cardiff Transport Strategy there is a dedicated website entitled “Keeping Cardiff Moving” which focuses on offering advice, support and knowledge on the more sustainable alternatives to car use (keepingcardiffmoving.co.uk, 2010). In addition to large-scale infrastructure projects such as Pont-y-Werin and the Cardiff Bay Barrage, there are a variety of sustainable and active travel initiatives and programmes in place across the Capital. In March 2009 for example, the Welsh Assembly Government announced that Cardiff would be Wales’ first Sustainable Travel City (Cardiff.gov.uk, 2014). From this, Cardiff aims to support and promote the uptake and continued use of sustainable modes. Developments and projects include;

- Improving **bus access** in the city centre;
- Making central areas more **pedestrian friendly**;
- **Improving links** between the city centre and Cardiff Bay;
- Expanding the **National Cycling Network**;
- Installing **Bus Corridors** and other infrastructure to support public transport;
- A new **Park and Ride/Park and Share scheme** and;
- A **Smart City Hub** which will help to keep the transport infrastructure in the city flowing.

These schemes are supported by Cardiff City Council's 'Smarter Choices' measures; providing better access to information and encouragement to try different ways of travelling. The aim is to get people to plan how they travel and to consider how different travel modes may suit particular journeys (Cardiff.gov, 2014). These include: an Individualised Travel Marketing programme; travel plans (workplace, school, residential, personalised journey planning); car/journey sharing; a Car Club; the Cardiff Bike Scheme and; Travel Awareness Campaigns (Keepingcardiffmoving.co.uk, 2010; Bartle and Avineri, 2014).

It can be seen that Cardiff is placing ever more emphasis on improving the public realm, especially by creating a high quality pedestrian core, improving facilities for public transport users and making the city centre more accessible for cyclists. In June 2011 for example, Cardiff held its first Cycle Festival; the nine-day festival hosted events across the City for both regular and new cyclists. Cardiff City Council promoted the event, and walking and cycling, as viable, low cost and convenient travel options. Cardiff clearly recognises that increased active travel has a positive impact on the city; helping reduce car use, congestion and air pollution, and improve accessibility making the city safer and more pleasant, alongside improvements in population health. In addition to this, Cardiff's "Keeping Cardiff Moving" strategy states that the City strives to provide;

1. *Safe, convenient and attractive routes for pedestrians and cyclists, to make walking and cycling an attractive alternative to the car for short journeys; provide clean, reliable and convenient buses that meet local needs and are able to move around more freely than the private car, in order to make buses an attractive alternative to the car;*
2. *Fast, reliable and efficient rail services, particularly for commuters within and into Cardiff;*
3. *Where there is a need, new and innovative forms of public transport and for these to become real alternatives to the car;*
4. *Freer-flowing and well-maintained roads for travel that keep heavy traffic away from the City Centre and residential areas, and which provide more space for public transport, pedestrians and cyclists; and*
5. *Introduce a 20 miles per hour pilot scheme*

Penarth and the Vale of Glamorgan

Conversely, Penarth and the Vale of Glamorgan's transport policy documentation mainly include a dedicated section on the Council's website to a redundant and outdated (by nine years) Local Transport Plan and a link to the Regional Transport Plan (i.e. the document discussed above). The web-portal provides a policy document focusing on the Provision of Home to School Transport (2010) but otherwise there are simply links to local transport statistics which lead into an external "Quick Report" generator, and general news and facts about concessionary bus tickets, bus timetables and road safety information etc. (valeofglamorgan.gov.uk, no date). It can be seen that vast improvements are required in how and where information is delivered and accessed and that the Vale of Glamorgan needs to stand independently from (or at least improve collaborations with) Cardiff's transport plans and strategies. It can be seen however that with the various policy strategies and documents in place, and with

Cardiff's documents and webpage being constantly reviewed and updated, and the multiple initiatives that are under construction or employed, Cardiff especially, but also Penarth have high intentions over the coming years to improve the provision of active travel facilities.

2.5 Sustrans: Role and ambition

Sustrans (sustrans.org.uk) is a UK-based charity with over 30 years of experience, they assist “local Authorities and transport bodies to develop strategy and vision for the delivery of ambitious but achievable cycling, walking and sustainable travel change” (Sustrans, no date). They have a dedicated research and monitoring unit (plus their academic partnerships) who aim to understand all aspects of sustainable travel behaviour through the monitoring and evaluation of outputs and assessing outcomes, and the impacts of their projects across the UK. Sustrans plays an important role as since the 1960s on a national level, transport policy in the UK has been dominated by technocratic ideologies; in the sense that there was a common belief that “technical fixing” of a problem was the best way to proceed (Spratt and Houston, 1999). This has led to an emphasis on the transport system rather than the cultures, practices and systems of mobility that are integral to society. The culture of transport planning in the UK is one that is dominated by the traditions of engineering and economics; however more recently, this has broadened to include notions of sustainability and the links between transport and society/environment etc. leading to the emergence of alternative discourses (Banister, 2002; Murray, 2011; Ferrer-i-Carbonell and Gowdy, 2007; Newman and Kenworthy, 2001). This is where Sustrans positions

itself and uses a variety of hard and soft intervention methods and techniques to adapt and change travel behaviours. These include among others, Personalised Travel Planning, transport interventions and marketing campaigns.

In the UK, cycling in particular became embedded in public policy only after policymaking had been variously outsourced to private, quasi-private, and voluntary organisations (i.e. Sustrans). Aldred (2012) argues that this broader context has contributed to the ongoing failure to treat cycling (and walking) as a strategically important mode meriting substantial national transport funding. The author additionally links a growing policy focus on the dispersal of cycling policy away from transport into other areas including public health and the environment. Aldred (*ibid*) argues that while there are benefits to this construct, it has helped to maintain cycling as perceived as being peripheral to the main business of “transport”. Cycling policy has therefore been doubly devolved, away from the state, and away from transport. This devolution has therefore charged Sustrans with the UK's national delivery of walking and cycling even whilst realistically they have continued to be considered “local” transport suppliers for “local” transport issues. Additionally, in low-cycling countries such as the UK, cycling has continued to be unevenly distributed across genders and age groups (Aldred, *et al.*, 2015). In the past cycling has been seen as a male and young preserve, however recent debates have highlighted the importance of dedicated infrastructure for cyclists as the means to increasing the diversity of cycling, e.g. to encourage more women and older people. It cannot be assumed that any growth in UK cycling levels will automatically increase the gender and age

diversity of cyclists. Therefore Aldred *et al.* (*ibid*) suggest that policymakers need to study and respond to the infrastructural preferences of women, older people and other under-represented groups in the battle for transport equality, and increases in cycling and overall active travel levels. Matching preferences with infrastructure design and implementation is something which Sustrans needs to ensure that its future travel programmes explore, deliver and evaluate.

Sustrans' work focuses on society-wide collaboration including partnerships with workplaces, schools, train stations, higher education institutions and community-wide organisations. Further robust evidence is required however through improved collaborations (i.e. the iConnect partnership) to ensure that academically-rigorous, valid, reliable and repeatable evidence is collected. This, together with newer conceptualisations of behaviour change theories and methods, could be introduced into Sustrans' working practices to ensure that the most relevant and up-to-date methods are employed, tested and monitored. Pawson and Tilley (1997) argue that explorative and evaluative research should be designed to test theories about “*how*” such interventions work rather than to test whether a given intervention “*works*” in an aggregate, generalisable sense. Therefore it is important to rigorously test whether such travel behaviour change interventions are “working” so that future funding can be justified and so that change, sustainable or otherwise, can be measured and evaluated.

2.6 Case study: Connect2 Cardiff, Wales, UK

This D.Phil. research examines Connect2 Cardiff's “Pont-y-Werin” (i.e. Folk Bridge, see Figure 2.4) site in Wales as a platform to investigate the changes and

interactions between travel behaviour and wellbeing. The Connect2 programme offered the opportunity to conduct mixed-method research with a cohort of respondents situated close to the intervention site. Sustrans' five-year Connect2 scheme was promoted as a way to;

“...create a new way of living, where people, not cars, are at the heart of travelling within communities throughout the UK. [Connect2] will transform local areas, enabling people to travel from their front door to school, the shops, green spaces, work, even the pub, without having to reach for their car keys”.



Figure 2.4: The Pont-y-Werin in the “open” position

Source: James (2010)

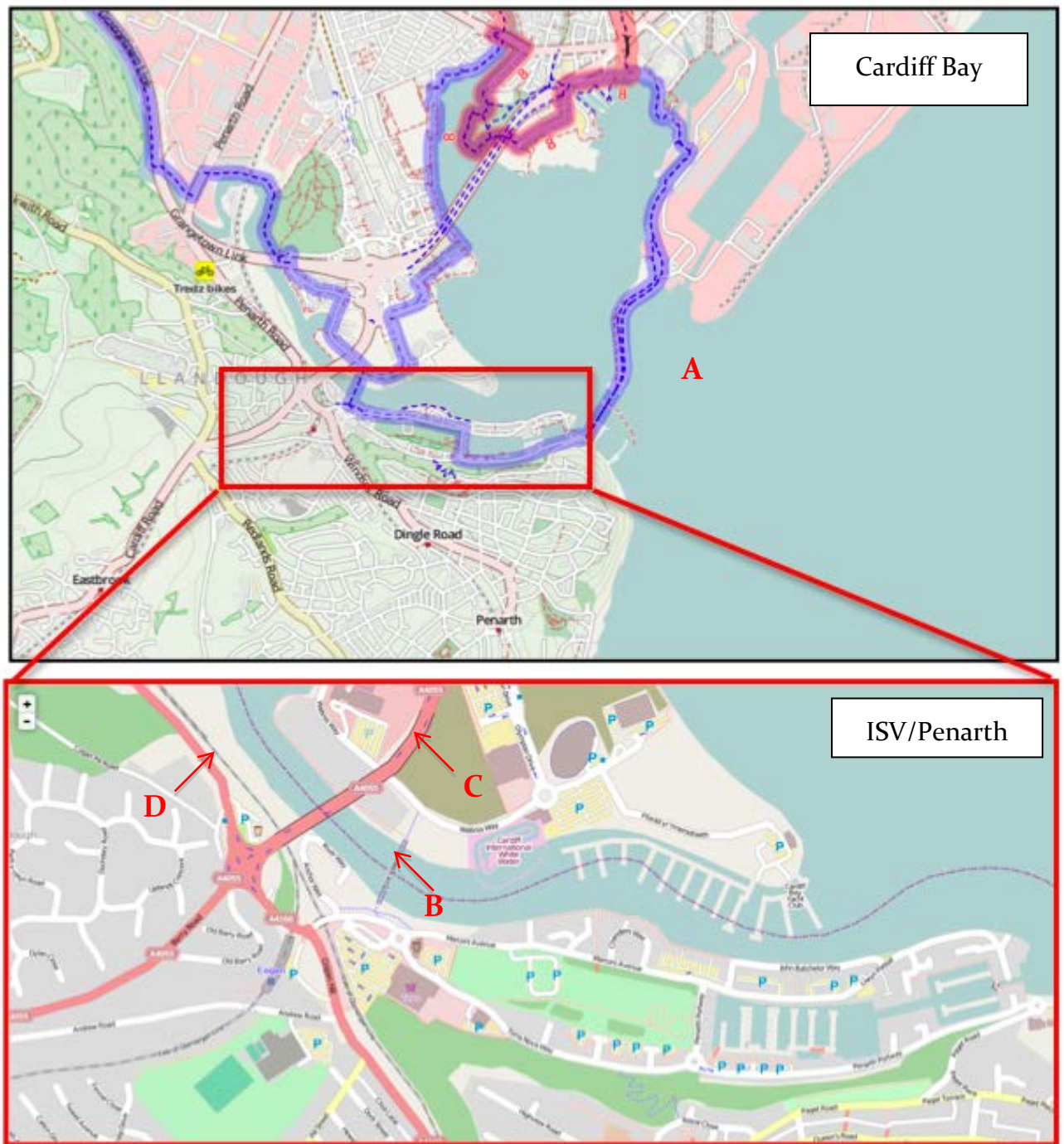


Figure 2.5: Map of Cardiff Bay (top) showing the NCN (highlighted) and the Cardiff Bay Barrage (A), and inset (bottom) of ISV/Penarth, showing the Pont-y-Werin (B), the Cogan Spur (C) and the Penarth Road (D)

Connect2 Cardiff's "Pont-y-Werin" is a major non-motorised link which connects the Cardiff Bay area (A) (specifically the International Sports Village (ISV)) of the Capital City, to the town of Penarth an important and affluent town to the

southwest of Cardiff (Figure 2.5). Considered by some to be the “final missing link” between the two urban areas the 140 metre Bascule Bridge was completed after three years construction in July 2010.

Connect2 Cardiff's project, “Pont-y-Werin” (B), connects Cardiff with Penarth, a dormitory town to the southwest of the Welsh capital. The scheme comprises a non-motorised bridge linking Penarth with Cardiff's International Sports Village and also a network of arterial routes from Penarth's town centre to the Bridge. Before the Pont-y-Werin was constructed, the main access route between the two urban centres was either by public transport or by car across a busy dual-carriageway bridge (i.e. the Cogan Spur (D)) with no legal pedestrian route (pedestrians can legally walk the longer routes to Cardiff either along the Penarth Road (C) or across the Cardiff Bay Barrage) and limited cycle access.

Opened by Deputy First Minister Ieuan Wyn Jones who commented that the Pont-y-Werin would be a "valuable asset" to residents on both sides of the river;

"Encouraging more people to walk and cycle across Wales will help reduce their dependence on the car, and contribute to cutting CO₂ emissions... we are all aware of the need to reduce our carbon footprint, and walking and cycling instead of driving can help to make a real difference." (BBC.co.uk, 2013)

The Pont-y-Werin (and several linking arterial networks) forms part of a six-and-a-half mile (i.e. ten kilometre) walking and cycling route connected to the National Cycling Network (NCN) (Route Eight – the Taff Trail) (Cope *et al.*, 2003) as highlighted in Figure 2.5. Sustrans has been charged with the delivery of the UK's NCN even whilst walking and cycling realistically have continued to be

defined as primarily “local” transport issues. This principally is because different sections have to be locally negotiated with planning authorities, local landowners (public and private sector), local heritage groups and so on (Aldred, 2012; Graffron, 2005; Spinney, 2009). The circular NCN route encompasses Cardiff Bay which includes; the £200 million Cardiff Bay Barrage (A), Pont-y-Werin (B), Penarth Marina (C), the ISV (D), Grangetown (E) and Butetown (F) (see Figure 2.6 below). Partners who provided financial backing included the Welsh Assembly Government, Cardiff Council, Sustrans, Cardiff Harbour Authority and the Vale of Glamorgan. The project was also heavily supported by the surrounding local communities as before the Bridge was completed and even before construction began, local and national press and media reports, as well as community residents heavily supported the project. The quotes below suggest increased support developed as the project advanced over time, with residents fully aware of previous issues surrounding travel in and around the area (www.theguardian.com/cardiff/2010/apr/01/pont-y-werin-bridge-cardiff-bay-link);

“This bridge will be really important for the Bay... really glad to see it happening, especially with things in the Sports Village now starting to come on stream.” (Guardian comment: 1st April, 2010, 11:42am)

“I second the above comment. It’ll provide a practical (and legal by avoiding the flyover!) cycling (and walking) link around the Bay for the first time. It hasn’t half taken a long time to get it built though...” (Guardian comment: 2nd April, 2010, 10:00pm)

Sustrans claim that by creating this new circular route active commuter travel will increase as Cardiff Bay residents, particularly residents living in the ISV, will

be able to reach Cogan railway station. Penarth's residents will also benefit due to the links provided into the town centre, residential areas and further afield (see Figure 2.6). This thesis implicitly tackles these claims, particularly within Chapters Four to Seven inclusively.



Figure 2.6: Penarth and Cardiff Bay non-motorised routes (late 2013)

Note: Cardiff Bay Barrage (A), Pont-y-Werin (B), Penarth Marina (C), ISV (D), Grangemore (E), Butetown (F)

Source: Sustrans (no date)

2.7 Cardiff Bay Barrage

The concept of a barrage was first suggested in the 1980s as a regeneration project for the disused docklands; the Barrage now creates a large freshwater lake and

has attracted investment to the docklands area. The bay forms part of the Bristol Channel which has the second largest tidal range in the world. As a result of the tidal range for half of the day the bay is empty of water leaving large, unappealing mudflats exposed (see Figure 2.7).

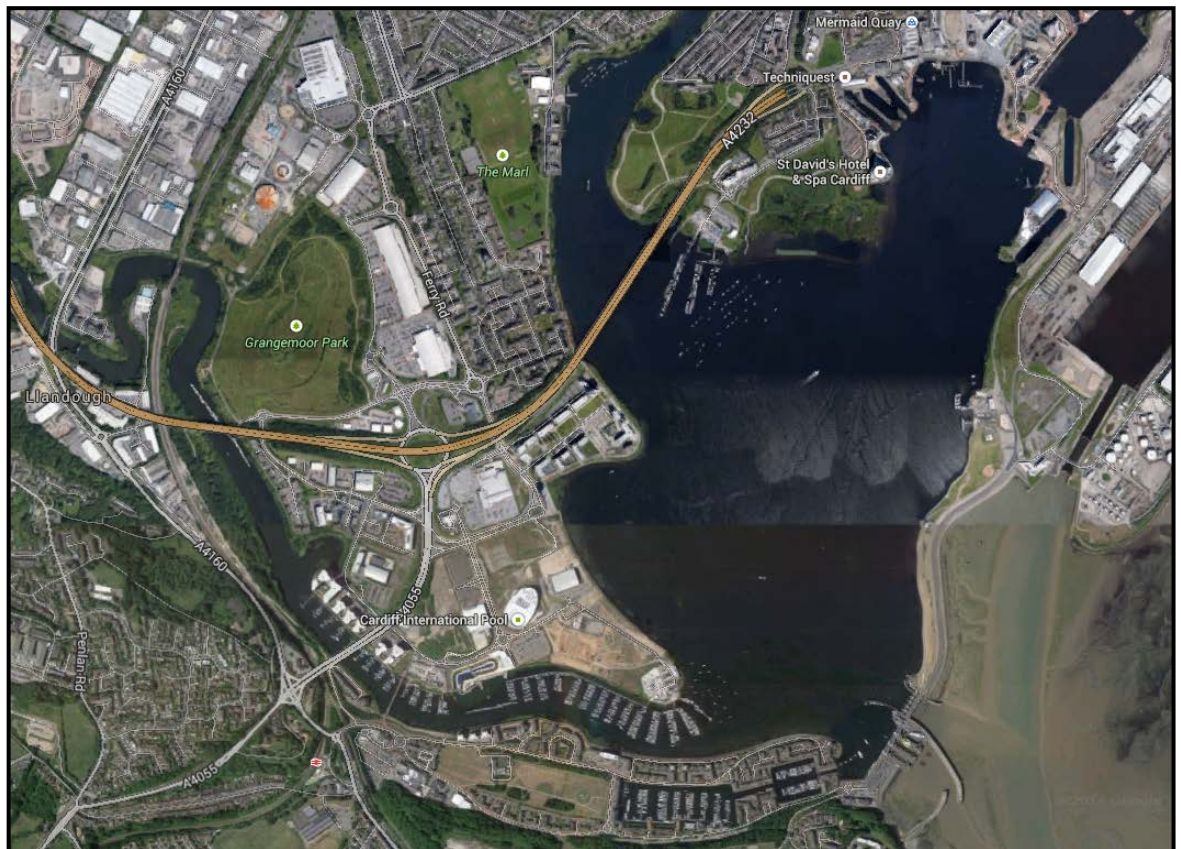


Figure 2.7: Aerial view of Cardiff Bay Barrage

Source: Googlemaps (2014)

The Cardiff Bay Barrage was consequently seen as central to the regeneration project. One of the major selling points of the proposed development was the opening of the new walking and cycling route across the Ely River. It was posited that, this would not only enhance tourism within Cardiff and Penarth but also provide safer, shorter leisure and commuting routes between the two areas. Construction of the barrage began in 1994 with the scheme completed in 2008;

the final link in the route was completed in 2010 with the installation of the Pont-y-Werin, the only “break” in the circuit.

Figure 2.8 is an annotated version of the Cardiff Bay Barrage to define the Barrage (A) and the Pont-y-Werin (B) infrastructure. The Cardiff Bay Barrage has changed not only the living landscape of the area but Cardiff’s future developments, prospects and uses; a brief discussion follows which assists in defining the role of and need for the Connect2 scheme.



Figure 2.8: The Cardiff Bay Barrage

Note: Cardiff Bay Barrage (A), Pont-y-Werin (B)

Source: OpenStreetMap.co.uk (no date)

2.8 Case study location: Case study characteristics

This section provides a background to the case study site as well as the results of the contextual fieldwork. This provides insights into the challenges and opportunities presented to the case study communities (i.e. when considering individual and household travel behaviour and wellbeing) and the researcher (i.e.

residents with bad health/long term illnesses); the topography of the region, demographic issues and where the case study site is situated temporally and spatially.

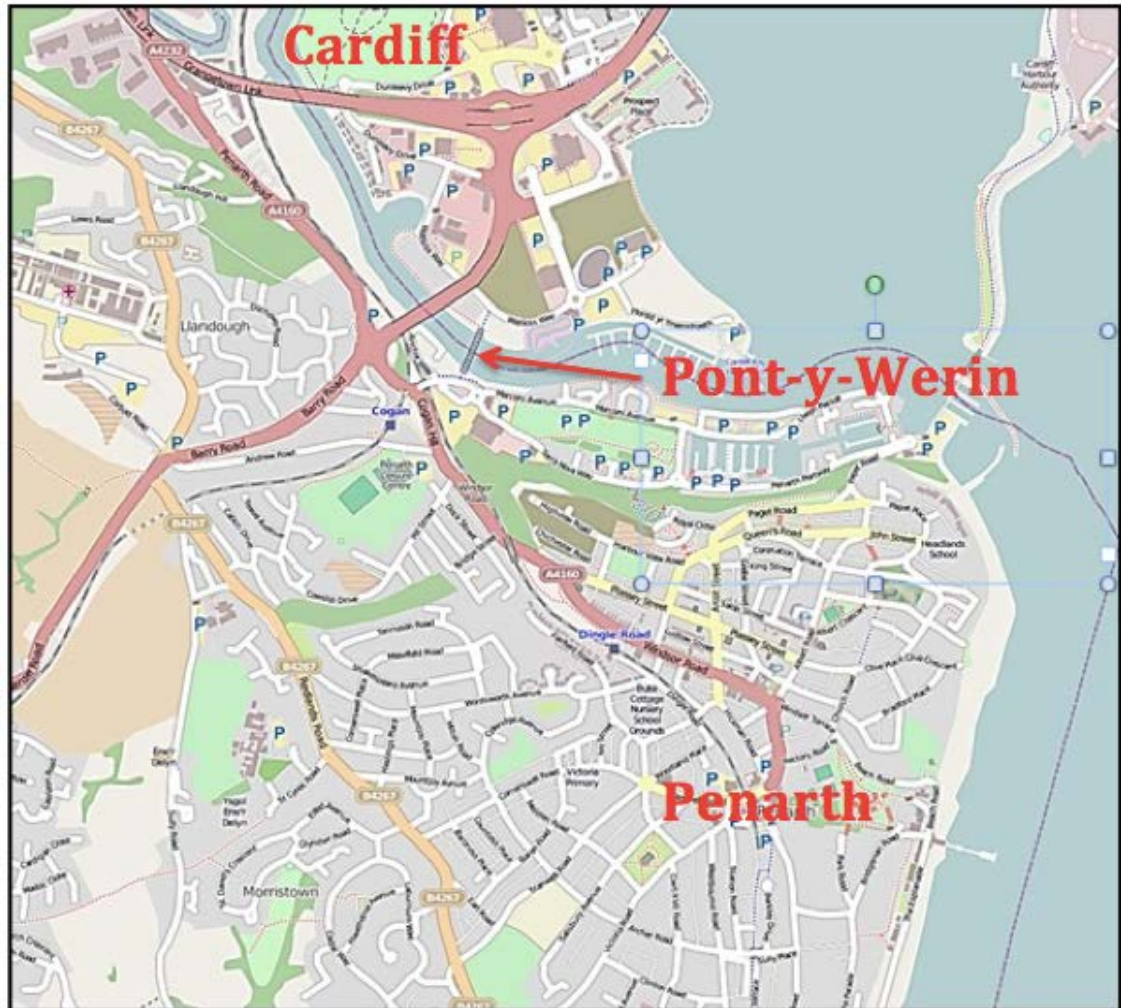


Figure 2.9: Map of case study location

Source: OpenStreetMap.co.uk (no date)

To the north of the Pont-y-Werin is Cardiff (See Figure 2.9). Cardiff (Caerdydd in Welsh, pronounced Cayer-Deeth) is the bilingual Capital with both English and Welsh languages spoken and taught; from within schools to within the walls of the Senedd (i.e. Welsh National Assembly). It is a major British city and the 12th largest in the UK, in 2012 the employment rate in Cardiff was 64.2% and a

population in 2010 of 341,100 (11.3% of total Welsh population) (Cardiff.gov.uk, 2014). Cardiff is a diverse waterside city with thriving cultures, languages and histories; located in southeast Wales and situated on the Bristol Channel. It hosts a large freshwater lake which is controlled by the Cardiff Bay Barrage. Cardiff is an extremely flat city with the only hills rising in the north of the city suburbs. Surrounding Cardiff is open countryside, leading to the Vale of Glamorgan in the west, Newport in the east and into Caerphilly in the north (visitcardiff.com, no date). Its geographical features were influential in its development as the world's largest coal port, most notably its proximity and easy access to the coal fields of the South Wales valleys (thewharfcardiff.com, 2011). After the demise of the mining industries, Cardiff turned towards transforming and developing the city and region socially, economically and environmentally through avenues such as commerce and tourism (Cardiff.gov.uk, 2014). Examples include Cardiff as the World's first "Fair Trade" Capital, and Wales' first "Sustainable Travel City" in 2008. As part of this over the past few years, transportation has come higher on the City's agenda with Cardiff's aim of establishing and maintaining a competitive edge particularly during and after the 2012 London Olympics.

To the south of the Pont-y-Werin is Penarth (see Figure 2.8 above). Penarth is located within the Vale of Glamorgan which has a total population of 124,605 (in 2009) with the majority concentrated in an area known as the Waterfront Strip. This area includes Barry and Penarth and smaller settlements of Dinas Powys and Rhose. Penarth itself is an attractive seaside town with a population of around 28,000. It is located less than 5 miles (8kms) southwest of Cardiff; only 11 minutes

by car and 26 minutes by bicycle from the city centre. Due to the dominating coal exporting industry, Penarth saw rapid development and growth, and was a major seaport for more than 150 years due to its prominent position; lying on the north shore of the fast flowing Bristol Channel. Penarth is diverse place with a Victorian pier, many acres of parkland, popular clifftop walks and a 450 berth yacht marina (visitcardiff.com, no date). Table 2.3 provides an overview of statistics for Cardiff and Penarth for comparison, the table demonstrates that although there are large differences in population size, there are many similar characteristics between the two urban centres.

Demographic Data	Penarth	Cardiff
Population	28,000	341,100
Median Age	42	37.31
Retirees	25.23%	20.75%
Unemployed	2.84%	3.46%
Educated to Degree Level	27.40%	17.36%
Full Time Students	848	40,639
Full Time Students	2.46%	4.34%
Average distance travelled to fixed place of work	12.01km	13.94km

Table 2.3: Demographics: Penarth and Cardiff

Source: ONS (2011); Cardiff.gov.uk (2014); visitcardiff.com (no date)

Average age is similar for both Penarth and Cardiff (42 and 37 respectively) with Penarth's average slightly higher due to a larger retired population (25% compared with 21%). Average distance to work is similar again for both sets of residents. However, due to the various Universities within the Capital, Cardiff has a far larger student number than Penarth. Furthermore, Table 2.4 depicts some basic statistics on modal shares across Cardiff and Penarth; average trip distance travelled, average duration per person, per day and percentage of all trips for

Cardiff and Penarth residents. It is important to highlight that 80% of trips were within Cardiff and 5% were within Penarth; 11% of trips were to/from Cardiff/Penarth and 1% of trips were outside Cardiff/Penarth.

	Average trip distance travelled door-to-door (km)	Average duration per person/per day (min)	Percentage of all trips (%)
Car	8.7	18	40
Car as passenger	7.9	7	21
Public transport	11.3	6	8
Walking	1.1	20	28
Cycling	3.6	1	3

Table 2.4: Average trip distance/duration and % of all trips

Source: Socialdata (2011)

2.9 Travel and transport provision in Penarth and Cardiff

Penarth is served by two heavily congested dual carriageways; the A4050 and A4055 roads providing links to and from Cardiff and the national road network. Passenger rail is concentrated in the area and the bus network of Penarth is more extensive than elsewhere in the Vale of Glamorgan (Cardiff.gov.uk, 2014; Valeofglamorgan.gov, no date). Excluding active travel, the infrastructure and accessibility between Penarth and Cardiff is ultimately very good. As of November, 2014 there are four train services per hour (three in the evening) from Penarth to Cardiff Central; each a duration of twelve minutes with an “anytime single” fare of £2.60. Cogan railway station has equivalent costs and number of train services per hour, but has a shorter duration of eight minutes into Cardiff Central. There are seven other stations in the Vale of Glamorgan; four of which have Park and Ride facilities and four stations are accessible to wheelchair users

through ramped access to platforms. At peak times there is concern regarding overcrowding on trains.

Bus travel within and between Cardiff, Penarth, Llandough, Dinas Powys, Sully and Wenvoe is based on a single ticket trip (adult £1.70, child £1) or a day's unlimited travel card (adult £3.50, child £2). For regular journeys it is possible to purchase an unlimited weekly ticket for all routes within Cardiff for £15 adult and £8.50 for children. A monthly unlimited travel card which extends to Penarth, Sully, Llandough and Dinas Powys is priced as £45 for adults and £27 for children (Cardiffbus.com, no date). An annual travel card is £530, a 2% saving of £10; not a significant incentive or saving. Although the bus network is considered by most to be "good", multiple transfers are required to get from one side of Cardiff to another. Aside from the road, rail and bus networks, there have been recent developments which both directly and indirectly impact active travel provision within the area, section 2.10 discusses this.

2.10 Pont-y-Werin: Linking Penarth and Cardiff Bay

Successful active travel network planning requires detailed consideration of a range of issues in order to produce a resource which a) satisfies the constraints within which the network must be developed and b) satisfies the demands of potential users (Nash *et al.*, 2005). The Pont-y-Werin (Latitude: 51.44774207730794, Longitude: 3.1862711906433105) was designed by Faber Maunsell and Holder Mathias architects; construction began in the summer of 2009 with the bridge opening to the public in July 2010. The bridge provides an integral link in the local walking and cycling network by further developing and

upgrading a series of routes incorporating the new bridge and connections to Penarth, Cardiff Bay, and the ISV and beyond. The scheme was particularly aimed at benefiting local residents, and it was hoped benefit students and staff travelling to and from Cardiff University approximately four miles away.

At a regional level, the Pont-y-Werin forms part of the NCN linking into the Ely Trail on the Cardiff side and Route Eight (i.e. the Taff Trail) of the NCN, a mainly off-road cycle and footpath which runs 89km from Cardiff to Brecon (Cardiff.gov, 2014). The bridge also completes a six-and-a-half mile Cardiff Bay circular trail which is part of the Coastal Access Path. The Pont-y-Werin links the city, the ISV and Penarth, allowing residents to travel between the urban centres and walk or cycle around the Bay area. The bridge has also significantly enhanced non-motorised access by providing quicker, safer access to Cogan railway station. Previously, the link between Penarth and Cardiff Bay was walking away from the Cardiff Bay area along the Penarth Road and into the Grangetown area of Cardiff, or to cross the Cogan Spur (Figures 2.10 and 2.11). Cycling across the Cogan Spur is discouraged due to the vast amount of fast-paced traffic and walking across the Cogan Spur is completely prohibited (although walkers still cross on the north side of the A4055) (Figure 2.11).



Figure 2.10: Cogan Spur – distance view of Pont-y-Werin (facing Cardiff/northeast)

Googlemaps.co.uk (2014)



Figure 2.11: Cogan Spur – no pedestrian access *blue sign (facing Penarth/southwest)

Googlemaps.co.uk (2014)

It can be seen that in particular, over the past ten years various travel-related infrastructure (some large scale, one of which a megaproject) projects have been introduced in and around Cardiff in an attempt to improve productivity, accessibility and the future legacy of the Capital. With so many new routes being introduced over the past decade, it is important to measure and understand how they fit into the existing urban landscape and also to identify that fact that they often require significant supportive infrastructure works. Within Penarth this was particularly apparent during the pilot study phase in 2011; with road resurfacing and new road layouts caused town-wide disruption. This arterial-route work

created multiple links to and from the Bridge, the town centre and residential areas and even as late as 2012, residents still spoke of disruption caused and the controversial layout of the new contra-flow cycle path in the town centre. Therefore as travel behaviours are complex, dynamic and non-linear, when large-scale infrastructure schemes are introduced the effects can be witnessed at the individual, household and population level. Positive effects and outcomes it is hoped, could promote shifts from using the car towards increased active travel. One of the main advantages of introducing such infrastructural improvements is the removal of some physical barriers to movement, and improvements in connectivity and access. Therefore Chapter Two has outlined and justified the opportunity for data to be collected

The thesis will now examine the research methodology employed. Chapter Three focuses on justifying the selection of methodology, the theoretical underpinning of the research, where the research is philosophically positioned and why a pragmatist approach was undertaken. This is followed by the conceptual framework focusing on the rationale for mixed-methods as well as considering the data collection methods used; household interviewing, surveying and contextual fieldwork. Finally, Chapter Three will discuss full details of the data collection procedure as well as sample sizes, sampling strategy and characteristics.

Chapter Three - Methodology

Chapter Three focuses on the adopted methodology applied to this D.Phil. research. Specifically this chapter begins by focusing on the justification and rationale of methodology selection and why the methods used were considered more appropriate than others. Chapter Three then discusses details of the methods used, i.e. qualitative interviews and quantitative surveys continuing with a brief discussion examining some of the methods and findings from the wider iConnect project, followed by full survey details for this study, outlining sample sizes and sample characteristics etc.

3.1 Justification and rationale for using the approach

Methodologies are derived from a researcher's assumptions about the nature of existence (ontology). These assumptions, in turn, lead to their perspective philosophy or set of philosophies on the nature of knowledge building (epistemology) regarding such foundational questions as: Who can know? and What can be known? (Hesse-Biber, 2010). In particular, the different epistemological and ontological assumptions and paradigms associated with qualitative and quantitative research have had a major influence on discussions on whether the integration of the two is feasible, let alone desirable (Morgan, 2007; Sale *et al.*, 2002; Östlund *et al.*, 2011). Quantitative researchers often work from the positivist paradigm; deducing reasoning and seeking causes that precede or occur at the same time as effects. Research conducted from positivists is expected to be objective, free of values, hypothesis driven and measurable. Qualitative researchers most often work from the constructivist paradigm;

supporting the notion that there are many realities that are constructed as the researcher engages with participants. Engaging in inductive reasoning, qualitative researchers use data to form theories working from the specific to the general (Graff, 2012).

This D.Phil. study works from the pragmatism paradigm which allows researchers to “study what interests and is of value to (them), study it in the different ways that (they) deem appropriate and use the results in ways that can bring about positive consequences within (their) value system (Tashakkori and Tefflie, 1998:30). This approach is more appropriate than other approaches (e.g. interpretivism) serving as a rationale for formal research design as well as a more grounded approach to research. Importantly, it inherently supports the use of mixed-methods while being guided by the researchers’ desire to produce socially useful knowledge (Feilzer, 2010; Kellehear, 1993). Using triangulation as a methodological metaphor can also help facilitate the integration of qualitative and quantitative findings, help researchers to clarify their theoretical propositions and the basis of their results. This offers a better understanding of the links between theory and empirical findings, challenges theoretical assumptions, and develops new theory (Östlund *et al.*, 2011); therefore, this study sought a mixed-methods approach. The rationale for this decision is that this research embeds itself and is created from, both a positivist and a constructivist paradigm; the belief that facts cannot necessarily prove a theory and determine a cause, but on the other hand the observations of reality are influenced by the values of the researcher. In addition to this, this thesis research uses both

inductive and deductive reasoning and participants are engaged from an objective and subjective point of view. The contribution of both methods to address the complex problems and questions asked by this thesis is vital to its success (Graff, 2012).

Figure 3.1 demonstrates a comprehensive approach to mixed-methods research and is a useful framework as it includes four elements which impact the “research problem”; stakeholder interests (Chapter Five; residents of Penarth and Cardiff, local councillors, funding bodies etc.), review of literature (Chapter Four), economic factors (discussed in Chapters Four, Six and Seven) and serendipity (i.e. outcomes and outputs) (Hesse-Biber, 2010).

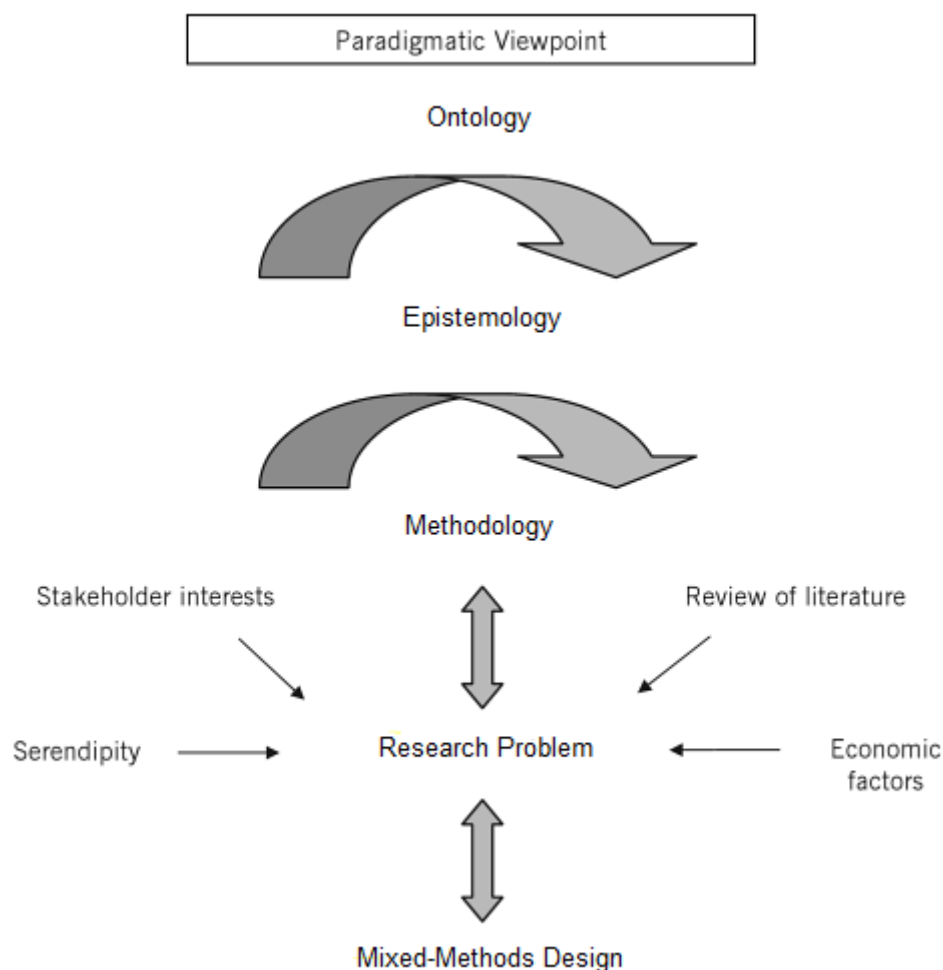


Figure 3.1: Comprehensive approach to mixed methods research

Source: Hesse-Biber (2010)

Pooley *et al.*, (2011) used a mixed-method approach to explore attitudes to and perceptions of, walking and cycling, and examined the process of household decision-making for everyday travel and the constraints that this imposed. Pooley *et al.*'s., (2011) study used survey, interview and ethnographic data to understand people's ambiguous and sometimes contradictory views of walking and cycling as effective means of everyday travel. Identifying with mixed-method research, it can be suggested that what people do, rarely matches precisely what they believe, and that the complexity and contingency associated with everyday travel for many households, is a major barrier to the use of more sustainable travel modes. Combining these methods supports the results and outcomes of the study and allows a deeper understanding of the context behind the case study.

iConnect's research began by suggesting that there was a lack of a single satisfactory model of how the environment influences walking and cycling behaviours. The consortium demonstrated that support was growing for ecological models of behaviour capable of encompassing people's experiences with their physical and socio-cultural surroundings. iConnect articulated a general theoretical model of the determinants of walking and cycling and moved towards an original, more specific model of the critical putative casual pathways the Connect2 projects were likely to work towards. This provided a framework within which the effects of the interventions could be meaningfully evaluated. Figure 3.2 depicts "The iConnect specific intervention theoretical model"

(Ogilvie, 2011) and demonstrates how the interventions were predicted to work; the solid connectors indicate the primary casual pathway for the intervention and the dotted line indicates effects.

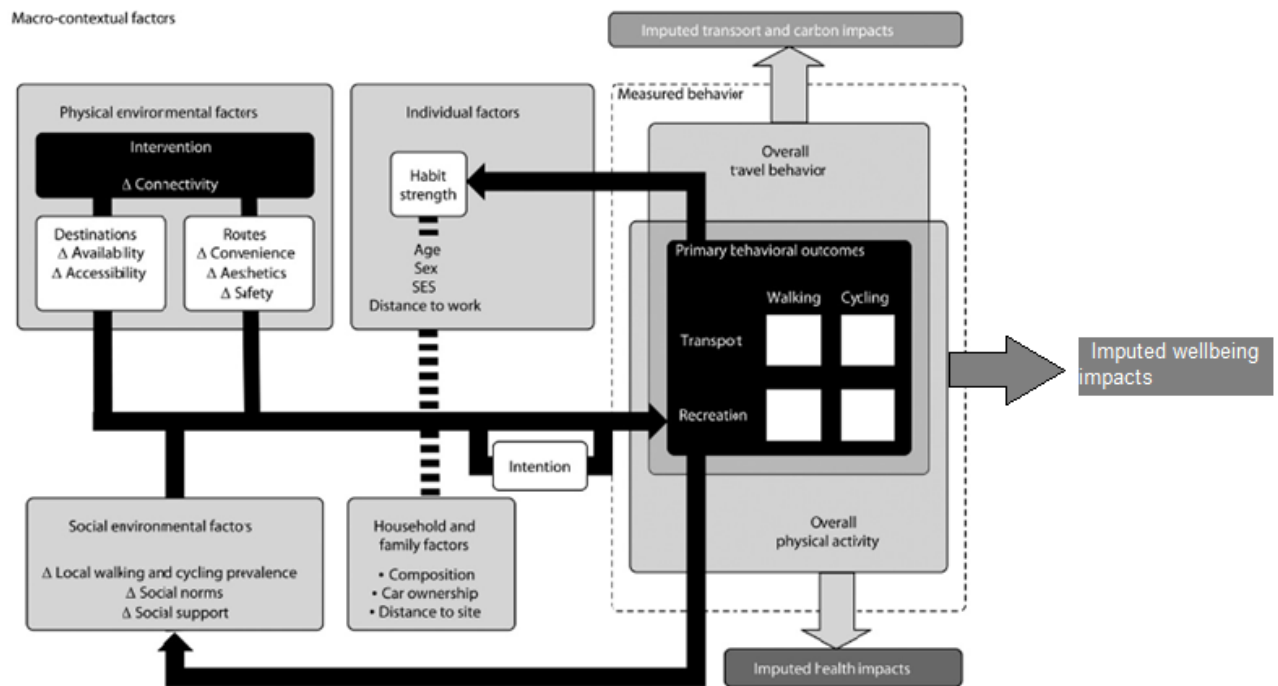


Figure 3.2: The iConnect specific intervention theoretical model

Adapted from: Ogilvie *et al.* (2011)

iConnect assumed that the relative contributions of different factors and pathways within this overall model were likely to vary according to which of the four different types of walking and cycling behaviours (shown as primary behaviour outcomes) was being considered (Ogilvie *et al.*, 2011:6). The iConnect framework however does not include imputed wellbeing impacts as it was constructed and developed pre-2010; before wellbeing came high on the research and political agenda (Dolan and Metcalfe, 2012). This D.Phil. study is therefore important as it adds to iConnect through an examination and measurement of

wellbeing as well as travel behaviours. The model has been adapted for the purpose of this thesis.

A mixed-method exploratory approach was used to answer this D.Phil. study's research questions and meet key objectives. Household interviews and a subjective wellbeing survey were used alongside contextualised fieldwork to explore and better understand peoples' beliefs and perceptions of constraints to travel behaviour and the impacts transport modes have on happiness. It was considered important to triangulate methods as the context behind decisions, and changes over time, were measured in an attempt to understand the nuances behind the survey and interview data (Flowerdew and Martin, 2005). As Graham (1999:83) discusses;

"...the division between questionnaires and interviewing is sometimes difficult to sustain in practice, for semi-structured interviews may produce quantitative data and useful qualitative information may result from work with structured surveys".

It can therefore be seen that identifying the most appropriate form or method of data collection is an important and crucial part of any research project. The incorrect choice may affect the "validity, reliability and credibility of the data... the adequacy of the research process... [and the] judgements made about the empirical grounding of the research findings" (Struss and Corbin, 1990). All research methods however have their problems and limitations (Östlund *et al.*, 2011; Cresswell, 2013; Davies, 2003; Walle, 1997) and it is not possible to place research techniques in a hierarchy of excellence, as different methods are

appropriate for different research questions (Bowling, 2002; Brown and Dowling, 1998; Yin, 2013).

Subjective wellbeing is characterised by the fact that it is measured at the level of the individual and is subjectively determined by the individuals who are being surveyed. Rather than using objective measures such as QoL as proxies for wellbeing research, individuals themselves are asked how satisfied they are with aspects of their own lives (Giovannini *et al.*, 2011; Diener, 1984, 1985; Delbosc, 2012). Subjective wellbeing for example can be used to provide an external check on societal indicators as well as economic. Studies such as Alesina *et al.* (2006) have used the Eurobarometer data to examine whether labour market regulation makes people better off. Gruber and Mullainathan (2005) researched the effect of cigarette taxes on self-reported happiness to draw inferences about the rationality of smoking using data from the General Social Surveys for the United States and Canada (Kahneman and Krueger, 2006; Blanchflower and Oswald, 2004).

The intent of subjective wellbeing methods is to measure the extent to which human needs are being met. Measures are based on the judgments of individuals (i.e. survey respondents) rather than on more easily quantifiable inputs of money and material goods. There are concerns though that these “subjective” measures are not factually based and are therefore less valid than “objective” measures like GDP (Constanza *et al.*, 2009:16). To a large extent however, the progression in the development of valid measures and methods within the field of wellbeing research has kept pace with demand as Pavot (2008:124) states:

“[R]elative to the early days of subjective wellbeing research... the array of measures and research methods available to contemporary researchers is impressive. The sophistication and reliability of subjective wellbeing measures has increased substantially.”

With a variety of innovative methods now available to researchers and decision makers, there is greater possibility to develop mixed-method studies that can overcome many of the shortcomings and weaknesses of earlier single-method studies (Pavot, 2008). Subjective wellbeing measures are of course fraught with methodological difficulties. They can, for example reflect different underlying concepts, be influenced by transient factors, or be affected by linguistic or cultural differences (Giovannini *et al.*, 2011). There is also a concern that such “cultural differences make it difficult to compare the results across different ethnic, gender, age, religion, and other cultural boundaries” (Constanza *et al.*, 2009:16). Mixed-method designs are therefore justified as essential for transport research on wellbeing, as rather than sole use of a stand-alone method examining the “what”, methods are combined to examine, discover and answer the “why”.

Over the last decades, empirical research on subjective wellbeing in the social sciences has provided a major new stimulation of the discourse on individual happiness (Stutzer and Frey, 2010). The majority of analyses of wellbeing and happiness (brief explorations of aggregated statistics aside) concentrate on activities rather than contextual factors - such as the co-presence of other people - in determining whether activities are unpleasant or not (Patulny and Fisher, 2011). This again is why this study combines the wellbeing survey with interviewing as a way to better understand the context behind activities. This is

due to that fact that there are a multitude of reasons behind why such activities (and in particular certain travel activities) might make people unhappy. This includes but is not limited to the persons activities are shared with (directly and indirectly).

Since the dynamics under investigation in this research study are currently poorly understood, the methodology adopted here is a mixed one centred on wellbeing surveys and face-to-face household interviews since these will yield detailed contextual data (Cresswell, 2013; Ritchie, 2013; Silverman, 2013; Anderson and Jones, 2009). Full household interviews were chosen alongside surveying, both because there remains a lack of evidence from the household perspective on the effects of physical interventions, and also because a number of academics (Teddlie, 2009; Guell *et al.*, 2012) have advocated the importance of triangulating findings between all household members rather than relying solely on one person's testimony. There were however a number of practical and logistical problems associated with this methodology, as well as ethical issues and power dynamics to negotiate. When analysing subjective wellbeing and personal travel behaviour, household data collection and analysis is necessary to facilitate an adequate interpretation of individual behaviour and happiness. The travel patterns for example, for each vehicle or individual in a multi driver/vehicle household are moderated as a function of influential household characteristics such as income, the presence or absence of dependent children, and the number of vehicles, drivers and workers. A careful treatment of the shared nature of the means of transport within a household, and of the individual responsibilities that

flow from this is essential in order to reveal accurate and fair reflections of travel levels. Specific interview questions for example were therefore designed to establish the influences of household structure and the communal nature of travel on individual behaviour.

Both qualitative and quantitative methods provide answers on the nature and extent of wellbeing and travel and can be used separately to validate each other's findings or brought together to deepen insights and possibly raise new questions (Camfield *et al.*, 2009). Goodman *et al.*, (2012) for example employed a mixed-methods study and integrated self-reported questionnaire data from 1142 participants in the Commuting and Health in Cambridge study (collected in 2009) and in-depth interviews with 50 participants (collected 2009-2010). The paper reported that the mixed-methods allowed the study to illustrate how cars simultaneously enable and constrain "wellbeing"⁶ in everyday life. There seems to be a lack of subjective wellbeing studies employing mixed-methods and in particular when examining subjective wellbeing and transport. Many other mixed-method subjective wellbeing studies at present have originated from within the public health and psychology literature. The vast majority of these studies focus on childhood wellbeing (Weisner, 2014; Jones and Sumner, 2009; Suldo *et al.*, 2009), teacher and/or family support (Spilsbury *et al.*, 2012) and parental roles (Mitchell, 2010).

⁶ Wellbeing here considered as "overall happiness" and not a study examining the specifics of wellbeing as a field of research

3.2 Quantitative data collection

This section of the methodology chapter examines how and why the quantitative method was chosen. It discusses how it served the purpose of the study, and describes how survey questionnaires as a data collection method were considered more appropriate for this research than other quantitative methods. This discussion is supported by examples from similar studies and briefly discusses their conclusive results. Details are also provided of the steps taken to adapt, create and utilise the data collection tool; the Day Reconstruction Method. Details are also provided on the type of data gathered, and the type of analysis applied to the data. Finally, throughout this section there are discussions on what the data collected means in the context of the thesis and how it adds to the study's overall conclusions.

In preparation for fieldwork, and whilst considering the statistical analysis to be conducted on the interview data, it was decided that it would be important to understand, expand upon and discuss some of the apparent and intricate nuances behind householders' decisions and possible constraints to active travel. A mixed-methods approach was required and a quantitative method was fully introduced to the research protocol receiving a more prominent (and in the end an equal) role. This was so that the data generated and outcomes discussed, were supported by various means and methods helping improve validity, reliability and robustness of the study and its results. A quantitative survey was chosen and included in the fieldwork data collection; its main purpose was to support and provide supplementary data to the findings of the qualitative research. This in

turn would help explain data and provide context to the survey outcomes so that the background, historical and family relations, and nuances behind answers could be understood and validated appropriately.

Wellbeing

After a series of extensive meetings where methods, analytical techniques and tests, and interdisciplinary work were discussed and critiqued in detail, a method very new to transportation research was decided upon. In addition to this, it was felt that in order to fulfil and answer the new research aims and objectives proposed, a different set of research questions needed to be established and examined (i.e. those presented within this thesis). In conjunction with the predicted outcomes and results of the interviewing schedule and also the decision to apply a new method, the overall focus of the study changed. Therefore the study now examines the impacts and consequences travel mode has on mood and emotions over time, when examining a cohort's travel behaviour and wellbeing.

Due to the ever increasing interest in “wellbeing” and measurements of “happiness”, Kahneman *et al's.*, (2004a) Day Reconstruction Method (DRM) was chosen as the most appropriate tool and adapted for purpose. This decision was initiated by the fact that in 2010 David Cameron, the UK Prime Minister, launched the National Measuring Wellbeing Programme led by the ONS. The aim of the programme is to develop and publish a trusted set of statistics on the nation's wellbeing (ONS, 2012). From these formal and popularised beginnings, wellbeing began to be explored within academia and highlighted in the media

with countries across the globe discussing this new hotly debated topic. This sealed the intention to undertake exploratory research on a cohort's wellbeing over time instead of explicitly examining impacts of travel on climate change. The DRM is the most suitable tool for measuring wellbeing within this context as it permits the measurement and evaluation of the three holistic elements that impact wellbeing; evaluations, experiences and eudæmonia as Figure 3.3 demonstrates. These elements are defined, analysed and critiqued within the following chapters.

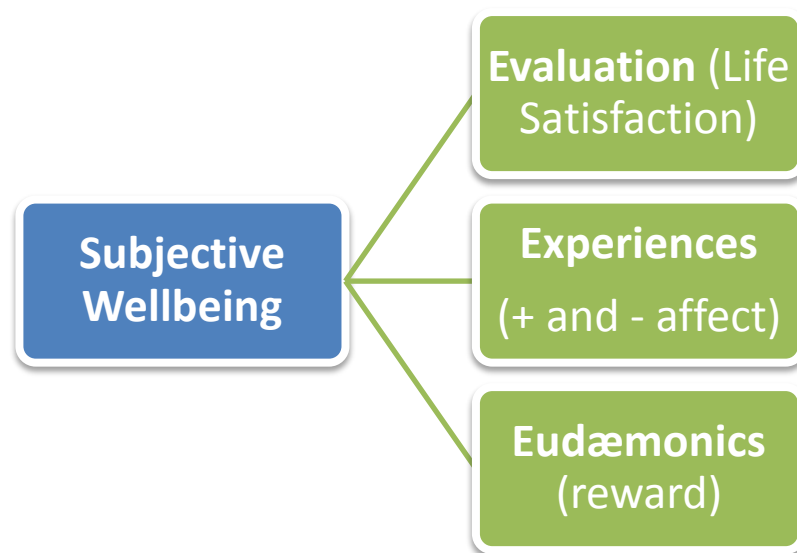


Figure 3.3: Subjective wellbeing measurement

Adapted from Dolan *et al.* (2011)

Wellbeing's popularity and the controversies it introduced were being examined and defined more and more as different governments globally wanted to improve the measurement, understanding and evaluations of the "state of the nation" and how they themselves compared against other countries across the world (see Chapter Four, Six and Seven). Many countries wanted to understand how people were "*generally feeling*" and how prosperous they were in terms of their quality of

life. Methods of measuring wellbeing were being (re)developed and (re)introduced across disciplines and across governments as a measurement tool or indicator, instead of using GDP as a standard indicator of progress (Kubiszewski, 2013). The UK government joined the movement and employed a “Behavioural Insights Team” in the UK government’s Cabinet Office. The Team were charged with attempting to understand and measure the “state of the country”. High profile academics and “experts” launched the initial scheme, and include Dr David Halpern as current director.

As a result of this national enthusiasm, this D.Phil. study incorporated wellbeing research and behavioural science methods into the research protocol. In mid-December 2010 the study’s wellbeing survey was finalised and a final adaptation of the DRM was undertaken. As well as examining everyday travel and the impacts on happiness, the study is intended to be experimental in nature and introduce a new, not frequently employed survey method to transportation studies and mobilities research (as of 2011). The work undertaken by Kahneman *et al.* (2004a) is well respected, robust and innovative, and full study documentation is freely available online which allowed for a quick transition to a new, complementary quantitative and qualitative research protocol.

Throughout the qualitative interviews, asking respondents about feelings whilst travelling provided a first insight into the impact travel experiences have on moods and emotions. Evidence from the behavioural sciences and psychology suggests however that for many everyday decisions and actions, people do not know why certain choices are made or why they act in certain ways (Kahneman

et al., 2004a). Household interviews provided the foundation for understanding participants everyday travel activities and demonstrated how and where people move and what they considered to be pleasant experiences. However, an in-depth understanding of the reasons and rationales behind behaviours, and measuring the emotions and feelings experienced whilst moving required a more specialised, appropriate and validated tool. The research outcomes of Kahneman *et al.*, (2004a) and additional evidence from behavioural science, psychology and economics verified that this method would be an interesting and worthwhile addition to the thesis. The Day Reconstruction Method is additionally generally cheaper and quicker to administer than alternative methods used to measure wellbeing such as the Experience Sampling Method; as discussed in detail in Chapters Six and Seven.

The quantitative research changed focus towards examining people's moods and emotions whilst travelling and the feelings experienced whilst undertaking everyday travel. The DRM documentation online was shortened and adapted for purpose; the online material suggested a completion time, per respondent of between 45 and 75 minutes which was too long for this study's data collection protocol (Kahneman *et al.*, 2004b). As per Appendix A the final survey had a reduced amount of total questions and a reduced amount of diary pages, feelings, adjectives and episodes. To limit attrition and participant burden the survey was shortened so that it took no longer than a total of 30 minutes to complete per respondent. Additionally, only 12 diary entries or "episodes" were provided

although some respondents completed more episodes when answering the survey.

The Day Reconstruction Method was chosen as it assesses feelings within situations and activities, and therefore goes beyond asking “are you happy?” to asking “when are you happy?” (Diener and Tay, 2013). It additionally covers the three main areas of consideration and measurement within wellbeing research; people’s experiences, emotions and eudæmonia which is recommended in the measurement of wellbeing by the ONS (2012). Through the use of an adapted subjective wellbeing survey; the Day Reconstruction Method (Kahneman *et al.*, 2004a), data were collected from each member of the household present at the time of data collection. The method incorporates elements of economics and psychology and seeks to assess how respondents spend their time, and how they experience the various activities and settings of their lives (*ibid*). The survey asks respondents to reconstruct the day preceding the interview by creating a diary of everyday activities, including travel. Respondents were then required to report the intensity of their feelings on a scale from 0 (“not at all”) to 6 (“very much”) through twelve affective dimensions such as happy, sad, anxiousness, focused etc. Respondents were then asked to answer questions on day and life satisfaction as a whole (Figure 3.4). It was the preferred method compared to Experience-Sampling or many of the other methods used to measure happiness or satisfaction (again discussed in Chapters Six and Seven) as it is less burdensome on respondents and administration costs are low compared to many of the alternative methods (Diener and Tay, 2013).

Surveys were distributed to each householder present at the time of meeting and the researcher stayed with the vast majority of respondents to be sure that the surveys were completed in full, completed correctly, in enough detail, and to answer any questions which may arise. Each 14 page survey was collected after completion and the data were numerically coded and entered into an Excel database ready to be transferred to the SPSS (Statistical Package for the Social Sciences) for in-depth analysis. Using SPSS allowed the researcher to examine basic information such as frequencies as well as more detailed findings to calculate t-tests to obtain p-values. Quantitative data collection was conducted before the household interviews were undertaken; therefore there were reduced responder biases and a limited misallocation of attention as respondents were unaware of the wider purpose of the survey – examining everyday travel and daily activities. The data collection method was initially conducted across the summer of 2011 and was repeated across the summer of 2012 as part of the longitudinal cohort study, in order to identify changes in wellbeing over time and the further effects of mode on moment-to-moment mood.

3.3 Qualitative data collection

This section discusses the qualitative method; how it served the purpose of the thesis and why for this research project, interviewing was considered the most appropriate method for collecting qualitative data compared to other methods such as focus groups or ethnography. This is supported by examples from similar studies and briefly discusses their results. Details are also provided of the steps taken to create and utilise the method; the interview schedule, the type of data

gathered and the type of analysis applied to the data. Finally, this section also discusses what the data collected means in the context of the thesis and how it adds to the study's overall conclusions.

The research approach emphasises the use of both quantitative and qualitative data collection through a longitudinal cohort of respondents. Household interviews were chosen as the qualitative method, and were employed as a way to examine the personal and practical constraints to travel behaviour change (Figure 3.4). Households (and the individuals within) were the main units of analysis because there is a paucity of evidence on travel behaviours and wellbeing measurement at the household level. Secondly evidence is lacking in regards to household responses to interventions aimed at increasing walking and cycling. Finally by examining the wider intra-household dynamics, deeper and more complex responses and reasoning behind travel behaviours and the resulting impacts on wellbeing can be induced and explored. Interviewing was chosen as it would provide explanations of beliefs and values, as well as explore the range and diversity of views on personal and active travel at the household level. In particular, one of the advantages of this approach is the close collaboration between researcher and the participant, while enabling participants to tell *their stories*. Through the interview process, participants are able to describe their views of reality and this enables the researcher to better understand their actions (Lather, 1992). An interview schedule (see Appendix B) was used to list the key themes to be discussed and all interviews were audio recorded, transcribed and coded. It is important for the interviewer to be able to pay full attention to the

respondent's account, capture detailed responses as well as the language used by the respondent, and to provide a verbatim transcript for subsequent analysis (Merriam, 2014; NCSR, 2002).

In-depth interviewing was chosen as respondents can spontaneously express their ideas in their own words in a flexible, interactive and responsive manner (NCSR, 2002). It is an appropriate method to obtain qualitative data as it helps provide rich descriptions of complex phenomena and is an unobtrusive systematic approach (Cresswell, 2013; Ritchie, 2013; Silverman, 2013; Jordan and Gibson, 2004). The questions were deliberately worded as openly as possible as a way to encourage detailed replies, followed by a series of responsive and probing questions to ensure that each point was articulated in detail. This was to ensure the respondent's motivations and behavioural decisions for example, and the factors that underpin and influence them, were understood (NCSR, 2002).

Subsequently, in-depth interviewing was the preferred method because it was felt that comparable travel behaviour studies had successfully utilised interviewing as a method to collect valuable data. Such studies on travel behaviour research where interviewing as a qualitative research method is used include the work of Guell *et al.*, (2012). This research conducted forty-nine semi-structured interviews and examined how people describe their commuting experiences and make commuting decisions. The study departed from narrow behavioural approaches to travel and instead investigated the social context of commuting with qualitative social research methods. Many studies used multiple qualitative methods by combining interviews and focus groups for example; Papangelis *et*

al's., (2013) study examined the effects of disruption on travel behaviour in rural areas and Lo *et al's.*, (2013) study focused on pro-environmental travel behaviours among office workers. For this research, interviewing was chosen as the sole qualitative method as applying two or more qualitative methods, plus the quantitative survey would present challenges for analysis, as well as being too great a burden for respondents and a strain on the study's strict time and cost budgets.

Within the context of this D.Phil. thesis and by examining academic studies, including those presented above, it can be seen that interviewing as a method can be successful in helping the researcher examine behavioural patterns as they occur (Black, 1999). Alongside this, interviews are predominantly inductive (Hoyle Harris and Judd, 2003) and invaluable when conducting initial explorations to develop theories and to generate hypotheses moving toward explanations (Sofaer, 2002).

Interviewing “excels in gaining an in-depth understanding of a situation in its natural context and provides an ‘insider’s view’ of that situation” (Belsky, 2004:277). It is however too easy for respondents to be influenced by interviewers and social acceptability biases (Merriam, 2014; Oppenheim, 1992); therefore interview skills training was undertaken for this research. Interviewing enables the development of grounded theory based on actual perceptions (Jordan and Gibson, 2004), and is a way to encourage deeper responses through supplementary questions, further explanations and personal experiences (Davies, 2003; Ritchie, 2013). The questions developed within this study’s interview

schedule were designed to obtain answers pertinent to the research problem (Kerlinger, 1973), gather a large amount of information from a small number of people (Pope *et al.*, 2006) and provide a greater depth of knowledge (Jordan and Gibson, 2004; Merriam, 2014; Silverman, 2013). The interview schedule (see Appendix C) included questions on:

- **Potential for change and actual change** of active travel behaviour for all household members; for both utility and leisure travel
- **Socio-demographics**, gender and age of each member of the household
- **Everyday household travel** and journeys to work/school and potential for change
- **Intentions** to walk and cycle more
- **Perceptions and attitudes** towards the Connect2 scheme
- Attitudes towards primary respondent's active travel/commuting
- **Satisfaction with travel** provision and facilities in and around local area
- **Accessibility** to services and opportunities relevant to each household member
- **Average household car use**, access and actual and potential plans to change (reduce amount/go car free)

Outcomes of interviewing entire households are that a lot of detailed audio recorded data is created; which for this study was professionally transcribed for analysis. The interview transcriptions were read and reread thoroughly, and each was subsequently coded into reoccurring themes and subthemes. Each transcription was reread multiple times to ensure that the themes presented were prominent and consistent. A combination of NVivo, Excel and Word were used to help speed analysis and validate and store data, as well as providing a database of interesting and important direct quotes from respondents. The data collected

were also quantitatively analysed in part, to fully exploit the data collected. Further discussions on the collection, storage and analysis of the qualitative data can be found in Chapter Five and Chapter Seven.

As briefly discussed in this section, household interviews were chosen as detailed information about household mobility needed to be collected. This was to ensure that the context behind decisions and any constraints to travel change were fully understood and evaluated. This also provided a background understanding of the elements which may influence household travel, activities and decisions. Additionally, household composition, issues and circumstances which impact everyday travel and any possible socio-psychological barriers to the uptake of active travel were examined. Interviewing in this manner allowed a deeper level of trust to be established and a connection with each householder was formed. Therefore the repeat data collection was straightforward and some of the more pertinent interviewer/interviewee inhibitions were removed. In addition to this, it is important to understand the role and activities of each householder, as changes in one person's activities or decisions, may spill-over positively or negatively on to other members (Lyubomirsky *et al.*, 2005). One householder for example, might be motivated to change from driving to work to using public transport, however the sudden availability of the family car may stimulate a different householder to take up driving (to work) themselves (Brög *et al.*, 2009). In this case, it is important to support and develop such theories through the introduction of a robust quantitative method which will allow the development and support of such theories and statements. In summary, this section has

demonstrated how and why the qualitative method was chosen, adapted for suitability and purpose, as well as highlighting how interviewing was considered a more appropriate method for this D.Phil. research compared to other, alternative qualitative methods. Figure 3.4 demonstrates the overall structure of the household data collection, the quantitative surveys and the qualitative interviews.

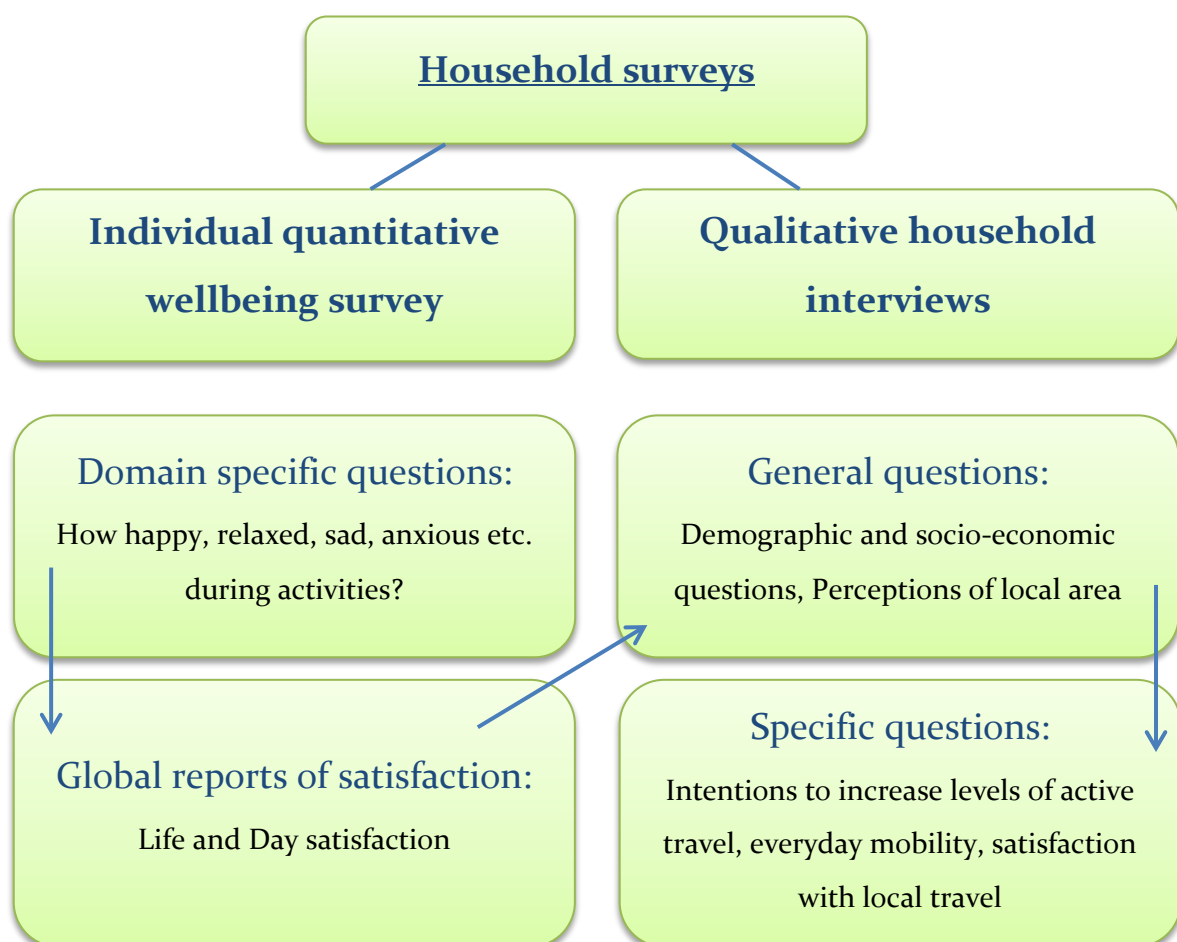


Figure 3.4 Overall structure of household surveys

3.4 Ethical considerations

Ethical concerns must be part of the fundamental design of any project (Merriam, 2014; Banister *et al.*, 1994) and must guide investigations (Willig, 2013; McNeill and Chapman, 2005) as social research involves collecting data from and about people (Punch, 1998; Geurs *et al.*, 2008). Fetterman (1989) states that ethical issues continuously arise throughout the different stages of research and each must be dealt with in order to continue progress. All respondents provided informed consent (Finn, Elliot-White and Walton, 2000) and their freedom and willingness to participate was respected (Thermil and Sheaffer, 2001). Ethical issues are more acute in some qualitative approaches (Punch, 1998) particularly in-depth interviews; therefore where interviewees are directly quoted they remained de-identified for confidentiality and are allocated a pseudonym or letter (Batten, 2005; Hoyle *et al.*, 2003). Participants may additionally withhold information or “may not want to be so accurate or attentive in their responses” (Oppenheim, 1993:66). This therefore leads on to issues of truth and memory which need consideration particularly as research is only reliable if the data collected can be repeated with the same results (Spark, 2002; Kirby, 1998; Merriam, 2014; Yin, 2013). Recognising the importance of ethical scrutiny and as it is a formal requirement of Oxford University that all research involving human participants should be subject to ethical review; approval was sought and granted from CUREC Research Ethics; Risk assessment and ethic approval number SSD/CUREC1A/11-014 was obtained. This was relatively straightforward as the iConnect consortium already had existing approval for the baseline survey with

respondents' agreeing to be contacted for an unspecified follow up research project.

3.5 Survey details and sampling

The sampling method used in this study was not based on a particular theory or statistical probability distribution, but rather on a purposive sampling criterion (Curtis *et al.*, 2000). It focused primarily on a specific sub-sample of households from the case-study site, itself drawn from the iConnect study's baseline core survey conducted at the Sustrans Connect2 Cardiff site.

iConnect

iConnect examined the Cardiff-based cohort as a way to measure changes in health, travel behaviour and carbon emissions within and across subjects. They recruited participants through the edited electoral register as it allowed for individual adults to be sampled independently, and for postal survey packs to be personalised. A postal questionnaire was developed (Ogilvie *et al.*, 2011; Ogilvie *et al.*, 2012) and issued to iConnect's Cardiff sample. It assessed among other aspects; perceptions of the supportiveness of the local environment for walking and cycling, travel behaviour, private vehicle ownership and use, and selected personal, occupational and household socio-demographic characteristics. Alongside this, contextual semi-structured interviews were conducted, as a way to inform understandings of the context and mechanisms of the intervention, with 20 key stakeholders from relevant local and national organisations. These stakeholders included representatives from the Pont-y-Werin project's steering

group, relevant local authorities, cycling groups, construction contractors and Sustrans (Ogilvie *et al.*, 2012).

To establish their sample, the consortium applied three concentric buffer zones to the site with the Pont-y-Werin demarcating the centre of each buffer. These zones were set at 1.5km (about 1 mile or a 20 min walk), 3.0km (about 2 miles: a longer but feasible walk or a short cycle ride) and 5km (about 3 miles: a 15–20 min cycle ride) and bisected the middle (1.5 to 3.0km) buffer perpendicular to the main longitudinal axis of the new infrastructure (i.e. the Pont-y-Werin) to form two sub-areas (Ogilvie *et al.*, 2012). In Cardiff this division distinguished people living on the south side of the Connect2 project, who could use the new infrastructure to travel towards the city centre – the direction in which the majority of the ‘utility’ flow of pedestrians and cyclists would be predicted, notably to travel to and from work – from those living on the north side, who could use the new infrastructure to travel towards the Vale of Glamorgan.

Finally, after a pilot study of 1000 participants (across all Connect2 sites) in 2009, the main iConnect survey was released. In terms of recruitment style, participants received an advance postcard alerting them to the study, followed a week later by a professionally designed postal survey pack containing a survey booklet (i.e. covering letter, information sheet, consent form and questionnaire) and a freepost return envelope. The covering letter issued in Cardiff was bilingual (i.e. Welsh and English). Telephone contact numbers were provided to enable potential respondents to ask questions: this proved useful in encouraging some people to complete the survey, for example by confirming that it was not

necessary to be a cyclist in order to take part. Two weeks later, non-responders received a reminder letter and a second complete survey pack. Participants who returned a questionnaire were entered into a prize draw to win one of twenty £25 gift vouchers (Goodman *et al.*, 2013; Ogilvie, 2011; Ogilvie *et al.*, 2012). There were 1,130 participants recruited for the iConnect baseline with 659 (58%) agreeing to participate in any follow-up research (Ogilvie *et al.*, 2012) and a further 487 retained for the 2012 data collection (i.e. iConnect's wave three).

D.Phil. study

The study population for this D.Phil. study was based on a purposive subsample of the iConnect Cardiff core baseline sample (Table 3.1). This sample consisted of adults aged 18 years and over who lived in private residential accommodation within a defined buffer zone around the Cardiff case study project (i.e. Pont-y-Werin) and whose names appeared on the edited electoral register held by the relevant local authority.

	Pilot (2009)		W1 (2010)		Bridge (July 2010)				W2 (2011)		W3 (2012)
iConnect	1000		1,130				-		402 of 659		487
D.Phil.	-		<i>No sample</i>				15 hh interviews and DRM		45 hh interviews and 48 DRM		42 hh interviews and 44 DRM from the original 60 hh
			W1 (2010)		Bridge (July 2010)		Pilot (W2) (April 2011)		W2 (2011)		W3 (2012)

Table 3.1: Sample comparisons: iConnect and D.Phil.

Source: Goodman *et al.* (2013); Sahlqvist *et al.* (2011)

Notes: Interviews conducted by households (hh), surveys conducted by individual within hh. Wave 2 data collection includes a pilot study, wave 3 data collection includes pilot sample.

Choices made in the sample selection strategy will of course have had significant implications for the way that the data can be interpreted. It is therefore essential to be explicit about both the nature of these choices and the justifications that lie behind them (Curtis *et al.*, 2000). The rationale behind choosing the Cardiff scheme to measure and evaluate travel behaviour and wellbeing was a combination of selection criteria including; accessibility for the researcher, likelihood of measurable population impact and low risk of delay/non-completion. Cardiff specifically was chosen as it provided a cosmopolitan urban case study site, was one of the more significant Sustrans Connect2 interventions and also had an appropriate population where “impact” could be measured (Ogilvie *et al.*, 2012). Due to timing restrictions and a switch in field sites, pre-intervention (i.e. pre-bridge) data could not be collected for this D.Phil. study.

The initial iConnect baseline survey helped to establish and build the sample of respondents; potential participants who indicated that they were willing to be contacted during future research. There were 659 participants who agreed to take part in follow up data collection in and around Penarth and Cardiff. Of these consenting households, respondents stating that they suffered from a long-term illness combined with a low intention (on a Likert scale from 1-5) to increase their active travel levels (N=120) were excluded. Additionally, households living outside three defined buffer zones (Figure 3.5) were also excluded from research (N=137) due to the distance to the intervention being too far, and therefore the

impact that the intervention had on household travel being too small. These buffer zones were smaller than those defined by iConnect and were drawn at 0.5km, 1km and 1.5km distance from the recently completed walking and cycling intervention; Sustrans “Connect2Cardiff: Pont-y-Werin” (www.sustrans.org.uk). Smaller buffer zones were chosen as the starting sample population (659) was smaller than iConnect’s core baseline (1,130). The buffer zones were based on distance to the Connect2 scheme and were defined to draw the sample from: approximately 50% of participants from buffer zone A (i.e. 0.5 km with 200 households); approximately 25% of participants from buffer zone B (i.e. 1 km with 136 households) and approximately 25% of participants from buffer zone C (i.e. 1.5 km with 66 households). Therefore, of the 659 participants who agreed to participate in follow-up research, a total 402 households were contacted.

Each household contacted received a recruitment pack consisting of an invitation letter (Appendix C), a stamped return postcard (to indicate willingness to participate) and an information booklet (Appendix D). A 35% response rate was achieved with 141 respondents. To reach the final sample of 60 households, further sampling criteria were applied to further exclude respondents with a low-to-moderate intention (on a Likert scale from 1-5) to increase their active travel levels (N=81). The final sample included in the study focused on respondents who “had intentions to do more active travel over the coming months” and who had stated a moderate-to-high intention (on a Likert scale from 1-5) to increase their walking and/or cycling levels (with or without a long-term illness).

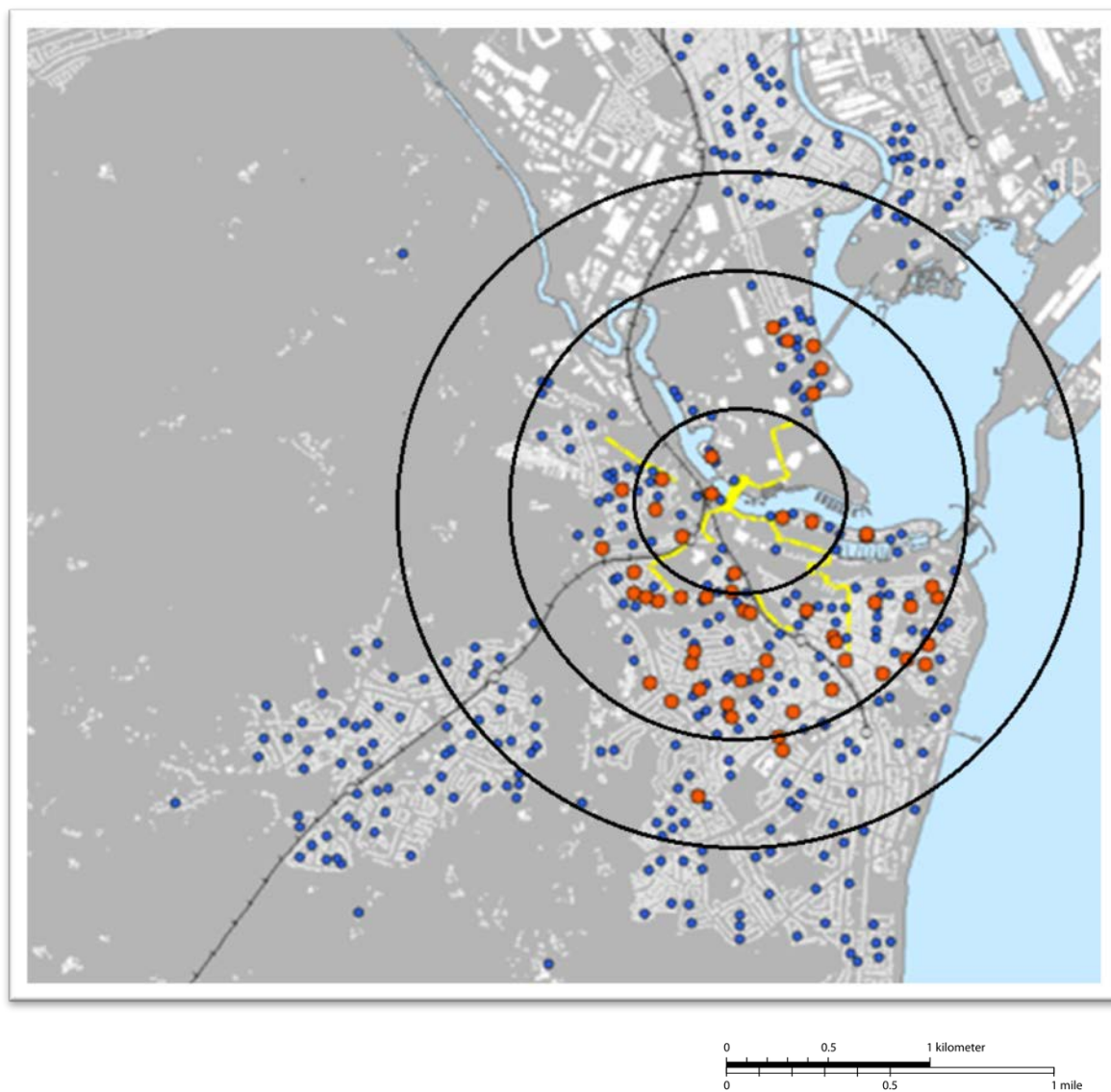


Figure 3.5: Buffer zones for sample participants

N.B. Blue, 659 iConnect respondents “willing to be contacted for follow up research”; Red, 60 households included in sample

Participants who stated that were willing to take part in the study were contacted either by phone or email and a meeting date and time was arranged at the respondents’ home. Wave two of data collection was carried out in June and July 2011 (N=45 households completing the interviews and N=48 individuals completing the survey) following the completion of a pilot study (N=15 households completing the interviews and N=15 individuals completing the surveys) in April 2011. Wave one data were not collected due to the timeframe of

the Pont-y-Werin installation not fitting with the timeframe of this study after the shift in case study sites (i.e. from Kenilworth, Warwickshire to Cardiff, Wales). Participants were also asked to ensure that all members of their household were present at the time of data collection to obtain household-level information. Figure 3.6 provides a clear depiction of the recruitment process and activities. The pilot was conducted to ensure suitability of methods and meant that the data collection tools could be modified and refined somewhat before further household data collection was conducted (McKercher and Hui, 2004). The pilot was useful as it helped highlight issues with the qualitative interview schedule, these issues were addressed and the overall instrument improved.

The majority of Cardiff's population (80%) describe themselves as white British with the remaining 20% of residents creating a significant mix of ethnicities. There is major socioeconomic deprivation in Cardiff's inner city areas of Grangetown and Butetown, whereas Penarth is mixed socioeconomically with some significant pockets of affluence (Ogilvie *et al.*, 2012; Census, 2011). The final sample within Penarth and Cardiff comprised households with both single occupants and couples (with and without children). Householders present at the time of data collection ranged from one person (the main contact who completed the iConnect survey) up to a family of five. Some households had a dual income, some were professionals, some were on career breaks after having children and some were retired. The sample therefore comprised a range of demographic and socioeconomic status groups. The average number of people per household was three, whilst the average number of years spent in the household was 12.

Respondents' ages varied from 23 to 77, and each household interview lasted an average of 25 minutes.

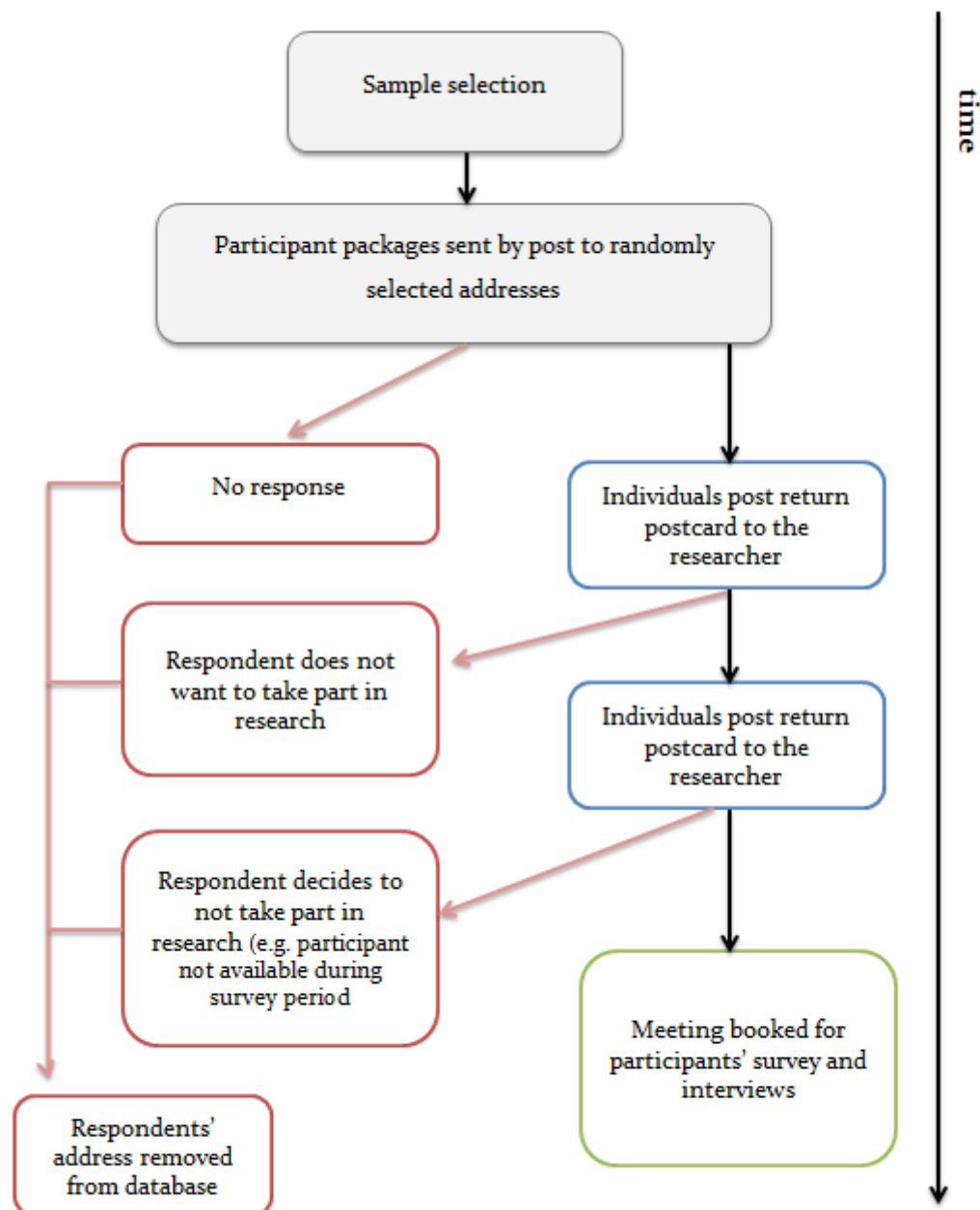


Figure 3.6: Flow chart of recruitment process and activities

In July 2012 the follow-up survey (i.e. wave three) was conducted with the same cohort of households with a second recruitment pack issued which included an

invitation letter; mailed to each household who took part in the previous year. This recruitment pack informed the main respondent of the purpose of the repeat study and that they would be contacted shortly to be invited to take part in follow-up data collection. From the original, combine sample of 60 households (i.e. the 15 pilot households plus the additional 45 wave two households), a 70% response rate was established with 42 households agreeing to take part in wave three. In terms of data collected, 42 household interviews were conducted with 48 individuals completed the wellbeing survey. To ensure the data collected were as valid and reliable as possible, follow up interviews and surveys were conducted over the same time period in 2012 (i.e. June and July). This repeat phase was to measure changes and the consequences in travel behaviour and wellbeing over time, but also to ensure effects such as seasonality etc. did not impact upon peoples' activities and therefore responses. The advantage of a longitudinal cohort is that a rapport and a degree of familiarity is established during the baseline survey, making the follow-up both more straightforward but also less time consuming than in a scenario where two separate sampling groups are used. A simplified sample breakdown is provided in Figure 3.7.

To improve response rate and limit attrition an incentive was offered to all participating households. Edwards *et al.*, (2002) show that the odds of response are more than doubled when small financial incentives are offered. Those who completed the household interviews and survey were given a £10 voucher and this was repeated with the third phase in June 2012. Wave three of data collection helped to reveal reasons for changes in household travel behaviour and

wellbeing, the characteristics and complexities of this behaviour and the extent it could be attributed to the Connect2 intervention.

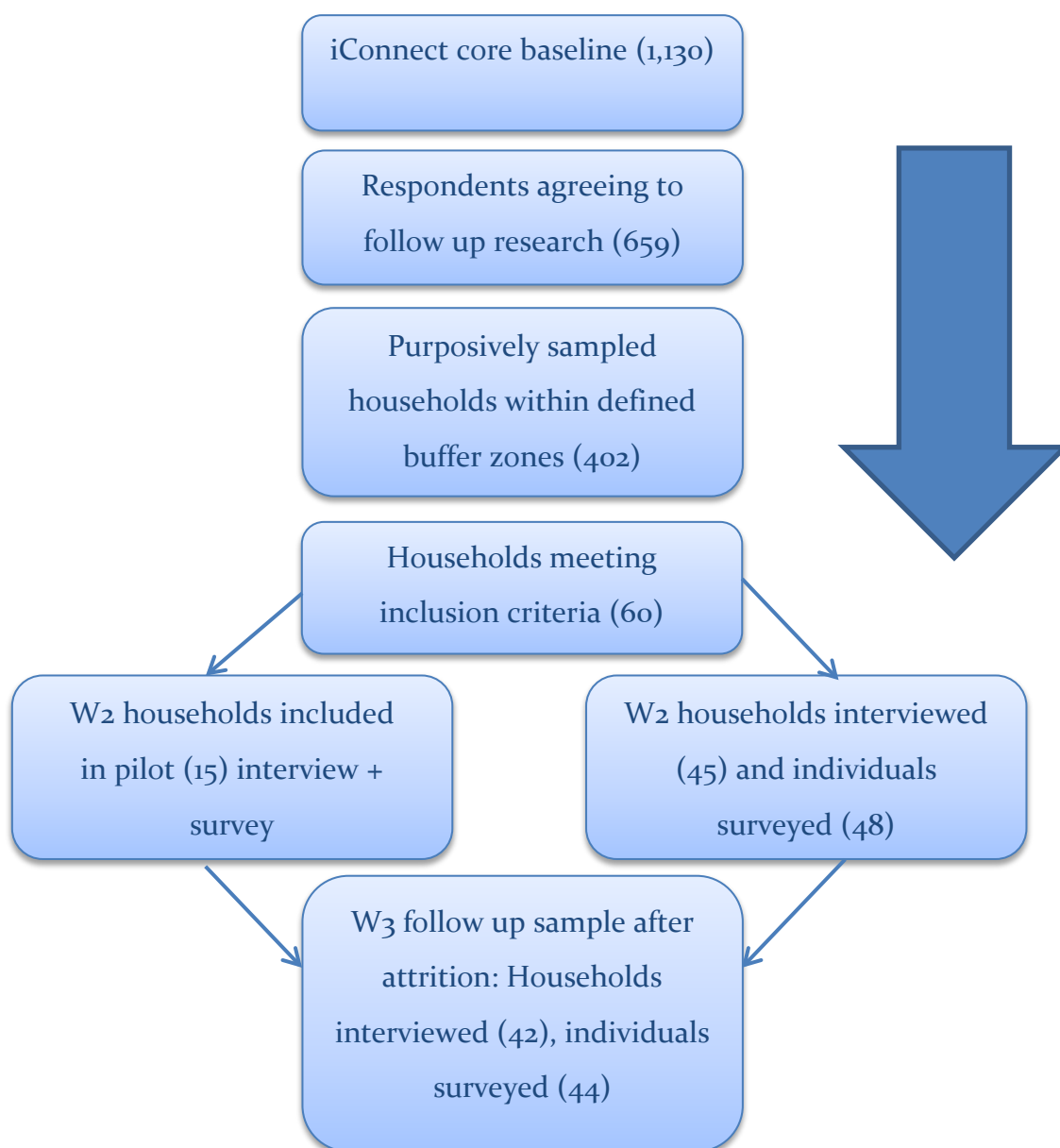


Figure 3.7: Sampling

Table 3.2 portrays results from the quantitative survey to clarify how its sample was achieved and combined when the two data sets were pooled. In wave two, 63

individual DRM surveys were completed and in wave three, 44 individual DRM surveys were completed; this means that in the pooled data a total of 107 DRM surveys were analysed.

Mode	Total mode activities (%) and transport episodes (N)		
	<i>Wave 2 data</i> <i>(i.e. 582 episodes from 63 DRM)</i>	<i>Wave 3 data</i> <i>(i.e. 412 episodes from 44 DRM)</i>	<i>Pooled data</i> <i>(i.e. 994 episodes from 107 DRM)</i>
Driving	16% (91)	16% (66)	16% (157)
Walking and Cycling	9% (49)	14% (58)	11% (107)
Public Transport	2% (10)	4% (17)	3% (27)

Table 3.2: Percentage of total activities by mode and total number of transport episodes

N.B. does not represent data from household interviews

Table 3.2 depicts the percentage of overall transport activities by mode against all activities (i.e. driving episodes represent 16% of total activities). It also shows the total number of transport episodes per mode recorded across wave two (i.e. 2011) and wave three (i.e. 2012) as well as when the two data sets were pooled. It can be seen that the number of driving episodes reduces from wave two (i.e. 91 driving episodes) to wave three (i.e. 66 driving episodes), but the total number of episodes recorded for all activities also reduced (i.e. 582 to 412). Therefore, although there seems to be a relative reduction in car use (i.e. 25 fewer car trips undertaken in wave three) in fact there is an equal percentage of driving activities (i.e. 16%) recorded across the two years when compared to all other activities.

There is nonetheless an increase in other modes (i.e. nine more walking and cycling trips and seven more public transport trips in wave three) with both the percentage of mode trips against total activities increasing, and the number of recorded transport episodes by mode. Finally, with 582 episodes recorded from 63 individual DRM surveys in wave two, the average number of episodes per respondent is 9.2. With 412 episodes recorded from 44 individual DRM surveys in wave three, the average number of episodes per respondent is 9.4. Thus as the total number of episodes have gone down between wave two and wave three, then it is the percentages that are more meaningful.

Chapter Three has focused on the study methodology, justified the use of mixed-methods, examined the philosophical underpinnings of the research and examined the role of iConnect in relation to this research study. It provides details of the qualitative interviews and the quantitative survey employed as well as providing full details of the surveys including sample sizes and sample characteristics. Chapter Four discusses relevant literatures, theories and methods surrounding travel behaviour and wellbeing and additionally reviews the evidence on wellbeing research within transport and mobilities studies. Here, it is important to highlight that Chapter four is a critical review of existing academic literature on travel behaviour, wellbeing and the connections that mediate between them. Chapters five and six use empirical data collected across the summer of 2011, and Chapter seven uses the same data plus empirical follow up data from the same time period across the summer of 2012 and is therefore longitudinal in nature.

Chapter Four – Embedding travel in daily life: from travel behaviour change to subjective wellbeing⁷

How happy are people whilst travelling? Does travel purpose affect happiness? How can happiness be successfully measured? How can happiness whilst travelling be improved? Why is this important..? Such questions and many others are in fact *vital* important in the quest to understand how travel behaviours affect mood, experiences, emotions and overall wellbeing. It is important to understand and measure this relationship as any negative experiences that affect mood and emotions, either consciously or subconsciously, may spill-over into everyday life and thus may influence a person's family relations, social interactions and work-life. The consequences which arise from these spill-overs may in turn, impact upon on the wider society, economy and environment. In essence it is important to measure wellbeing in a fastidious manner as appreciating the factors that impact travel behaviours helps increase momentum towards understanding why people follow certain behavioural paths and how we can look towards changing or adapting behaviours to improve overall happiness. This Chapter therefore aims to review evidence on wellbeing in transport and mobilities studies, and discuss a series of theories and methodologies used across different disciplines inside and outside of academia. Consequently, this will support and help ground the philosophical underpinnings and research methods undertaken within the empirical chapters of this D.Phil. thesis.

⁷ This is the first of four papers in a series submitted for peer review. This review paper was submitted to the journal "Transport Reviews" on 23/04/15

4.1 Introduction

Rapidly growing urban populations and the changing morphologies of urban settlements are placing unprecedented stresses upon global transportation systems. Innovative, effective, integrated, sustainable, intermodal, safer, secure, reliable and cost effective transportation would help improve the scenario dramatically, especially in terms of social sustainability (Pooja *et al.*, 2013; Banister, 2013). In order to realise and achieve a more sustainable transport system, it is paramount to gauge and understand present travel behaviours alongside the experiences of travel. This is especially important as travel behaviours that are considered pleasant are more likely to be sustained and repeated over time (Shizgal, 2003). From this position, measuring, evaluating and improving the travel experience, especially when considering sustainable modes, could help to influence or “nudge” users towards changing their behaviours permanently. This would allow access to an improved understanding of the factors that influence individual behaviour, wellbeing and happiness. At present, literatures on travel behaviour and behaviour change lack understandings on the affects travel has on moods and emotions. Therefore, incorporating work on subjective wellbeing would improve understandings of this relationship.

Understanding travel behaviours and levels of happiness within the transport system, not solely from a utilitarian perspective but from an experiential viewpoint, is an important area within mobility research. All of the factors that Pooja *et al.* (2013) mention can impact upon, or be impacted by, changes in travel behaviour or changes in happiness and wellbeing. Many theories and concepts

have been developed and articulated recently. This Chapter adds to the evidence on the nexus between travel behaviour and wellbeing research to explore and better understand the emotions experienced whilst undertaking different types travel. This is important for practitioners and policymakers as a way to ensure travel experiences are measured and improved for users so that more sustainable behaviours and more happiness-enhancing behaviours can be understood, promoted and sustained.

Measuring travel behaviour and any shifts in behaviour, (either naturally occurring or by intervention) is essential in the move towards improving, understanding and/or changing the experiences of travel. Identifying and examining how public transport for example impacts mood, and whether or not commuting to work by train makes people unhappy is important. This is because it can help identify the factors which influence mood and emotions and the opportunities in which happiness levels and public transport can be improved (Martin *et al.*, 2014). Important questions need to be answered such as; is the travel mode undertaken helping people fully achieve their goals? Do certain modes help fulfil hedonic elements (pleasurable experiences, emotional wellbeing) and/or eudæmonic elements (rewarding activities, personal flourishing) of wellbeing more than others? These questions and many more stretch the connections between travel behaviour and wellbeing.

A clearer and more nuanced record of the research, processes, theories, methods and techniques undertaken is additionally required as it would help improve future research on the interconnections between these two fields of research.

Some of the tools and methods used within economics and psychology for example have been adapted for purpose and applied to travel behaviour research, as discussed later in the Chapter. While the connections are being established, more empirical studies need to advocate and apply such theories and methods as an alternative or a support mechanism (through mixed-methods) to the traditional and standard models and theories of behaviour change. Combining traditional, newer techniques and practices could for example, enhance current research and allow an accessible evidence base for a multitude of disciplines allowing greater opportunities for follow up, repeat research. A transport field experiment using and applying certain theories developed by economists such as, “Nudge Theory” (Thaler and Sunstein, 2008) for example, followed by repeat measurement and evaluation could help identify any shifts in travel behaviours, happiness and the explanations (context) behind such shifts.

This Chapter seeks to review the growing interconnections between travel behaviour and wellbeing research by evaluating the current body of knowledge. The review is not intended to be a systematic review, it aims to report on a selective sample of concepts from the fields of travel behaviour and wellbeing. The Chapter begins with a definition of the research question and an examination of current relevant literatures and databases searched in order to assess and identify pertinent studies. This review is designed to locate, appraise and synthesise the best available evidence relating this Chapter’s research question (Research Question One). It provides informative, evidence-based answers and allows judgements to be made (Dickson *et al.*, 2013; Gough *et al.*,

2012). Throughout the Chapter, the findings and results of the review are reported and analysed alongside recommendations and concluding remarks. This review provides access to a greater understanding of different research methodologies and theories within the fields of travel behaviour and wellbeing. This provides an insight into the strengths and limitations of published research in this area (Dickson *et al.*, 2013). Findings from this review have guided the theoretical and methodological decisions made within this thesis. Inclusion criteria for searches of online databases (Google Scholar and Scopus) included the terms; “travel behaviour change”, “wellbeing”, “happiness”, “active travel” and “walking and cycling”.

This Chapter begins by first outlining some of the “traditional” theories and methods used within travel behaviour research, moving towards an understanding of some of the new(er) approaches developed to understand, influence and measure overall travel behaviour. The second section of the Chapter examines some of the measures and methods used within wellbeing research and then explores the links between the two disciplines. The third section provides a discussion on the importance of understanding travel behaviours alongside the measurement and evaluation of wellbeing and vice versa. A suggested example includes:

If a certain travel mode is making people unhappy (whether or not they know it is making them unhappy) how can interested parties (academics, policymakers, practitioners etc.) measure and identify this and work collaboratively in a move towards improving the travel experience and thus improving wellbeing.

This can be considered as either shifting behaviours towards modes which have been found to *generally* make more people happy or the alternative; measuring happiness and promoting/utilising this link to shift (or “nudge”) travel behaviours towards modes which provide improved, happier experiences. The final section of the Chapter provides discussions and concluding remarks, and suggestions for future research.

4.2 Literatures

There is much literature examining travel behaviour change and there are many popular theories and techniques used to measure and understand travel behaviours. For the purpose of this thesis, it is important to examine this plethora of research and to identify and rationalise an appropriate method and theoretical framework to comprehensively examine travel behaviour change and the experiential side of travel. This is significant as a means to understanding and suggesting improvements to overall travel experience.

In line with this, a new paradigm has seen the wellbeing agenda being introduced across different academic disciplines and can be used here as a way to better understand the emotions experienced whilst undertaking travel. Subsequently, aligned with developments in the policy-sphere, there is a considerable volume of research within the social sciences that has sought to acknowledge the ways in which individuals react to environmental dilemmas (i.e. climate change; carbon and emissions from transport) through their behavioural responses. Particularly within the field of social psychology, research has for some time argued for a focus on understanding individual responses to environmental issues and the

ways in which theoretical work could be used to inform policy for changing travel behaviours (Oskamp, 2000; Stern, 2000). It is evident therefore that travel behaviour and wellbeing research remain high on the academic and political agenda. Consequently, Spaargaren and Mol (2008) have argued for a focus on the individual as a unit of measurement rather than population based surveys etc. which are now being charted across a range of approaches, involving disciplines such as economics, sociology, geography, and marketing. Therefore, whilst the epistemological basis for understanding behaviour and wellbeing clearly varies between these disciplines, the basic approach is grounded on the assumption that individual engagement can lead to behaviour change and improved understandings of happiness and wellbeing (Barr and Prillwitz, 2013).

Theoretical Approaches to Behaviour Change

The scholarship from which travel behaviour literature is drawn comes from not one but a number of disciplines including transport geography, sociology, economics and psychology. From within these disciplines, there have been a series of ground-breaking theories and frameworks developed and redeveloped over the decades which transcend academic boundaries. Within social psychology, approaches include; the Theory of Interpersonal Behaviour (Schutz, 1958); Norm-Activation Theory (Schwartz, 1977); the Theory of Planned Behaviour (TPB) (Ajzen, 1991); Value-Belief-Norm Theory (Stern *et al.*, 1999); Self-Determination Theory (Ryan and Deci, 2000); and the 'Value-Action' Gap (Shove, 2010). As Avineri (2012) highlights, TPB assumes behaviour is a product of attitudes and intention, provides a powerful explanation of behaviour in a wide

range of contexts, and also argues that some behaviours occur with little or no pre-planned intent. It suggests that the relative strengths of individual's intentions to perform alternative behaviours guide the choices between them, where the determinants of intended behaviour are a set of individual beliefs; attitudes toward behaviour, subjective norms and perceived behavioural control. Figure 4.1 demonstrates the different elements within the TPB and their various interconnections.

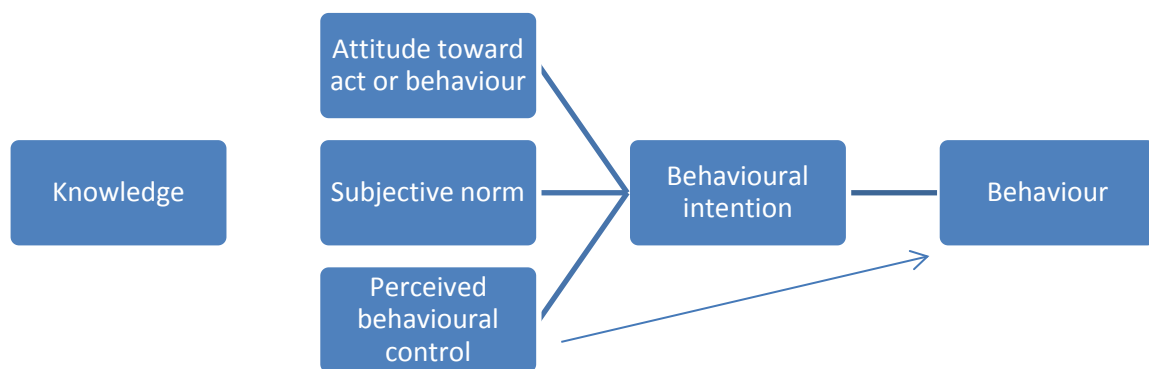


Figure 4.1: Theory of Planned Behaviour

Source: Ajzen (1991)

A popular theory within travel behaviour research, TPB and the alternatives mentioned above were considered unsuitable for this research. As Metcalfe and Dolan (2012) state, effectively there are major problems when asking people about their intentions and future behaviour. Principally, a great deal of behaviour is automatic and what people attend to in their day-to-day lives is very different to what they attend to in research surveys and interviews. Further theories were

considered however; from within transport geography popular behavioural theories; the Activity-based Approach (Mitchell and Rapkin, 1954); Time Geography (Miller, 2005) and Prospect Theory (Li and Hensher, 2011). From within microeconomics; the Utility Maximisation Theory (Ettema *et al.*, 2010) and in environmental policy the popular but heavily debated paradigm used to measure behaviour the Attitude-Behaviour-Choice (ABC) model (Shove, 2010). Some of these theories however prevalent and respectable, lacked innovation, were considered outdated, and no longer fit for purpose (particularly in terms of a single method research study). Shove, (2010) for example discusses the ABC model suggesting that:

“...it is important to acknowledge that the ABC is not just a theory of social change: it is also a template for intervention which locates citizens as consumers and decision-makers and which positions governments and other institutions as enablers whose role is to induce people to make pro-environmental decisions for themselves and deter them from opting for other, less desired, courses of action”.

Consequently, Shove (*ibid*) suggests that the ABC is seen as the “easy option” and therefore there remains little political engagement with other theoretical paradigms. The ABC is useful in part but this is where new ideas and theories can be proffered to policymakers as an alternative to the traditional models. A shift towards these new(er) concepts is needed as they too can be considered as being a “template for intervention” with the added ability to “induce people to make pro-environmental decisions for themselves and deter them from opting for other, less desired, courses of action” (Shove, 2010:1280). The difference being

that the evidence produced is more robust, more easily repeatable, more feasible and valid, and in some cases cheaper to implement in terms of time and costs.

In terms of intervention studies, guidance from the Medical Research Council (MRC) proposes that intervention development should begin by examining existing evidence and theory to develop a theoretical understanding of how behaviour change occurs. However, even those studies that are considered theoretically based, consistently fail to report on how theory is used in intervention development and evaluation (Baker *et al.*, 2012). Various policy measures have been proposed and introduced through recent intervention studies, behaviour change projects and schemes. These programmes were launched across the UK in an attempt to measure, monitor and evaluate changes in travel behaviour (and other factors such as health, carbon etc.) and provide adequate details of how theories were selected and applied. The five year iConnect study adapted Saelen *et al's.*, (2003) Ecological Framework Model which encompasses people's transactions with their physical and socio-cultural surroundings as well as focusing on walking and cycling as the behavioural outcomes of interest. Additionally it shows individual, psychosocial, and environmental factors interacting to influence walking and cycling both as a mode of transportation and as a recreational activity (Ogilvie *et al.*, 2011). Furthermore, the Understanding Walking and Cycling (UWAC) project which ran from 2008-2011 used the TPB in a questionnaire survey format to examine attitudes towards walking and cycling. The study aimed to understand how people make decisions about everyday travel and to identify why walking and

cycling might be seen as unattractive options (Energy Lancaster, no date). A final example is the Smarter Choices Smarter Places programme which ran from 2009-2012 aiming to monitor and evaluate the Scottish Government's £15 million investment in seven local authorities across Scotland to develop travel behaviour change programmes known as "Smarter Choices" (Transport Scotland, 2015). Implicit to the project's evaluation were two theories; the Theory of Change approach and TPB. The Theory of Change was used to interpret the interventions themselves which outlined four elements relating to people and partnerships, institutional structures, process, and methods (including decision-making, review procedures, funding processes). The TPB attempted to evaluate changes in behaviour and was expanded to include habit and social learning (Triandis) to inform the attitudinal questions included in the before and after intervention surveys (Norwood *et al.*, 2014; Sloman *et al.*, 2010).

Increasing awareness that travel behaviours generate positive and negative effects on individual and collective wealth, health and wellbeing extend the application of travel behaviour research to a wider context (Avineri, 2012). Often the standard and traditional geography-based theories and concepts are repeated and overused within travel behaviour studies. Introducing theories from other disciplines to the programme or study helps strengthen and support findings. As there appears to be a strong link and relationship between travel behaviours and the impacts on wellbeing/happiness then it seems justified that this D.Phil. study should apply a combination of theories and methods from alternative disciplines. Of particular importance is highlighting the premise that the iConnect

theoretical framework requires adaptation to consider the wellbeing implications which at present are not acknowledged and are missing from the construction, theoretical underpinnings and outcomes of the iConnect research study.

Numerous studies have examined the impact of spatial, socio-economic and socio-psychological characteristics on travel behaviour but as mentioned, there has been a turn towards further understanding the experiences of travel and the resulting impacts on happiness. Recently, some researchers have started to look at wellbeing in addition to traditional theories, strengthening further the links between economics and psychology (Kahneman *et al.* 2004a; Ettema *et al.* 2010; Gärling *et al.*, 2013) in an attempt to understand travel behaviours. Therefore it is important to consider and examine the extensive evidence published over recent years. New(er) conceptualisations and ways of thinking suggest that transitions toward sustainable mobility do not depend on policymakers persuading individuals to make sacrifices. Instead, relevant societal innovation in which contemporary rules are eroded and where the *status quo* is called into question is considered a more appropriate way of stimulating social action (Shove, 2010). Such innovations and conceptualisations are now discussed in the following section within this Chapter.

New(er) conceptualisations of behaviour change

Research in behavioural economics is at odds with many of the traditional theories of behaviour change that have dominated the field of transport and mobilities; although such theories still have a large impact on the discourse of research (Metcalf and Dolan, 2012). It can be seen through the previous

discussion that the main thinking in transport, stems from neoclassical economics in which individuals are largely assumed to apply cognitive processes of decision-making to maximise their economic utility, and make rational, consistent, and efficient choices (Booth *et al.*, 2000). New concepts and practices of governance aim to apply some behavioural economics insights in the design of behaviour change initiatives and measures; an approach recently advocated in the US and the UK (Avineri, 2012). Within the UK, the House of Lords Science and Technology Committee (2011) recently noted that, despite the wide range of both regulatory and non-regulatory measures available to implement policies for carbon reduction, there has been an increasing reliance on non-regulatory (or “soft”) measures that focus on shifts in individual behaviours. Adopting the philosophy of “choice architecture”, policy has frequently sought to use a range of approaches drawn from consumer behaviour studies and marketing research to implement “nudge” theory and ideas of “social marketing” (Thaler and Sunstein, 2008; French *et al.*, 2009) to generate desired shifts in individual behaviour. Indeed, both the UK Cabinet Office’s Behavioural Insights Team and the Centre for Expertise in Influencing Behaviours within the Department for Environment, Food and Rural Affairs (DEFRA) have undertaken extensive research that has sought to develop sophisticated frameworks for changing consumer behaviour without the need for regulation (Barr and Prillwitz, 2013; DEFRA, 2011).

UK policymakers have developed individual behaviour change strategies in recent years. In the first instance, behaviour change campaigns, which have typically been implemented at the population scale, have attempted to use information

and awareness-raising techniques to increase public knowledge about a specific issue and to present ways of changing behaviour as a result of this heightened awareness (Collins, 2004; Barr, 2008). Examples of such campaigns in the environmental field include “Are You Doing Your Bit?” from 2000 and the most recent “Act on CO₂” campaign, both administered by DEFRA. However, evidence has been accumulating for a number of years that such campaigns are often ineffective or poorly targeted (e.g., Agyeman and Angus, 2003) and more recently, Crompton (2010) has highlighted the ways in which such campaigns reinforce cultural values that work against sustainability objectives. Accordingly, major information-based initiatives have given way to more closely related and sophisticated approaches (Barr and Prillwitz, 2013).

Moving from information-based campaigns to “Nudge” theory for example, Barr and Prillwitz (*ibid*) discuss this alternative as a relatively recent development but one which has received considerable attention by central government since 2010; based on the influential book by Thaler and Sunstein (2008) entitled “Nudge”. The authors outline the ways in which individual behaviour can be changed through the manipulation of contexts. Thus a “nudge” is: “any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any options or significantly changing their economic incentives. To count as a nudge, the intervention must be easy, cheap and not considered a mandate; putting fruit at eye level counts as a nudge, banning junk food does not” (*ibid*, page8). Popularly referred to as the “Number 10 Nudge Unit”, the Behavioural Insights Team has applied Thaler and Sunstein’s work in a number of

policies, notably within the context of health and wellbeing (Barr and Prillwitz, 2013; Welsch, 2002, 2006). To a certain degree, nudge theory has also been applied within transport contexts, for example organisers of the London 2012 Olympic Games tried to make enjoyable “Olympic experiences” that might otherwise be considered annoying. Travel between Stratford station in the east of London to the Olympic Park was lined with volunteers “shouting cheery messages reminding people that this is a ‘once-in-a-lifetime event’ and ‘You’re part of it!’” Additionally, public travel passes were sent out with tickets persuading people to avoid hotspots, Transport for London repeatedly warned people how “exceptionally busy” the city would be, and many individuals either stayed at home or travelled late or early to avoid crowds (Economist, 2012).

Important limitations however need considering; for example the long-term sustainability of nudges on behaviours. Nudging works best on unintentional/automatic behaviours within a controlled context. Avineri and Goodwin (2010) suggest that nudges are not designed to change the decision-making process of the reflective system, nor do they lead directly to a real change in the individual’s knowledge, attitudes or values towards sustainable travel choices. By designing measures that are based solely on the nudge approach the effects are likely to be cancelled. The promise of behavioural economics might be primarily in improving the design of bigger initiatives, that is to *add* “nudges” to improve or speed up the effects rather than as a replacement for other interventions. From this, it can be seen that research in the behavioural sciences indicates that individuals’ choices in a wide range of contexts deviate from the

predictions inspired by the standard research agenda within the field of travel behaviour (Avineri, 2012).

The discourse on the relationship between changing travel behaviours in an attempt to improve travel experiences and increase happiness is starting to develop. Additionally, identifying the links between the experiential side of travel and wellbeing research is becoming more distinct. Advancing from nudge theory, the 2010 MINDSPACE report published by the Behaviour Insights Team draws on some of the key avenues that individuals, communities and policymakers can use to influence behaviour. The report identifies nine principles which are underpinned by considerable research from the fields of social psychology and behavioural economics (Dolan *et al.*, 2010). The nine effects or contextual factors that impact behaviour make up the acronym MINDSPACE as depicted in Table 4.1.

MINDSPACE	Contextual factors	Transport examples
<i>Messenger</i>	We are heavily influenced by who communicates information	Department for Transport; Transport for London vs. Sustrans; Campaign for Better Transport
<i>Incentives</i>	Our responses to incentives are shaped by predictable mental shortcuts, such as strongly avoiding losses	Losing 10 minutes on a trip is more important than saving 10 minutes on a trip – same applies to paying for travel
<i>Norms</i>	We are strongly influence by what others do	Family and friends cycle/drive, so makes it more achievable and acceptable
<i>Defaults</i>	We ‘go with the flow’ of pre-set options (pre-selected if an active choice is not made)	Opt-out defaults for car insurance and car option purchases

MINDSPACE	Contextual factors	Transport examples
Salience	Our attention is drawn to what is novel (or extreme) and seems relevant to us	Negative (extreme) public transport experiences, positive (novel) cycle to work
Priming	Our acts are often influenced by sub-conscious cues	Using certain words/images about peak oil or climate change could prime people into buying more fuel efficient cars
Affect	Our emotional associations can powerfully shape our actions	Weekend driving vs. weekday driving (utility vs. leisure)
Commitments	We seek to be consistent with our public promises, and reciprocate acts	‘Put it in writing’ - commit to future clean vehicle technologies or innovations – car clubs?
Ego	We act in ways that make us feel better about ourselves	Latest EV technology (Teslar, BMWi)

Table 4.1: MINDSPACE: Context and examples

Adapted from: Dolan *et al.* (2010); Metcalfe and Dolan (2012)

The elements of MINDSPACE show that people are heavily influenced in ways they are not aware of and in ways that they sometimes would not believe. The reflective system is not totally divorced from the automatic system in the brain, but greater emphasis and appreciation has to be given to the automatic system (Metcalfe and Dolan, 2012). This means that theories such as the TPB, do not actually capture most of what drives human behaviour, since “humans are blind to their own blindness” (Kahneman, 2011). Further research therefore needs to be conducted into understanding wellbeing consequences as a result of travel behaviours, as there is a large potential for researchers in transport to link up behaviour change with changes in wellbeing. Such developments could enable

behaviour change interventions in transport to reduce actual suffering and improve people's lives, while at the same time reducing the carbon dioxide emissions from transport (Metcalf and Dolan, 2012).

4.3 Transport and wellbeing research: Discussing the links

Both the psychology literature and to a lesser extent economic literatures provide an understanding of what influences wellbeing but in recent years, research on how travel behaviour is associated with subjectively experienced wellbeing has gained new impetus (Delbosc, 2012; de Vos *et al.*, 2013). In order to explore how the transport system can facilitate positive wellbeing, transport researchers must have an understanding of what makes people happy. This next section of Chapter Four focuses on the links between travel behaviour and wellbeing as well as some of the measurement tools, methods and theoretical models circulating the academic sphere. These are briefly critiqued and suggestions for development and improvement are provided.

Mobility often stimulates social and emotional wellbeing by providing improved access for quality interactions that are necessary for life's necessities and experiences (Carp, 1988; Kwan *et al.*, 2003). It is additionally widely accepted that mobility is critical for social integration in a complex urban society (Irwin, 1970) and is "essential to the maintenance of life satisfaction and wellbeing because it allows one to more readily meet all the other life needs" and wants (Spinney *et al.*, 2009:2; Lawton and Nahemow, 1973). It can be seen that within a transport context, it is of interest to identify how people spend their time and how they experience the various activities and settings of their lives (Kahneman *et al.*,

2004a; Kahneman *et al.*, 2010), so that happiness whilst travelling can be improved. Collecting quantitative information about time use and the frequency and intensity of affective states such as stress and enjoyment etc. is important when measuring wellbeing. The focus on moods and experiences of travel and daily routines is relevant since travel that is experienced as pleasant is more likely to be sustained over a longer period. This results in the actual or anticipated journey experience associated with different travel modes affecting travel mode choices (Ettema *et al.*, 2011; Stradling, 2011). Therefore identifying what makes people suffer most in terms of transport mode can be a step change in a move towards improving the sustainable transport system; providing more pleasurable experiences and thus being closer to changing and sustaining changed behaviour away from motorised modes. An important research question first raised by Ettema *et al.* (2010) is therefore; to examine the extent to which subjective wellbeing (i.e. moods and emotion) depends on travel context (i.e. travel mode). Consequently if such a relationship exists, subjective wellbeing measurement would potentially be a very influential tool for policy appraisal (Dolan and Peasgood, 2008).

Recently there have been a number of studies on subjective wellbeing and travel. Roberts *et al.*'s. (2011) study on commuting time-use found that commuting has a detrimental effect on the psychological health of women, but not men, due to a woman's greater day-to-day household responsibilities (e.g. childcare/housework) and not related to shorter working times or weaker occupational position. Moreover, Stutzer and Frey (2008) found a large negative

effect of commuting time on people's life satisfaction. The study found that people in Germany who commute 22 minutes one way, (i.e. the mean commuting time for Germany), reported on average a lower satisfaction with life. From this, Ettema *et al.* (2012) suggest that activities during travel may be undertaken, not to make the trip more pleasant, but to achieve satisfaction in other life domains at other times and that the impact of activities may depend on an individuals' mind-set (possibly related to travel purpose).

Travel in itself affects individuals' mood and leads to a cumulative satisfaction with the transport system, which in turn impacts on global subjective wellbeing. Travel may also affect subjective wellbeing in an indirect way; within travel behaviour analysis it is acknowledged that travel is valued because it is instrumental for engagement in daily activities. The availability of travel options is therefore an important determinant of how individuals and households schedule their activities (Ettema *et al.*, 2010). Other studies have examined the value of travel (Mokhtarian *et al.*, 2001; Mokhtarian and Salomon, 2001; Steg, 2005), the effect of social comparisons on travel happiness and behaviour (Abou-Zeid and Ben-Akiva, 2010) and the cognitive and affective responses associated with travel (Ettema *et al.*, 2011). Stradling *et al.*'s study (2007a) suggests that independently of travel mode, a trip will result in a variety of affective responses, which will eventually impact on satisfaction with travel. Satisfaction with bus services depends on a variety of non-instrumental factors including cleanliness, privacy, safety, convenience, stress, social interaction, and scenery. Alongside this, the study found that pedestrians evaluated walking trips in terms of non-

instrumental factors; crowdedness, air quality, presence of trees and flowers, presence of beggars, and type of pavement.

Subsequently, as suggested, travel satisfaction has a cognitive component related to cost, travel time, and punctuality so essentially, travellers' satisfaction stems from a whole variety of events experienced when using a travel mode. Travellers will likewise develop a cumulative satisfaction with these aspects based on their repeated daily encounters with services (Stradling, 2011). Therefore looking at the effects travel mode has on time pressure, delays or uncertainty in achieving daily and life goals and, more generally, the efficiency with which activities and projects can be carried out, all impact subjective wellbeing. This suggests that improvements in travel options, such as better reliability, could result in more efficient and less stressful performance of activities (Ettema *et al.*, 2010) and reduce any negative impacts travel may have on moment-to-moment moods.

So far however there has been limited research on the effects travel mode has on experiences, and daily experience of other activities; the spill-over effects. Studies have mainly concentrated on the spill-over of travel experience onto workplace performance and wellbeing (Olsson *et al.*, 2012). Wener *et al.*'s, (2005) study for example, examined the causes and nature of commuter stress of a trip and the spill-over into the workplace. Results show that commuters using an improved transit service showed reduced stress and reduced job strain compared to those who remained on the previous service. Mohd Mahudin *et al.*, (2010) also conducted a study on rail passenger overcrowding and found that the spill-over effects posed a significant risk to individual wellbeing and organisational

behaviour. From this, the present study seeks to examine the impacts travel has on subjective wellbeing when compared to other activities. It then examines the spill-over effects on overall daily life from the emotions and experiences before, during and after transport activities. This will demonstrate the impacts of transport mode on mood and other daily activities and see the different affective emotions as a result of different modes of travel.

Numerous studies have supported the relationship between overall wellbeing and behaviour, demonstrating that people tend to repeat experiences that they remember as more satisfactory than others (Ettema et al., 2011). However people often make choices that bear a mixed relationship to their own happiness (Kahneman and Krueger, 2006); people strive to achieve a goal which when reached, they quickly adapt to that level of pleasure. Alternatively when travel by a certain mode is undertaken, the habits formed are so ingrained that changing and adapting behaviours to an alternative is often very hard to do. Wellbeing research has introduced models such as the “Hedonic Treadmill Theory” which implies that good and bad events temporarily affect happiness but that people quickly adapt back to neutrality (Diener *et al.*, 2006) making it difficult to shift behaviours as a result of a positive or bad experience due to adaptation. The literature in affective forecasting however suggests people over-estimate how much (un)happiness they get from an event (e.g. commuting) because they neglect adaptation. The AREA model (Attend, React, Explain, Adapt) (Wilson and Gilbert, 2008) suggests people attend to self-relevant events; react emotionally to these events; attempt to explain or understand these events; and,

if they succeed, adapt to the events inasmuch as they attend less to them, have weaker affective reactions and thus make unpleasant experiences more tolerable.

There are more specific scales or frameworks developed to measure wellbeing with those concentrating on hedonic wellbeing; presence of positive feelings, absence of negative and over all life satisfaction (Diener, 2000; Kahneman *et al.*, 1999). These include the Positive and Negative Affect Scale (Watson *et al.*, 1988); the Personal Wellbeing Index (Stanley *et al.*, 2011); and the Satisfaction with Travel Scale (STS) specifically asking participants how they felt during travel and their overall evaluation of travel (Olsson *et al.*, 2013; Ettema *et al.*, 2011; 2012). de Vos *et al.*, (2013) agree that there are multifarious links between travel behaviour and wellbeing which are still under-examined with most studies only focusing on one aspect of this link (i.e. travel satisfaction) and not the three holistic elements of wellbeing; experiences and evaluations (i.e. hedonic wellbeing), and eudæmonia (i.e. eudæmonic wellbeing) as advocated by the ONS (2012) and the findings and conclusions of this thesis.

Measurements of wellbeing have been a hotly debated and controversial topic for quite a few years, however some robust and rigorous measurement methods have been established within the academy from real-time measures such as the Experience Sampling Method (ESM) (Larson and Csíkszentmihályi, 1983; Hektner *et al.*, 2007; Scollon *et al.*, 2003) and the Ecological Momentary Assessment (EMA) (Stone *et al.*, 1999) to retrospective reports such as the Day Reconstruction Method (DRM) (Kahneman *et al.*, 2004a). These methods have the ability to measure both hedonic and eudæmonic wellbeing, but as de Vos *et*

al., (2013) identify within their review there are no published studies (as of March 2014) within travel behaviour research which use ESM or EMA. A more in-depth discussion and analysis of wellbeing measurement methods is provided in Chapter Six as well as in Chapter Seven. Table 4.2 synthesises the discussions within the de Vos *et al.*, (2013) review, addressing some of the studies undertaken to examine the links between travel behaviour and wellbeing. The authors propose that travel behaviour affects wellbeing in five ways; feelings experienced during travel; destination-orientated travel; motility; travel as the activity; and activity participation enabled by travel (de Vos *et al.*, 2013). Within each of these five sections, studies linking travel and wellbeing, their outcomes and empirical examples are discussed.

	Links between travel and SWB	Affects/Effects	Example	de Vos <i>et al.</i>, (2013) review
1	Positive or negative feelings experienced during travel	*Feelings experienced during travel *Enables activity participation	*Drivers stuck in traffic *Social bonds strengthened	*Abou-Zeid (2009); *Ettema <i>et al.</i> (2010) *Archer <i>et al.</i> (2012)
2	Wellbeing affected due to inability to participate in activities because of travel limitations	*Social exclusion *Spill-over effects into other episodes	*Stressful, low quality travel to an activity can adversely affect outcomes of activity	*Currie <i>et al.</i> (2010); Delbosc and Currie (2011) *Bergstad <i>et al.</i> (2011)
3	Destination-orientated travel	*Feelings experienced during travel *Evaluation of the trip	*Activities undertaken whilst travelling; read, work, study	*Ettema <i>et al.</i> (2012)
4	Travel as the activity (undirected	*Undertaken to increase satisfaction	*Walking, cycling, driving and	*Mokhtarian and Salomon (2001)

	Links between travel and SWB	Affects/Effects	Example	de Vos <i>et al.</i>, (2013) review
	travel)		motorcycling etc. for leisure	
5	Motility – capacity to become mobile	*Access to transport resources *Knowledge and skills *Goal realisation	*Living close to a public transport network *Creating confidence and competence	*Kaufmann <i>et al.</i> (2004)

Table 4.2: Links between travel behaviour and subjective wellbeing

Adapted from: de Vos *et al.* (2013)

de Vos *et al.*, (2013) additionally provide a well-designed and concise theoretical model of the links between travel behaviour and wellbeing (see Figure 4.2). The model demonstrates the importance of linking and measuring both hedonic and eudæmonic elements (Layard, 2010). The explanations provided within the model consider many facets behind travel behaviours. As advocated by Nordbakke and Schwanen (2014), attention needs to be drawn however to the multiple ways in which wellbeing and its linkages to transport and mobility are context-dependent and shaped by the particularities of time and space. Considering this, the model could be developed further to include a focus not only on the links between travel behaviour and the impacts on wellbeing, but also explicitly including the impacts of transport externalities and contexts (i.e. pollution, noise, safety, and fear of crime) on wellbeing. Such examples are important when considering hedonic elements of wellbeing; Simon (1956) who coined the term “bounded rationality” stresses the importance of emotions as a determinant of behaviour

and choice making, taking into account intuition and heuristics in decision-making processes.

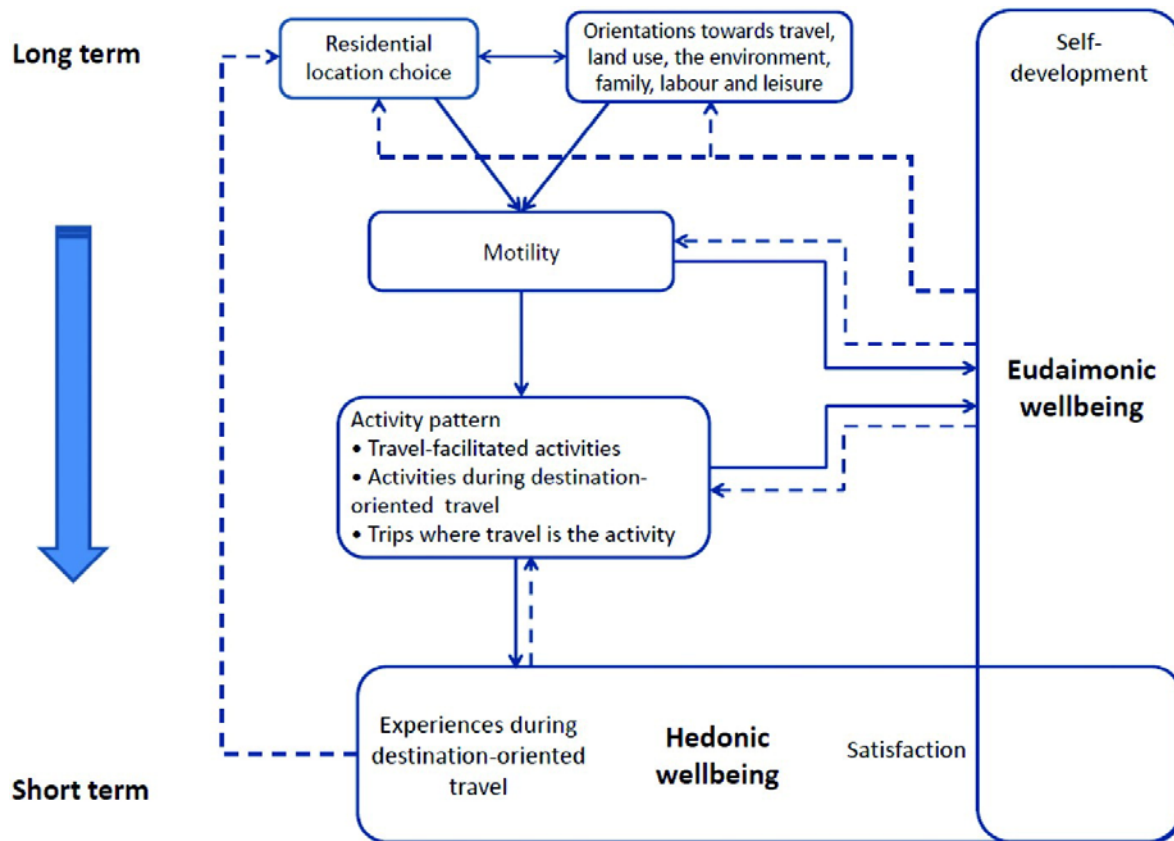


Figure 4.2: Theoretical model of links between travel behaviour and wellbeing

Source: de Vos et al., (2013)

Figure 4.2 separates longer term and shorter term decision-making processes and the effects of residential location, land use and the environment etc. on realised activity and travel. This in turn impacts on a person's motility. As the model indicates, the direct link from motility to activity and travel patterns of individuals, reflects that greater (smaller) motility can facilitate (diminish) participation in certain activities and so enhance (reduce) both hedonic and eudæmonic wellbeing (de Vos *et al.*, 2013). As an alternative to the above model, Delbosc (2012) developed a theoretical framework of transport's influence on (subjective) wellbeing (Figure 4.3). The model outlines the possible influences

that transport can have on wellbeing and suggests that the transport system can impact happiness through three different approaches: access to important activities, physical mobility and physical infrastructure.

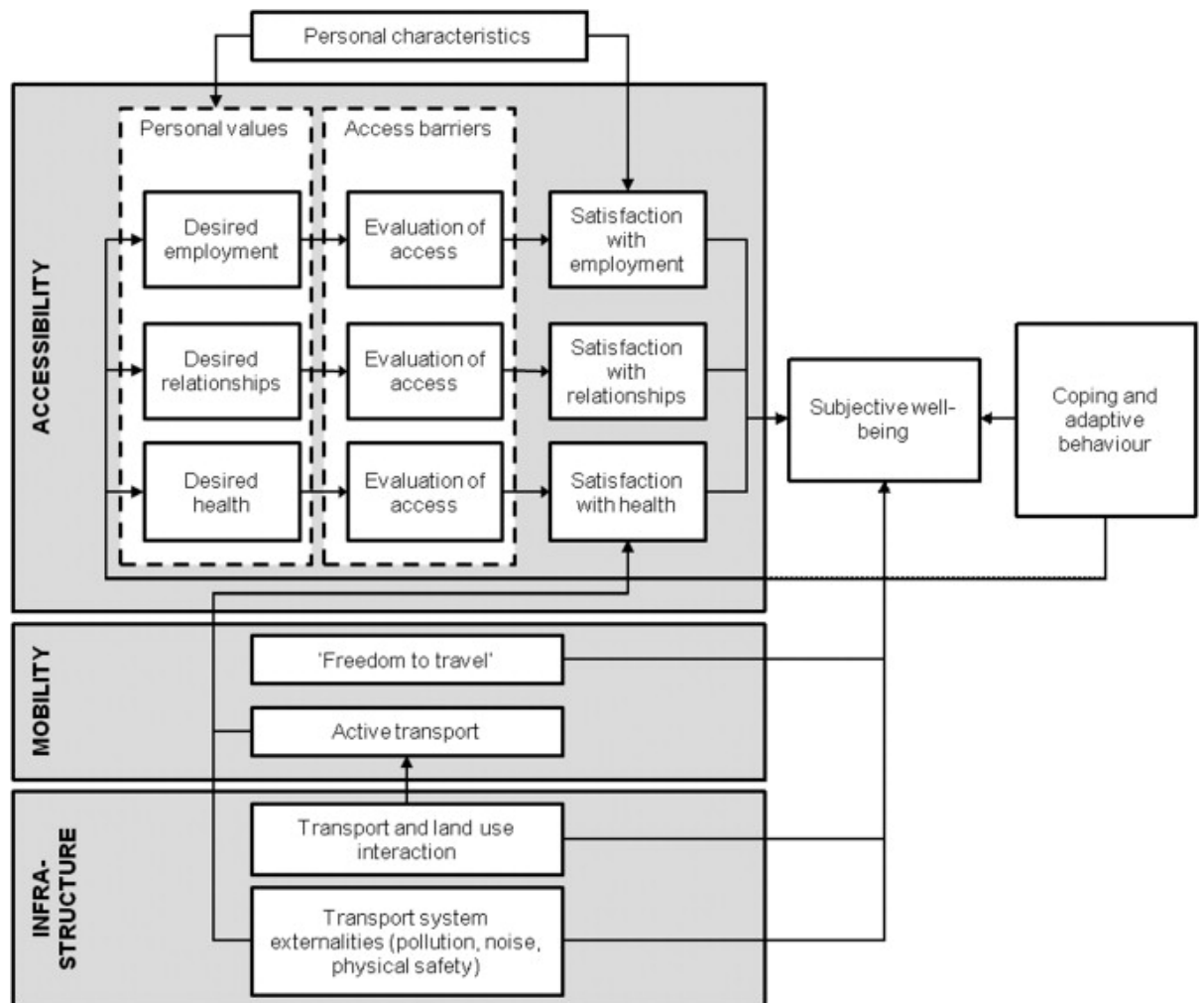


Figure 4.3: Theoretical model of transport's influence on subjective wellbeing

Source: Delbosc (2012)

This model includes transport infrastructures and indicates that their externalities can influence wellbeing. An explicit identification and separation of hedonic and eudæmonic wellbeing however is absent, and the model also excludes residential location (although it does focus on access) and the impacts of time scales such as longer term and shorter term decision-making processes that are incorporated within the de Vos *et al.*, (2013) model.

It can be seen that both of the theoretical frameworks discussed above require further advancement and adaption, and need to include some of the broader concepts that impact travel and wellbeing. A concluding discussion within this Chapter relates to such models and considers a more “synergised” approach. Adapting the main focus of research from how *travel* affects *wellbeing*, to a synergistic emphasis of also understanding and measuring wellbeing *first*, and then evaluating and monitoring the modes used across different contexts and scenarios. This is a valuable alternative research avenue as behaviour change is generally associated with additional effort or decreased comfort; reducing car use for example, implies a need to adjust lifestyles, which may evoke (initial) resistance because it requires effort and reduces freedom, comfort and convenience (Steg and Gifford, 2005). Measuring wellbeing levels before promoting travel behaviour changes may in theory further improve understandings of how and why people move. Travel behaviour research focuses mainly on experiences and thus does not capture or measure subjective wellbeing in its entirety, therefore including wellbeing may permit a deeper interpretation. For example if a person feels unhappy, anxious or frustrated, is there a relationship between these emotions and undertaking car travel for utility purposes (i.e. they think they would get to work quicker, quiet-time in their own personal space etc.)? The alternative being if a person is happy would they choose a more environmentally friendly mode of transport? Or an extension of this, when a person feels relaxed, happy and competent do they drop their children off at school for example by bicycle (aspirations to improve their children’s independent mobility on the “school run”)? Questions arising from such

hypotheses include “how do different levels of happiness affect different travel decisions” and “how do timescales/time constraints affect emotions and people’s capacity for modal change?”. Therefore to move beyond the limits of current research on travel behaviour and wellbeing, using subjective wellbeing as a framework for analysis, it is easier to ensure that all elements of wellbeing are covered in future studies. Figure 4.4 demonstrates the impacts different elements of wellbeing can have on different elements of travel (and of course, vice versa).

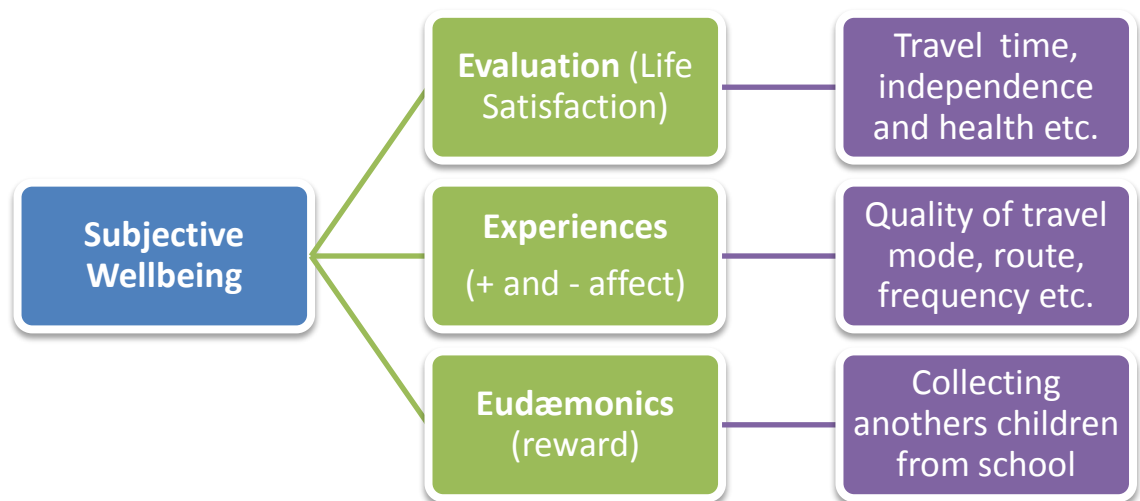


Figure 4.4: Subjective wellbeing and transport measurement

Adapted from Dolan *et al.* (2011)

Measuring happiness and promoting the link between happiness enhancing modes and travel behaviours could be a powerful alternative tool within the policy sphere. Combining the two would allow for further discourses and debates surrounding this research agenda to be fully realised and examined, and would result in a more balance “toolkit”. However measuring happiness and then identifying the travel modes which impact wellbeing the most, may not directly

translate into shifts towards and increases in levels of active travel, especially when considering the many embedded “benefits” of the car. Nonetheless, the contexts behind experiences and emotions are vital as a way to understand the nuances and processes which impact everyday travel and happiness. It can be therefore seen that understanding the differences in how travel behaviours and wellbeing are measured, understood and evaluated across time and space is important and requires further unpacking within academia and policy.

4.4 Discussion, future research avenues and conclusions

Chapter Four reviewed a series of evidence on wellbeing in transport and mobilities studies. It discussed a set of theories and methodologies used within both disciplines from inside and outside of academia. Reviewing this evidence supports and grounds the philosophical underpinnings and research methods used within this D.Phil. thesis. This Chapter discussed, analysed and critiqued some of the more traditional theories and techniques used within travel behaviour research. The Chapter also examined some of the theories and measurement methods used within wellbeing research and then explored in detail the links and interconnections between travel behaviour and wellbeing. A discussion promoting the connections between happiness and travel behaviour was also provided, extending some of the proposed research ideas currently under discussion within academia. Finally, this Chapter examined travel and its impacts on wellbeing as well as an alternative angle; examining and measuring happiness levels and the impacts our emotions and moods have on the use of different modes and travel experiences. It can be seen that at present literatures

on travel behaviour and behaviour change lack understandings on the affects travel has on moods and emotions. Therefore, a recommendation for policymakers and academics is to incorporate work on subjective wellbeing when measuring and examining travel behaviour which would assist in improving understandings of this relationship.

Chapter Four uncovers and examines some of the discourse and debates surrounding travel and wellbeing literatures. It proffers the notion that many transport projects, interventions, theoretical frameworks or opportunities to study transport behaviours would benefit from incorporating wellbeing measurement into study protocols. Advocating such an inclusion would be appropriate across a wide range of travel and transport research projects. Existing travel behaviour models and theories have also been examined within this Chapter advocating for their enhancement and adaptation with regards to incorporating the impacts of happiness and wellbeing (Duarte *et al.*, 2010). Combining the traditional and standard methods and theories of travel behaviour with new(er) conceptualisations from the behavioural sciences (as well as other disciplines), would also improve and reinvigorate present frameworks and theories as well as provide more rigorous and reliable data sets. Additionally, the notion of introducing more “nudges” to support longer term strategies also seems justified (Avineri and Goodwin; 2010).

Nordbakke and Schwanen (2014) support the idea of cross-cutting research and a deeper engagement with the various theoretical traditions. The authors suggest that future work focusing on mobility and wellbeing would benefit from such

insights and would be particularly imperative when combined and integrated. They highlight however the fact that differences in ontological, epistemological and methodological predispositions between the outlined approaches to wellbeing would have to be considered and somehow negotiated. The authors suggest that one way to overcome these differences would be to follow a mixed-method strategy, whereby relatively open-ended qualitative methods (in-depth interviews) are used in combination with the quantitative methods outlined above such as EMA, ESM or the DRM; a methodology that this D.Phil. thesis has addressed and implemented from the outset. Subsequently, de Vos *et al*, (2013: 434) suggest that it is “important to avoid policies that seek to enhance wellbeing via travel behaviour in isolation”. The authors state that a set of integrated policies should be considered where the relationship between transport and wellbeing is reflected in conjunction with other associations which often impact them (i.e. housing, health, employment (fear of) crime, public service provision etc.). Therefore, applying and testing the outcomes of the research methods used at the Connect2 intervention has provided an ideal platform to conduct such work. The work presented within this thesis again has similarly advocated for the contexts and externalities behind travel and everyday movement to be fully acknowledged, considered and appropriately addressed within all travel and wellbeing theories, frameworks and conceptualisations.

It is important to address the fact that this review cannot include all available information and published materials. Therefore some of the conclusions drawn and recommendations made need to be complimented by promising avenues of

future research. As a start, improving understandings of the impacts residential and work location have on happiness and travel mode and the resulting effects long and short timescales have on hedonic and eudæmonic wellbeing, is an important area to address. Additionally understanding how weather, and how travel on different days of the week, affect mood and emotion would allow for the wider use of contexts to be considered and justified. Furthermore, research collecting longitudinal data would permit repeat measurement and would potentially offer more robust and interesting findings. Finally as the literature suggests, it can be seen that everyday travel behaviours impact the quality of travel experiences as well as emotions, rewards and moods whilst travelling. Therefore to extend the frontiers of such research and to provide a valid example of how travel and wellbeing studies can further cut across disciplines and be incorporated more into a diverse range of research projects, the following example is proposed. A very timely prospect for future research, an example project could theoretically consider investigating the impacts of travel and wellbeing on “Ecosystem Services”. To elucidate, under the four broad categories of ecosystem services (i.e. provisioning, regulating, supporting and cultural) the overall concept could be expanded further to include wellbeing and transport. Within the *cultural* category, investigating the gains acquired by humankind from visiting or living near ecosystems, and the impacts of travel and transport to a specific site could offer multiple avenues for research. The inspirational benefits (i.e. art, music, traditions, “life-long living by the sea” and it “being part of a person’s personality”) and the recreation and tourism benefits (i.e. experiencing or relaxing by the sea) from travelling to, visiting and/or living alongside such

ecosystems could also have wider impacts, outcomes and consequences on wellbeing as a result of such experiences (Inieta-Arandia *et al.*, 2014). There are direct impacts some services have on the wellbeing and the livelihoods of neighbouring populations (i.e. aesthetic value etc.) as well as general environmental conditions which indirectly impact the wellbeing of the global population (i.e. climate change, natural hazards etc.) (Wegner and Pascual, 2011). In addition to this, there is increasing interest in assigning economic values to ecosystem services, therefore the quantitative measurement of wellbeing may provide a robust assessment and go some way towards providing a *value* to such services (de Groot *et al.*, 2010; Farber *et al.*, 2006).

In summary, from the literature examined within Chapter Four it can be seen that wellbeing is much more than satisfaction (experiences) and affect (emotions) and travel can impact both hedonic and eudæmonic aspects of wellbeing across time and space. Thus, it is important to consider and measure both types of wellbeing in all future research (de Vos *et al.*, 2013) as examined further in Chapters Six and Seven. The Chapter now however, provides a reflective section examining the links between this review of literatures and the next empirical qualitative research Chapter.

4.5 Reflections: Relevant literatures to a qualitative study

This reflective discourse will provide a transition from the literatures examined in Chapter Four (and highlight how the Chapter's outcomes assist in developing the overall thesis) to the context, purpose and intended outcomes of Chapter Five. By examining relevant literatures in Chapter Four, current understandings of some

of the personal and practical constraints to travel behaviour change outlined in the next Chapter will be improved both theoretically and methodologically. In response, the findings and explorations within Chapter Five will add to the body of empirical academic research presented within this thesis. In order to answer Research Question One and Two, whilst also tackling Objective One and Two, the fifth Chapter will use the most relevant theories and methodologies examined within Chapter Four and apply them to this next empirical section as well as throughout the entire thesis. In particular the methods, theoretical understandings and prominent results that have emerged from some of the more robust, evidence rich studies are useful to consider when discussing the research undertaken in the following Chapters. The highlighted text box below revisits the research questions and objectives tackled within these Chapters.

Chapter Four and Five: Research Questions -

- 1. What are the links between travel behaviour and wellbeing?*
- 2. What are the perceived and actual constraints to walking and cycling among households and individuals?*

Chapter Four and Five: Objectives -

- 1. Explore the existing evidence base and identify gaps in research on the relationship and linkages between travel behaviour and wellbeing research.*
- 2. Examine individual and household travel behaviour, in a case study context, to identify factors affecting travel choices.*

There is a great deal of relevant literature available on the constraints to travel behaviour, both theoretical in nature as well as applied empirical research. Some

of the theories covered in Chapter Four, as well as discussions on the multiple interventions, projects and schemes launched across the UK provide evidence that this is an area of intense academic and political interest. It can be seen however that wellbeing and travel behaviour are areas of research where direct causality has been difficult to identify. If the number of studies proving causality were increased (e.g., through more field experiments with control groups), then empirically robust evidence would further support the future promotion, uptake and/or continuation of wide-scale infrastructure schemes which promote and support active travel. Previous UK-wide large-scale projects examining active travel and travel behaviours for example the Understanding Walking and Cycling project and the Smarter Choices Smarter Places scheme, have progressed along similar lines to the wider iConnect programme and thus this D.Phil. research. They are useful case studies to examine and compare against the outcomes and processes undertaken within this body of research.

Chapter Five seeks to explore some of the perceived and actual constraints to travel behaviour change in an attempt to discover and strengthen the links between travel behaviours and the impact travel experiences have on wellbeing (i.e., in Chapter Six). In an attempt to examine the constraints to travel behaviours change within Cardiff and Penarth, Wales, Chapter Five empirically examines the personal and practical constraints for a cohort of respondents. The purpose of this Chapter is to measure and evaluate the rationales and justifications respondents make to understand how and why different travel and movement is undertaken in and around the cohort's local area. In addition to

this, understanding travel experiences and the factors that impact current and future travel decisions is important and links to the wellbeing elements studied within the later chapters.

Through qualitative measurement the data collected here on how and why people avoid certain modes, how and why they perceive certain constraints to travel, and the wider impacts on the context of travel experiences, will contribute to the wider understandings and narrative of the overall study. It can be seen from the findings within Chapter Five that individuals themselves believe they cannot control the problems caused by car use. For many for example, it does not seem sensible to forego the individual advantages of car use because of the uncertainty about whether others also will do so. However, various factors (i.e. problem awareness, perceived responsibility for the problems, trust in others contributions and personal norms) encourage people to act in the common interest, even though this may not have immediate positive consequences (Steg and Gifford 2005). Such factors and many more are discussed and analysed within Chapter Five in an attempt to better understand and explore some of the personal and practical, perceived and actual constraints to travel behaviour.

Chapter Five - Reflections on daily behaviour in a changing environment⁸

Within literatures on active and sustainable travel and transport there is a lack of credible evidence documenting the effects of infrastructural interventions on population-based levels of walking and cycling. It is widely acknowledged that there is great potential for active travel to play a greater role in reducing motorised travel. Critical questions remain however, over precisely *how* to increase this modal share. Amongst other things, once infrastructural interventions have been made there seems to still be a range of personal and practical constraints that continue to inhibit household active travel. In this Chapter, results are presented from interviews conducted with households in Cardiff and Penarth, Wales throughout 2011. It is anticipated that the case-study methodology will provide unique insights into intra-household dynamics and thus help to reveal the specific contexts and circumstances under which active travel occurs as a result of new physical infrastructure being introduced. This chapter seeks to examine and improve understandings on a cohort of respondents travel patterns following the opening of the new walking and cycling bridge. It examines their (dis)satisfaction with local travel in and around the case study area, constraints to active travel, and local perceptions surrounding everyday movements which in turn may influence travel choices. Study results demonstrate that negative perceptions of travel in the area in particular household commuter travel are a very prominent constraint to everyday active

⁸ This is the second of four papers in a series submitted for peer review. This paper was submitted to the journal "International Journal of Sustainable Transportation" on 23/04/15

travel; unachievable distances, topography, fear of crime and a lack of supporting facilities such as cycle lock-ups face the “potential” cycle-commuter. That said however, when cycling for leisure these issues are drastically reduced or become invisible. The Chapter additionally examines the role of social norms and discusses the experienced “freedom” whilst undertaking active travel as well as issues of independent mobility.

5.1 Introduction

It is widely acknowledged that current and future forms of sustainable transport will have differentiated effects across society (Pooja *et al.*, 2013; Holden, 2012). In order to better understand the nature and intensity of relationships between transport provision, travel behaviour and opportunities to engage in active travel, this Chapter explores post-intervention perceptions of one local transportation system in Wales. The qualitative research presented here forms part of the iConnect consortium research programme, which aims to investigate changes in travel behaviour as a result of a new physical intervention for walking and cycling. In short, this programme addresses the sustainable transport charity Sustrans’ Connect2 scheme (<http://www.sustrans.org.uk>), specifically the “Pont-y-Werin”, a 140 metre bascule bridge connecting Cardiff and Penarth, Wales. The Pont-y-Werin aims to provide safer, non-motorised transport links and offer residents safer and improved access between local communities (**see Figure 2.2**). By providing detailed insights from an empirical study exploring changes in travel behaviour and perceptions at the individual and household level, this

Chapter will make an important contribution to knowledge in the field of active travel and travel behaviour.

The study's principle aim is to enhance the existing evidence base documenting travel behaviour responses to physical interventions. Specifically, it seeks to provide a detailed account of the many personal and practical concerns that have in this case, operated to constrain actual and potential opportunities for behaviour change. In addition, the Chapter also aims to examine a set of behaviours influenced by values, beliefs and norms toward the environment (based on the value-belief-norm model) alongside household-level motivations and constraints to increasing active travel (Stern, 2000; Stern *et al.*, 1999). In pursuing these objectives, it is hoped that the research will further improve academic understandings of the direct and indirect links between household-level attitudes towards active travel and actual transport mode choices.

The remainder of the Chapter is structured as follows. Section two provides an overview of the existing literature relating to travel behaviour and current transport interventions; paying particular attention to present understandings of the links which mediate between them. Section three describes the sampling strategy and overall methodological approach deployed in this research with section four presenting and discussing the study's main findings. Finally, in conclusion, the Chapter will reflect on the implications of its findings for future policies seeking to promote participation in active travel, particularly those underpinned by physical interventions.

5.2 The evidence base

There is now a consensus view that transport must become much more sustainable, not just environmentally, but also socially and economically (Banister *et al.*, 2011). Individuals, communities, the economy and society as a whole have much to gain from increased participation in active travel (Cycling England, 2008). At the same time, there is also an increasing recognition of the role that walking and cycling might potentially play in making urban and rural areas more sustainable in themselves (Ogilvie *et al.*, 2012). Whilst declining levels of active travel strongly mirrors a growth in the affordability of the car, this is only one of a series of psychological and sociological factors that are known to influence modal decisions. Other factors include generally poor transport provision, poor levels of fitness, a fear of crime associated with active travel, and – more prosaically – an unwillingness to engage in active travel during unfavourable weather (Black *et al.*, 2001). Consequently, in the specific case of cycling, across much of the industrialised world, people engage only as a means of recreation, and rarely for practical everyday travel (Pucher and Buehler, 2008).

Increasing the proportion of trips made by non-motorised transport in urban areas is desirable from environmental, health, and natural resource conservation perspectives. Providing supportive environments is seen as one way to influence travel behaviour. However, far more research is needed to understand the differing preconceptions (that are held by those not already engaged in active travel) of any potential personal and practical constraints that might prevent them from walking or cycling for leisure and utility. Such constraints can be

linked not just to our competencies, capabilities, fears and perceptions of safety; they might also emerge from movements across space and time (Jacobsen, 2003). There is a wide body of research that indicates that thoughts, feelings and behaviours are grounded in bodily interactions with the environment (Lovelace *et al.*, 2011; Nash *et al.*, 2005; Meier *et al.*, 2012). Concomitantly, the concept of time-space convergence developed by Janelle (1968), described as the rate at which the travel time between places declines in response to transport and communication innovation and investment, reflects the dramatic (space shrinking) effects of 200 years of transport innovation (Janelle and Gillespie, 2004). Through this innovation, and the resulting advances in technology, transport (in particular air transport) has collapsed the fastest long distance journey times from days to hours. Time/space can continue to collapse locally through inter-modalism and new fixed links. Janelle's (1969) concept of spatial reorganisation reflects the changes in space-time connectivity that result from places adapting both the locational structure and characteristics of their social, economic and political activities. From this, the implications of time and space on our travel must be considered and the perceived and actual constraints which are realised as a result.

Given the scale of potential benefits, many countries have shown an increased interest in policy initiatives seeking to promote travel behaviour change throughout whole populations (Sygiyama *et al.*, 2009), with a diverse range of strategies being adopted across different contexts. One useful way of categorising these various types of initiatives is to distinguish between those that are designed

to promote *behavioural* changes and those which are instead focused on bringing about *technological* changes. Behavioural change-oriented initiatives; the focus of this Chapter, aim to reduce individuals' overall level of car use, for example by shifting journeys to less polluting modes of transport, changing destination choices, combining trips, or incentivising people to travel less often. Many authors' suggest that such strategies often synergistically lead to rapid improvements in environmental quality, overall urban quality of life, and destination accessibility (Steg and Gifford 2005; Heath *et al.*, 2006; Killoran *et al.*, 2006). Furthermore, increases in active travel are usually also associated with public health benefits, and might even help to reduce the socially divisive and inequitable effects of a transport system dominated by less sustainable modes (Woodcock *et al.*, 2007). Given the range of scales at which these alleged benefits would accrue, a comprehensive strategy for promoting more research in to sustainable transport interventions arguably would have to focus attention and effort on changes at each of the individual, household and population levels (Dietz *et al.*, 2009).

Providing conditions that will help to actually bring about changes in behaviour however, remains a critical challenge. Specifically here, it is arguable that greater effort must be invested both in ensuring that innovative schemes are implemented to a high standard, and gain public confidence and acceptance for measures; if possible through active involvement and action (Brög *et al.*, 2009; Banister, 2008; Yang *et al.*, 2010). Against this backdrop, a major advantage of studying interventions that seek to enhance the physical environment is that the

entire population of a given target neighbourhood may be influenced in a way that transcends many of these physical and conceptual barriers (van Dyck *et al.*, 2009). Indeed, the effects of such interventions, and specifically the extent to which they do promote a shift away from cars towards active travel, is likely to be far easier to observe at the individual, household and population level (Ogilvie *et al.*, 2004). Yang *et al.*, (2010) and Ogilvie *et al.*, (2007) however conducted systematic reviews assessing the effects of interventions to promote active travel in individuals and populations. Ogilvie *et al.*'s, (2007) results indicate that interventions to promote walking target either the most sedentary or the most motivated, and are delivered either at the individual level (i.e. pedometers, advice) or at household/ group level (i.e. individualised marketing). The sustainability and generalizability of these approaches were uncertain but conclusions of the review found that the most successful interventions could increase walking among targeted participants by up to 30-60 minutes a week on average, at least in the short term. Yang *et al.*'s, (2010) review examined interventions to promote cycling; finding that community-wide promotional activities and improving infrastructure have the potential to increase cycling by modest amounts; the findings however need to be confirmed using more robust study designs. From this it can be seen that intervention design does require improvement so that all groups are targeted and that approaches provide sustainable changes.

As interest has grown around sustainable, socially-inclusive lifestyles (Ornetzeder *et al.*, 2008; Woodcock *et al.*, 2007), researchers have recognised the critical role

played by the quality of the environment itself in influencing individual behaviour (Rehdanz and Maddison, 2005). As such, many hypothesise that where local trips are *perceived* as being safe, realistic and achievable, people will be more likely to walk and cycle (Burden *et al.*, 1999; Chapman, 2007; Pucher *et al.*, 2010). Infrastructure design, safety, street patterns, destinations, traffic, and population densities are also all acknowledged as key factors associated with bringing about increased levels of active travel. However, it is extremely difficult to *prove* unequivocally that a change in any one of these factors will automatically bring about an increase (Roth and Kåberger, 2002; Krizek *et al.*, 2009), or indeed that any change in travel behaviour can be attributed to one particular factor over another. Accounting for observed changes in levels of walking and cycling as particular modes of sustainable transport, therefore forms a critical challenge for researchers (Krizek *et al.*, 2009). Factors which are likely to play a role here include, amongst other things, the nature of relevant infrastructural provisions (e.g. cycle lanes and cycle parking facilities), the degree to which these are well integrated with public transport networks, education and marketing programmes, cycle access programmes, as well as various legal and political issues (Pucher and Buehler, 2009).

Against this complexity, this study endeavours to measure the impact of a single physical intervention on modal choice. This is valuable because policies seeking to promote a more integrated and sustainable transport system routinely highlight the potential contribution that active travel could make. Across the UK government for example, urban planning and transport agencies have developed

a range of policies and strategies aimed at directly influencing levels of walking and cycling in a neighbourhood (Pikora *et al.*, 2003). In order to ensure that future policies are well designed however, policymakers today ultimately need to know whether or not their existing policies and programmes are actually leading to increases in active travel levels. It is for this reason that intervention studies which examine the impact of a given programme on the behaviour of those to whom the intervention applies, are so critically important in the overall drive towards a more sustainable transport system (Krizek *et al.*, 2009; Merom *et al.*, 2003).

5.3 Research design

The categories of “personal” and “Environmental (practical)” offer a useful way to breakdown the data into components for analysis. Together and also independently, both concepts provide an interrelated platform which covers the majority of perceived and actual constraints observed by the sample of participants. Alongside this, the value-belief-norm model proposed by Stern *et al.*, (1999) and Stern (2000) (Figure 5.1) is considered as it proposes that pro-environmental behaviour is based on a causal chain of representational variables, where personal norms act directly on behaviour. This model was chosen as it focuses on the importance of moral components when setting environmental behaviours in motion (Aguilar-Luzón *et al.*, 2012). The values-beliefs-norms theory is one of the most prominent explanations of voluntary pro-environmental behaviour emerging from the social sciences.

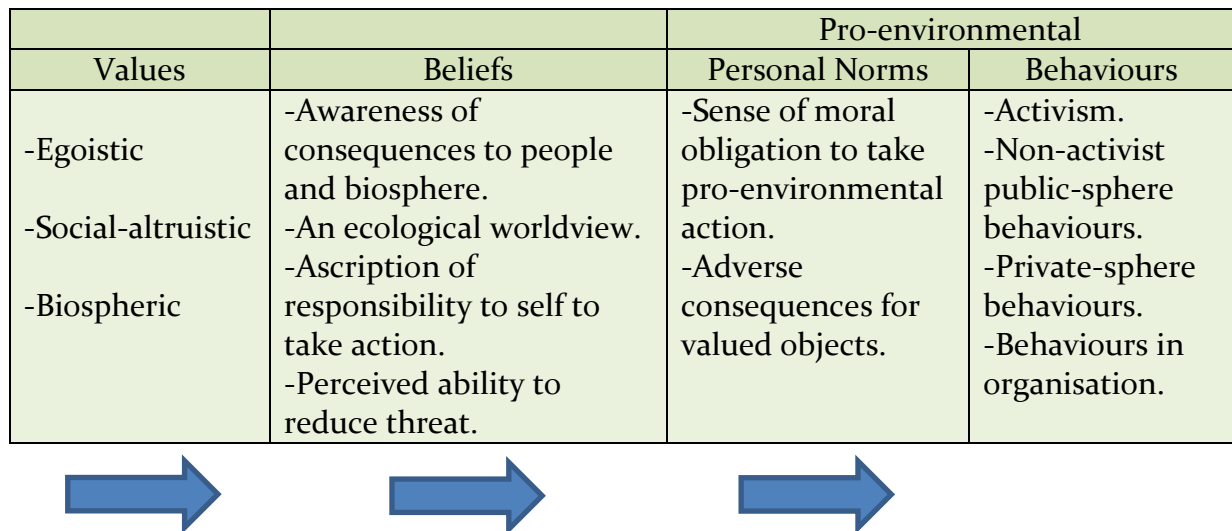


Figure 5.1: Values-beliefs-norms Theory

Adapted from: Stern (2000)

The concept provides a framework for linking several factors in a causal chain and recognises that moral motivations including personal values, beliefs and norms, strongly induce environmental actions within the boundaries imposed by certain practical constraints such as time and money. Gardner (2013) discusses the theory outlining that there are three separate clusters of values that can promote environmental concern; egoistic, altruistic and biospheric values. Egoistic values concerned the self and include wellbeing, individual welfare, health, lifestyle, future. Altruistic values are concerned with the wellbeing and welfare of others; children, community, other social groups and humanity in general. Biospheric values are concerned with nature which has intrinsic value and is worth protecting for its own sake.

Since the dynamics under investigation in this research study are currently poorly understood, the methodology adopted here is a predominantly qualitative one centred on face-to-face household interviews since these will yield detailed

contextual data (Cresswell, 2013; Ritchie, 2013; Silverman, 2013; Anderson and Jones, 2009). Full household interviews were chosen both because there remains a lack of evidence from the household perspective on the effects of physical interventions, and also because a number of academics (Teddlie, 2009; Guell et al., 2012) have advocated the importance of triangulating findings between all household members rather than relying solely on one person's testimony. There were however a number of practical and logistical problems associated with this methodology, as well as ethical issues and power dynamics to negotiate. When analysing personal travel choices, household data collection and analysis is necessary to facilitate an adequate interpretation of individual behaviour. The travel patterns for example, for each vehicle or individual in a multi driver/vehicle household are moderated as a function of influential household characteristics such as income, the presence or absence of dependent children, and the number of vehicles, drivers and workers. A careful treatment of the shared nature of the means of transport within a household, and of the individual responsibilities that flow from this is essential in order to reveal accurate and fair reflections of travel levels. Specific interview questions were therefore designed to establish the influences of household structure and the communal nature of travel on individual behaviour.

Sampling

The sampling method used in this study was not based on a particular theory or statistical probability distribution, but rather on a purposive sampling criterion (Curtis et al., 2000). It thus focused primarily on a specific sub-sample of households from the case-study site, itself drawn from the iConnect study's

baseline core survey conducted at the Sustrans Connect2 Cardiff site. Connect2 Cardiff's project, "Pont-y-Werin", connects Cardiff with Penarth, a dormitory town to the southwest of the Welsh capital. The scheme comprises a non-motorised bridge linking Penarth with Cardiff's International Sports Village and also a network of arterial routes from Penarth's town centre to the Bridge. Before the Pont-y-Werin was constructed, the main access route between the two urban centres was either by public transport or by car across a busy dual-carriageway bridge (the Cogan Spur) with no legal pedestrian route (pedestrians can legally walk the longer routes to Cardiff either along the Penarth Road or the Cardiff Bay Barrage) and limited cycle access. The Pont-y-Werin has therefore been cast as the final "missing link" in a safer, six-and-a-half-mile non-motorised route that circumnavigates the Cardiff Bay area.

Choices made in the sample selection strategy will of course have had significant implications for the way that the qualitative data can be interpreted. It is therefore essential to be explicit about both the nature of these choices and the justifications that lie behind them (Curtis et al., 2000). The initial iConnect baseline survey helped to establish and build the sample of respondents; potential participants who indicated that they were willing to be contacted during future research. There were 659 participants who agreed to take part in follow up data collection in and around Penarth and Cardiff. Of these consenting households, respondents stating that they suffered from a long-term illness combined with a low intention (on a Likert scale from 1-5) to increase their active travel levels (N=120) were excluded. Additionally, households living outside three defined buffer zones (Figure 5.2) were also excluded

from research (N=137) due to the distance to the intervention being too far, and therefore the impact that the intervention had on household travel being too small. These buffer zones were smaller than those defined by iConnect and were drawn at 0.5km, 1km and 1.5km distance from the recently completed walking and cycling intervention; Sustrans “Connect2Cardiff: Pont-y-Werin” (www.sustrans.org.uk). Smaller buffer zones were chosen as the starting sample population (659) was smaller than iConnect’s core baseline (1,130). The buffer zones were based on distance to the Connect2 scheme and were effectively boundaries drawn around the Pont-y-Werin. The buffers were defined to draw the sample from: approximately 50% of participants from buffer zone A (i.e. 0.5 km with 200 households); approximately 25% of participants from buffer zone B (i.e. 1 km with 136 households) and approximately 25% of participants from buffer zone C (i.e. 1.5 km with 66 households). Therefore, of the 659 participants who agreed to participate in follow-up research, a total 402 households were contacted.

Each household contacted received a recruitment pack consisting of an invitation letter (Appendix C), a stamped return postcard (to indicate willingness to participate) and an information booklet (Appendix D). A 35% response rate was achieved with 141 respondents. To reach the final sample of 60 households, further sampling criteria were applied to further exclude respondents with a low-to-moderate intention (on a Likert scale from 1-5) to increase their active travel levels (N=81). The final sample included in the study focused on respondents who “had intentions to do more active travel over the coming months” and who had stated a moderate-to-high intention (on a Likert scale from 1-5) to increase their walking

and/or cycling levels (with or without a long-term illness) and focused in addition on demography and space; consequently the sample is not representative. Of the 60 households, 15 were included in a pilot study undertaken in April 2011, followed by the remaining 45 being surveyed in July 2011.

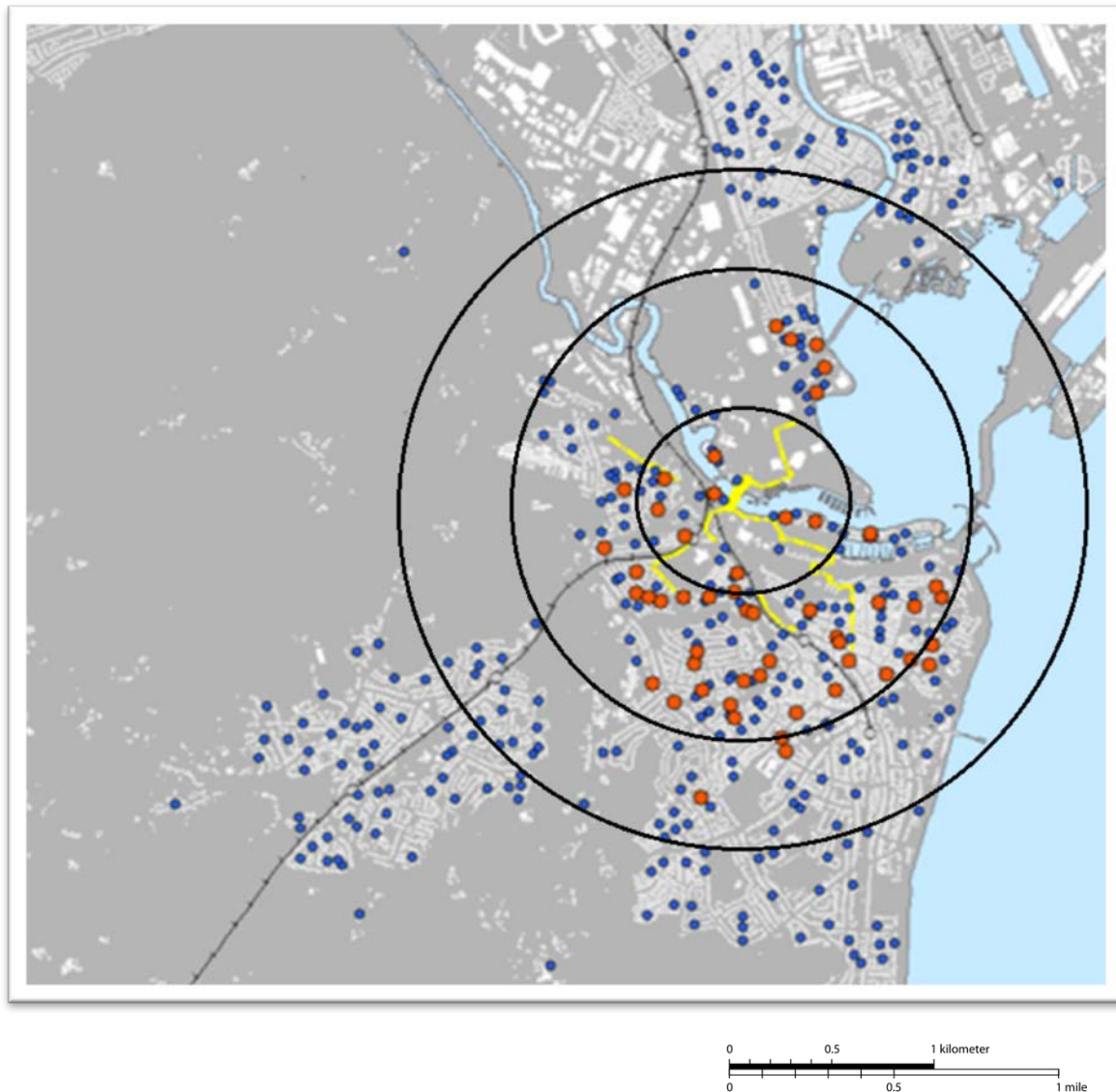


Figure 5.2: Buffer zones for sample participants

N.B. Blue, 659 iConnect respondents “willing to be contacted for follow up research”; Red, 60 households included in sample

Incentives were offered to participants to help enhance the response rate, since *Edwards et al., (2002)* show that the odds of response are more than doubled when

financial incentives are offered. Participants were asked to ensure that all members of their household were present for data collection so that the entire household could be surveyed together. Interviewing all members within a household is useful as it allows for the intra-household dynamics and the relationships between people to be fully explored. It automatically increases the complexity and sophistication of data by exposing the negotiated and sometimes antagonistic nature of household relations and decision-making (Valentine, 1999; Southerton, 2003).

The final sample within Penarth and Cardiff comprised households with both single occupants and couples (with and without children). Householders present at the time of data collection ranged from one person (the main contact who completed the iConnect survey) up to a family of five. Some households had a dual income, some were professionals, some were on career breaks after having children and some were retired. The sample therefore comprised a range of demographic and socioeconomic status groups. The average number of people per household was three, whilst the average number of years spent in the household was 12. Respondents' ages varied from 23 to 77, and each household interview lasted an average of 25 minutes.

A semi-structured interview schedule was developed (see Appendix B), ensuring that each interview yielded detailed information about demographics, typical household travel, modal use and perceived and actual constraints and motivations to travel behaviour change. Interviews also focused on journeys to and from work, school and around the local area, levels of satisfaction with local

travel, knowledge of the Connect2 scheme and intentions to increase active travel levels. A list of prompts was used to elicit more detailed responses, the schedule was pilot-tested for clarity and the researcher's positionality was considered so not to disturb the dynamics of the household or affect the data (Bryman, 2012).

5.4 Results

Each interview was transcribed verbatim to provide a descriptive record and permitted evaluation of findings after the interview had taken place (Cresswell, 2012). Consequently, data were analysed using content analysis and interview transcripts were coded using the main themes of "Personal" and "Environmental (Practical)" and the subthemes of "Time", "Space", and "Body", the last of which was included to encapsulate our competencies and capacities to deal with certain practical and personal constraints to active travel. Firstly however, to help contextualise results presented later, the more general categories of "everyday travel" and "satisfaction with local travel" are now examined.

Everyday travel

This theme originated from the questions "How do you usually travel to and from work/school?" and "How do you usually travel around your local area?" Responses varied and as seen in Table 5.1, some respondents combined or switched trips/modes depending on time constraints, work commitments or other activities. "Travel around your local area" included activities such as shopping, social and leisure trips.

	To/from work/school	Shopping trips Penarth	Shopping trips Cardiff	Leisure/social/local area trips	Weekend trips
Walking	6%	28%	0%	36%	9%
Cycling	4%	0%	0%	0%	0%
Public Transport	2%	0%	24%	8%	0%
Car	38%	28%	34%	7%	24%
Walk and/or Cycle	0%	0%	0%	4%	0%
W/C and/or PT	7%	6%	4%	9%	17%
Car and/or PT	11%	4%	15%	6%	2%
Car and/or W/C	9%	19%	4%	34%	23%
Retired	15%	-	-	-	-
Other	6%	-	-	-	-
Non- response	3%	13%	17%	9%	17%

Table 5.1: Proportion of individual's trips for everyday travel activities

Notes: Percentage of sample is the percentage of individuals who engage in the activity. If a trip involved more than one mode, it enters more than once, so total trips are not constrained to sum 100. Other consists of housewives, persons on medical leave etc., shopping trips include food and leisure shopping. Non-response refers to the respondent not directly stating a mode for a certain combination of trip.

Table 5.1 demonstrates that the majority of trips were by car or a combination of car and other modes; significantly, walking and cycling trips combined, accounted for 40% of trips in and around the local area for leisure/social. Walking accounted for 28% of shopping trips within Penarth. Importantly, it seems as though cycling trips are underrepresented, but 15% of respondents stated that they already walk and/or cycle to work/school. This is due to

multimodality or people changing from their normal mode depending on the weather or work commitments etc. This is discussed further on in the Chapter as the household interviews demonstrate *how* and *why* people use a particular mode is full of complexities. A further interesting finding is that 28% of shopping trips in Penarth were by car, understandable when children and the amount of shopping bought is considered but by linking this to the subtheme of “parking, congestion and delays” we can see that this causes recurring issues and is a continuously mentioned problem for many of Penarth’s residents.

Satisfaction with local travel

This sub-theme originated from the open-ended question; “How satisfied are you with the travel conditions in and around Penarth and Cardiff?”. Table 5.2 demonstrates the level of satisfaction with travel conditions and provision in and around Penarth and Cardiff.

Level of satisfaction	Percentage of sample
Satisfaction with travel conditions in and around Penarth and Cardiff	66%
Satisfaction with walking and/or cycling provision	17%
Unsatisfied with travel conditions in and around Penarth and Cardiff	21%
Satisfied with some aspects	4%
Non response households	6%

Table 5.2 Satisfaction with local travel conditions

Responses to the question varied across households with many identifying both positive and negative aspects to satisfaction with travel. The majority of responses were positive and if there were negative comments, they came after first mentioning benefits. Most households were satisfied with many stating that

they would walk into Penarth and catch some sort of public transport into Cardiff, even if the car was their usual mode for other trips:

“Generally umm yeah it’s pretty good... [because] of where we live it’s literally the bus stop is there, the train is there... very convenient I mean and like he [toddler] loves going on the train and prefers to walk down there [station] and go into town rather than taking the car.” (Early 30s, female, walk/driver, living Penarth, working Cardiff)

The subthemes of “Satisfaction with Travel” and “Everyday Travel” can be linked by identifying the practical and personal constraints to travel participants faced, and the discourse on dissatisfaction with local travel. These include; poor public transport network links and services; both within the area and further afield (6% of households suggested this was a major issue), and a lack of knowledge with regards to public transport provision and timings (19% of households). Participants also suggested that making route and network design and signage clearer, or increasing public transport frequency, would help their partners make more informed decisions if they wanted to/could not use the car:

Male: "For me... there's no problem taking the bus into Cardiff because there's three routes that come past the station but when you want to go beyond... to another part of Cardiff there is no way of easily finding out which bus it is or where to get it... which makes it hard to visit family who live locally, especially for you [wife], you have a complicated bus route." (Early 40s, couple with children, Car/public transport/cyclist, living in Penarth, working Cardiff)

Male: "I recently, we recently had one of our cars that was out of action so [wife] had to take public transport to work for two weeks. On a Sunday."

Female: "On a Sunday and there was no train that would get me into work on time at all on a Sunday and on the way back for Sunday I had to wait a whole half an hour to an hour for a train and it was only half past five, it wasn't late so Sunday trains are a nightmare. During the week they're not too bad but again for people that work late nights, I work till quarter past eight every Monday when it hits I think six o'clock the trains go from every quarter of an hour to every half an hour which is a big wait when you've been working all day and want to get home." (Couple late 40s, drivers, both work Cardiff, live Penarth)

There were also recurring statements suggesting further dissatisfaction with local travel conditions. A few households stated that they only used public transport because they lived close to a train station or bus stop and 15% of households stated issues with the convenience of the stations/stops i.e. that they are located too far from home/work/destination. The rationale behind such decisions would introduce an interesting discourse where one partner would contradict the other's justification. This was particularly mentioned by households whose demographic profile or modal choice had recently changed and/or whose everyday mobility was constrained in terms of time.

“The train is not too bad but the thing is... there’s not a stop near to where I work, I have to walk quite a distance so that was fine before [children], but now having to get back in time to pick him up [from nursery]... it’s a bit time consuming and costly having to pay for nursery, and there’s no direct bus.” (Early 30s, female, driver/walk/cyclist, living Penarth, working Cardiff)

Male: “I’m not that satisfied... I [cycle] to the train because it’s convenient but if I didn’t live near a train station I’d drive into Cardiff and park the car there.”

Female: “...you’re always saying that but I think secretly you like to go, you like cycling” (Early 40s, couple with children, Car/public transport/cyclist, living in Penarth, working Cardiff)

The themes of “Personal” and “Practical” are valuable and exploring them suggests that they do influence everyday travel and satisfaction with local travel within households. Now the subthemes of time, space and body are discussed.

Time

Congestion, parking and delays (personal and environmental)

The subtheme of “time” requires significant consideration as many respondents continuously referred to issues with personal and practical time constraints of travel. This included time spent in traffic congestion, finding suitable parking spaces, getting children to/from school or after-school activities and also, importantly, some respondents acknowledged that the time spent in a car on the daily commute would be equal to the time spent if they cycled to work.

Time was seen as a recurring issue with drivers viewing the car as convenient but still time consuming due to congestion levels in the area, and time “wasted” finding suitable parking. Most walkers, cyclists and public transport users agreed that driving in the area was seen as too time consuming. It was suggested that

travelling to a destination by foot, cycle or public transport would take a similar amount of time as travelling by car. Respondents agreed that parking was either too expensive or that there was not enough suitable provision (24%) with 34% agreeing that the congestion in the area was bad. There were four households who had given up one car, two of which now did not have a car in the household; they agreed on the benefits of reducing or giving up driving by highlighting the time consuming problems of local travel within the area:

"I did own a car a couple of years ago and I used to drive but because of traffic it used to take basically the same amount of time as it does to take the train and walk. I have to concentrate; I can't sit and read a paper so I'd prefer the train basically." (Late 20s male, public transport user, living in Cardiff Bay, working in Cardiff)

"[Work] is an hour's cycle ride each way... and it saves me money, and it's a work bike so it didn't even cost me for the bike... to drive in the rush hour in the morning it takes me about 40 minutes... and the train about 40, 50 minutes so it's not much worse than the bike." (Late 20s female, cyclist, living in Penarth, working in Cardiff)

In contrast there were households who identified issues with congestion etc. but as it had a limited impact on their daily activities (due to work/school location), they did not openly acknowledge that their actions still contributed to wider problems:

"I think if I had to leave Penarth to be in work in Cardiff every day at 9am, it would be a nightmare. I'm very lucky... I somehow seem to be going the opposite direction to the traffic, so that's unusual actually, so if it was the normal I'd be in a traffic queue." (Early 40s female, driver, living and working in Penarth)

Public transport in the area was also viewed as time consuming for respondents; 3% of households stated that they chose to commute to work by cycle due to the lack of interconnecting public transport networks, unreliable services or the

extended journey length due to transport hubs being “too far from the workplace”. For one household however, one partner dictates the reasons behind the other’s choice to cycle to work when in reality the reasoning and outcomes are due to different motivations:

Male: “The thing is though, now I can’t imagine ever driving to the Bay, I’d do anything but drive, so I would take public transport but I just like cycling.” (Early 30s couple, female walk/driver, male cyclist, living in Penarth)

For this and subsequent households however, if driving was not an option and they faced walking or cycling to work they would choose public transport, even if they had previously stated that it was too time consuming or that services were unsatisfactory:

Female: “I would avoid the bike for work only because there’s, there is shower facilities at work but I’m a girl... so I would probably use public transport. We would probably as a family use public transport a lot more like get the bus to the shops and that sort of thing.” (Couple, late 30s, drivers/male cyclist, living Llandough, both work Cardiff)

The unreliable nature of public transport in the area was also further acknowledged. Most regular users would revert back to driving on days where time was considered tight as a way to regain control over strict timescales:

“Monday to Friday I walk to the railway station just to the top of here and then... get the train from there to a mile away from work and then walk the last bit; apart from on a Wednesday when I do that club and I have to be back at a specific time. I can’t rely on the trains being on time, so one day a week I drive.” (Late 20s, female, public transport /drive, living Penarth, working Cardiff)

Although 34% of households used their car to access Cardiff from Penarth for shopping or leisure activities, 28% of respondents preferred to walk/cycle and/or

use public transport. A few households, depending on the weather, stated that they would walk into the city centre if time was not a restriction as it was seen as a better option than driving or public transport:

“If I’m going into Cardiff shopping for the day or you know to the Bay for a meal then I tend to walk because it’s nice... it takes less than an hour to walk into Cardiff Bay umm and because if you get a train to Cardiff Bay, it’s two trains so it’s a bit of a faff to get across the river to somewhere you can see and on a nice day it’s lovely to go either the Barrage way or the Pont-y-Werin way.” (Early 30s, female, walk/public transport /drive, living Penarth, working Llandough)

As identified within this theme, the perceived causes of lack of time and other associated beliefs varied across households due to differing personal and practical perceptions and constraints.

Perceptions of space (environment and personal)

“Space” within the local area, and how householders move through and used their local space was seen as a predominant but complex subtheme. This next discussion examines household views towards the positive and negative aspects of travel in and around Penarth and Cardiff. Respondents highlighted the positive aspects of moving around the area with 59% agreeing that access to public transport provision, for example, was “pretty good”. Additionally having access to the Pont-y-Werin and the Barrage and was viewed positively, even if for the majority of the time, they were mainly used for leisure activities rather than a combination of leisure/utility. There were however multiple personal and practical issues discussed by households contemplating changing their travel behaviour. These included insufficient cycle storage and a lack of secure areas at home and work, and a lack of general knowledge as to how to efficiently and

conveniently switch to more sustainable modes. Thus the next discussion from includes household perceptions of levels of walking and cycling in the area and whether the recent infrastructural interventions, including the Pont-y-Werin and the Cardiff Bay Barrage have influenced active travel levels.

Perceptions of walking and cycling levels in the area (personal)

Householder discussions on the perceived active travel levels and the effects of new schemes and provisions (i.e. the Pont-y-Werin and the Cardiff Bay Barrage) created some interesting and diverse responses; Table 5.3 provides an insight into responses when participants were asked “Is there much walking and cycling in the area?”

Walking and cycling activities in local area?	Percentage from sample
Agreed that there are high levels	85%
Agreed that active travel levels were on the increase	15%
Agreed that people were actually walking or cycling for leisure	23%
Agreed that people were commuting by bicycle	15%

Table 5.3 Interview question on levels of active travel in local area

The following quotation demonstrates the diversity of responses between householders when discussing active travel in and around the area and the new Pont-y-Werin infrastructure.

Female: "There definitely is more now, I think ummm like cycling you see a lot more people all the time. It's amazing the amount of people you see when you're going to work every morning and stuff there's loads of people doing it, so I think especially because it's a cheap way of doing it, I think more people are doing it now."

Male: "Is it because it is cheaper or is it because it's quicker than driving around here?" (Early 40s, couple, cyclists, living Penarth, working Cardiff)

Female: "...I usually see people on it there are people like walking back and forth but I think it's brilliant it's like a nice railed route around the bay and you've got options, you can go across there or you can go across the barrage."

Male: "So and I think it's made a real difference, I think it's made the whole bay area much more attractive to people I would have thought. It's like where before it was really you could either go one way or the other but you couldn't go all the way round." (Couple late 30s, driver/walk/cycle, living in Penarth, working in Cardiff)

From such responses it could be considered that walking and cycling are indeed viewed as inferior modes by this cohort of participants. Participants commenting on "amazing the amount of people", "I think it's brilliant" and "It's made a real difference" as if before the Pont-y-Werin was installed, there really was a consensus view that walking and cycling were not considered to be viable modes. There is also a sense that active travel would be difficult to introduce to the mainstream system which aligns with Aldred (2012) suggesting that (walking and) cycling has been devolved from transport and possibility shifted to "leisure", "sport", "recreation" or "play". Table 5.4 demonstrates the general impact of the Pont-y-Werin on household active travel and activities.

Impact of Pont-y-Werin	Percentage of sample
Heard about the Pont-y-Werin	79%
Crossed the Pont-y-Werin	68%
Agreed that it has made or will make a considerable difference to active travel levels in the area	66%
Agreed that the Bridge has had some sort of impact on everyday activities (i.e. commuting, leisure,	47%

Table 5.4 Impact of Pont-y-Werin

Some respondents said that they did not currently use the Pont-y-Werin (13%) but could see how in the future it would be used; e.g. to help with their partner's business, if the Barrage was closed, if their children wanted to access the ISV facilities, or to visit friends in the Cardiff Bay area:

"I think it'll increase it, you know it's definitely increased it for me... even just the walking side of it, you know before I would walk over the Bay over the Barrage and stuff which is nice but if I was working in the Bay which I do occasionally, walking back I'd have to go the long way round, whereas now I can just come straight across [Pont-y-Werin] or I can just do a circle route on the weekend and things, it's definitely made it better." (Mid 30s, female, driver/walker/cyclist, living in Penarth, working in Cardiff)

Households with teenage children often spoke of the "freedom" it now permits, both from the parent and child's perspective, this is important due to the wider consequences independence, responsibility and "freedom" can have on young adolescents emotional, physical and mental wellbeing:

Son: "It gives me my freedom."

Female: "It gives me more freedom too!"

[Laughter] (Couple with children, mid 40s, walk/cycle/drive, work in Cardiff, live Penarth)

Those disagreeing that the Pont-y-Werin would have a significant impact stated such excuses as "the hills are too big", "not much space" and "only when the linking routes connect you to the Bridge". Some households strongly disagreed that the Pont-y-Werin would affect levels of active travel:

"No, it won't make any difference, 90% of people travel by car, people will never stop using their cars in Penarth, the infrastructure for that kind of thing just isn't there and it's not safe." (Mid 70s, retired male, driver, living Penarth)

Female: "Well I mean generally it's pretty good but trying to get across the Pont-y-Werin is a pain in the backside because you've got to go down Windsor Road."

Male: "I mean it's, I never cycle down there, never, ever, ever cycle down there. I only ever go across Pont-y-Werin frankly now if I'm out running because I can run up a pavement that's easy, you can't really cycle up the pavement as easily as you can run up it so yes so but apart from that we're really lucky aren't we, we've got the train, we can go by bus, we can go by car, we can go across Cardiff Bay barrage..." (Couple with children, late 30s, cycle/walk/car, work Cardiff, living Penarth)

So far, this theme has focused on discussions about satisfaction with local travel, perceptions of active travel and briefly upon the impact of interventions in the area. It can be seen that there are ever more practical and personal issues that inhibit active travel at the household level, whilst the contrasting or cynical answers demonstrate that the nuances behind household dynamics require further investigation. Further issues households faced stemmed from spatial conflicts between active travellers and other road users, alongside geographical inhibitors such as the topography of an area.

Further constraints: Spatial conflicts and topography (environment)

There are of course many more constraints, and perceptions of constraints that affect travel behaviour. This subtheme allows us to examine the common recurring issues regular walkers and in particular cyclists face, and the further practical and personal issues they contend with. Respondents stated that additional improvements to transport provision (47%) is needed such as further increasing of cycle (segregated) routes, upgrading of pavements, and better

network linkages and network signage. If provided, these could help reduce some of the conflicts faced between other road users (including pedestrians).

Female: "[T]hey've gone to great efforts I think to sort of put in cycle lanes etc. though a little confusing, they can be 50 yards long then you've got to go back to the main flow with the traffic."

Son: "It seems a bit ridiculous to me, it's either a bike lane or not, I think probably that causes more problems than it actually helps really." (Couple mid-40s, son 17, drivers, living and working in Penarth)

"I think the cycling could be a lot better. [T]he problem is... if we want to cycle into Cardiff, for example, if we went over the Bridge the first thing we have to do is work out how to get around all the area around [the supermarket] and the swimming pool... You definitely get the impression, particularly around junctions, you get the impression that the people that designed it or authorised it have never been on a bike." (Mid 40s, male, cyclist, living in Penarth, working in Barry)

It is interesting that this household sees both respondents having similar views on the worth and benefits of cycle lane provision within the local area. This quote supports the second statement with the respondent suggesting that, where provision is good, signage is lacking. Issues with cyclist/pedestrian interaction saw 15% of households stating conflicts either where cyclists are using the pavements, or with the insufficient number of cycle/pedestrian crossings etc.

"It makes it difficult because it's putting cyclists and pedestrians in direct conflict a lot of the time. You know when there is not enough space they use the space where the pedestrians were." (Mid 30s, male, cyclist, living and working in Penarth)

As well as constraints arising from Penarth's street planning and road layout, several studies have also focused on the inhibitors the natural environment introduces (Bickerstaff and Shaw, 2000) such as the topography of the area. The

main access road to Penarth from Cardiff city centre presents a steep incline in to the town. There are also significant hills along the seafront in Penarth when entering the town from the Barrage. Gradients across the area (particularly by the Barrage) were commented on by 13% of households stating that it resulted in a quieter route (for all modes) but it was often suggested that this would discourage active travel due to users requiring a certain level of fitness:

“I did go over the Barrage the other week and go up the hill, which in terms of quietness it’s better but in terms of the hill... that hill’s a killer!” (Late 20s, female, cyclist, living in Penarth, working in Cardiff)

The topography of Penarth impacts respondents modal decisions for work; when asked about distance and mode used for utility travel, 70% worked in the local area (Penarth N=17%, Cardiff N= 53%) however needing the car for work alongside the landscape were seen as common constraints to active travel, even when work and home were in close proximity to each other. Alongside this, the rationale and justification behind travel decisions were often validated across householders; to support of each other’s responses:

Male: “So I... use the car to travel, go to work which is based in Cardiff. I use the car, within my work as well, travelling across Cardiff umm, quite regularly...”

Female: “It would be by bicycle if [husband] was fitter and there were less hills.”

Male: “...but sometimes we have to transport families so by bicycle that would be very tricky.” (Early 50’s couple, driver/walk, living Penarth, working Cardiff)

This theme has introduced and examined the perceived personal and practical inhibitors to household active travel from a spatial perspective. The discussions on satisfaction with local travel, perceptions of walking and cycling levels in the

area, and also an identification of some of the further constraints help establish and confirm a degree of solidarity within households when discussing decisions and justifications behind travel.

Body (personal and environmental)

This section explores the multidimensional issues households face in terms of travel behaviour and the uptake of active travel. It examines the relationship households have with their local environment and how these impact capacities and capabilities. Respondents regularly discussed issues with poor driver and cyclist training and education. This suggests that further improvements are required in terms of driver awareness and cyclist proficiency; hopefully leading to improved road safety levels. Additionally, perceptions of individual and family safety during travel, and fear of crime were seen as important areas regularly discussed through household-wide discussions.

Confidence, safety and fear of crime

Confidence and stress levels whilst walking and cycling (e.g. due to traffic levels and congestion) impacted household personal and practical motivations to undertake active travel. For cyclists, moving around the Cardiff area was seen in a positive light, except for cycle security and fear of crime. On the contrary when in Penarth, or when cycling between the two areas, issues with personal and family road safety were common topics under discussion. As can be seen from the example quote below, both householders have individual concerns but link to the same theme:

Female: "Cardiff Bay and Cardiff are great, umm in terms of cycling it's once you get into Penarth that's the problem. Literally the moment you get off the Bridge [Pont-y-Werin] its stress and you know I don't like it, we will quite often get off the bikes at rush hour... I leave here early in the mornings so I'm not going through really busy traffic. So it's just Penarth, Cardiff's great, you know I can get almost all the way to work without going on a road."

Male: "Ah, yeah in Cardiff definitely, you know I like the dual cycle pathways are good, you know I'm not, not that confident on a bike so I don't like being in traffic if there's an alternative, then I'm gonna use it." (Early 30s, couple, cyclist/public transport, living Penarth, working Cardiff)

From this, 40% of households agreed that the provisions for walking and cycling were sufficient. However, 23% were strongly unsatisfied stating such examples as "not user friendly as fails to connect areas", "some cycle lanes are too dangerous as when they end, they lead you directly into the traffic" and "need more cycle crossings" and "cycles lanes are too short". The concept of safety was a major recurring issue with 34% of households agreeing that road traffic made Penarth even with the Pont-y-Werin, too dangerous for cycling as they felt vulnerable on the roads. Only 4% of households stated that travel conditions are safer now than in previous years. Respondents' statements suggest that further route and cycle lane improvements and extensions are required to improve safety, confidence and also if further route segregation is undertaken then the car/cyclists conflixtions could be further alleviated.

Female: "I would say the one thing about this place about cycling into Penarth because I do it occasionally and back is the bit after you come off that mini roundabout and go under the railway bridge that's a bit narrow there... Especially with the cars parked."

Female: "But it's because it is so narrow there, it would be nice if they could I don't know, I don't want to deny the people parking outside their house but there's that one bit where..."

Male: "Just the first sort of houses as you go under that bridge by there it's quite narrow, a bit hairy. It is because they do two cars either way don't they, so oncoming and..."

Female: "Really squeezed."

Male: "Yes so when you're on a bike and there's a car trying to overtake and a car or a bus coming in the other direction..." (Couple late 30s, cyclists, living Penarth, working Cardiff)

Personal and family safety, in particular for spouses and children was discussed with 11% of households mentioning this as an issue. It was seen that allowing children to walk or cycle to school, or in and around the area was perceived as a positive experience but safety or vulnerability due to age, confidence or experience resulted in parents being anxious about their child's independent mobility.

"Oh I'd be delighted, provided of course they were safe, again as a parent you want to know that they're cycling in a safe area." (Mid 40s, female, driver, living and working in Penarth)

"I suppose, I might be a bit ummm cautious if they were doing that regularly, especially if he [partner] wasn't wearing a helmet and I know people can be quite vain. I would be I probably wouldn't wear a helmet so that would be a minor concern but, apart from that, fine. And like I said as well at night, at Dumble's Road, which is the main road linking us and town, it's not terribly safe at night, neither Bute Street or Lordridge Avenue, the main routes at night aren't particularly great for walking at night, on your own." (Early 30s, male, public transport user, living in Cardiff Bay, working in Cardiff)

This last quote links into the fear of crime both genders perceived from cycle security due to a lack of sufficient cycle lockups at home, work or in and around the area with 26% of households stating that this would put them off walking and/or cycling.

“You know today of course, sadly we have to lock up our bikes... Even if it is chained up, chances are the wheels are taken, so times have changed so therefore we’ve got to change with it”. (Mid 40s, male, driver/ public transport, living and working in Penarth)

“I thought I could go with the boys which I can’t, because I simply don’t have anywhere to keep a bike which is my big bugbear. You know we’ve got a big shed that’s got rubbish trolleys in it or whatever, it’s dirty and scruffy in there and they could easily accommodate, yes I’m sure. So with a little bit of pressure, I think really with new builds, I think the government will have to bring in something, whereby you know, new builds, now have to accommodate umm cyclists.” (Late 40s, female, walker/ public transport, living Penarth, working Cardiff)

Additionally, fear of crime from a personal/family safety perspective, particularly during the night in Cardiff was mentioned by 4% of households. No households stated these fears were present in Penarth.

“I can’t imagine that many people would probably walk, I mean I don’t mind walking into Cardiff, it’s an hour but that’s quite a long way really isn’t it, and it’s not, you have to walk through Grangetown and stuff which isn’t the nicest of areas to walk through.” (Late 20s, female, walk/cyclist, living in Penarth, working in Cardiff)

“I’m not terribly happy walking around at night sometimes and [at Cardiff Central] I don’t think there is adequate security down there, I don’t know, I probably wouldn’t be happy leaving my bike there the whole day.” (Early 30s, male, public transport user, living in Cardiff Bay, working in Cardiff)

When exploring household decisions to increase active travel levels, there are a wide set of complex issues to consider. It can be seen that respondents’ anxieties

for example, trickle across to other household members and create wariness about individual confidence and abilities.

5.5 Discussion and conclusion

The study reported here focused on perceived and actual household-level constraints to active travel within Penarth and Cardiff, Wales within the context of a physical intervention aimed at increasing walking and cycling. It examined the range of personal and practical inhibitors that continue to impede household active travel, after infrastructural interventions have been introduced.

In terms of general conclusions, the views expressed vary somewhat in terms of age, gender and which side of the bridge the participants reside (and whether they would need to cross it for utility and to some degree for leisure purposes). When examining age, participants in their 20s expressed a greater willingness to limit their car use and either cycle to work for example or take the train/bus and walk. Those in their thirties were concerned for their own personal safety and for the safety of their family members whilst undertaking active travel but agreed that the Pont-y-Werin provides people with more travel options and makes the area more attractive. Participants in the forties wanted their children to benefit from the freedom surrounding independent mobility which in turn benefited them by allowing them more freedom. They did however still find the routes and signage confusing or limited. Participants fifty and over seemed keen to increase levels of walking, stated that they would like to start cycling, but found the area too hilly alongside a perceived lack of fitness and adequate infrastructure (see Table 5.5).

	Benefits	Disbenefits
Twenties	Saving money, longer by car	Fear for personal safety
Thirties	More options for local travel and a noticeable increase in active travel. Whole area more attractive.	Lack of adequate cycle lock-up facilities, fear of crime and personal safety, conflict with other road users
Forties	Independence for children, freedom for children and parents. A noticeable increase in active travel.	Fear of crime, lack of adequate cycle lock-up facilities, lack of signage and connections
Fifties +	Cycling faster than walking but too many hills	Lack of physical fitness. Not safe in Penarth due to lack of infrastructure

Table 5.5 Benefits and dis-benefits associated with active travel by age of respondent

Therefore when considering the Pont-y-Werin and in general when moving around the local area, it can be seen that age impacts the choice of travel mode, the feelings experienced whilst travelling and the potential for changing current travel behaviour.

In terms of gender, both women and men perceived a fear of personal safety, fear for the safety of others and a fear of crime when moving around certain areas of Cardiff (including areas near the Pont-y-Werin) as well as the issue of adequate safe lock-up facilities for their cycles. Both female and male participants discussed the issues of road space whilst cycling, the lack infrastructure, issues of the area's topography as well as an obvious increase in levels of active travel. Women mostly preferred to travel by car, walk or use a combination of walking and public transport. Men mostly preferred to cycle or use public transport. Both women and men spoke of the positives and negatives of the Pont-y-Werin equally.

In terms of geographical proximity to the bridge, participants who lived closer to the bridge used it more for leisure active travel trips and those who lived further into the centre of Penarth, used it for both leisure and utility. It seemed more apparent that those living on existing active travel routes, or near a train station or bus stop were less likely to use a car for both leisure and utility travel. Those who cycled for utility did so due to a lack of time (i.e. car travel affected by congestion) or for financial and health reasons. Those who walked, either combined the trip with public transport, or walked into Cardiff Bay for physical and/or mental wellbeing. In terms of public transport, it was positively discussed within the interview if people lived close to a station or a bus stop however, issues were raised the end of a trip with stops/stations being far away from participants work destination. Additionally, when travelling further (i.e. the other side of Cardiff) issues with public transport were raised, especially if travelling on a weekend. It is heavily perceived that the Cardiff side of Pont-y-Werin has superior infrastructure, signage and routes (if a little confusing and lacking clarity). These concerns were all mentioned by participants living on the Penarth side of the Bridge and travelling in to Cardiff, the sample of participants on the Cardiff side of the bridge was limited and therefore needs further investigation. It can however be seen that the geographical element has an impact on active travel as a result of the Pont-y-Werin as well as residential distance from a public transport hub.

Findings indicate that when householders are generally discussing other peoples' practical (environmental) travel a greater amount of cynicism is introduced to their answers (e.g. "I don't count cyclists so don't know whether numbers have increased" and "traffic around here is terrible, that's why people cycle"). When discussing other householders' (in particular their partners') constraints to active travel, householders react from contradiction, to pessimism, to teasing ("you'd have to cycle to work" – "I'd take public transport!" – "But you said the trains don't get you there on time..." and "you'd struggle to use public transport to get to work so you have to cycle" – "I would never consider driving so I would take public transport if I couldn't cycle"). When householders provide information regarding personal constraints to increasing their level of active travel however, for all household members including children there is a far greater degree of solidarity and support within the household group (being fitter, being less hilly, safety, independence, having more confidence).

Alongside these key findings, there are concerns about the time consuming nature of travel, particularly commuter travel within the area. Drivers are both affected by, and are the cause of, serious congestion and delays with 28% of local shopping trips within Penarth currently made by car. Public transport users face unreliable services with *perceived* unachievable distances from stations/stops to destinations (work/home). Additionally, for 19% of households there is a lack of knowledge regarding public transport routes and timings which inhibits a greater uptake of public transport for commuter travel in the area. From an active travel perspective, those who are regular walkers or cyclists contend with cycle security

concerns, conflicting road ownership issues and disjointed cycle routes. Thus the perceived and actual impacts seem to both directly and indirectly affect all members within a household. Subsequently, for *potential* walkers and cyclists, there are perceptions that distances are too great and/or that supporting facilities are not present at start or end destinations, however when this is discussed from a “leisure” perspective, these concerns are not vocalised. Interestingly, certain households increased their walking and cycling for leisure, but when faced with an active commute, would revert to the infrequent and unsatisfactory public transport option if driving was not possible. This again presented some interesting intra-household dynamics whereby certain household members “caught the other one out” in the way that their concerns were articulated and justified. This was also apparent when looking at power relations within households; often if an individual’s initial statement was not accepted by the other respondent, they would quickly and, seemingly subconsciously, change their view to agree with the other persons; “Is the Pont-y-Werin regularly used?”, for example, would stir mixed opinions and responses.

Within these broad trends, it is of course important to differentiate between the perceptions of local travel for commuting and leisure. For instance, results indicate that 59% of households are satisfied with public transport provision around Cardiff (excluding the provision to and from Penarth) and 34% of households stated that they drive from Penarth into the City for leisure purposes. This is one of many examples where the gap between perceptions of the quality of travel provision, and the actual choice of mode used to access local

destinations could be improved through targeted information, incentives and regulation on the benefits of public transport and active travel. With 49% of households agreeing that more needs to be done in terms of active travel provision, it can be seen that more *hard* a travel behaviour measures need to be introduced. This could include for example, further improvement of route signage, pedestrian and cycle crossings, cycle lanes and cycle parking facilities (as mentioned by 23% of respondents). This, in combination with more *soft* measures, such as better localised promotion of the Bridge and of the linking networks (only 79% of respondents had heard of the Pont-y-Werin)⁹, as well as more investment in education and information provision, incentives, cycle training, as well as awareness programmes could result in an increased uptake of active travel (Abroms and Maibach, 2008).

Lastly, results can be seen to replicate the findings of other academic studies (Lorenc *et al.*, 2007; Tyrell, 2000; Cahill *et al.*, 1996). Dora's (1999) study for example, looks at parents establishing active travel habits for their children within their local neighbourhood by suggesting that children should be encouraged to engage critically to establish social norms. Further examples indicate that parents perceive a trade-off between fostering independent mobility and ensuring their child's safety. The results of this study replicate this, with 34% of respondents agreeing that in the first instance, the roads in Penarth and Cardiff were too dangerous for walking and cycling, and 11% expressing fears for their children's safety due to their vulnerability, experience and confidence whilst

⁹ Similar findings to iConnect core research (Goodman *et al.*, 2014)

undertaking active travel alone. Intervention design needs to take this perception into account and where appropriate, to the address social norms that discourage parents from allowing their children to walk and cycle (Dora, 1999). On the contrary though, for some teenagers within certain households, the opportunities to access facilities near the Bridge were perceived as allowing increased “freedom”, both for themselves and their parents. This is extremely relevant as these new freedoms can have an impact on the wellbeing of young adults (and therefore their families) due to the increased opportunities to; improve life and day satisfaction (i.e. evaluations); everyday activities and experiences (i.e. experiences) and importantly; greater opportunities for personal flourishing (i.e. eudæmonia). Such findings begin to highlight the relationship and linkages between travel behaviour, active travel and wellbeing.

In summary, this Chapter has sought to examine unique insights into intra-household dynamics thus helping to reveal the specific contexts and circumstances under which physical interventions are more or less likely to increase active travel levels. Caveats to the research include possible misallocations of attention due to social acceptability bias and interviewer bias. Respondents may have felt a need to provide certain types of responses so as to “fall in line” with the researcher’s preferences or perhaps to avoid giving a negative perception of the local area. Therefore, future research would seek to include a slightly wider ranging interview schedule with no obvious acknowledgement that active travel is the main focus. Additionally, ensuring all householders were present at the time of data collection is complex; all pre-

interview correspondence and materials directly highlighted the need for a “full household” to be present. This however was sometimes disregarded/difficult to implement. Finally, there are a number of constraints and perceptions of constraints that go beyond the scope of the research documented in this Chapter. These include examining the impacts of the financial costs of travel, the effects of the weather on active travel levels, attitudes and concerns over the environment and social norms, as well as the issues of individuals’ perceived lack of fitness. Lastly, there is also a need for further research focusing on whether travel behaviour is sustained over time, as well as measuring any changes and the resulting impacts on physical and mental wellbeing. This last point is the focus for the research presented in Chapters Six and Seven.

5.6 Reflection: Qualitative to quantitative

This reflective section aims to comment on Chapter Five. It provides a discourse on the transition from the results, analysis and qualitative research outcomes within this Chapter and contributes to the context, purpose and intended outcomes of Chapter Six. In order to answer Research Question One and Two, whilst also tackling Objective Two and Four, the next Chapter will use the knowledge and data obtained so far, and apply it to its empirical research design as well as periodically throughout the remainder of the thesis. As with most qualitative research, the aim of this study was to produce in-depth, exploratory and explanatory findings rather than to address the expectations of representativeness or generalizability (Guell *et al.*, 2013). The more that can be learned about the expectations and constraints faced by individuals or

households in terms of increasing active travel, the more effective policies that can be made and targeted to meet specific needs. The next chapter addresses and extends the outcomes of Chapter Five (i.e. recording and evaluating individual and household travel behaviour). It will measure and evaluate the study cohort's actual travel experiences and the impacts and affects travel has on moods and emotions across time and space. It is hoped that this will highlight reasons for a lack of active travel uptake or go some way to explain the increasing dominance of the car within this case study. The highlighted text box below revisits the research questions and objectives tackled within these Chapters.

Chapter Five and Six: Research Questions

- 1. What are the links between travel behaviour and wellbeing?*
- 2. What are the perceived and actual constraints to walking and cycling among households and individuals?*

Chapter Five and Six: Objectives

- 2. Examine individual and household travel behaviour, in a case study context; to identify factors affecting travel choices.*
- 4. Develop a novel approach to identify and evaluate the case for “a greater understanding of context”; apply mixed-methods within a case study context in Cardiff and Penarth, Wales.*

Drawing on the literatures examining the relationship between wellbeing and travel behaviour, it can be seen that there is still a paucity of empirical evidence which explores and connects the two research avenues. Through applied research, exploring the impacts travel behaviour has on happiness and wellbeing by gathering empirical data is vital to understanding the contexts behind this

case study scenario. It is also important to empirically measure this relationship as it allows a robust interpretation of the rationale and justifications presented within, and the lessons learnt from the cohort's household interviews. It can be seen from current literatures and the discussions within Chapter Five that there are a broad spectrum of positive outcomes from increasing and sustaining travel behaviour change. Among many others this includes the public health benefits which can directly and indirectly affect emotional and mental wellbeing (Bradburn, 1969). Goodman *et al.*, (2014) (partners within the iConnect research consortium) conducted a study focusing on Cardiff but also Southampton and Kenilworth using data collected from 1796 adult residents in the three UK municipalities. Their findings support the potential for walking and cycling infrastructure to promote physical activity. The study's participants completed postal questionnaires at baseline (2010) and one-year follow-up (2011), after the construction of new infrastructure. 1465 adults completed the questionnaires at baseline as well as two-year follow-up (2012). Transport network distance from home to infrastructure defined intervention exposure and provided a basis for controlled comparisons. Results demonstrated that those living nearer the infrastructure did not predict changes in activity levels at one-year follow-up but did predict increases in activity at two years relative to those living farther away; effects were larger among participants with no car. Conclusions demonstrated that the new local routes may mainly have displaced walking or cycling trips in the short term but generated new trips in the longer term, particularly among those unable to access more distant destinations by car. Alongside the public health benefits of increased active travel the wellbeing consequences (i.e. the

benefits to emotional and mental wellbeing) as well as travel experiences are also important to consider; these are measured and evaluated within Chapter Six.

Considering the links between wellbeing and travel behaviour, a frequent assumption in travel behaviour research is that behaviours consist “mainly of routines as travellers prefer to repeat those activity patterns with which they were satisfied in the past” (Schlich and Axhausen, 2003:13). For households having access to a car, forced reduction in car use may have a large impact on wellbeing that has not until recently, been possible to assess. Gärling *et al's.*, (2002) study discusses a number of difficulties that car-using households are likely to have in adjusting to reduced car use. Jakobsson Bergstad *et al.*, (2010) also investigated households unable to use a car but suggested that these households may indeed be satisfied with their daily travel. This was due to the fact that they have adjusted their activity schedule so that they have little need for multi-purpose, multi-stop travel, for which the car is superior to other modes, or that they have chosen to live in areas which have access to satisfactory public transport services. Therefore as an example, increased improvements of public transport services are needed in order to achieve a more substantial reduction in car-use (Ettema *et al.*, 2011) but first it is important to measure the affect public transport use has on the cohort's wellbeing. Consequently, it is important to measure both utility and leisure trips when examining wellbeing as at present many studies focus solely on utility travel with large data sets concentrating purely on commuting.

As people spend a lot of time travelling it is important to measure and understand how and why people move about and the various impacts travel

experience can have on moods and emotions. This is important to explore in order to support the wider context provided by the household interviewing and qualitative findings. It also helps to identify how happiness whilst travelling can be increased and unhappiness reduced, alongside identifying which modes evoke more positive feelings. Objective criteria such as good health or gainful employment are not necessary criteria although they may influence wellbeing. Although there is a belief that objective measures are somehow more concrete than subjective measures, there is a genuine correspondence between self-reported levels of wellbeing and the metaphysical concept of “happiness”. This assumption has been supported by a strong correlation between subjective assessments and event-memory recall tests, assessments by family and friends, emotional expressions and brain activity (Sandvik *et al.*, 1993; Kahneman and Krueger, 2006).

Methodologically, to further understand household dynamics and interconnections, and to measure ratings of subjective wellbeing, informant reports were considered a potential quantitative method in this study’s mixed-methods approach. Informant reports are a commonly used alternative data source within the subjective wellbeing literature. Lessons from this method were applied to this study and outcomes were of particular interest as informant reports or ratings of subjective wellbeing of a target individual, are typically obtained from spouses and other family members, friends, co-workers or supervisors, or others who are well acquainted with the person of interest, a method which would be easy to implement within this study design. One

approach to the use of informant data is to obtain reports from several informants for each target individual, and then aggregate the data from the separate informant reports into one composite index. This procedure has the effect of averaging the ratings made by multiple informants and it tends to reduce the effect of error or response differences between the various rate-ers. This would have suited the householder-style of data collection as well as that fact that informant reports of life satisfaction have been shown to have substantial correlation to self-reports of life satisfaction (Pavot *et al.*, 1998). After much deliberation however, the DRM was chosen as the preferred method for this thesis as explained in full in Chapter Six.

Chapter Six - Exploring moods and modes: How transport mode impacts on subjective wellbeing¹⁰

There is increasing interest amongst academics and policymakers on the subject of happiness and public wellbeing. Within a transport context, one aspect would be to examine the experiences and effects different transport modes have on happiness whilst moving, and the potential impact on activities outside of the actual process of travel. From this, spill-over effects of transportation mode choice can be examined to look at the impact modes of travel have on peoples' moods during their daily activities. This Chapter investigates happiness and wellbeing amongst a cohort of respondents taking part in a larger travel survey (see www.iconnect.ac.uk). The exploratory results demonstrate that there are strong associations between happiness and wellbeing, and various travel modes, suggesting that attention to factors that influence journey experience could potentially contribute to improvements in overall national happiness. Highlights include the apparent associations between transport and peoples' experiences and the examination of the spill-over effects of travel mode choice on wellbeing.

¹⁰ This is the third of four papers in a series submitted for peer review. This paper was submitted to the journal "Transportation Research Part A: Policy and Practice" on 23/04/15

6.1 Introduction

Subjective wellbeing refers to peoples affective and cognitive evaluations of their lives and can be useful in assessing and evaluating the effects, desirability and outcomes of a given policy or policy intervention (Diener, 2000; 2006; Angner, 2010). With the aim of reducing oil dependency, and transitioning from the car to more sustainable modes, it is important to understand the impact of the experiences and emotions different transport modes have on overall wellbeing (Aftabuzzaman and Mazloumi, 2011; Chapman, 2007). Within a transport context, subjective wellbeing can be measured to better understand the effects of various transport modes on moment-to-moment moods. The literature suggests that sustainable transportation for both leisure and commuting, has the potential to change travel behaviour away from motorised modes (Banister and Gallent, 1998; Pucher and Buehler, 2008; Woodcock *et al.*, 2007). However, there is a lack of credible evidence on the wellbeing consequences of travel behaviour and the impact modes have on moods, and thus how well people can perform their daily activities. An important question therefore is how people feel using various transport modes and to measure the spill-over effects of transport on wellbeing. Spill-over effects occur when a problem arising from the preceding time period or its effects persist, because an individual has been unable to cope with the issue or that it takes some time to do so successfully (Marco and Suls, 1993). This Chapter therefore aims to establish a better understanding of transport decisions and subjective wellbeing by addressing the following objectives; (a) explore the existing evidence base and identify gaps in research relating to transport mode and the effects on mood and overall subjective wellbeing. (b) Identify and

examine the emotions and experiences from travel mode, and (c) look at the spill-over effects these transport choices have on daily life activities.

Findings from this exploratory research on the spill-over impacts transport modes have on moods may lead to future studies assisting in improved transport policy design and evaluation. This Chapter is therefore structured into five sections. Section two discusses previous literature on travel modes and wellbeing, exploring why there is a need to identify the spill-over effects of transport on everyday activities. Section three describes the sampling strategy and the method, and in Section four the main findings and results are discussed. The final Section presents the most important conclusions, caveats and recommendations for further research.

6.2 Assessment of literature

Subjective wellbeing is the subject of much discussion in academia and beyond (Diener, 1994; Diener *et al.*, 1999; Diener *et al.*, 2003; Dolan *et al.*, 2008; Kahneman *et al.*, 2004a; Kahneman *et al.*, 2010) and can be defined as comprising people's longer-term levels of pleasant affect, lack of unpleasant affect and life satisfaction. It has been proposed as an alternative to welfare and as a measure of individuals' benefits in a number of domains (Kahneman, 1999). Dolan *et al.* (2011) advocate, amongst others, to the Office of National Statistics (ONS) measurement of three separate elements of subjective wellbeing: evaluation, experience and eudæmonia. Experiences with travel are different to evaluations of travel (i.e. day and life satisfaction) with experiences examining specific domains such as family life, work life and leisure (Jakobsson Bergstad *et al.*, 2010).

Eudæmonia is included in the measurement of subjective wellbeing as White and Dolan (2009) suggest that thoughts as well as feelings are important to examine, as some activities that are relatively low in pleasure are nonetheless thought of as rewarding and therefore contribute to overall subjective wellbeing (e.g., work and time with children). The concept of eudæmonia adds an important perspective to the understanding of wellbeing as it is concerned with “living well”, “flourishing” or “actualising one’s human potentials” in so much as it is not an end state but a process of fulfilling our potential (Deci and Ryan, 2008:2).

Mobility often stimulates social and emotional wellbeing by providing improved access for quality interactions that are necessary for life’s necessities and experiences (Carp, 1988; Kwan et al., 2003). It is additionally widely accepted that mobility is critical for social integration in a complex urban society (Irwin, 1970) and is “essential to the maintenance of life satisfaction and wellbeing because it allows one to more readily meet all the other life needs” and wants (Spinney et al., 2009:2; Lawton and Nahemow, 1973). It can be seen that within a transport context, it is of interest to identify how people spend their time and how they experience the various activities and settings of their lives (Kahneman et al., 2004a; Kahneman et al., 2010), so that happiness whilst travelling can be improved. Collecting quantitative information about time use and the frequency and intensity of affective states such as stress and enjoyment etc. is important when measuring wellbeing. The focus on moods and experiences of travel and daily routines is relevant since travel that is experienced as pleasant is more likely to be sustained over a longer period. This results in the actual or anticipated journey experience

associated with different travel modes affecting travel mode choices (Ettema et al., 2011; Stradling, 2011). Therefore identifying what makes people suffer most in terms of transport mode can be a step change in a move towards improving the sustainable transport system; providing more pleasurable experiences and thus being closer to changing and sustaining changed behaviour away from motorised modes. An important research question for this Chapter, first raised by Ettema et al. (2010) is therefore; to examine the extent to which subjective wellbeing (moods and emotion) depends on travel context (travel mode). Consequently if such a relationship exists, subjective wellbeing measurement would potentially be a very influential tool for policy appraisal (Dolan and Peasgood, 2008).

Recently there have been a number of studies on subjective wellbeing and travel. Roberts et al.'s. (2011) study on commuting time-use found that commuting has a detrimental effect on the psychological health of women, but not men, due to a woman's greater day-to-day household responsibilities (e.g. childcare/housework) and not related to shorter working times or weaker occupational position. Moreover, Stutzer and Frey (2008) found a large negative effect of commuting time on people's life satisfaction. The study found that people in Germany who commute 22 minutes one way, (i.e. the mean commuting time for Germany), reported on average a lower satisfaction with life. From this, Ettema et al. (2012) suggest that activities during travel may be undertaken, not to make the trip more pleasant, but to achieve satisfaction in other life domains at other times and that the impact of activities may depend on an individuals' mind-set (possibly related to travel purpose). Ettema et al.'s (2012) study in particular sets the empirical basis for this

Chapter's research; understanding the spill-over effects travel has on moment-to-moment moods¹¹.

Travel in itself affects individuals' mood and leads to a cumulative satisfaction with the transport system, which in turn impacts on global subjective wellbeing. Travel may also affect subjective wellbeing in an indirect way; within travel behaviour analysis it is acknowledged that travel is valued because it is instrumental for engagement in daily activities. The availability of travel options is therefore an important determinant of how individuals and households schedule their activities (Ettema et al., 2010). Other studies have examined the value of travel (Mokhtarian et al., 2001; Mokhtarian and Salomon, 2001; Steg, 2005), the effect of social comparisons on travel happiness and behaviour (Abou-Zeid and Ben-Akiva, 2010) and the cognitive and affective responses associated with travel (Ettema et al, 2011). Stradling et al.'s study (2007a) suggests that independently of travel mode, a trip will result in a variety of affective responses, which will eventually impact on satisfaction with travel. Satisfaction with bus services depends on a variety of non-instrumental factors including cleanliness, privacy, safety, convenience, stress, social interaction, and scenery. Alongside this, the study found that pedestrians evaluated walking trips in terms of non-instrumental factors; crowdedness, air quality, presence of trees and flowers, presence of beggars, and type of pavement.

Subsequently, as suggested, travel satisfaction has a cognitive component related to cost, travel time, and punctuality so essentially, travellers' satisfaction stems

¹¹ Spill-over effects occur when a problem arising from the preceding time period or its effects persist, because an individual has been unable to cope with an issue, or that it takes some time to cope with the issue successfully (Marco and Suls; 1993).

from a whole variety of events experienced when using a travel mode. Travellers will likewise develop a cumulative satisfaction with these aspects based on their repeated daily encounters with services (Stradling, 2011). Therefore looking at the effects travel mode has on time pressure, delays or uncertainty in achieving daily and life goals and, more generally, the efficiency with which activities and projects can be carried out, all impact subjective wellbeing. This suggests that improvements in travel options, such as better reliability, could result in more efficient and less stressful performance of activities (Ettema et al., 2010) and reduce any negative impacts travel may have on moment-to-moment moods.

Numerous studies have supported the relationship between overall wellbeing and behaviour, demonstrating that people tend to repeat experiences that they remember as more satisfactory than others (Ettema et al., 2011). The literature in affective forecasting suggests people over-estimate how much (un)happiness they get from an event (e.g. commuting) because they neglect adaptation. The AREA model (Attend, React, Explain, Adapt) (Wilson and Gilbert, 2008) as discussed in Chapter Four suggests people attend to self-relevant events; react emotionally to these events; attempt to explain or understand these events; and, if they succeed, adapt to the events inasmuch as they attend less to them, have weaker affective reactions and thus make unpleasant experiences more tolerable.

So far however there has been limited research on the effects travel mode has on experiences, and daily experience of other activities; the spill-over effects. Studies have mainly concentrated on the spill-over of travel experience onto workplace performance and wellbeing (Olsson et al., 2012). Wener et al's., (2005) study for

example, examined the causes and nature of commuter stress of a trip and the spill-over into the workplace. Results show that commuters using an improved transit service showed reduced stress and reduced job strain compared to those who remained on the previous service. Mohd Mahudin et al., (2010) conducted a study on rail passenger overcrowding and found that the spill-over effects posed a significant risk to individual wellbeing and organisational behaviour. Westman et al. (2013) examined children's affective experience of everyday travel and suggest that travel mode seems to have a spill-over effect on affective experiences which has long-lasting effects throughout the school day. The study states that the physiological effects educed by active commuting are not likely to occur while travelling by car, and though children's cycling corresponds to a limited proportion of their total physical activity, the cycling that does occur have qualities that are important to children's health and well-being (Raustorp et al., 2013). From this, the present study seeks to examine the impacts travel has on subjective wellbeing when compared to other activities. It then examines the spill-over effects on overall daily life from the emotions and experiences before, during and after transport activities. This will demonstrate the impacts of transport mode on mood and other daily activities and see the different affective emotions as a result of different modes of travel.

6.3 Research design

Sampling

This study positions itself within the fields of transport and psychology forming part of the iConnect (Impact of COnstructing Non-motorised Networks and

Evaluation of Changes in Travel) consortium research programme. The iConnect study seeks to measure and evaluate the changes in travel, physical activity and carbon emissions at various “Sustrans Connect2” sites. The Connect2 site examined in this study is Cardiff’s “Pont-y-Werin” project connecting Cardiff and the dormitory town of Penarth to the southwest of the Welsh Capital. Before the non-motorised Pont-y-Werin was constructed, the main access route between the two urban centres was either by public transport (i.e. train and bus) or to drive or cycle across a busy dual carriageway bridge with no legal pedestrian access. The Pont-y-Werin is therefore positioned as a safer link in the 6.5 mile non-motorised circular route around the Cardiff Bay area.

The initial iConnect baseline survey helped to establish and build the sample of respondents; potential participants who indicated that they were willing to be contacted during future research. There were 659 participants who agreed to take part in follow up data collection in and around Penarth and Cardiff. Of these consenting households, respondents stating that they suffered from a long-term illness combined with a low intention (on a Likert scale from 1-5) to increase their active travel levels (N=120) were excluded. Additionally, households living outside three defined buffer zones (Figure 3.5) were also excluded from research (N=137) due to the distance to the intervention being too far, and therefore the impact that the intervention had on household travel being too small. These buffer zones were smaller than those defined by iConnect and were drawn at 0.5km, 1km and 1.5km distance from the recently completed walking and cycling intervention; Sustrans “Connect2Cardiff: Pont-y-Werin” (www.sustrans.org.uk).

Smaller buffer zones were chosen as the starting sample population (659) was smaller than iConnect's core baseline (1,130). The buffer zones were based on distance to the Connect2 scheme and were defined to draw the sample from: approximately 50% of participants from buffer zone A (i.e. 0.5 km with 200 households); approximately 25% of participants from buffer zone B (i.e. 1 km with 136 households) and approximately 25% of participants from buffer zone C (i.e. 1.5 km with 66 households). Therefore, of the 659 participants who agreed to participate in follow-up research, a total 402 households were contacted.

Each household contacted received a recruitment pack consisting of an invitation letter (Appendix C), a stamped return postcard (to indicate willingness to participate) and an information booklet (Appendix D). A 35% response rate was achieved with 141 respondents. To reach the final sample of 60 households, further sampling criteria were applied to further exclude respondents with a low-to-moderate intention (on a Likert scale from 1-5) to increase their active travel levels (N=81). The final sample included in the study focused on respondents who "had intentions to do more active travel over the coming months" and who had stated a moderate-to-high intention (on a Likert scale from 1-5) to increase their walking and/or cycling levels (with or without a long-term illness). *Of the 60 households, 15 were included in a pilot study undertaken in April 2011, followed by the remaining 45 being surveyed in July 2011.* Each member of the household present at the time of data collection who agreed to take part in this element of the study completed a subjective wellbeing survey to measure and evaluate the

three elements of wellbeing; evaluation, experiences and eudæmonics (Dolan *et al.*, 2011). Overall, 63 surveys were completed.

Measures

The Day Reconstruction Method (DRM) was used to assess how respondents spend their time and how they experience the various activities and settings of their lives. Adapted from the work by Kahneman *et al.* (2004a) and the subjective wellbeing measures advocated by the ONS (Dolan *et al.*, 2011) the survey is designed to collect data by systematically reconstructing activities and experiences of the preceding day and includes procedures designed to reduce recall bias. The DRM combines elements of experience sampling and time-budget measurement (Juster and Stafford, 1985; Robinson and Godbye, 1997; Stone *et al.*, 1999). It additionally employs techniques which aim to recover affective experiences through facilitating accurate emotional recall (Kahneman *et al.*, 2004a; Kahneman and Krueger, 2006).

The DRM provides an accurate picture of the experiences associated with activities (e.g., commuting) and circumstances (e.g., traffic jams). Respondents were first asked to create a short diary which consisted of a sequence of episodes to help revive memories and re-instantiate the previous day (see Appendix A). The survey began with the statement:

“Please describe your day. Think of these hours as a continuous series of scenes or episodes in a film that covers all of this time. Give each episode a brief name that will help you remember it. Write down the approximate times at which each episode began and ended. Try to remember each episode in detail, and write a few words that will remind you of exactly what was going on. What you write only has to make sense to you, to help you remember what happened when you are answering the later questions”.

Episodes by respondents included examples such as “Commuting to work” or “Cooking supper”, and each episode identified usually lasted between 15 minutes and 2 hours. The end of an episode occurred either by the respondent going to a different location, ending one activity and starting another, or by a change in the people they were interacting with. From the 63 individual surveys completed, a total of 582 episodes were recorded, the average number of episodes per respondent was 9.2, and average episode duration was 93 minutes. Respondents were asked to complete the diary before they were questioned. This is to reduce selection bias as early knowledge of the questions to be asked may affect the previous day’s reconstruction (Kahneman *et al.*, 2004a). Creating episodes facilitates the retrieval from autobiographical memory through multiple pathways and it satisfies biases commonly observed in retrospective reports as the format draws on insights from cognitive research (Belli, 1998; Robinson and Clore, 2002; Schwarz and Oyserman, 2001).

Respondents used their completed diaries to help answer a series of structured questions about each episode, to give details of the situation and what feelings were experienced (Kahneman *et al.*, 2004a). Respondents were first asked to state episode duration with start and end times; who they were interacting with (alone,

spouse, children, boss, pets) and also by selecting one or more of twelve activities to identify what they were doing. Respondents were then asked to report the intensity of their feelings for each of the twelve activities on a scale from 0 (“Not at all”) to 6 (“Very Much”) in order to identify affective dimensions. The dimensions included the adjectives; happy, relaxed, frustrated, sad, anxious, impatient for the episode to end, engaged, focused, competent, worthwhile and the meaningfulness of the activity, whether it benefited someone else, and if it helped them achieve their goals. Finally, respondents answered questions such as “how satisfied are you with your day?” (“Very” through to “Not at all”) and also satisfaction with life as a whole (0 - 10) (Kahneman *et al.*, 2004a).

The analysis that follows examines the differences in peoples’ affective states whilst conducting everyday activities, compared to when they are using different transport modes for leisure or commuting. Kahneman and Krueger (2006) suggest that collecting data on people’s emotional experiences at various times of the day opens up many opportunities for research. Therefore the study also seeks to examine the spill-over effects transport modes have on other daily life activities. From this, the net affect and U-Index as defined below, are calculated in order to gain a deeper understanding of overall moods during the transport episode and also during various times of the day and week. Transport episode by mode was initially identified, followed by the two activities undertaken before and the two after the transport episode to identify the spill-over effects that transport mode has on moment-to-moment moods and overall wellbeing. This was then supported with an analysis of day and life satisfaction by comparing one

transport mode (e.g. driving) against the other modes (e.g. walking and cycling, and public transport). Finally a robustness check was performed looking at the types of activities undertaken after the transport episode and compared against one another.

Net affect and U-Index

When examining affective dimensions, net affect can be used as it provides a window on people's experiences that is distinct from that captured by standard life satisfaction measures (Kahneman and Krueger, 2006; Kahneman *et al.*, 2004a). It is calculated by taking the average of the four positive adjectives (happy, relaxed, engaged, focused), less the average of the four negative adjectives (frustrated, sad, anxious, impatient). This is to categorize an episode's intensity as either pleasant or unpleasant.

Once episodes have been classified as pleasant or unpleasant, the U-Index can be calculated to obtain a deeper understanding of the levels of unhappiness. Used to measure the fraction or proportion of time an individual spends in an unpleasant state, the U-index can be computed for each individual and averaged over a sample of individuals. This is to obtain a clearer picture of the experiences and emotions people feel before, during and after using the chosen transport mode. To calculate the U-Index the proportion of time in which the most intense negative affect outweighs the most intense positive is measured. Therefore it clearly combines positive and negative affect but is calculated by measuring each separately (Dolan *et al.*, 2011; Kahneman and Kruger, 2006).

From a psychological perspective the U-index has some desirable attributes. First, the predominant emotional state for the majority of people, most of the time is positive, so any episode when a negative feeling is the most intense emotion is a significant occurrence. It is not necessary to have more than one salient negative emotion for an episode to be unpleasant. Second, selecting negative feelings as more intense than all positive ones is likely to be a mindful and deliberate choice; the maximal rating is salient, especially when it is negative, because negative feelings are relatively rare. Third, because the correlation of the intensity among various positive emotions across episodes is higher than the correlation among negative emotions, one dominant negative emotion probably colours an entire episode (Kahneman and Krueger, 2006).

Calculating both net affect and the U-Index separately is important as each measure is used for a slightly different purpose and outcome. Net affect is measuring the intensity of feelings and the U-Index is measuring exposure to negative experiences and therefore a higher value for one activity type (i.e. working) than another (i.e. driving) may be due to a longer average duration, not a 'worse experience' per unit time. This distinction is valuable as it has important implications for interpretation but at present is unclear within existing literature.

6.4 Results

Differences in transport mode

Tables 6.1 and 6.3 present the differences in DRM net affect and U-index for general daily activities and aggregated transport episodes (Table 6.1) when compared against disaggregated transport episodes (Table 6.3). The tables also

include a weighted U-Index to take account of differences in average duration (i.e. the time spent on an undertaking activity) as a means of getting a measure of the relative proportion of respondents who are dissatisfied per hour of participation. For Table 6.1, when looking at the U-Index (i.e. the proportion of time spent in an unpleasant state) it can be seen that working (9%), self-care (7%), eating (5%) and shopping (4%) demonstrate particularly unpleasant everyday experiences. Comparing these four activities DRM net affect (affective scale from 0 - 6), respondents are far happier on most accounts when eating compared to shopping or working. Alternatively, activities such as playing sport or watching television demonstrate pleasant experiences (U-Index 0%) and for sport in particular a strong net affect compared to other activities, including transport. Comparing everyday activities with transport activities, when examining DRM net affect and the U-Index, there is a major increase in unpleasant experiences compared to general daily activities. Apart from working episodes, all transport activities demonstrate a higher percentage of time spent in an unpleasant state. For public transport users in particular, they have the highest percentage of unpleasant experiences (20%) with the lowest net affect of 1.800 (SD: 2.485) when compared to all other activities (general everyday and transport) however as the sample is very small (see Table 6.1), nothing of significance can be said about public transport in this exploratory study. It can be seen though, that activities such as self-care and driving are comparably unpleasant experiences, where 7% of the time, people are experiencing unpleasant emotions. Driving however has a higher net affect of 3.077 (SD: 1.920) so people are happier driving than when undertaking self-care. Similar results are

demonstrated with walking and cycling and eating activities; 5% of the time is an unpleasant experience, however people are happier eating (a higher net affect of 3.349 SD: 1.646) than when walking and cycling.

Activity	Sample Percentage (N)	Time Spent (in hours)	DRM Net Affect (SD)	U-Index (SD)	U-Index*
Public Transport	2 (10)	01:31 (1:58)	1.800 (2.485)	0.20 (.422)	0.30 (.640)
Driving	16 (91)	01:28 (01:17)	3.077 (1.920)	0.07 (.250)	0.10 (.366)
Walking and Cycling	9 (49)	01:22 (01:35)	3.150 (1.948)	0.05 (.229)	0.07 (.313)
Working	13 (78)	03:17 (02:23)	2.375 (1.642)	0.09 (.288)	0.29 (.946)
Self-Care	18 (104)	01:06 (00:47)	2.889 (1.816)	0.07 (.252)	0.08 (.277)
Eating	26 (149)	01:29 (01:18)	3.349 (1.646)	0.05 (.212)	0.07 (.314)
Shopping	5 (27)	00:55 (00:38)	2.204 (1.688)	0.04 (.192)	0.04 (.176)
Socializing	10 (56)	02:06 (01:47)	3.862 (1.803)	0.04 (.187)	0.08 (.400)
Cooking	16 (97)	01:33 (01:24)	3.299 (1.776)	0.04 (.200)	0.06 (.31)
Other	15 (89)	01:27 (01:07)	2.874 (1.770)	0.04 (.208)	0.06 (.302)
Relaxing	12 (71)	01:44 (01:18)	3.651 (1.585)	0.03 (.167)	0.05 (.290)
Housework	10 (58)	01:45 (01:29)	3.263 (1.580)	0.03 (.184)	0.05 (.322)
Reading/ Internet	14 (81)	01:54 (01:31)	3.694 (1.477)	0.01 (.111)	0.02 (.211)
Listening to Music	6 (35)	01:51 01:38	3.414 (1.606)	0.00 (.000)	0.00 (.000)
TV	15 (86)	02:04 (01:28)	3.709 (1.326)	0.00 .000	0.00 (.000)
Voluntary Work	1 (5)	01:26 (01:02)	3.050 (2.003)	0.00 .000	0.00 (.000)

Activity	Sample Percentage (N)	Time Spent (in hours)	DRM Net Affect (SD)	U-Index (SD)	U-Index*
Intimate Relations	0.3 (2)	03:17 (03:49)	3.875 (.883)	0.00 (.000)	0.00 (.000)
Sport	3 (15)	01:23 (00:38)	4.233 (1.174)	0.00 .000	0.00 (.000)
Praying	0.3 (2)	01:14 (00:21)	4.750 (.353)	0.00 (.000)	0.00 (.000)

Table 6.1: DRM net affect and U-Index for transport and daily activities

Source: Kahneman and Kruger (2006) and authors' calculations. Notes: Percentage of Sample is the percentage of individuals who engaged in the activity, and Time Spent is not conditional on engaging in the activity (for Public Transport, see Appendix E for full details). If an episode involved more than one activity, it enters more than once, so total hours in a day are not constrained to sum to 24. Net Affect is the average of four positive adjectives (happy, relaxed, engaged, focused) less the average of four negative adjectives (frustrated, sad, anxious, impatient). All of the adjectives are reported on a 0 to 6 scale, ranging from 0 - "not at all" to 6 - "very much." The U-Index is the proportion of each person's time engaged in an activity in which the dominant emotion was negative, averaged over individuals. The weighted U-Index takes account of differences in average duration as a means of getting a measure of the relative proportion of respondents who are dissatisfied per hour of participation

Examining differences by transport mode for net affect when using driving as a reference case compared to public transport, it can be seen that 13% ($p= 0.170$) of experiences for public transport users are less pleasurable than when driving. When comparing driving as a reference case against walking and cycling, 4% ($p= 0.697$) of experiences for walkers and cyclists are more pleasurable than when driving. However, these differences are not statistically different from each other at the 10% level. Next an analysis of life and day satisfaction by transport mode is undertaken as it is a useful way to distinguish between the impacts transport mode has on life and day evaluations. Table 6.2 below shows the results by mode with driving used as a reference case:

	Walking and Cycling (SD)	Public Transport (SD)
Day Satisfaction	0.00 (0.00)	-0.15 (0.68) ($p= 0.250$)
Life Satisfaction	0.31 (2.6446) ($p= 0.876$)	0.15 (1.2993) ($p= 0.664$)

Table 6.2: Life and Day Satisfaction: Driving as a reference case

Examining life and day satisfaction with drivers as the reference case compared to public transport users, drivers have 15% more day satisfaction and 15% less life satisfaction. These differences are not statistically significant at the 10% level. Walkers and cyclists have the same day satisfaction as drivers but 31% more life satisfaction; again the difference is not significant. This demonstrates that the evaluative measures of subjective wellbeing (i.e. life satisfaction and day satisfaction), when applied to this study with its relatively low number of cases, are not fine-grained enough to examine the impact of different transport modes on subjective wellbeing.

Transport episodes have been disaggregated so that any nuances will become more apparent by deeper analysis. Schwarz and Xu's (2011) study for example asked respondents to think about the value of their car (correlation with car value is 0) and then asked different respondents "how happy you are with your commute to work in your car" (correlation 0.4 car value and happiness from driving). It can be seen that the car matters when the car is on the drivers' mind, so perhaps there is a focusing effect (misallocation of attention). It can be said that for weekend driving, people are focusing their attention on the car and

where they are going; which is far more pleasurable. Midweek however they may be focusing on the commute and not on the car which is not as pleasurable. Therefore in Table 6.3, transport episodes are disaggregated into (a) rush-hour vs. non-rush hour, (b) weekend vs. weekday driving (c) and to/from work/school to provide a deeper analysis of net affect for each mode and to calculate the U-Index to understand which mode results in the most unpleasant experience.

From these disaggregated transport activities, when examining DRM net affect and the U-Index, there is again a major increase in unpleasant experiences compared to general daily activities. The strongest unpleasant everyday activity in Table 6.1 was “Working” with a relatively low net affect of 2.375 (SD: 1.642) and the highest U-Index of 0.09. Driving when disaggregated also demonstrates a still higher percentage of unpleasant experiences with 18% of rush hour driving experiences, 16% of weekday driving experiences and 14% of weekend driving experiences being unpleasant. Weekend driving has the highest net affect of 2.200 (SD: 2.087) out of the three (possibly due to less time restrictions and the absence of general weekday commute stresses) which still demonstrates less pleasant experiences compared to working episodes.

Disaggregating walking and cycling demonstrates that for rush hour walking and cycling, 6% of the time is an unpleasant experience compared to 5% for aggregated walking and cycling. Interestingly, the net affect for rush hour walking and cycling is higher at 3.266 (SD: 1.969) than the aggregate of 3.150 (SD: 1.948) so people’s experiences are more pleasant during rush hour walking and cycling than the aggregate. Two forms of transport activity have a U-Index of 0,

travelling to/from school and non-rush hour walking and cycling, with this last activity presenting the highest net affect compared to all other transport episodes. Subsequently non-rush hour walkers and cyclists have the highest overall happiness rating (NA: 3.461, SD: 1.478) and 0% of the time undertaking the activity was unpleasant.

Examining differences by disaggregated transport mode for net affect, using driving as a reference case when compared to rush hour driving, demonstrates that 0.9% ($p=0.154$) of the time rush hour drivers are experiencing more unpleasant emotions than when driving. When compared against weekday driving, 9% ($p= 0.110$) of the time weekday drivers are experiencing a more unpleasant emotion than when driving. When comparing rush hour driving to rush hour walking and cycling, 11% ($p= 0.824$) of experiences for rush hour walkers and cyclists are more pleasurable than for rush hour drivers. When comparing non-rush hour driving against non-rush hour walking and cycling 13% ($p= 0.751$) of experiences for non-rush hour walkers and cyclists are more pleasurable.

In Table 6.1 the U-Index for driving is 0.07, a result lower than all of the disaggregated car values in Table 6.3. When weighted against duration, aggregate driving activities shift to a U-Index of 0.10. This shift supports the findings within Table 6.3 with the weighted “non-rush hour driving” result of 0.09 which is therefore a slightly less unpleasant activity compared to the other disaggregated car driving data.

	Sample Percentage (N)	Time Spent (hours)	DRM Net Affect (SD)	U-Index (SD)	Weighted U-Index
Rush Hour Driving (a)	8 (35)	00:59 (01:02)	2.140 (2.075)	0.18 (.388)	0.18 (.381)
Weekday Driving (b)	14 (61)	00:54 (00:54)	2.135 (2.121)	0.16 (.366)	0.14 (.330)
Weekend Driving (b)	16 (30)	01:00 (01:02)	2.200 (2.087)	0.14 (.352)	0.14 (.352)
Non-Rush Hour Driving (a)	6 (38)	00:47 (00:41)	2.129 (2.222)	0.12 (.331)	0.09 (.260)
To/From Work (c)	8 (43)	01:08 (01:34)	2.181 (1.579)	0.08 (.272)	0.09 (.308)
Rush Hour Walking & Cycling (a)	5 (28)	01:23 (01:36)	3.266 (1.969)	0.06 (.246)	0.08 (.340)
Non-Rush Hour Walking & Cycling (a)	2 (34)	01:02 (01:27)	3.461 (1.478)	0.00 (.000)	0.00 (.000)
To/From School (c)	2 (11)	00:52 (00:37)	2.023 (1.217)	0.00 (.000)	0.00 (.000)

Table 6.3: DRM net affect and U-Index by disaggregated transport mode

Source: Kahneman and Kruger (2006) and authors' calculations.

Spill-over effects

Tables 6.4.1 to 6.4.8 demonstrate two episodes before (B-2), and one episode before (B-1) the transport activity (o) and one episode after (A+1) and two episodes after the transport activity (A+2). This explores the spill-over effects each transport mode has on peoples' moods throughout the day. The number of each transport episode is presented, plus the mean and standard deviation with a clearer depiction of the results seen in Figures 6.1.1 to Figure 6.1.8. Additionally a difference-in-difference estimate for each affective dimension when comparing one mode (e.g. driving) against the other modes (e.g. walking and cycling, and

public transport) will be used to calculate differences in affective state before (B2) and after (A2) the transport activity (o).

The difference-in-difference estimate is:

$$\begin{aligned} X1 (B2) - Y1 (A2) &= \delta1 - \text{Driving} \\ X2 (B2) - Y2 (A2) &= \delta2 - \text{Walking and cycling} \\ X3 (B2) - Y3 (A2) &= \delta3 - \text{Public Transport} \end{aligned}$$

The main results of this exploratory study are now discussed but consideration however needs to be taken over the small sample size and in particular the small number of public transport observations. An interesting observation from Table 6.4.1 is that public transport users have higher happiness episodes compared to users of other modes before undertaking the transport activity. This drops dramatically when compared to walkers, cyclists and drivers where happiness increases and stabilises during and after the transport episode. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is 0.03 ($p= 0.557$) and -0.1 ($p= 0.320$) respectively. Comparing drivers against public transport users the difference in A+1 and A+2 is -1.13 ($p= 0.112$) and -1.24 ($p= 0.120$) respectively.

	B-2	B-1	o	A+1	A+2
W&C	N = 42 Mean = 4.48 SD = 1.311	N = 45 Mean = 4.16 SD = 1.242	N = 49 Mean = 4.63 SD = 1.112	N = 47 Mean = 4.66 SD = 1.069	N = 44 Mean = 4.57 SD = 1.087
Driving	N = 81 Mean = 4.30 SD = 1.336	N = 79 Mean = 3.96 SD = 1.382	N = 86 Mean = 4.64 SD = 1.245	N = 82 Mean = 4.63 SD = 1.242	N = 81 Mean = 4.67 SD = 1.225
Public Transport	N = 7 Mean = 5.00 SD = 0.816	N = 9 Mean = 4.56 SD = 1.130	N = 10 Mean = 3.20 SD = 2.486	N = 8 Mean = 3.50 SD = 2.507	N = 7 Mean = 3.43 SD = 2.440

Table 6.4.1: Happy

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

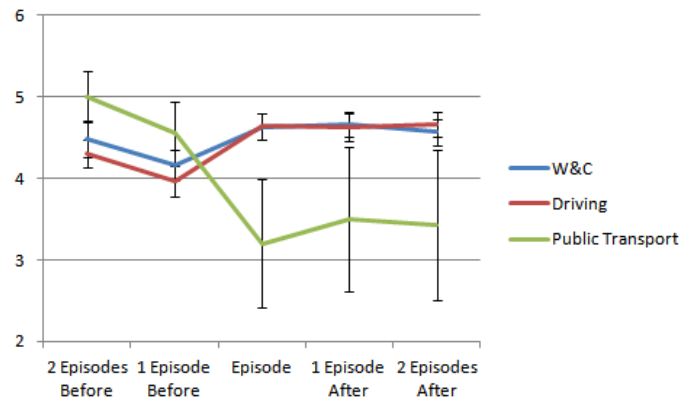


Figure 6.1.1: Happiness

The results are not significant to each other at the 10% level. To demonstrate the level of difference in happiness before and after undertaking a transport activity, when using driving as a reference case compared against walking and cycling, a difference-in-difference estimate for happiness is calculated as -0.46 ($p = 0.154$) (SD: 4.390). For driving compared against public transport the difference-in-difference estimate is -1.94 ($p = 0.049$) (SD: 2.687). This result demonstrates the persistence of lower levels of happiness in the public transport episode on later episodes and shows that there is a large difference in the level of happiness for public transport, before and after the transport episode as the results are statistically significant at the 5% level.

Public transport users are least relaxed as demonstrated in Table 6.4.2 during the transport episode but nearly recover to previous relaxation levels whereas walkers, cyclists and drivers are less relaxed before transport episodes. This increases after the activity is finished with drivers once again remaining stabilised

throughout the next episodes. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.31 ($p= 0.309$) and -1.09 ($p= 0.138$) respectively. The relaxation between these two modes after the actual episode has taken place is not significantly different at the 10% level. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is -0.18 ($p= 0.269$) and -0.63 ($p= 0.016$) respectively.

	B-2	B-1	0	A+1	A+2
W&C	N = 41 Mean = 4.29 SD = 1.601	N = 44 Mean = 3.66 SD = 1.627	N = 49 Mean = 4.35 SD = 1.521	N = 47 Mean = 4.26 SD = 1.700	N = 44 Mean = 3.89 SD = 1.631
Driving	N = 81 Mean = 4.14 SD = 1.531	N = 80 Mean = 3.80 SD = 1.521	N = 97 Mean = 4.37 SD = 1.518	N = 84 Mean = 4.44 SD = 1.383	N = 82 Mean = 4.52 SD = 1.399
Public Transport	N = 7 Mean = 4.29 SD = 1.496	N = 8 Mean = 3.62 SD = 1.506	N = 10 Mean = 3.40 SD = 2.171	N = 8 Mean = 4.13 SD = 1.642	N = 7 Mean = 3.43 SD = 2.299

Table 6.4.2: Relaxed

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

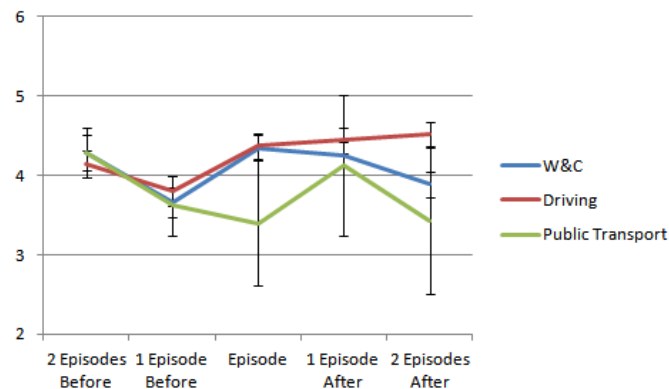


Figure 6.1.2: Relaxed

The level of relaxation between these two modes after the actual episode has taken place is significantly different at the 5% level demonstrating the persistence of relaxation during the transport episode on later episodes. To demonstrate the

level of difference in relaxation before and after undertaking a transport activity, when using driving as a reference case compared against walking and cycling, a difference-in-difference estimate for relaxation can be calculated at -0.79 ($p=0.088$) (SD: 5.2052). For driving compared against public transport the difference-in-difference estimate is -1.24 ($p=0.000$) (SD: 3.082). This result shows that there is a large difference in the level of relaxation for both walking and cycling and public transport, before and after the transport episode and the results are statistically significant at the 10% and 1% level respectively.

Table 6.4.3 shows that public transport users are most anxious before the transport activity compared to other modes; this is again probably due to the unpredictability of arrival and departure times. Walkers, cyclists and drivers anxiety levels are steady throughout the episodes, with drivers least anxious. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is 0.02 ($p=0.533$) and 0.05 ($p=0.569$) respectively. Comparing drivers against public transport users the difference in A+1 and A+2 is 0.74 ($p=0.887$) and 0.62 ($p=0.822$) respectively. When using driving as a reference case compared against walking and cycling a difference-in-difference estimate for anxiousness is -0.01 ($p=0.493$) (SD: 4.967) and driving compared against public transport the difference-in-difference estimate is 0.51 ($p=0.664$) (SD: 3.061). These differences are not statistically different.

	B-2	B-1	o	A+1	A+2
W&C	N = 38 Mean = 0.95 SD = 1.524	N = 38 Mean = 0.97 SD = 1.479	N = 41 Mean = 0.85 SD = 1.424	N = 41 Mean = 0.78 SD = 1.194	N = 37 Mean = 0.86 SD = 1.437
Driving	N = 71 Mean = 0.89	N = 69 Mean = 1.13	N = 83 Mean = 0.78	N = 79 Mean = 0.76	N = 74 Mean = 0.81

	SD = 1.498	SD = 1.504	SD = 1.353	SD = 1.370	SD = 1.401
Public Transport	N = 6 Mean = 1.00 SD = 1.549	N = 7 Mean = 1.57 SD = 1.813	N = 10 Mean = 1.00 SD = 1.247	N = 8 Mean = 1.50 SD = 1.512	N = 7 Mean = 1.43 SD = 1.618

Table 6.4.3: Anxious

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

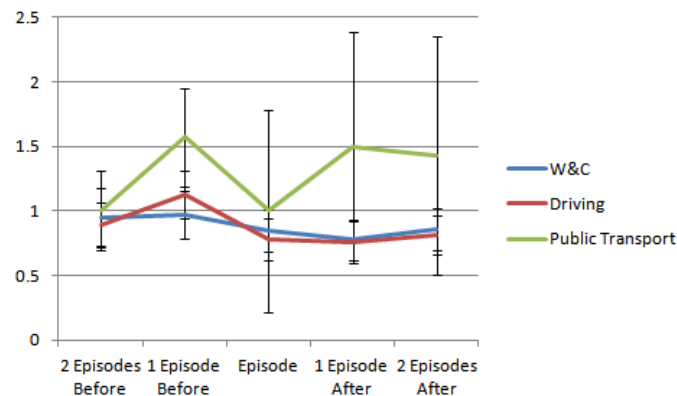


Figure 6.1.3: Anxious

Table 6.4.4 shows impatience during episodes. Each mode is more impatient for B-1 to end with walkers and cyclists impatience increasing after the transport episode. Drivers' impatience remains constant after the episode and public transport users impatience decreases after the transport activity, but then sharply increases in A+2. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is -0.09 ($p= 0.409$) and -0.01 ($p= 0.490$) respectively. Comparing driving against public transport the difference in A+1 and A+2 is -0.39 ($p= 0.401$) and 0.53 ($p= 0.701$) respectively. When using driving as a reference case compared against walking and cycling a difference-in-difference estimate of -0.36 ($p= 0.33$) (SD: 6.618) is found; driving compared against public transport sees a difference-in-difference estimate of 0.72 ($p= 0.683$) (SD: 4.102). These differences are not statistically different to each other at the 10% level.

	B-2	B-1	o	A+1	A+2
W&C	N = 35 Mean = 1.54 SD = 2.091	N = 36 Mean = 1.69 SD = 1.880	N = 44 Mean = 1.34 SD = 1.842	N = 40 Mean = 1.47 SD = 1.935	N = 35 Mean = 1.60 SD = 1.943
Driving	N = 70 Mean = 1.19 SD = 1.828	N = 60 Mean = 2.02 SD = 2.021	N = 82 Mean = 1.63 SD = 2.105	N = 75 Mean = 1.56 SD = 2.055	N = 72 Mean = 1.61 SD = 2.113
Public Transport	N = 5 Mean = 1.00 SD = 1.732	N = 9 Mean = 2.67 SD = 1.871	N = 10 Mean = 1.90 SD = 2.079	N = 6 Mean = 1.17 SD = 3.871	N = 7 Mean = 2.14 SD = 2.478

Table 6.4.4: Impatient for it to end

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

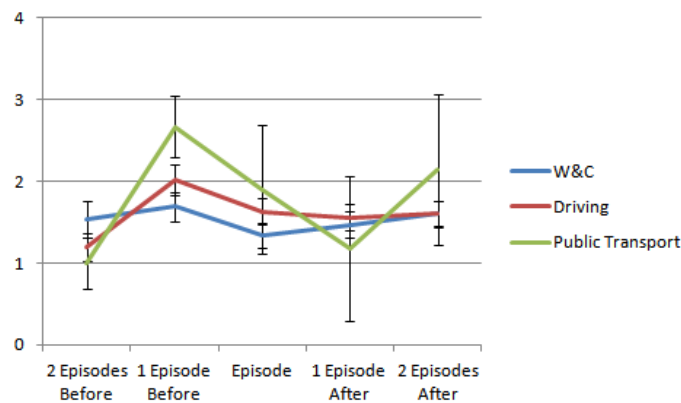


Figure 6.1.4: Impatient for it to end

Table 6.4.5 demonstrates that public transport users are most engaged before the transport activity but engagement drops significantly during, and in A+1 but does recover in A+2. Drivers' and walkers and cyclists engagement constantly drops after the transport activity. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is 0.16 ($p= 0.712$) and 0.25 ($p= 0.795$) respectively. Comparing drivers against public transport users the difference in A+1 and A+2 is -1.08 ($p= 0.053$) and 0.06 ($p= 0.535$) respectively.

	B-2	B-1	o	A+1	A+2
W&C	N = 38 Mean = 3.37	N = 42 Mean = 3.79	N = 44 Mean = 4.30	N = 42 Mean = 4.12	N = 38 Mean = 4.05

	SD = 1.667	SD = 1.601	SD = 1.374	SD = 1.435	SD = 1.451
Driving	N = 74 Mean = 3.43 SD = 1.721	N = 74 Mean = 3.78 SD = 1.455	N = 80 Mean = 4.00 SD = 1.551	N = 79 Mean = 3.96 SD = 1.573	N = 79 Mean = 3.80 SD = 1.682
Public Transport	N = 6 Mean = 3.50 SD = 1.049	N = 7 Mean = 3.43 SD = 1.618	N = 10 Mean = 3.30 SD = 1.337	N = 8 Mean = 2.88 SD = 1.553	N = 7 Mean = 3.86 SD = 1.676

Table 6.4.5: Engaged

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

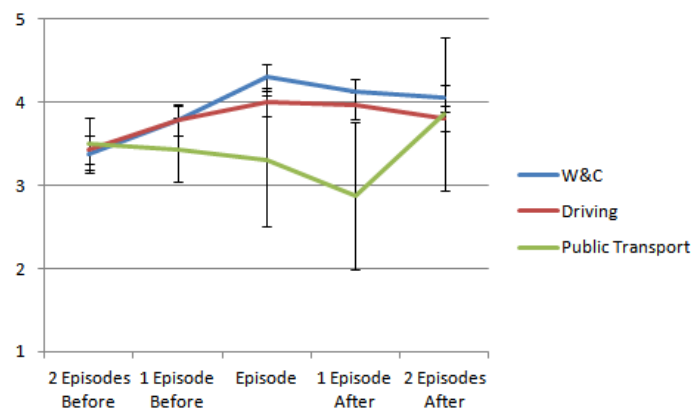


Figure 6.1.5: Engaged

The level of engagement between these two modes after the actual episode has taken place is significantly different to each other at the 5% level. This demonstrates the persistence of engagement of the transport episode on later episodes. When using driving as a reference case compared against walking and cycling a difference-in-difference estimate for engagement is seen at 0.31 ($p=0.690$) (SD: 5.5818) and driving compared against public transport the difference-in-difference estimate is -0.01 ($p=0.496$) (SD: 2.744).

Results from Table 6.4.6 show that public transport levels of focus gradually decrease until A+2. Drivers are the reverse, with focus levels slowly increasing throughout. Walkers and cyclists increase as well, dropping in A+1 but then

recovering to higher than previous levels. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is 0.24 ($p = 0.745$) and 0.87 ($p = 0.991$) respectively. Comparing drivers against public transport users the difference in A+1 and A+2 is -1.2 ($p = 0.040$) and -0.16 ($p = 0.421$) respectively. The level of focus between these two modes after the actual episode has taken place is significantly different at the 5% level. This demonstrates the persistence of focus during the transport episode on later episodes. When using driving as a reference case compared against walking and cycling we find a difference-in-difference estimate for focused of 0.71 ($p = 0.838$) (SD: 5.976) and driving compared against public transport a difference-in-difference estimate of -0.46 ($p = 0.321$) (SD: 3.029).

	B-2	B-1	0	A+1	A+2
W&C	N = 42 Mean = 3.69 SD = 2.089	N = 45 Mean = 4.51 SD = 2.170	N = 49 Mean = 4.65 SD = 1.932	N = 47 Mean = 4.19 SD = 2.183	N = 44 Mean = 4.89 SD = 2.082
Driving	N = 74 Mean = 3.53 SD = 1.537	N = 75 Mean = 3.93 SD = 1.464	N = 81 Mean = 3.95 SD = 1.548	N = 81 Mean = 3.95 SD = 1.572	N = 80 Mean = 4.02 SD = 1.599
Public Transport	N = 6 Mean = 3.83 SD = 0.753	N = 9 Mean = 3.78 SD = 1.563	N = 10 Mean = 3.20 SD = 1.476	N = 8 Mean = 2.75 SD = 1.581	N = 7 Mean = 3.86 SD = 1.864

Table 6.4.6: Focused

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

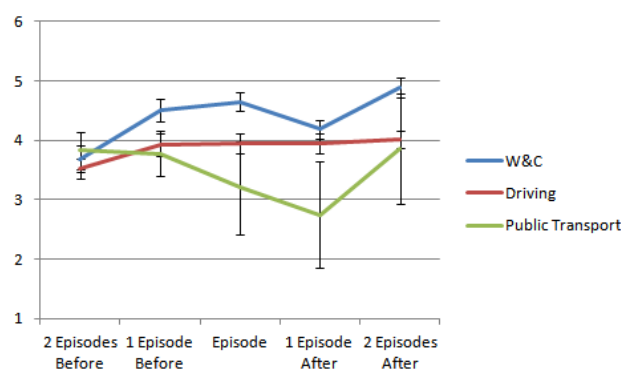


Figure 6.1.6: Focused

Table 6.4.7 shows walkers and cyclists' competence levels increase in B-1 but then gradually decrease thereafter. Drivers and public transport users' competence again increase before the transport activity, drops off, but then increases again in A+2. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is 0.17 ($p= 0.720$) and -0.17 ($p= 0.288$) respectively. Comparing drivers against public transport users the difference in A+1 and A+2 is -1.05 ($p= 0.106$) and -1 ($p= 0.158$) respectively. The level of competence between these two modes after the actual episode has taken place is not significantly different to each other at the 10% level. When using driving as a reference case compared against walking and cycling the difference-in-difference estimate for competence is -0.02 ($p= 0.487$) (SD: 5.246) and driving compared against public transport the difference-in-difference estimate is -0.59 ($p= 0.074$) (SD: 3.442). This result shows that there is a large difference in the level of competence for public transport, before and after the transport episode and the results are statistically significant at the 10% level.

	B-2	B-1	0	A+1	A+2
W&C	N = 35 Mean = 3.66 SD = 1.454	N = 37 Mean = 4.11 SD = 1.577	N = 42 Mean = 4.10 SD = 1.462	N = 39 Mean = 4.05 SD = 1.376	N = 35 Mean = 3.97 SD = 1.445
Driving	N = 70 Mean = 3.81 SD = 1.671	N = 62 Mean = 4.27 SD = 1.369	N = 80 Mean = 3.90 SD = 1.718	N = 74 Mean = 3.88 SD = 1.630	N = 73 Mean = 4.14 SD = 1.548
Public Transport	N = 5 Mean = 3.40 SD = 1.517	N = 8 Mean = 3.50 SD = 1.414	N = 10 Mean = 2.90 SD = 1.792	N = 6 Mean = 2.83 SD = 1.835	N = 7 Mean = 3.14 SD = 2.268

Table 6.4.7: Competent

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

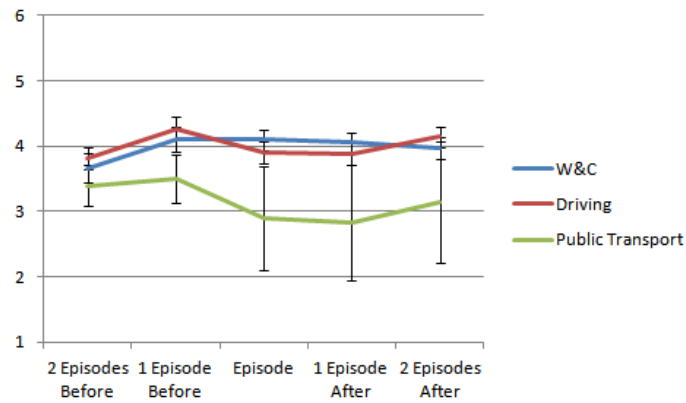


Figure 6.1.7: Competent

For Table 6.4.8, walkers and cyclists transport episodes are more worthwhile and meaningful than the episodes before, this drops slightly after the transport activity but recovers in A+2. Drivers B-1 episodes are the most worthwhile and meaningful which decrease until the A+2 episodes. For public transport users, episodes were more worthwhile and meaningful before the transport activity which then increased in A+1 but again dropped to an even lower level than before. Comparing drivers against walkers and cyclists the difference in A+1 and A+2 is -0.04 ($p= 0.452$) and 0.03 ($p= 0.536$) respectively. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.26 ($p= 0.359$) and -1.5 ($p= 0.0143$) respectively.

	B-2	B-1	o	A+1	A+2
W&C	N = 39 Mean = 3.77 SD = 1.784	N = 43 Mean = 3.95 SD = 1.647	N = 42 Mean = 4.29 SD = 1.551	N = 41 Mean = 3.85 SD = 1.696	N = 38 Mean = 4.24 SD = 1.715
Driving	N = 73 Mean = 3.85 SD = 1.769	N = 82 Mean = 4.41 SD = 2.239	N = 81 Mean = 4.20 SD = 1.661	N = 80 Mean = 3.89 SD = 1.743	N = 78 Mean = 4.21 SD = 1.557
Public Transport	N = 7 Mean = 4.00 SD = 1.732	N = 8 Mean = 3.75 SD = 1.488	N = 10 Mean = 2.90 SD = 1.524	N = 8 Mean = 3.63 SD = 1.847	N = 7 Mean = 2.71 SD = 1.496

Table 6.4.8: Worthwhile and Meaningful

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

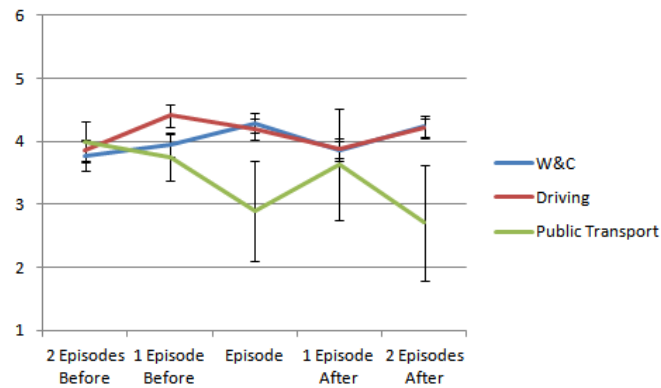


Figure 6.1.8: Worthwhile and meaningful

The level of worthwhile and meaningfulness between these two modes after the actual episode has taken place is significantly different to each other at the 5% level. This demonstrates the persistence of worthwhile and meaningfulness of the transport episode on later episodes. When using driving as a reference case compared against walking and cycling the difference-in-difference estimate for worthwhile and meaningfulness is 0.11 ($p= 0.565$) (SD: 5.653) and driving compared against public transport the difference-in-difference estimate is -1.65 ($p= 0.092$) (SD: 3.202). This result shows that there is a large difference in the level of worthwhile and meaningfulness for public transport, before and after the transport episode and the results are statistically significant at the 10% level.

It can therefore be said that walkers, cyclists and drivers have similar experiences and emotions before, during and after their transport episodes. They are happier, for example, more relaxed and their activities are more worthwhile and meaningful, when compared to users of public transport. Conversely, public

transport users when compared to other modes have the most anxiety and lack focus and engagement in activities and the effects spill-over to other daily activities.

6.5 Public Transport: A pooling of data sets

To identify whether the findings relating to experiences of public transport are attributable to specific characteristics of the wave two sample, a further longitudinal analysis was undertaken in which data from the two waves were combined. Table 6.5 demonstrates the percentage of total activities by mode and the total number of transport episodes for wave two and wave three as well as the pooled data set. The results of the pooled data sets for public transport are presented below; this pooling increases the sample of public transport users to a total of 27 episodes. Here, it assists in identifying whether a larger sample for public transport episodes produces significant results, the same analysis and statistical tests are conducted to aid comparison.

Mode	Total mode activities (%) and transport episodes (N)		
	Wave 2 data <i>(i.e. 582 episodes from 63 DRM)</i>	Wave 3 data <i>(i.e. 412 episodes from 44 DRM)</i>	Pooled data <i>(i.e. 994 episodes from 107 DRM)</i>
Driving	16% (91)	16% (66)	16% (157)
Walking and Cycling	9% (49)	14% (58)	11% (107)
Public Transport	2% (10)	4% (17)	3% (27)

Table 6.5: Percentage of total activities by mode and total number of transport episodes

Results from Table 6.5.1 show that public transport users have higher happiness episodes compared to users of other modes before undertaking the transport activity, this is a similar finding to wave two of data. After the public transport episode, the level of happiness recovers slightly in A+1 but drops again in A+2. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.5 ($p= 0.083$) and -0.65 ($p= 0.059$) respectively. The differences are statistically significant at the 10% level. To demonstrate the level of difference in happiness before and after undertaking a transport activity, when using driving as a reference case compared against public transport, a difference-in-difference estimate for happiness is calculated as -0.72.

	B-2	B-1	0	A+1	A+2
W&C	N = 96 Mean = 4.48 SD = 1.361	N= 102 Mean = 4.27 SD = 1.306	N = 107 Mean = 4.41 SD = 1.566	N = 55 Mean = 4.38 SD = 1.209	N = 50 Mean = 4.54 SD = .973
Driving	N = 145 Mean = 4.41 SD = 1.517	N = 64 Mean = 4.14 SD = 1.446	N = 157 Mean = 4.53 SD = 1.435	N = 86 Mean 4.66 SD = 1.386	N = 83 Mean = 4.75 SD = 1.607
Public Transport	N = 21 Mean = 4.48 SD = .928	N = 26 Mean = 4.46 SD = 1.029	N = 27 Mean = 3.96 SD = 1.720	N = 25 Mean = 4.16 SD = 1.599	N = 20 Mean = 4.10 SD = 1.619

Table 6.5.1: Pooled Happiness data

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

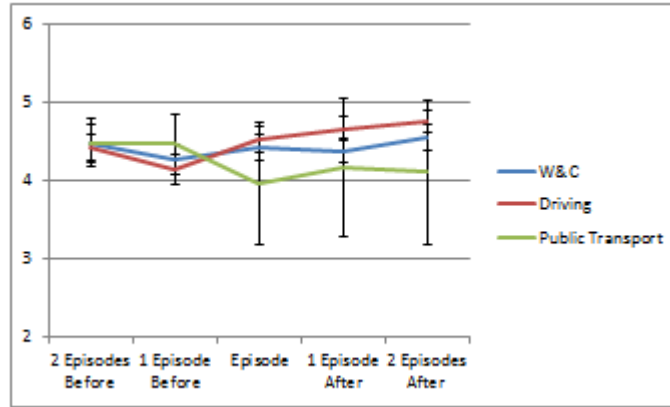


Figure 6.1.9: Pooled Happiness

Public transport users are least relaxed as demonstrated in Table 6.5.2 during the transport episode but nearly recover to previous relaxation levels in A+1. Again this drops down in A+2 with public transport episodes being the least relaxed when compared to other modes. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.51 ($p = 0.066$) and -0.77 ($p = 0.138$) respectively. The level of relaxation between these two modes after the actual episode has taken place is significantly different at the 5% level demonstrating the persistence of relaxation during the transport episode on later episodes. To demonstrate the level of difference in relaxation before and after undertaking a transport activity, when using driving as a reference case compared against public transport the difference-in-difference estimate for relaxation can be calculated at -0.61.

	B-2	B-1	o	A+1	A+2
W&C	N = 96 Mean = 4.36 SD = 1.674	N = 102 Mean = 3.97 SD = 1.626	N = 107 Mean = 4.23 SD = 1.751	N = 55 Mean = 4.09 SD = 1.431	N = 50 Mean = 4.22 SD = 1.529
Driving	N = 145 Mean = 4.30 SD = 1.369	N = 64 Mean = 4.03 SD = 1.652	N = 157 Mean = 4.24 SD = 1.654	N = 86 Mean = 4.63 SD = 1.472	N = 83 Mean = 4.57 SD = 1.740
Public	N = 21	N = 26	N = 27	N = 25	N = 20

Transport	Mean = 4.14 SD = 1.276	Mean = 3.92 SD = 1.719	Mean = 3.96 SD = 1.605	Mean = 4.12 SD = 1.453	Mean = 3.80 SD = 1.576
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Table 6.5.2: Pooled Relaxation data

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

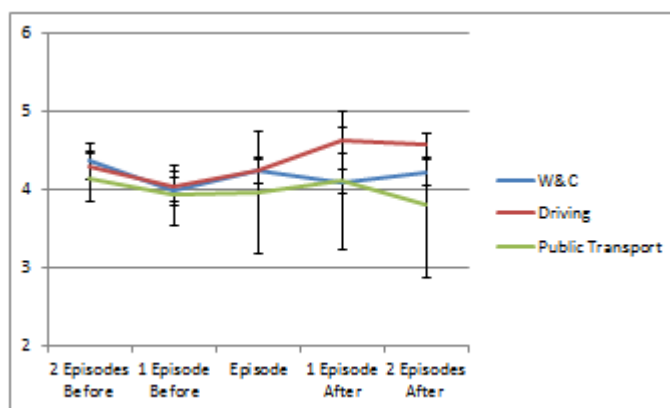


Figure 6.1.10: Pooled Relaxation

Table 6.5.3 demonstrates that public transport users are most engaged before the transport activity. This is a similar finding to wave two data, but engagement drops significantly during the transport episode, in A+1 engagement in public transport activities increases, but drops again in A+2. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.34 ($p= 0.163$) and -1.15 ($p= 0.002$) respectively. The level of engagement between these two modes after the actual episode has taken place is significantly different to each other at the 1% level. This demonstrates the persistence of engagement of the transport episode on later episodes. When using driving as a reference case compared against public transport a difference-in-difference estimate for engagement is seen at -0.75.

	B-2	B-1	0	A+1	A+2
W&C	N = 96 Mean = 3.96 SD = 1.984	N = 102 Mean = 3.99 SD = 1.859	N = 107 Mean = 3.91 SD = 2.003	N = 55 Mean = 3.85 SD = 1.545	N = 50 Mean = 3.52 SD = 1.940
Driving	N = 145 Mean = 4.11 SD = 2.157	N = 64 Mean = 3.86 SD = 1.934	N = 157 Mean = 4.17 SD = 2.073	N = 86 Mean = 4.30 SD = 1.922	N = 83 Mean = 4.45 SD = 2.210
Public Transport	N = 21 Mean = 3.71 SD = 1.821	N = 26 Mean = 4.42 SD = 1.793	N = 27 Mean = 3.30 SD = 1.103	N = 25 Mean = 3.96 SD = 1.369	N = 20 Mean = 3.30 SD = 1.342

Table 6.5.3: Pooled Engaged data

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

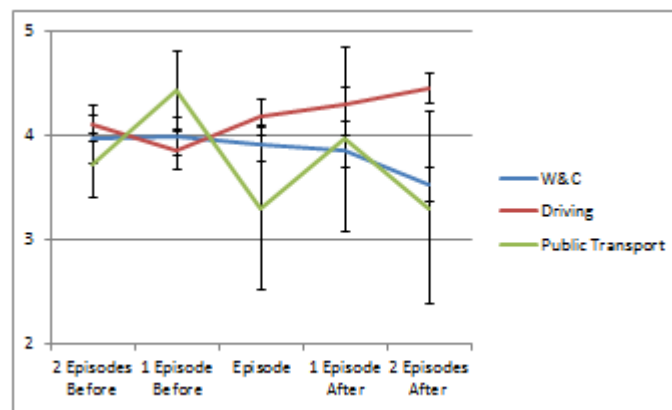


Figure 6.1.11: Pooled Engaged

Results from Table 6.5.4 show that public transport users levels of focus increases before the transport episode, sharply decreases whilst undertaking the transport activity, recovers in A+1 but declines again further in A+2. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.76 ($p = 0.022$) and -1.26 ($p = 0.001$) respectively. The level of focus between these two modes after the actual episode has taken place is significantly different at the 5% level. This demonstrates the persistence of focus during the transport episode on later episodes. When using driving as a reference case compared against public transport a difference-in-difference estimate for focus is -0.88.

	B-2	B-1	0	A+1	A+2
W&C	N = 96 Mean = 3.89 SD = 1.951	N= 102 Mean =4.28 SD = 1.921	N = 107 Mean = 4.05 SD = 1.988	N = 55 Mean = 4.22 SD = 1.462	N = 50 Mean = 3.74 SD = 1.850
Driving	N = 145 Mean = 4.14 SD = 2.108	N = 64 Mean = 3.77 SD = 1.815	N = 157 Mean = 4.05 SD = 1.880	N = 86 Mean 4.56 SD = 1.895	N = 83 Mean = 4.51 SD = 2.062
Public Transport	N = 21 Mean = 3.76 SD = 1.972	N = 26 Mean = 4.15 SD = 1.255	N = 27 Mean = 3.19 SD = 1.241	N = 25 Mean = 3.80 SD = 1.528	N = 20 Mean = 3.25 SD = 1.446

Table 6.5.4: Pooled Focused data

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

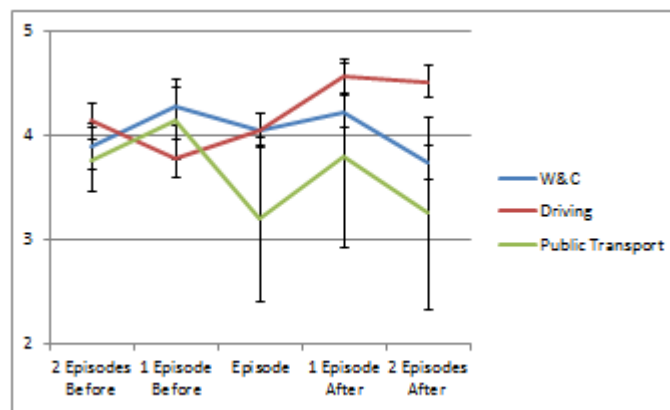


Figure 6.1.12: Pooled Focused

Table 6.5.5 demonstrates competence levels for public transport. Users feel more competent before the transport episode which decreases sharply whilst undertaking the public transport activity. Levels of competence recover to pre-transport levels but again reduces to a lower than previous level in A+2. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.35 ($p= 0.224$) and -1.12 ($p= 0.009$) respectively. The level of competence between these two modes after the actual episode has taken place is significantly different to each other at the 1% level. When using driving as a reference case

compared against public transport the difference-in-difference estimate for competence is -0.65.

	B-2	B-1	0	A+1	A+2
W&C	N = 96 Mean = 4.29 SD = 2.152	N= 102 Mean =4.45 SD = 2.090	N = 107 Mean = 4.15 SD = 1.980	N = 55 Mean = 3.93 SD = 1.585	N = 50 Mean = 3.78 SD = 2.003
Driving	N = 145 Mean = 4.57 SD = 2.130	N = 64 Mean = 4.16 SD = 2.025	N = 157 Mean = 4.50 SD = 2.093	N = 86 Mean 4.59 SD = 2.225	N = 83 Mean = 4.57 SD = 2.338
Public Transport	N = 21 Mean = 4.10 SD = 2.166	N = 26 Mean = 4.15 SD = 1.515	N = 27 Mean = 3.22 SD = 1.281	N = 25 Mean = 4.24 SD = 1.943	N = 20 Mean = 3.45 SD = 1.701

Table 6.5.5: Pooled Competence data

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

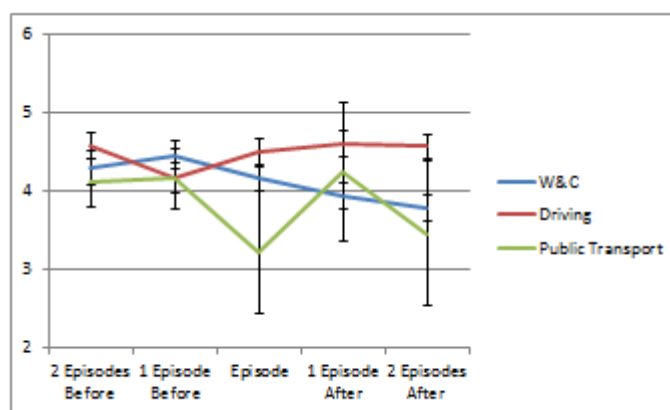


Figure 6.1.13: Pooled Competence

In interesting observation from Table 6.5.6, public transport episodes were more worthwhile and meaningful before the transport activity, the worth and meaning behind activities increased in A+1 but tailed off in A+2 to lower than previously recorded. Comparing drivers against public transport users the difference in A+1 and A+2 is -0.87 ($p= 0.015$) and -1.25 ($p= 0.002$) respectively. The level of worthwhile and meaningfulness between these two modes after the actual

episode has taken place is significantly different to each other at the 5% level. This demonstrates the persistence of worthwhile and meaningfulness of the transport episode on later episodes. When using driving as a reference case compared against public transport the difference-in-difference estimate is -0.01.

	B-2	B-1	0	A+1	A+2
W&C	N = 96 Mean = 3.95 SD = 2.139	N = 102 Mean = 4.05 SD = 1.831	N = 107 Mean = 4.20 SD = 1.920	N = 55 Mean = 3.71 SD = 1.750	N = 50 Mean = 3.52 SD = 1.876
Driving	N = 145 Mean = 4.43 SD = 2.185	N = 64 Mean = 3.80 SD = 1.845	N = 157 Mean = 4.06 SD = 2.040	N = 86 Mean = 4.43 SD = 1.980	N = 83 Mean = 4.40 SD = 2.089
Public Transport	N = 21 Mean = 3.19 SD = 1.965	N = 26 Mean = 3.92 SD = 1.742	N = 27 Mean = 2.81 SD = 1.570	N = 25 Mean = 3.56 SD = 1.609	N = 20 Mean = 3.15 SD = 1.461

Table 6.5.6: Pooled worthwhile and meaningfulness data

Notes: B-2 = two episodes before the transport episode, e.g. 'self-care', B-1 = one episode before the transport episode, e.g. 'eating', 0 = transport episode, e.g. 'walking and cycling', A+1 = one episode after the transport episode, e.g. 'working', A+2 = two episodes after the transport episode, e.g. 'socialising'.

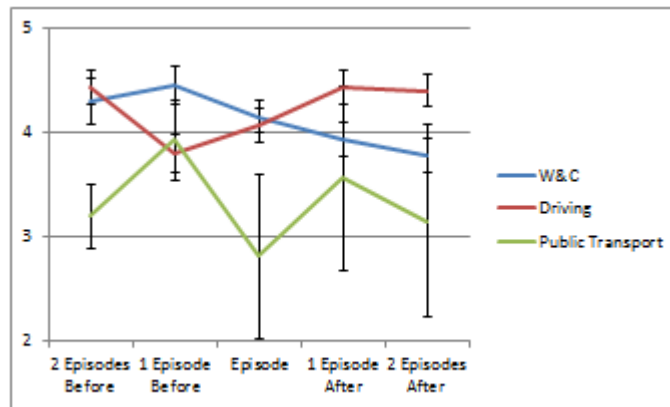


Figure 6.1.14: Pooled worthwhile and meaningfulness

6.6 Discussion

The exploratory study reported here focuses on the experiences of various daily activities, including transport modes on moment-to-moment moods and examines the spill-over effects of transportation mode on wellbeing. It examines

the various emotions and experiences as a result of travel mode and looks in to the spill-over effects these decisions have on our daily life activities. The study replicated Kahneman *et al.*'s (2004a) results but no significant differences of the evaluative measures were produced. Public transport is discussed in this results section but it again must be acknowledged that there were a low number of public transport observations and the public transport results cannot be considered significant. Therefore the outcomes discussed below are suggested associations which would require further exploration and analysis within a larger data set.

Key findings include the results from comparing everyday activities against transport activities, demonstrating that people experience far less pleasant emotions during transport episodes than when undertaking daily life activities. In particular when driving, 7% of the time is spent in an unpleasant state, more than when undertaking most of the other activities; 9% of the time spent working is in an unpleasant state and self-care is equally as unpleasant as driving. The analysis also highlights interesting results supported by other studies which examine the "driving experience" for example, less anxiety before driving than for public transport users and greater engagement during the driving episode than as a public transport passenger (Stradling *et al.*, 2007b). It can be seen that drivers during rush hour are experiencing for 3% of the time, more pleasurable emotions compared to users of public transport. An even stronger comparison comes from rush hour walkers and cyclists experiencing for 15% of the time, more pleasant emotions compared to users of public transport. As mentioned these emotions

could be due to a lack of control and the pressure from time restrictions and delays; such unpleasant emotions could be lessened by providing an improved, more efficient service with real-time information. Additionally, further data explorations need to be undertaken to gain a greater understanding of the differences within public transport trips which could offer further useful insights to this research.

Wave two

It is important to examine the spill-over effects of transport mode as travel decisions may be impacting on happiness and the productivity of other everyday activities. Collating the persistent effects and large results from the spill-over analysis, drivers have 32% higher happiness than public transport users in the episode after the transport activity. When assessing overall changes in happiness between episode B-2 and episode A+2, the difference in difference estimate for public transport users compared to drivers is -1.94 ($p=0.04885$), which is statistically significant at the 5% level. This suggests an association between transport and experiences but again, a larger data set with more public transport observations is required to support this. There was a smaller sample to replicate findings but no obvious changes were observed. To be certain that this association is due to travel mode, it would be necessary to check that the kinds of before and after activities of public transport users do not differ significantly from those engaged in by other mode users. When compared against each other, public transport users are 16% less relaxed in the two episodes after the transport activity than drivers. When assessing overall changes in relaxation between

episode B-2 and episode A+2, the difference in difference estimate for public transport users compared to drivers is -1.24 ($p=0.00016$), which is statistically significant at the 1% level. When compared, drivers are 37.5% more engaged and public transport users are 30% less focused immediately after the transport episode but there is no difference before the transport episodes in terms of their engagement or focus.

For competence and worthwhile and meaningfulness which are two measures of eudæmonia, there is a significant difference in comparison to before and after the transport episode for public transport users when compared to drivers. For the two episodes after the transport activity, public transport users are 26% less competent and perceive their activities as 22% less worthwhile and meaningful, when compared to drivers. When assessing overall changes in competence and levels of worth and meaningfulness between episode B-2 and episode A+2, the difference in difference estimates for public transport users compared to drivers are -0.59 ($p= 0.074$) and -1.65 ($p= 0.092$). Both of these observations are statistically significant at the 10% level.

This is important in terms of affect but also the meaning and reward they get from later episodes. The overriding findings are that people using public transport are unhappier on most accounts when compared to other transport modes and daily activities but again this is based on the assumption that episodes are the same before and after transport activities and do not differ significantly from those engaged in by other mode users.

Pooled analysis of waves two and three

After conducting the longitudinal study to identify whether the results of the 2012 data sets correspond with the results of the 2011, it was found that findings for public transport users were not replicated in the follow up study. To further investigate the experiences and emotions of public transport users the two data sets were pooled to see if a larger sample would lead to more significant findings. It can be seen that by combining data sets, the public transport effect observed in the 2011 data has led to similar statistically significant findings. Collating the persistent effects and large results from the spill-over analysis, drivers have 12% higher happiness than public transport users in the episode after the transport activity. When assessing overall changes in happiness between episode B-2 and episode A+2, the difference in difference estimate for public transport users compared to drivers is only -0.72. When compared against each other, public transport users are 14% less relaxed in the two episodes after the transport activity than drivers. When assessing overall changes in relaxation between episode B-2 and episode A+2, the difference in difference estimate for public transport users compared to drivers is only -0.61. When compared, drivers are 9% more engaged and public transport users are 17% less focused immediately after the transport episode. When assessing overall changes in engagement and focus between episode B-2 and episode A+2, the difference in difference estimates for public transport users compared to drivers are -0.75 and -0.88 respectively.

For the two episodes after the transport activity, public transport users are 16% less competent and perceive their activities as 24% less worthwhile and

meaningful, when compared to drivers. When assessing overall changes in competence and the perception of worth and meaningfulness in activities between episode B-2 and episode A+2, the difference in difference estimates for public transport users compared to drivers are -0.65 and -0.01 respectively. The marked reduction in this difference in difference estimate for levels of worth and meaningfulness that results from pooling wave 3 data with wave 2 data is almost entirely attributable to the much higher levels of worth and meaningfulness ascribed to activities in episode B-2 by wave 2 respondents (mean = 4.00) than those in the pooled sample (mean = 3.19). Since the pooling of these data sets results in a trebling of the sample size for episode B-2, it is likely that the lower mean level of worth and meaningfulness observed here is more reliable than that observed in wave two respondents alone.

Overall Findings

Overall, the pooling of wave two and wave three data reduces many of the effects of public transport episodes which were observed in wave two. However, mean levels of happiness, relaxation, engagement, focus, competence, and worth and meaningfulness, all remain lower for public transport users in the episodes after their transport activity than they do for drivers. Interestingly, when data from waves two and three are combined, the shortfall in public transport users' relaxation in the episodes following a transport activity, as compared to that reported by drivers, remains very similar, at 14%, to that observed in wave 2 (16%). Moreover, the shortfall in the level of worth and meaningfulness attached

to activities following a transport episode by public transport users as compared to drivers has increased slightly, from 22% to 24%.

This pooled data supports the suggestion that people using public transport are unhappier on most accounts when compare to other modes and daily activities but as before, this is based on the assumption that episodes are the same before and after transport activities.

Caveats and policy implications

Ettema *et al.*'s (2011) study used a transport survey which would create a focusing effect for participants; where attention and therefore answers are focused on transport and travel habits, emotions and experiences. The DRM is not a transport survey, it is a general wellbeing survey so there is limited misallocation of attention on transport; making respondents less aware of the researcher's preferences. Caveats to the research however include low public transport observations and that the study does not show pure causality. This Chapter has not attempted to prove causality but it has started to look at the causal impacts of a transport episode. Results however, are indicating that something of interest is happening with public transport shown through the spill-over results. Additionally, the associations show that there is a relationship between subjective wellbeing and transport but it is not known which way causation is going but indicative exploratory results show that it could be from public transport. Furthermore, issues with the spill over analysis may arise as there are not equal observations within each of the five separate time periods.

There are some interesting policy implications which arise from the findings. Roberts *et al.*, (2011) for example suggest that policy should be designed to make it easier for certain types of people to travel, for leisure and commuting, in particular ways while still preserving the right to freely express travel mode preferences. Providing information about the subjective wellbeing implications of transport modes could be useful as if an activity is making a person unhappy, breaking and changing habits is often very difficult. Thus further research is needed on subjective wellbeing and travel behaviour to show the full effects of transport on experiences of life, moment-to-moment moods, and the links between emotions and feelings. From this, it can be suggested that by examining mood before, during and after a transport episode, there could be a step change towards identifying what makes certain travel activities unpleasant. Subsequently, the exploratory results demonstrate interesting associations between happiness and public transport so there needs to be further investigations into public transport provision and conditions, but married within a larger data set. Finally, further data explorations could also be undertaken as a way to gain a greater understanding of the differences within public transport trips offering further useful insights to this research.

6.7 Reflections: Quantitative to mixed-methods

This reflective section aims to comment on Chapter Six. It provides a discourse on the transition from the results and outcomes of the empirical quantitative research presented in this Chapter and how the analysis and results produced help towards the developments of the entire thesis as well as towards the context,

purpose and intended outcomes of Chapter Seven. In order to answer Research Questions One, Three and Four, whilst also tackling Objective One, Two and Four, Chapter Seven will use the wider knowledge and understandings obtained from Chapter Six and apply them to this next mixed-methods Chapter. The highlighted box below revisits the research questions and objectives tackled within these Chapters.

Chapter Six and Seven: Research Questions

1. *What are the links between travel behaviour and wellbeing?*
3. *How does transport mode impact on individual moment-to-moment moods and what are the spill-over effects from transport mode on everyday activities?*
4. *What lessons can be learned and what policy implications may arise from using a longitudinal, mixed-method approach when examining changes in travel behaviour and the subjective experiences of travel?*

Chapter Six and Seven: Objectives

1. *Explore the existing evidence base and identify gaps in research on the relationship and linkages between travel behaviour and wellbeing research.*
2. *Examine individual and household travel behaviour, in a case study context, to identify factors affecting travel choices.*
4. *Develop a novel approach to identify and evaluate the case for “a greater understanding of context”; apply mixed-methods within a case study context in Cardiff and Penarth, Wales.*

Martin *et al's.*, (2014) study support the results of Chapter Six, their main findings contrast with two recent cross-sectional studies of commuter behaviour in the UK which did not identify any statistically significant positive association

between active commuting and wellbeing (ONS 2014), or between time spent in active commuting and wellbeing (Humphreys *et al.*, 2013; ONS, 2014). A cross-sectional study published by the ONS identified statistically significant negative associations between walking (and cycling for journeys of 16–30 min) and most aspects of psychological wellbeing when compared to car travel. Nonetheless, Martin *et al.*'s., (2014) research findings were consistent with other studies (Hamer *et al.*, 2009), including randomised studies of exercise interventions (Gusi *et al.*, 2008), which identified positive associations between some aspects of wellbeing and physical activity in other domains.

Subjective ratings however, may mean very different things to different people. For example, someone with easy access to a car may say they are “very dissatisfied” with their travel because they are annoyed by road congestion, whereas another person may be “very dissatisfied” because they must rely on an infrequent bus service for all of their travel needs. The psychological impact of this dissatisfaction is likely to differ greatly between these individuals. In future, subjective ratings scales may overcome this limitation by further careful crafting of specific wording to remove some of this ambiguity (Delbosc, 2012). There is however a growing demand for methods that address the range and scope of novel research questions. Mixed-methods hold greater potential to address such complex questions by acknowledging the dynamic interconnections that traditional, single research methods have not adequately addressed (Hesse-Biber, 2010). This next Chapter examines the application of mixed-methods; the qualitative interviews and the quantitative subjective wellbeing survey applied

longitudinally to the cohort of respondents from Cardiff and Penarth. The methods used for Chapter Seven aim to measure and evaluate travel experiences and mood when undertaking travel (principally public transport) for either utility or leisure purposes. Chapter Seven aims to understand the relationship between the outcomes of these combined methods and the longitudinal results and conclusions. It additionally seeks to specifically explore the cohort's experiences during travel and the spill-over effects of travel activities on moods before, during and after travel episodes. The Chapter demonstrates that combining methods not only supports and validates results and improves robustness, but that collecting longitudinal data is invaluable to the fields of both wellbeing and transportation research. This is due to the fact that experiences and activities change and adapt over time and therefore results need to be supported by follow up repeat data to ensure that outcomes can be accounted for and if random, can be justified as so.

Using the qualitative data from the cohort interviews in conjunction with the quantitative subjective wellbeing survey provides a deeper understanding of the reasons and rationale behind moods and everyday travel. Marrying together household interactions and the dynamics behind decisions to walk and cycle, and the subjective wellbeing consequences of travel mode provides an in-depth portfolio of evidence. As previously discussed, the use of the DRM in transportation studies is limited in application and alongside this, there are no studies which attempt to measure *and* evaluate subjective wellbeing. Sometimes generalisations, broad outlooks, and perspectives on important issues under

research leave some studies with an overwhelming feeling of having not a lot to say about the thing of substance (Stake, 2010). Many interesting assumptions can arise from conducting such research, however it is vital to also examine at a deeper level rather than generalising about the effects at the population level. Therefore Chapter Seven moves on from averaging results across the sample for the two longitudinal waves of data, and investigates individual cases to demonstrate the importance of applying mixed-methods to longitudinal studies.

Few studies at present have concentrated on measuring wellbeing let alone combining the two methods in an attempt to further improve the rationale, reasoning and consequences of travel behaviour on our everyday lives. Importantly, also exploring the pitfalls and underlying issues that come about from using one method as the single source of exploration. The results reported within this next Chapter focus primarily on public transport users' subjective wellbeing outcomes and interview data. This was chosen as the longitudinal outcomes present differing results and Chapter Seven seeks to explore why.

It is considered important to conduct mixed-methods research in order to establish whether the quantitative and qualitative findings corroborate each other (Bryman, 2012). Thompson *et al's.*, (2012) study for example discussed the use of metrics (i.e. passengers per square metre) to define optimum/crowded rail passenger density. They found that whilst such metrics are important to operational procedures, service evaluation and reporting, they failed to fully capture and convey the ways in which passengers experience crowded situations. Therefore they introduced a novel mixed-methodology including ethnography,

focus groups and an online stated preference choice experiment demonstrating that the experience of over crowdedness cannot be understood in isolation from other rail customer services issues such as safety, quality of environment etc. Furthermore, Ogilvie *et al.*, (2010) employed a longitudinal mixed-methods study exploring interview data from local resident's perspectives on a new urban section of the M74 motorway in Glasgow, Scotland; interviews were combined with quantitative epidemiological and spatial data. Results indicated that altering the urban landscape may influence active travel in ways that may vary between individuals, may be inequitable, and may not be predictable from quantitative data alone. Stathi *et al's.*, (2012) study of determinants of neighbourhood activity of adults aged 70 and over found that by using accelerometers, a questionnaire and interviewing, residents activities were influenced not only by perceived quality and accessibility, but also by the influence of personal and interpersonal determinants such as maintenance of good health, functional ability, and supportive social networks.

Moreover, Lovejoy and Handy (2011) sought to improve cycle statistics (thefts, cycle/cyclist volumes, abandonment) at the University of California and found that by combining the use of police reports, cycle rack counts and a random sample survey they were able to identify the extent that bicycle thefts are under-reported, the extend that cycles are used as a secondary circulator mode and how planners can aim to better estimate the volume of abandoned cycles on campus. O'Connor and Brown's (2010) study used mixed-methods (i.e. focus groups and a quantitative survey) focussing on serious leisure cyclists providing insights into a

cohort's experiences of road sharing with motorists. Furthermore Pooley *et al.* (2011) examined household decision-making for everyday travel in Lancaster using surveys, interviews and ethnographic data. Finally Steiner *et al.*, (2012) explored the diverse range of parking supply and demand strategies that could be used to address congestion using mixed-methods including contextual fieldwork, case studies of comparable cities and interviews. These studies provide the foundations, support and evidence of the multiple benefits of mixed-methods research. Mixed-methods ease the burden on researchers and allow much more data to be collected than if solely one method was used as demonstrated within the next Chapter presented here, Chapter Seven.

Chapter Seven - Everyday travel and subjective wellbeing: assessing the case for a mixed-methods approach in a longitudinal context¹²

This Chapter uses a mixed-method approach. The study under investigation introduces semi-structured interviews alongside the use of the Day Reconstruction Method to a longitudinal cohort of respondents across two years. This Chapter explicitly outlines the decisions made and the tools and methods implemented as a way to highlight the potentials and pitfalls of using mixed-methods within this context. Mixed-methods allow a deeper exploration, measurement and evaluation of subjective wellbeing and transportation with the Day Reconstruction Method (Kahneman *et al.*, 2004a) being in itself an extremely useful, easy to administer and financially viable tool that allows researchers to collect large amounts of data. It is however a method that has had limited application to the field of transport research, mobilities studies and also longitudinal cohort studies. Alongside this, no studies exist which attempt to measure *and* evaluate subjective wellbeing using a mixed-methods approach. Findings from the mixed-methods methodology (i.e. DRM and interviews) when applied to the longitudinal cohort provide complementary insights a DRM-only methodology would not have provided. These include the nuances behind changes and shifts in peoples' happiness and the fact that the interviews add the much needed context and explanation to the quantitative data. Therefore, it can be seen that it is of course important to capture a snapshot of the broader

¹² This is the fourth of four papers in a series submitted for peer review. This paper was submitted to the journal "Case Studies in Transport Policy" on 23/04/15

scenario by conducting quantitative surveys, but there is also much value when honing down and qualitatively investigating the individuals behind these large data sets.

7.1 Introduction

Interest in the concept of subjective wellbeing has grown rapidly in recent years, as governments in many Western countries seek to evaluate not just the economic benefits accruing from their policy decisions, but also how those decisions impact upon an individual's happiness and life satisfaction¹³. Accordingly, within the social sciences, efforts to design and implement valid and reliable methodological tools that can be used to assess the impact of specific variables on subjective wellbeing have themselves redoubled (Pavot, 2008). This Chapter reports the potential for using a method seldom used in transportation research to measure *and* evaluate subjective wellbeing; Kahneman *et al.*'s (2004a) "Day Reconstruction Method" (DRM). The Chapter aims to discuss the process and application of administering an adapted version of the DRM within a longitudinal cohort study, alongside in-depth interviews. This mixed-methods approach provides new insights into the specific strengths and limitations of the DRM when applied within a transportation context. Overall, it is hoped that the Chapter will point to productive ways forward for future research aiming to apply wellbeing measurement techniques to transportation research, specifically where a longitudinal cohort approach is taken.

¹³ There are several terms that are used interchangeably when talking about wellbeing; "happiness", "QoL", "subjective wellbeing", and "life satisfaction". For the sake of clarity and simplicity, the term "subjective wellbeing" will be used from here on in (Delbosc, 2012).

The case study emerges from the sustainable transport charity Sustrans “Connect2” infrastructural programme, which aims to improve community access to walking and cycling facilities, and to the NCN, across the UK. Sustrans posits that those living close to Connect2 schemes would witness a tangible transformation on their liveability and connectivity. In addition to this, they suggest that the overall ambience of the local neighbourhood would be improved. This provides an opportunity to examine the impact of such active travel programmes on the wellbeing of local residents over a period of time. This Chapter explores how travel can affect subjective wellbeing and how certain modes impact moment-to-moment moods. It also reflects on the utility of the DRM administration as part of a longitudinal cohort survey of participants living close by to newly implemented Connect2 walking and cycling infrastructure.

First the Chapter begins by examining subjective wellbeing as a school of thought discussing the various methods used to attempt to measure wellbeing as a proxy for economic *and* societal progress. This is followed by discussions on the measurement, evaluation and analysis of subjective wellbeing and its application in the field of transportation studies. The Chapter then revisits the Connect2 case study where the DRM was applied and considers the sampling techniques, the approach used and application of instruments in the field. The final section of the Chapter draws on the strengths and limitations of the method and outlines future research opportunities alongside the Chapter’s conclusions.

7.2 Literatures

There are a number of unresolved challenges in the area of subjective wellbeing research, particularly relating to the issue of measurement and evaluation (Krizek *et al.*, 2009). Understanding and measuring quality of life (QoL), economic and societal progress and wellbeing are of interest to governments and policy-makers. A number of ways of measuring national-level progress have been proposed, developed, and used to address the growing realization that Gross Domestic Product (GDP) in particular, is a measure merely of economic quantity, and not economic quality (Helliwell, 2003). Various approaches have been proffered as superior when measuring individual wellbeing and social welfare as a constructed alternative (Costanza *et al.*, 2009; Fleurbaey, 2009; Frey and Stutzer, 2008a, 2008b). GDP can be considered as a partial proxy of wellbeing at best; indeed there are several areas in which it fails to take into account factors that are of fundamental importance in this equation. It excludes for example, a range of non-market activities (perhaps due to the difficulties associated with measuring them) that influence wellbeing such as leisure time. It also does not take account of externalities such as pollution or environmental deterioration, nor of depletion of non-renewable resources. In addition to these shortcomings, it further fails to illuminate intra-country differences in the distribution of income (i.e. income equity), and also fails to measure the skills of the nation's workforce; an

important determinant of a nation's future economic well-being¹⁴ (Giovannini *et al.*, 2011:7; ONS, 2011b; Costanza *et al.* 2009).

In the field of transport policy, one practical example of such shortcomings can be found in the inability of GDP to distinguish between fuel consumed in traffic jams (which is highly unlikely to positively affect wellbeing), and fuel consumed in the course of actually moving from one place to another (which is far more likely to do so) (ONS, 2011b). Against this rather limiting backdrop, some more appropriate tools and techniques have recently been developed to replace GDP as a sole measure of wellbeing. The Organisation for Economic Co-operation and Development (OECD), for instance, issued guidelines for measuring wellbeing and societal progress (Giovannini *et al.*, 2011), and the UK's Office of National Statistics has also pursued a "Measuring National Wellbeing" programme, leading in 2011 to some subjective wellbeing questions being added to ONS household surveys, as well as to the development of a "Measuring National Wellbeing Index" (ONS, 2011b; Dolan *et al.*, 2011). The ONS's "Measuring National Wellbeing" programme examines a vast array of areas of daily life pertaining to society, economy and the environment, including specific aspects that are likely to have a particularly significant impact on wellbeing (such as leisure time, renewable energy production, air quality and satisfaction with local area). It does not, however, specifically address or delve deeper into the impacts of transport for work or leisure (ONS, 2011b) or the relationships and interactions between subjective wellbeing and sustainable transport policy, which provides scope for

¹⁴ These criticisms need separating out as some areas may have been excluded due to the nature of the measurement method, or excluded as they have yet to be highlighted as an area requiring attention.

further exploration of how such activities might impact upon subjective wellbeing.

Measuring subjective wellbeing

Subjective wellbeing is characterised by the fact that it is measured at the level of the individual and is subjectively determined by the individuals who are being surveyed. Rather than using objective measures such as QoL as proxies for wellbeing research, individuals themselves are asked how satisfied they are with aspects of their own lives (Giovannini et al., 2011; Diener, 1984, 1985; Delbosc, 2012). Subjective wellbeing for example can be used to provide an external check on societal indicators as well as economic. Studies such as Alesina et al. (2006) have used the Eurobarometer data to examine whether labour market regulation makes people better off. Gruber and Mullainathan (2005) researched the effect of cigarette taxes on self-reported happiness to draw inferences about the rationality of smoking using data from the General Social Surveys for the United States and Canada (Kahneman and Krueger, 2006; Blanchflower and Oswald, 2004).

The intent of subjective wellbeing methods is to measure the extent to which human needs are being met. Measures are based on the judgments of individuals (i.e. survey respondents) rather than on more easily quantifiable inputs of money and material goods. There are concerns though that these “subjective” measures are not factually based and are therefore less valid than “objective” measures like GDP (Constanza et al., 2009:16). To a large extent however, the progression in the development of valid measures and methods within the field of wellbeing research has kept pace with demand as Pavot (2008:124) states:

“[R]elative to the early days of subjective wellbeing research... the array of measures and research methods available to contemporary researchers is impressive. The sophistication and reliability of subjective wellbeing measures has increased substantially.”

With a variety of innovative methods now available to researchers and decision makers, there is greater possibility to develop multi-method designs that can overcome many of the shortcomings and weaknesses of earlier single-method studies (Pavot, 2008). Subjective wellbeing measures are of course fraught with methodological difficulties. They can, for example reflect different underlying concepts, be influenced by transient factors, or be affected by linguistic or cultural differences (Giovannini et al., 2011). There is also a concern that such “cultural differences make it difficult to compare the results across different ethnic, gender, age, religion, and other cultural boundaries” (Constanza et al., 2009:16). Multi-method designs are therefore justified as essential for transport research in wellbeing, as rather than sole use of a stand-alone method examining the “what”, methods are combined to examine, discover and answer the “why”.

Subjective wellbeing within transport literature

Currently, there is very little empirical work that directly studies the relationship between transport and the impacts that it may have on wellbeing. Delbosc (2012) provides a comprehensive review of empirical studies examining transport and wellbeing concluding that despite the ultimate importance of wellbeing and in particular life satisfaction there still remains a dearth of evidence (Currie et al., 2010; de Vos et al, 2013; Stanley and Vella-Brodrick, 2009). Furthermore, there is an absence of research examining the additional subjective wellbeing

measurement areas recommended by the ONS: experiences and eudæmonics¹⁵ (ONS, 2011b). Bergstad *et al.*'s (2011) study of 1330 Swedish citizens examining satisfaction with daily travel and whether it has a positive impact on subjective wellbeing, either directly or indirectly, through facilitating the performance of out-of-home activities. Other studies have included examining the value of travel and identified situations where people derive pleasure from the act of travelling (Mokhtarian and Salomon, 2001) but as mentioned there is still this absence of transportation studies measuring subjective wellbeing in its entirety as advocated by Dolan *et al.*, (2011) and the ONS (2011b).

Over the last decades, empirical research on subjective wellbeing in the social sciences has provided a major new stimulation of the discourse on individual happiness (Stutzer and Frey, 2010). The majority of analyses of wellbeing and happiness (brief explorations of aggregated statistics aside) concentrate on activities rather than contextual factors - such as the co-presence of other people - in determining whether activities are unpleasant or not (Patulny and Fisher, 2011). This is why this study combines the DRM with interviewing as a way to better understand the context behind activities. This is due to that fact that there are a multitude of reasons behind why such activities (and in particular certain travel activities) might be classed as unpleasant. This includes but is not limited to the persons activities are shared with (directly and indirectly).

Both qualitative and quantitative methods provide answers on the nature and extent of wellbeing and can be used separately to validate each other's findings or

¹⁵ As discussed in Chapter Four and in this Chapter's methodology section

brought together to deepen insights and possibly raise new questions (Camfield et al., 2009). Goodman et al., (2012) employed a mixed-methods study and integrated self-reported questionnaire data from 1142 participants in the *Commuting and Health in Cambridge study* (collected in 2009) and in-depth interviews with 50 participants (collected 2009-2010). The paper reported that the mixed-methods allowed the study to illustrate how cars simultaneously enable and constrain “wellbeing”¹⁶ in everyday life. There seems to be a lack of subjective wellbeing studies employing mixed-methods and in particular when examining subjective wellbeing and transport. Many other mixed-method subjective wellbeing studies at present have originated from within the public health and psychology literature. The vast majority of these studies focus on childhood wellbeing (Weisner, 2014; Jones and Sumner, 2009; Suldo et al., 2009), teacher and/or family support (Spilsbury et al., 2012) and parental roles (Mitchell, 2010).

Furthermore, within a transportation context, the tiered definitions of wellbeing vary across/within studies; from providing definitions of wellbeing itself, to those examining objective versus subjective wellbeing. Subsequently the methods used to draw conclusions within studies Delbosc (2012) found, varies across the board. These methods ranged from psychometrically validated measures of wellbeing such as the Temporal Satisfaction with Life Scale (Pavot et al., 1998; Pavot and Diener, 1993) and the Personal Wellbeing Index (Stanley, et al., 2011) to other non-psychometrically validated measures such as asking “would you describe yourself as happy?” (de Groot and Steg, 2006). Finally, measurement tools and

¹⁶ Wellbeing here considered as “overall happiness” and not a study examining the specifics of wellbeing as a field of research

analysis methods vary across the literature from simple categorical analyses with no tests of statistical significance through to structural equation models (de Groot and Steg, 2006; Mollenkopf *et al.*, 2005). Therefore we can see that there is no “magic method” or even basic protocol in an attempt to synthesise the various definitions, measurement techniques and evaluations of subjective wellbeing studies. This Chapter aims to go some way towards addressing this gap in the research by suggesting that the method proposed here is one of the most complete methods available. This Chapter additionally suggests that the DRM when applied in conjunction with interviews provides a robust and valid subjective wellbeing measurement tool. Consequently, the strengths are enhanced by the marrying of the two methods permitting an in-depth examination by pinpointing the reasoning and rationale behind peoples’ responses to subjective wellbeing questions.

The next section of this Chapter describes the research approach, the case study, sampling framework and longitudinal cohort. This is followed by the methodology and the methods employed justifying their use and explaining their application.

7.3 Research approach: Case study, sampling and longitudinal cohort

In justification of the combined DRM and interview approach, the main aim of the research was to explore the interactions between travel behaviour change and subjective wellbeing in a longitudinal case study setting. Research objectives sought to identify changes in peoples’ subjective wellbeing over time and the impact travel has on moment-to-moment moods. Finally, key research questions

included “What are the spill-over effects from transport mode on everyday activities?”; “How does transport mode impact on individuals moment-to-moment moods?” and “What lessons can be learned and what policy implications may arise from using a longitudinal, mixed-method approach?”

Case study: Connect2 Cardiff

The Cardiff Connect2 programme is a 140 metre bascule walking and cycling bridge called the ‘Pont-y-Werin’. It links Penarth, an affluent residential town in the southwest of Vale of Glamorgan (population 23,000 approx.) to the International Sport Village (ISV) located in the Cardiff Bay area of Cardiff (population 346,090). *The majority of Cardiff’s population (80%) describe themselves as white British with the remaining 20% of residents creating a significant mix of ethnicities. There is major socioeconomic deprivation in Cardiff’s inner city areas of Grangetown and Butetown, whereas Penarth is mixed socioeconomically with some significant pockets of affluence (Ogilvie et al., 2012; Census, 2011).* The hypothesis established by Sustrans for the Connect2 scheme was that the project would:

“[T]ransform everyday travel for local people in communities across the UK, creating new bridges and crossings to overcome busy roads, rivers and railways, and linking these to networks of walking and cycling routes, making it easier for millions of people to walk and cycle for everyday journeys.” (Sustrans, no date)

Before the Pont-y-Werin was built the most direct route between Penarth and Cardiff was to drive or cycle across a very busy 4 lane dual carriage way ominously called the “Cogan Spur” with no legal pedestrian access. There is a

much longer route linking the two urban areas along the “Penarth Road” but this is not conducive to safe, quick, and easy walking (and to some degree cycling) trips to and from Penarth/Cardiff/ISV. Alternatively there is the Cardiff Bay Barrage route, a longer scenic route crossing the Barrage which closes at night and in heavy winds. Aside from driving routes, which at peak times are heavily congested, and a lack of easily accessible walking and cycling provisions, public transport links between the two areas are considerable. The Penarth branch line consists of three train stations connecting directly into Cardiff Central alongside regular bus networks linking areas in and around the city.

Other than the work of iConnect the only monitoring, evaluation and data collection undertaken in the area and at the Pont-y-Werin site are the routine user-monitoring data counts such as those collected by Sustrans on the NCN (Ogilvie *et al.*, 2012; Cope *et al.*, 2003). Therefore, it was posited that a large scale UK-wide scheme aimed at improving networks for walking and cycling such as Connect2 required further valid and robust monitoring and evaluation to justify the feasibility of similar future projects.

Sampling strategy

The initial iConnect baseline survey helped to establish and build the sample of respondents; potential participants who indicated that they were willing to be contacted during future research. Of the 1,130 participants who took part in the iConnect study, 659 participants (58%) agreed to take part in follow up data collection in and around Penarth and Cardiff (Ogilvie, et al., 2012). Of these consenting households, respondents stating that they suffered from a long-term

illness combined with a low intention (on a Likert scale from 1-5) to increase their active travel levels (N=120) were excluded. Additionally, households living outside three defined buffer zones (Figure 3.5) were also excluded from research (N=137) due to the distance to the intervention being too far, and therefore the impact that the intervention had on household travel being too small. These buffer zones were smaller than those defined by iConnect and were drawn at 0.5km, 1km and 1.5km distance from the recently completed walking and cycling intervention; Sustrans “Connect2Cardiff: Pont-y-Werin” (www.sustrans.org.uk). Smaller buffer zones were chosen as the starting sample population (659) was smaller than iConnect’s core baseline (1,130). The buffer zones were based on distance to the Connect2 scheme and were defined to draw the sample from: approximately 50% of participants from buffer zone A (i.e. 0.5 km with 200 households); approximately 25% of participants from buffer zone B (i.e. 1 km with 136 households) and approximately 25% of participants from buffer zone C (i.e. 1.5 km with 66 households). Therefore, of the 659 participants who agreed to participate in follow-up research, a total 402 households were contacted.

Each household contacted received a recruitment pack consisting of an invitation letter (Appendix C), a stamped return postcard (to indicate willingness to participate) and an information booklet (Appendix D). A 35% response rate was achieved with 141 respondents. To reach the final sample of 60 households, further sampling criteria were applied to further exclude respondents with a low-to-moderate intention (on a Likert scale from 1-5) to increase their active travel levels (N=81). The final sample included in the study focused on respondents who “had

intentions to do more active travel over the coming months” and who had stated a moderate-to-high intention (on a Likert scale from 1-5) to increase their walking and/or cycling levels with or without a long-term illness. This approach was taken because some respondents suggested that although they had a long term illness, they still had a moderate to high intention to undertake more active travel. These households were contacted either by phone or by email and a meeting date and time was arranged at the respondents’ home. To improve response rate and limit attrition a financial incentive was offered to all participating households. Of the 60 households, 15 were included in a pilot study undertaken in April 2011 (i.e. 15 household interviews and 15 DRM surveys), followed by the remaining 45 being surveyed in July 2011 (i.e. 45 household interviews and 48 DRM surveys).

Longitudinal cohort

In July 2012 a follow-up survey was conducted with the same cohort of households with a second recruitment pack issued which included an invitation letter; mailed to each household who took part in the previous year. This recruitment pack informed the main respondent of the purpose of the repeat study and that they would be contacted shortly to be invited to take part in follow-up data collection. From the original 60 households (the pilot and W2 combined) a 70% response rate was established with 42 households agreeing to take part in wave three. The advantage of a longitudinal cohort is that a rapport and a degree of familiarity is established during the baseline survey, making the follow-up both more straightforward but also less time consuming than in a scenario where two separate sampling groups are used. In terms of data collection 42 households took

part in the interviewing out of which a total of 44 individuals completed the DRM survey.

A field team of two researchers were deployed, one of whom collected data for an analogous study. The households were surveyed to collect data for both projects, however in retrospect this may have overburdened some participants and possibly discouraged them from taking part in the follow-up phase. However, combining data collection activities in this way did have the advantage of reducing financial outlay, as well as saving time in the field. Table 7.1 demonstrated the sampling framework for this D.Phil. as well for the main iConnect consortium study.

	Pilot (2009)		W1 (2010)		Bridge (July 2010)				W2 (2011)		W3 (2012)
iConnect	1000		1,130					-	402 of 659		487
D.Phil.	-		<i>No sample</i>				15 hh interviews and DRM		45 hh interviews and 48 DRM		42 hh interviews and 44 DRM from the original 60 hh
			W1 (2010)		Bridge (July 2010)		Pilot (W2) (April 2011)		W2 (2011)		W3 (2012)

Table 7.1: Sample comparisons: iConnect and D.Phil.

Source: Goodman *et al.* (2013); Sahlqvist *et al.* (2011)

Notes: Interviews conducted by households (hh), surveys conducted by individual within hh. Wave 2 data collection includes a pilot study, wave 3 data collection includes pilot sample

7.4 Methodology, rationale and justification

A mixed-method exploratory approach was used to answer this study's research questions and meet key objectives. Household interviews and a subjective wellbeing survey were used to explore and better understand peoples' beliefs and perceptions of constraints to travel behaviour and the impacts transport modes have on happiness. It was considered important to mix-methods as the context behind decisions, and changes over time, were measured in an attempt to understand the nuances behind the survey and interview data (Flowerdew and Martin, 2005). As Graham (1999:83) discusses;

"...the division between questionnaires and interviewing is sometimes difficult to sustain in practice, for semi-structured interviews may produce quantitative data and useful qualitative information may result from work with structured surveys".

It can therefore be seen that identifying the most appropriate form or method of data collection is an important and crucial part of any research project. The incorrect choice may affect the "validity, reliability and credibility of the data... the adequacy of the research process... [and the] judgements made about the empirical grounding of the research findings" (Struss and Corbin, 1990). All research methods however have their problems and limitations (Östlund et al., 2011; Cresswell, 2013; Davies, 2003; Walle, 1997) and it is not possible to place research techniques in a hierarchy of excellence, as different methods are appropriate for different research questions (Bowling, 2002; Brown and Dowling, 1998; Yin, 2013).

The main study sought to explore the changes and consequences in travel behaviour and subjective wellbeing in response to physical interventions for

walking and cycling. Understanding people's mood whilst undertaking travel activities is an important area for research, therefore the research questions for this study sought to examine the consequences of transport activities on individual subjective wellbeing and the impacts on moment-to-moment moods known as "spill-over effects". Whilst examining travel behaviour this was seen to be a critical step towards understanding certain constraints, and the motivations and justifications behind travel decisions.

Figure 7.1 demonstrates a comprehensive approach to mixed-methods research and is a useful framework as it includes four elements which impact the "research problem"; stakeholders interests (Chapter Five; residents of Penarth and Cardiff, local councillors, funding bodies etc.), review of literature (Chapter Four), economic factors (discussed in Chapters Four, Six and Seven) and serendipity (i.e. outcomes and outputs) (Hesse-Biber, 2010). Pooley et al., (2011) used a mixed-method approach to explore attitudes to and perceptions of, walking and cycling, and examined the process of household decision-making for everyday travel and the constraints that this imposed. Pooley et al's., (2011) study used survey, interview and ethnographic data to understand people's ambiguous and sometimes contradictory views of walking and cycling as effective means of everyday travel. Identifying with mixed-method research, it can be suggested that what people do, rarely matches precisely what they believe, and that the complexity and contingency associated with everyday travel for many households, is a major barrier to the use of more sustainable travel modes. Combining these methods

supports the results and outcomes of the study and allows a deeper understanding of the context behind the case study.

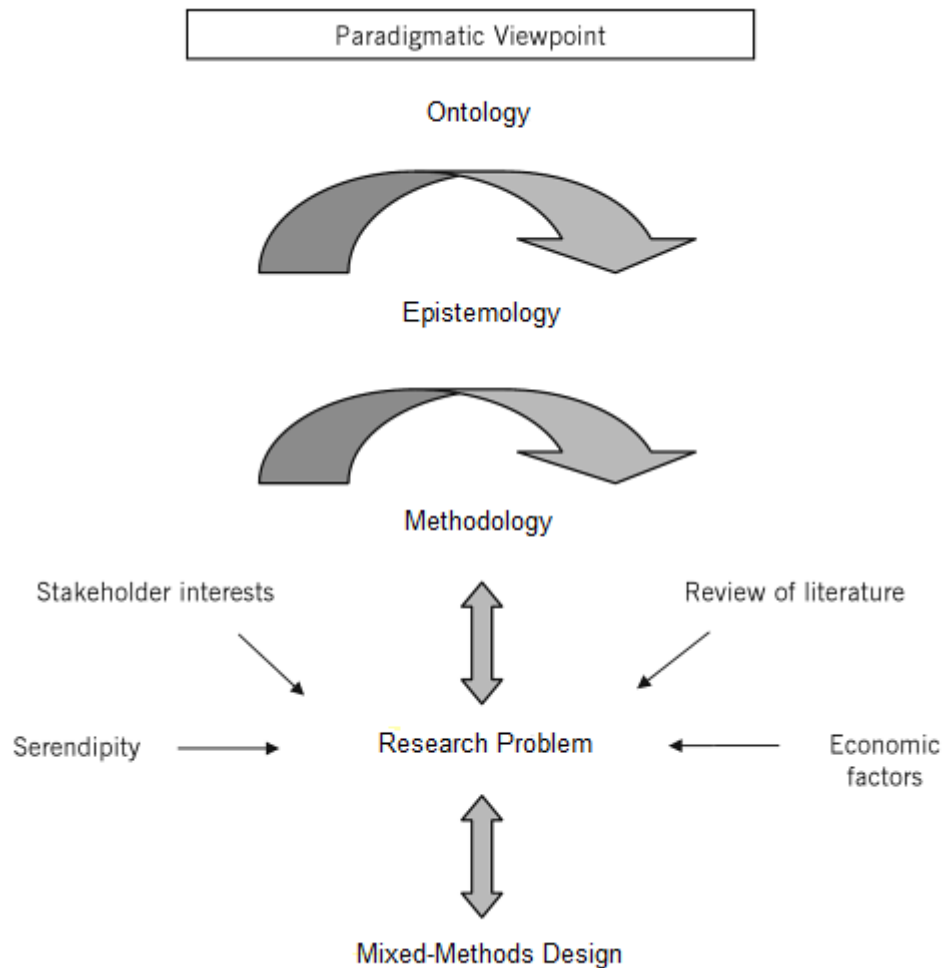


Figure 7.1: Comprehensive approach to mixed methods research

Source: Hesse-Biber (2010)

Day Reconstruction Method

The rationale for using the DRM is that it constitutes a reliable, valid and easily administered survey that would not represent too onerous a task for the cohort of respondents to complete effectively; especially as it was adapted and shortened from Kahneman et al.'s (2004a) version. Use of the same survey during the follow-up wave of data collection was far less arduous, since participants knew

what was involved, what was expected of them, and how long it would take to complete. Finally, as depicted in Figure 7.2 in addition to focusing on the evaluation of life satisfaction and the measurement of experiences (e.g. happiness and anxiousness), the DRM also permits an examination of eudæmonics (i.e. participants' perception of the worth and meaningfulness of activities), as advocated by the ONS and Dolan et al. (2011).

As suggested, global reports of happiness or general life satisfaction must be measured. A cognitive evaluation of the conditions and circumstances of life in positive and satisfying terms is also required. This measures domains such as home life and employment through affective responses to questions posed within measurement tools to examine emotions and moods (it can be divided into positive and negative affect and measured as two separate components (Lucas *et al.*, 1996; Pavot, 2008; Argyle *et al.*, 1995)). Generally there is a strong relationship between individual domain satisfaction and overall life satisfaction and therefore, at the conceptual level, domain satisfaction is often subsumed within the life satisfaction component of measurement. As above, it is additionally important to measure eudæmonia (ONS, 2011b; Dolan *et al.*, 2011) as White and Dolan (2009) suggest; thoughts as well as feelings are important to examine, as some activities that are relatively low in pleasure (e.g., work) are nonetheless considered rewarding and worthwhile and therefore contribute significantly to overall subjective wellbeing. As Figure 7.2 demonstrates the evaluations, experiences and eudæmonia behind travel feed directly into overall subjective wellbeing and can

be easily included in measures and evaluations within travel behaviour studies as well as wellbeing studies.

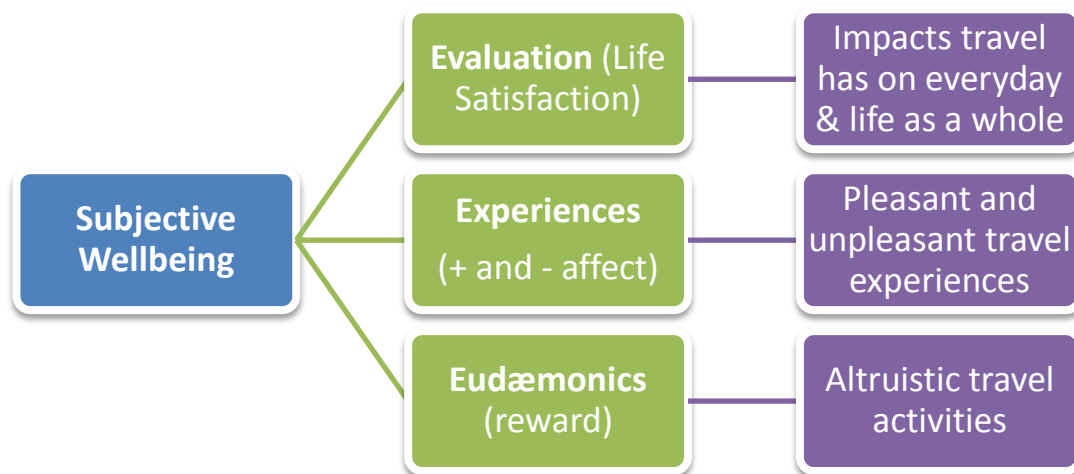


Figure 7.2: Subjective wellbeing and transport measurement

Adapted from Dolan *et al.* (2011)

The DRM was originally designed by Kahneman *et al.* (2004a) whose study applied the method to a sample of 909 working women in Texas to compare against the results of the Experience Sampling Method (ESM)¹⁷; the DRM presented here is adapted from the original protocol to assist understandings of the impact travel has on moment-to-moment moods. Ultimately, it can be argued that the DRM is successful as it constitutes a hybrid method encompassing both ESM techniques and time-use diaries in a way that ensures weaknesses are reduced. Time-use studies usually rely on global reports of happiness or satisfaction with life in general, or focus only on the home life and employment experiences of participants. ESM adds to this measurement as participants are required to record where they are, what they are doing, and how they feel several

¹⁷ A method of capturing daily life as it is directly perceived from one moment to the next (Hektner *et al.*, 2007).

times throughout a single day which enables a far richer measurement of people's QoL and provides a better description of a sample of moments in respondents' lives (Diener and Suh, 1997). It also helps to avoid the distortions that affect the delayed recall and evaluation of experiences (Robinson and Clore, 2002). Therefore, we can see the true basis and origin of the DRM is the combined use of these two techniques which allows for the weaknesses of both methods to be compensated for; time-use studies typically not including measures of satisfaction derived from activities or the subjective experience of specific situations, and ESM usually being expensive, often placing a high burden upon participants, and normally failing to sample rare or brief events. Cast against these partial methods, the DRM can be viewed as advantageous in that it combines not only experiential and evaluative measures, but also a consideration of eudæmonics, thereby providing a comprehensive overview of subjective wellbeing. It is a contemporary and reliable tool that can be readily adapted and applied in the field with relatively low responder pressure.

For methodological reasons it is important that respondents complete the DRM diary before they are aware of the specific content of the later questions. Early knowledge of the survey questions may affect "day reconstruction" and may introduce selection bias (Kahneman, et al., 2004b). Many authors (e.g. Schimmack et al., 2002; Eid and Diener, 2004; Schimmack and Oishi et al., 2007; Pavot, 2008) have demonstrated that the influence of contextual factors, bias and response styles is limited, and that self-reporting of subjective wellbeing is generally reliable and valid. This however has been contested by some (e.g.,

Schwarz and Strack, 1999) even though it has the advantage in that it represents the direct report of the individual's subjective experience without the need of inference or interpretation by others (Pavot, 2008). Within Kahneman et al.'s (2004b) DRM documentation a comprehensive list of strengths is included; "joint assessment of activities and subjective experiences"; "information about the duration of each experience, allowing for duration weighted analyses of experiences" and "lower respondent burden" and "provides a more complete coverage of the day". Furthermore, they state that the DRM provides "lower susceptibility to retrospective reporting bias than typical for global reports of daily experiences" and has "high flexibility in adapting the content of the instrument to the needs of the specific study".

As with any method there are of course, limitations and weaknesses in its application, adaptability and/or analyses that require consideration. Dolan et al. (2011:11) suggest that these are "not fundamental flaws but rather issues to address when moving forward any measure" of subjective wellbeing; two key issues include salience and selection. Salience issues stem from a respondent's attention being focused on answering surveys rather than life experiences. The mere act of asking a subjective wellbeing question might affect experiences, and responses can be influenced by salient cues (See Table 4.1; "MINDSPACE"), such as the previous question and perhaps also by the organisation carrying out the survey (Dolan and Kahneman, 2008; Wilson and Schooler, 1991). Selection effects are crucial as well, as respondents who select into answering a survey could be of a certain life-stage etc. (i.e. retirees or students); therefore it is important to

establish whether the effects of any factors associated with subjective wellbeing are generalisable or specific to the sample population. Attrition of certain types of people to different types of subjective wellbeing surveys is also important to generalising treatment effects. Watson and Wooden (2004) for example show that people with lower life satisfaction are less likely to be involved in longitudinal surveys.

Interviews

In-depth interviewing was chosen as respondents can spontaneously express their ideas in their own words in a flexible, interactive and responsive manner (NCSR, 2002). It is an appropriate method to obtain qualitative data as it helps provide rich descriptions of complex phenomena and is an unobtrusive systematic approach (Cresswell, 2013; Ritchie, 2013; Silverman, 2013; Jordan and Gibson, 2004). The questions were deliberately worded as openly as possible as a way to encourage detailed replies, followed by a series of responsive and probing questions to ensure that each point was articulated in detail. This was to ensure the respondent's motivations and behavioural decisions for example, and the factors that underpin and influence them, were understood (NCSR, 2002).

Subsequently, in-depth interviewing was the preferred method because it was felt that comparable travel behaviour studies had successfully utilised interviewing as a method to collect valuable data. Such studies on travel behaviour research where interviewing as a qualitative research method is used include the work of Guell et al., (2012). This research conducted forty-nine semi-structured interviews and examined how people describe their commuting experiences and make commuting

decisions. The study departed from narrow behavioural approaches to travel and instead investigated the social context of commuting with qualitative social research methods. Many studies used multiple qualitative methods by combining interviews and focus groups for example; Papangelis et al's., (2013) study examined the effects of disruption on travel behaviour in rural areas and Lo et al's., (2013) study focused on pro-environmental travel behaviours among office workers. For this research, interviewing was chosen as the sole qualitative method as applying two or more qualitative methods, plus the quantitative survey would present challenges for analysis, as well as being too great a burden for respondents and a strain on the study's strict time and cost budgets.

Within the context of this D.Phil. thesis and by examining academic studies, including those presented above, it can be seen that interviewing as a method can be successful in helping the researcher examine behavioural patterns as they occur (Black, 1999). Alongside this, interviews are predominantly inductive (Hoyle Harris and Judd, 2003) and invaluable when conducting initial explorations to develop theories and to generate hypotheses moving toward explanations (Sofaer, 2002).

Interviewing "excels in gaining an in-depth understanding of a situation in its natural context and provides an 'insider's view' of that situation" (Belsky, 2004:277). It is however too easy for respondents to be influenced by interviewers and social acceptability biases (Merriam, 2014; Oppenheim, 1992); therefore interview skills training was undertaken for this research. Interviewing enables the development of grounded theory based on actual perceptions (Jordan and Gibson, 2004), and is a way to encourage deeper responses through supplementary

questions, further explanations and personal experiences (Davies, 2003; Ritchie, 2013). The questions developed within this study's interview schedule were designed to obtain answers pertinent to the research problem (Kerlinger, 1973), gather a large amount of information from a small number of people (Pope et al., 2006) and provide a greater depth of knowledge (Jordan and Gibson, 2004; Merriam, 2014; Silverman, 2013). The interview schedule (see Appendix B) included questions on:

- **Potential for change and actual change** of active travel behaviour for all household members; for both utility and leisure travel
- **Socio-demographics**, gender and age of each member of the household
- **Everyday household travel** and journeys to work/school and potential for change
- **Intentions** to walk and cycle more
- **Perceptions and attitudes** towards the Connect2 scheme
- Attitudes towards primary respondent's active travel/commuting
- **Satisfaction with travel** provision and facilities in and around local area
- **Accessibility** to services and opportunities relevant to each household member
- **Average household car use**, access and actual and potential plans to change (reduce amount/go car free)

Outcomes of interviewing entire households are that a lot of detailed audio recorded data is created; which for this study was professionally transcribed for analysis. The interview transcriptions were read and reread thoroughly, and each was subsequently coded into reoccurring themes and subthemes. Each transcription was reread multiple times to ensure that the themes presented were prominent and consistent. A combination of NVivo, Excel and Word were used to help speed analysis and validate and store data, as well as providing a database of

interesting and important direct quotes from respondents. The data collected were also quantitatively analysed in part, to fully exploit the data collected.

7.5 Method

An adapted version of Kahneman *et al*'s (2004a) DRM was used alongside in-depth interviewing to gain deeper understandings about how people spend their time and how they experience the various activities and settings of their lives in and around Penarth and Cardiff, Wales, UK. The DRM survey (Appendix A) was distributed before respondents took part in a household semi-structured interview (Appendix B). *The interview schedule was developed ensuring that each interview yielded detailed information about demographics, typical household travel and activities, modal use and perceived and actual constraints and motivations to travel behaviour change. Interviews also focused on journeys to and from work, school and around the local area, levels of satisfaction with local travel, and included questions on perceptions of a new local transport infrastructure that had been recently installed; the Pont-y-Werin Connect2 scheme. Additional questions examined constraints to increasing individual and household-level active travel. A list of prompts was used to elicit more detailed responses, the schedule was pilot-tested for clarity and the researcher's positionality was considered so not to disturb the dynamics of the household or affect the data (Bryman, 2012).*

The final sample within Penarth and Cardiff comprised households with both single occupants and couples (with and without children). Householders present at the time of data collection ranged from one person (the main contact who completed the iConnect survey) up to a family of five. Some households had a dual income,

some were professionals, some were on career breaks after having children and some were retired. The sample therefore comprised a range of demographic and socioeconomic status groups. The average number of people per household was three, whilst the average number of years spent in the household was 12. Respondents' ages varied from 23 to 77, and each household interview lasted an average of 25 minutes.

The longitudinal study used the adapted DRM and the semi-structure interview and included the subjective wellbeing measures advocated by the ONS (Dolan *et al.*, 2011); experiences, evaluations and eudæmonia. The DRM employed also involved the introduction of further transport activity options into the survey and was shortened to fit the timeframe and purpose of this research. Kahneman *et al.*'s (2004a) DRM allowed this study to examine the spill-over effects of transport mode on a person's moment-to-moment mood allowing deeper understandings of the psychological processes and emotions before, during and after undertaking transport activities. Wave two of data collection commenced in April and July 2011. A total of 60 household interviews were conducted and 63 DRM surveys completed, were found suitable and therefore included in analysis. Wave three data collection in July 2012, received 44 completed DRM surveys from 42 household interviews; thus the study obtained a 70% response rate for the follow-up phase of data collection. Not all members of the household who took part in the first set of interviews were present in the second, and some participants decided to fully opt-out of the survey.

The DRM attempts to capture *all* activities in an unbiased manner and so was distributed before the interviews in the hope that the respondents' attention would not necessarily be focused on answering questions solely in relation to transport. The DRM consists of a diary page, a survey and some general day and life satisfaction questions. At the beginning of the diary a statement was presented and read aloud by the researcher to help ease understanding of instructions;

"Please describe your day. Think of these hours as a continuous series of scenes or episodes¹⁸ in a film that covers all of this time. Give each episode a brief name that will help you remember it. Write down the approximate times at which each episode began and ended. Try to remember each episode in detail, and write a few words that will remind you of exactly what was going on. What you write only has to make sense to you, to help you remember what happened when you are answering the later questions." (Dolan et al., 2011)

After the diary (of approximately 11 episodes per person) was created, respondents were asked for each of the episodes to:

"Please look at your list of episodes and select the earliest [next] episode you noted, right after you woke up [the previous episode]. Please try to remember the times as precisely as you can."

Following this, questions such as "Who were you with?"; "What were you doing?" and "How did you feel during this episode?" were asked. After the diary and the first episode were completed, the majority of respondents seemed confident and at ease with what was required of them and any initial apprehension soon disappeared. As mentioned, final survey questions asked respondents to state on

¹⁸ "Moments" or "time periods"

a Likert Scale day and life satisfaction and whether their answers represented a typical day.

This approach was advantageous as it allowed the interviews to be introduced after survey completion and to a certain degree, allowed both the interviewer and respondent time to familiarise themselves with the research process. It was decided that a mixed-method approach was suitable as a large amount of data could be collected in a small timeframe and, after survey completion the addition of the interview seemed to create and stimulate an extension of a conversation rather than the start of a formal interview. Therefore, it was hoped that the strengths and limitations of both methods could be alleviated and balanced out and that by introducing interviews the true nuances behind survey responses could be explicitly brought forward.

7.6 Results and discussion

The average number of episodes recorded per respondent over the two waves was 9.2 and 9.4 respectively and average episode duration was 93 minutes and 87 minutes respectively. The DRM results and interviews of two respondents (i.e. “Henry” and “Poppy”) will be used to demonstrate the importance of a mixed-method approach.

Case One: “Henry”

Henry in wave two was extremely car-centric (for work, leisure and shuttling children around), living and working in Penarth. The DRM analysis demonstrates a shift in Henry’s subjective wellbeing but does not offer any highlights as to the

reasons behind such findings. Results indicate that there was a change in Henry's life satisfaction from 8 out of 10 in 2011 to 7 out of 10 in 2012 and also day satisfaction; when asked "Overall, compared to a typical day, yesterday was..." his response changed from "Pretty Typical" (i.e. 3 out of 5) in 2011 to "Much Worse" (i.e. 1 out of 5) in 2012. The results of the first DRM indicate that although Henry was happy whilst driving (5 out of 6), and that the experience benefitted someone else (6 out of 6) and helped achieve goals (6 out of 6), the other feelings experienced during that activity signify that for Henry, driving actually was not a very pleasant experience. Henry was not very relaxed (2 out of 6) but in fact quite impatient for the episode to end (4 out of 6), and quite frustrated (3 out of 6), sad (3 out of 6) and anxious (3 out of 6) (although this episode was recorded at end-of-day rush hour with children in the car). In 2012 higher and more frequent levels of unpleasant experiences were recorded; generally it can be said that from waking until 6pm, Henry experienced higher levels of frustration, impatience for episodes to end, and anxiety on that day in 2012 compared to 2011. The reasons behind such findings would not be apparent if the DRM did not have the support of the interviews. As such it is possible to identify whether Henry simply "had a bad day" or, "chose not to drive that day", or in fact that there are deeper elements to be investigated behind his responses.

The results of Henry's interview in fact indicate that due to a sudden change in circumstances outside of his control, Henry stopped using his car and started walking and car-sharing with friends. This extreme event, alongside Henry having to dissolve his town-centre based business (a few months beforehand) and

continue his business from home, resulted in two very different sets of data. The first 2011 interview with car-centric Henry included responses and discussions regarding commuting and dropping children at school:

“Typical journey is leaving about 8.15am to take the boys to school... one after the other then into work at 8.45am where I stay, generally in my business which is in the town centre and then the two boys... walk to me or get a lift to my office. And then we leave about 4pm... [and] we’ll drive home. Sometimes I have consultancies where I do have to take my car to go out of Penarth, usually within a 12 mile radius maximum sometimes a little bit further, but generally I would say on average, out of Penarth, once every fortnight”.

Discussions on satisfaction with local travel were also interesting with Henry’s use of words suggesting his was “lucky” and that he has the “luxury” of travelling when and where he wished. The interview continued to demonstrate that Henry made full use of the many opportunities to drive and that any alternative mode was not considered an option, even when distances were short:

“[Work is] a mile, it’s basically up the hill... I think if I had to leave Penarth to be in work, in Cardiff, everyday at 9am it would be a nightmare. I’m very lucky in so much as I somehow seem to be going the opposite direction to the traffic, so that’s unusual actually, so if it was the normal I’d be in a traffic queue. And coming home, because of the way I go via the Marina, I’m very rarely in a traffic queue... and if I see a queue I turn around and but then you know I have that luxury...”

When examining the follow-up interview in 2012 we can start to understand why the results of the DRM were suggesting a shift in subjective wellbeing, when asked “Could you tell me briefly about the journeys you make during a typical week, have they changed at all from last year?” Henry’s response was:

“Oh well yes they have changed, the other side of the scale I suppose because I can’t drive since my accident on March twenty-ninth so I’m having to rely on lifts from family and friends and walking to the nearest Tesco’s with a trolley... It’s amazing when you are put in a situation, you manage...”

As demonstrated in Henry’s household interviews, the changes in behaviour and nuances behind decisions would not have been brought forward if the supporting interviews had not been conducted.

Table 7.2 compares the two waves of data providing DRM scores for Henry’s work episodes with colleagues, his boss and clients. The 2012 work episode data resulted in a U-Index of 1, and therefore can be considered a very unpleasant experience. This demonstrates the importance of mixed-methods as there otherwise would be no way to identify the reasons behind such negative experiences.

	DRM score 2011	DRM score 2012
Happy	6	1
Relaxed	2	1
Engaged	6	6
Focused	6	6
Frustrated	2	6
Sad	2	3
Anxious	2	6
Impatient for episode to end	2	6
Competent	6	3
Worthwhile and meaningful	5	6
Benefitted someone else	6	0
Helped achieve goals	6	6
Eudæmonia	5.75	3.75
Positive Affect	5.00	3.50
Negative Affect	2.00	5.25
Net Affect	3.00	-1.75
U-Index	0	1

Table 7.2: DRM scores: Episode with colleagues, boss and clients

Net Affect is the average of four positive adjectives (happy, relaxed, engaged, focused) less the average of four negative adjectives (frustrated, sad, anxious, impatient). All of the adjectives are reported on a 0 to 6 scale, ranging from 0 - "not at all" to 6 - "very much." The U-Index is the proportion of each person's time engaged in an activity in which the dominant emotion was negative, averaged over individuals.

Henry faced a non-transport change between 2011 and 2012 affecting his travel behaviour and (dis)satisfaction, the second case to be examined "Poppy" is provided as she experiences a change in travel behaviour between the two waves as well as a life event affecting her DRM, travel patterns and views expressed.

Case Two: "Poppy"

Poppy in wave two was commuting to work in Cardiff Bay everyday by car, she walked for leisure and before moving to live in Penarth, used to cycle for leisure (albeit infrequently) too. Poppy stopped cycling after moving to the area because "Penarth [is] really hilly for cycling". The DRM analysis demonstrates a shift in Poppy's subjective wellbeing but again does not offer any context or explanations behind such findings. Results indicate that there was a change in Poppy's life satisfaction from 7 out of 10 in 2011 to 8 out of 10 in 2012 and also day satisfaction; when asked "Overall, compared to a typical day, yesterday was..." her response changed from "Pretty Typical" (i.e. 3 out of 5) in 2011 to "Somewhat Worse" (i.e. 2 out of 5) in 2012. The results of the first DRM indicate that although Poppy was happy (5 out of 6) commuting by car and that she was engaged, focused and competent (all 6 out of 6) during the episode, she was also not very relaxed, and a little frustrated and anxious (all 3 out of 6). Additionally, whilst driving she was sad and impatient for the episode to end (both 2 out of 6). In the 2012 data set, the two driving episodes within the DRM are linked to socialising and the commuting activities are by train and by walking. It can be seen that in 2012

Poppy's commuting episodes were happy (4 out of 6), relaxed (4 out of 6) and helped her achieve her goals (5 out of 6). She was not however very engaged or focused (2 out of 6) and she was frustrated, sad, anxious (all 2 out of 6) and that the experience did not benefit someone else (1 out of 6). Therefore, in terms of commuter trips, it can be said that Poppy was less happy, engaged and focused in 2012 than 2011 but was more relaxed and the activity helped her achieve her goals.

Once again, a deeper examination behind such results is needed to identify whether these findings were due to Poppy simply "having a one-off commute by public transport" or whether she "wanted to start travelling more sustainably" for example.

The results of Poppy's interview indicate that due to a life event change in 2012 she had the opportunity to switch modes of transport for her commute to and from work. This resulted in two very different sets of data. The first 2011 interview with car-commuter Poppy included responses on travelling to and from work and in and around her local area:

"[Driving] around here isn't really that great... it's too busy especially at rush hour and it takes too long, I think the schools maybe make it bad. I have to drive 'cos there's no other like reasonable way for me to get to work, I'd have to take two trains, but it's probably also because I get free parking at work too. [laughs]"

Poppy's responses are interesting as she rationalises her driving by stating how "the schools maybe make it bad" and "there's no other reasonable way to get to work" as well as "I get free parking at work" so therefore either shifting the blame or justifying her travel as having no other suitable alternative modes. Again

Poppy seems very car-centric, when asked about “Satisfaction with local travel” her interview demonstrated that there were a vast number on constraints to her using local public transport for work as well as increasing her walking and cycling for utility.

“Well the trains are good and ummm, ah I’m not really sure about the buses, I’ve never taken one [in Penarth], that’s pretty bad isn’t it! But like I say the trains are good although I have the problem of having to take two to [get to] work... For bicyclists there are loads and loads of cycle paths around here, and there’s the Taff up to Brecon, and there are good running routes too along the railway tracks. I used to cycle but moving to Penarth, well it’s really hilly for cycling and I wouldn’t want to do that every day...”

When examining the follow-up interview in 2012 we can start to understand why the results of the DRM were suggesting a shift in subjective wellbeing, when asked “Could you tell me briefly about the journeys you make during a typical week, have they changed at all from last year?” Poppy’s response was:

“Oh I got my new job! I’m working for another accountancy firm in the centre, since ummm the beginning of January. It’s been very stressful and the hours are really long, but I really do love it and it’s nice to work in the centre. I’ve started going in by train because Cardiff Central is pretty close to work which is OK, so now I just walk to and from Dingle Road and at the other end. We still walk for pleasure around here, mostly up the Country Park...”

A new job and a change in work location opened up opportunities for Poppy to commute to work by foot and by train and resulted in her experiencing very different transport modes and trips in 2012 when compared to 2011. However, because of the changes in her DRM scores in 2012 it could be suggested that she was suffering more when commuting by public transport than by car but the context behind her life event change could equally be a factor. The stresses of her new position may have meant that she had higher levels of frustration, sadness

and anxiety but the new job may have increased her overall life satisfaction and she finds her commute more relaxing now than when she travelled by car. Again as demonstrated in Poppy's household interviews, the changes in travel behaviour and nuances behind her decisions would not have been brought out if the supporting interviews had not been conducted.

Table 7.3 compares the two waves of data providing DRM scores for Poppy's commuting episodes. The results demonstrate interesting findings for travel episodes but there is no context behind such experiences to understand what is happening and why, this therefore again demonstrates the importance of mixed-method studies.

	DRM score 2011	DRM score 2012
Happy	5	4
Relaxed	4	4
Engaged	6	2
Focused	6	2
Frustrated	4	2
Sad	2	2
Anxious	4	2
Impatient for episode to end	2	4
Competent	6	3
Worthwhile and meaningful	5	3
Benefitted someone else	5	1
Helped achieve goals	6	5
Eudæmonia	5.50	3.00
Positive Affect	5.25	3.00
Negative Affect	3.00	2.50
Net Affect	2.25	.50
U-Index	0	0

Table 7.3: DRM scores: Commuting episodes

Net Affect is the average of four positive adjectives (happy, relaxed, engaged, focused) less the average of four negative adjectives (frustrated, sad, anxious, impatient). All of the adjectives are reported on a 0 to 6 scale, ranging from 0 - "not at all" to 6 - "very much." The U-Index is the proportion of each person's time engaged in an activity in which the dominant emotion was negative, averaged over individuals.

Successes

A major advantage of the DRM in this application is that it allows you to successfully examine the eudæmonics or rewards behind activities; doing something which is thought of as perhaps not enjoyable (e.g. picking up sibling's children from school) but in retrospect the rewards are great, and in the long run it makes a person happy. The results gathered from using the DRM therefore allow for differences to be reflected between belief-based generic judgments ("I enjoy my kids") and specific episodic reports ("but they were a pain last night") (Kahneman *et al.*, 2004a). This is reflected in much of the study's results; respondents write in their diaries, episodes such as "travelling with children" and when examining their survey responses (to the twelve proffered adjectives) to such activities/experiences, they indicate for example that they are "very happy" and "very frustrated" but not "not at all sad".

Mixed-method longitudinal cohort design is important when evaluating and measuring subjective wellbeing as it helps limit population generalisations in a way that cross-sectional studies specialise in. This design was important; allowing the researcher to understand exactly what the cohort experienced in their daily lives and as a result, how subjective wellbeing can change over time. This, alongside interviewing, was seen to be a robust mixed-method allowing the collection of insightful, interesting and innovative data. There are evermore multiple reasons why such research is valid, required and sought after which include but are not limited to; a lack of credible evidence on how such activities impact upon under-represented groups such as cyclists, and walkers and public

transport participants from a leisure perspective. There is also a paucity of longitudinal subjective wellbeing evidence and a clear lack of understanding as to the spill-over effects of transport mode on mood. The spill-over data is important, in conjunction with the supporting interviews, as it is a starting point towards identifying what makes people happy/unhappy before, during and after a transport activity; this can then be compared across modes. Of course problems with sample size arise especially with the study described here, however if a large enough, representative sample of users across all modes could be established then this method could be very useful in understanding what impacts a person's subjective wellbeing.

Alongside this, repeat data collection was straightforward as most households already knew the study protocol and, so long as the initial data collection was a pleasant experience, were happy to be involved again. This is demonstrated through the high percentage (70%) of households who agreed to follow up data collection. This combined with a second method ensures the methodological approach, research strategy and survey results are more robust. This is due to the DRM not only supporting within-subject comparisons (e.g., different situations or times of day) as per interviewing, but also between-subjects comparisons (e.g., different age groups) (Kahneman *et al.*, 2004a).

Limitations

Limitations of the DRM in this context include; issues of respondent apathy and overload especially in the follow-up phase as participants were already aware of the time consuming nature of the survey. From this however, the average number

of episodes per respondent recorded was 9.2 for wave two (from a total of 582 episodes) and 9.4 for wave three (from a total of 412 episodes); respondents were therefore providing more information within their diary in the follow-up visit.

Some respondents in both waves, had issues answering certain questions including; “Overall, how satisfied are you with your day yesterday?” and “Overall, how satisfied are you with your life as a whole?” This could be due to the fact that they possibly felt pressure to give a more “positive” answer or that, although “extremely satisfied”, they aspired for more; improvements in work-life, home-ownership, wanting a partner/family etc. so were unable to indicate their responses at the extreme end of the scale. Such questions possibly made some feel uncomfortable, but cross-referencing to household interviews helped improve understandings behind decisions and responses to certain questions. Also as with any survey, total non-response to questions was an issue, even though for the vast majority of questions the survey provided the option of a midway choice rather than solely the extremes of “not at all” or “very much”. Subsequently, questions such as “Who were you with?” did not allow respondents the opportunity to state “other” (e.g. doctor) and so could be left blank; thus impacting upon analysis.

In addition to the concerns discussed above, problems arose from issues with certain underrepresented groups (i.e. commuter and leisure cyclists). The resulting low sample size from such groups meant that their data had to be aggregated with walkers for example, to assist with analysis. Again, it was important to have the supporting interviews to pinpoint and identify why certain

respondents' stated particular reasons behind their decisions to walk or cycle and why for some, cycling (for example) was not an option. Additionally, the first DRM survey, grouped bus and train travel as one activity, the second separated them as it is important to differentiate between activities in the first instance and then proceed to aggregate them in an attempt to identify causes of any "unpleasant" experiences. This helped to demonstrate the importance of including both work and leisure travel and activities, and to ensure that activities are disaggregated fully in the first instance. Leisure time is clearly of great importance to almost everyone's wellbeing and therefore needs to be appropriately represented within the data (Giovannini *et al.*, 2011). Finally, there were issues with measuring the experiences of activities as when asked; "How did you feel during this episode?" in which respondents could choose from on a Likert scale from "0 to 6" against a list of 12 adjectives - respondents struggled to differentiate between certain adjectives (e.g. focused and engaged) so perhaps a slight reduction in the number of options on offer, particularly if they are not obviously dissimilar, would help simplify the process.

Issues subsequently came about from the study being longitudinal in nature; particularly with the repeat wave, where in a couple of households the main respondent was not present to take part in the survey and substituted the opportunity to an alternative householder. This causes data continuity issues, impacting on analysis and also the ability to state that the study is strictly comparative in nature. There is a great need to ensure that the same household members who were present in wave two complete wave three, as it allows the

researcher to capture the matching reasoning behind responses and answers to the survey. Other longitudinal limitations include the fact that over the course of a year; respondents move away, household dynamics change and also as witnessed in the household interviews, getting a full household to take part in a longitudinal study is sometimes very difficult indeed. This said, further issues with this type of research approach are that specifically the method used is very time consuming, describing how to fill out the diary and survey alongside the actual completion increases the amount of time spent with the respondent. This accompanied with the household interview means that visits to households can range from 40 minutes to two hours (with one household in wave two). Additional longitudinal cohort issues are that during wave three, the interviewer has to ensure that the survey is not rushed and that questions are answered fully and correctly, even though the respondent may believe that they can remember the process and requirements.

As suggested, there are certain limitations due to sample size but if a larger sample was achieved, in particular from walkers, public transport users and cyclists the data could in turn be more representative of the population as a whole as well as improving robustness. This study's sample evidence suggests for example that public transport users are unhappy before, during and after travel activities but due to the boundaries of the sample size it means that results are not significant, and when compared to wave two it is suggested that this result occurred by random chance. Thus the importance of a representative sample combined with the longitudinal element is vital. As demonstrated in Table 7.4 it

can be seen that over both years of data collection there are low numbers of public transport episodes recorded, driving is constant and walking and cycling episodes increased from the first year. However, as the total number of episodes has gone down between wave two (i.e. 582 episodes recorded from 63 individual surveys, average number of episodes per respondent; 9.2) and wave three (i.e. 412 episodes recorded from 44 individual surveys, average number of episodes per respondent; 9.4), then it is the percentages that are more meaningful.

Mode	Total mode activities (%) and transport episodes (N)		
	<i>Wave 2 data</i> <i>(i.e. 582 episodes from 63 DRM)</i>	<i>Wave 3 data</i> <i>(i.e. 412 episodes from 44 DRM)</i>	<i>Pooled data</i> <i>(i.e. 994 episodes from 107 DRM)</i>
Driving	16% (91)	16% (66)	16% (157)
Walking and Cycling	9% (49)	14% (58)	11% (107)
Public Transport	2% (10)	4% (17)	3% (27)

Table 7.4: Percentage of total activities by mode and total number of transport episodes

The sample was large enough to collect valuable qualitative data but the quantitative survey data suffered from a low number of transport episodes recorded, thus a lack of evidence on under-represented groups; mainly cyclists (commuter and leisure) but to some degree walkers (commuter) and public transport users (commuter). Further in-depth analysis is also required to understand whether certain (transport) episodes are the result of one participant repeating an activity, or if there are in fact many people using public transport,

for example. It was therefore extremely difficult to obtain statistically significant results with such a small sample. The data were however pooled to identify whether the findings from wave two could be replicated and if a larger sample would lead to more significant findings. *Overall, the pooling of wave two and wave three data reduces many of the effects of public transport episodes which were observed in wave two. However, mean levels of happiness, relaxation, engagement, focus, competence, and worth and meaningfulness, all remain lower for public transport users in the episodes after their transport activity than they do for drivers.*

A result a larger scale study needs to be undertaken to identify whether certain effects occur by random chance. This data is however useful for an exploratory study such as this, indicating that there is something of interest happening between transport and its effects on subjective wellbeing.

7.7 Summary and prospects for future research

The present study represents an innovative, original and timely addition to existing literatures on the impacts of transport systems, in that it is likely to be of interest and relevance to on-going policy debates as governments grapple with subjective wellbeing, and its measurement and evaluation. Furthermore, the research is also original in that it has been undertaken in a field that is currently devoid of longitudinal DRM studies, and indeed of work examining the spill-over effects between transport mode and moods. By focusing on spill-over effects in this way, the study seeks to better understand how transport mode impacts upon

the mood of people before, during and after they take part in transport activities in an attempt to appreciate what may make them happy.

The DRM represents an important potential addition to the toolkit currently deployed by transport geographers and mobilities researchers, yet to date its use in this field has been limited. Moreover, despite the advantages outlined above (i.e. relatively simple administration requirements and high potential to cross-compare with data derived from other DRM-based studies) even those transport studies that have deployed the DRM have not done so longitudinally. Particularly where research seeks to establish the impacts of infrastructural interventions designed to provoke behavioural change, longitudinal studies have a clear advantage in that they afford insight into whether participants' subjective wellbeing remains the same, recovers or in fact gets worse over time.

Key findings suggest that despite this, it is also clear that where the DRM is deployed longitudinally, full explanations for any trends that emerge will have to be underpinned by complementary insights derived from qualitative interviews. For example, if a longitudinal DRM study indicates that a respondent who drives to work and was extremely satisfied at the outset of a study began to travel to work by bus and became dissatisfied, only a qualitative interview with that individual would be able to confirm exactly why this had occurred. In the absence of that interview the researcher would be unable to tell whether such a change had been brought about by the rising cost of fuel, a change in the individual's medical circumstances, or through a conscious effort to reduce their environmental impact when travelling to work (to cite but a few possibilities)

(Baumeister *et al.*, 2011). Interview data, in short, is indispensable to interpretation of the DRM data if the varying reasons for shifts in subjective wellbeing are to be discerned, especially amongst groups of individuals whose circumstances and satisfaction appear to have followed the same path according to the quantitative data supplied by the DRM. Moreover, interview data also has the advantage of providing respondents with the opportunity to comment on their overall circumstances and satisfaction with life, rather than taking a snapshot – as the DRM does – of just a single day that may or not be representative of their general subjective wellbeing¹⁹.

Future research in this area is a very exciting prospect, seeking to measure over time whether economic and societal progress, for example, is getting better or worse. There is a gap however between the subjective wellbeing assessment techniques that are currently available and the manner in which these methods are actually being utilised within empirical research. As mentioned, there are a complex set of factors likely to have contributed to this deficit; assessing subjective wellbeing too narrowly or incompletely and a high proportion of cross-sectional single-method studies will not help inform where and what is making people unhappy. From the results of this study it can be seen that it is essential to introduce a mixed-method approach to subjective wellbeing research so that the nuances behind responses and decisions can be fully realised and understood; this in combination with a standardised definition, assessments and techniques both nationally and internationally would allow for more robust

¹⁹ The DRM survey does provide participants with the opportunity to indicate whether or not their responses are representative of a typical day, but not to explain why.

data sets to be collected. However, authors including Pavot (2008) and Constanza *et al.*, (2009) suggest that there is a prevailing lack of refinement and standardisation in the measurement process and an absence of a common protocol/set of standards for the development and use of subjective wellbeing measures. The importance of timeliness, scale and scope of the data is also undervalued. Nordbakke and Schwanen (2014:125) advocate the use of mixed-methods stating that such strategies are important; “research with qualitative methods can complement quantitative measurement and highlight facets of wellbeing that elude quantitative methods. Those facets include, but are not limited to, wellbeing’s shifting and unstable character, subtle differences between individuals and situations, and the performative effects of methods used to examine and evaluate wellbeing and its linkages to mobility”.

Wider population scale measurements of subjective wellbeing do however need to be further implemented, supported by dedicated interviews so that we can attempt to identify what is making people unhappy and where the extremes of this can be identified as being dispersed across the country. The impact of activities on wellbeing and what could possibly be done to alleviate unhappiness also needs to be better understood. Wellbeing questions have been introduced into the ONS but supporting this with an additional method, such as interviews, would improve the reliability and rationality behind responses. Yet the feasibility in the UK of such a study, due to cost time and constraints would need to be investigated. A successful example sees the United States obtaining population-wide data on the health of its citizens through established

programmes such as the National Health Interview Survey (since 1957) which creates vast amounts of interview data. Data are collected by 400 part-time interviewers, who are trained and directed (selected through an examination and testing process) by health survey supervisors (Centres for Disease Control and Prevention, 2012). This example proves that major wide-scale interview data can be collected, and that integrating interviews into subjective wellbeing/ONS surveying and measurement can help create a clearer picture on the wellbeing of the UK as a whole.

7.8 Reflections: Mixed-methods to conclusions

This reflective section aims to comment on Chapter Seven and demonstrate how the results and outcomes of the mixed-methods Chapter contribute to the entire thesis as well as towards the final Chapter, Chapter Eight. In order to answer each of the four Research Questions, (with a particular focus on Research Question Four), whilst also tackling Objectives Three and Four, the wider knowledge and understandings obtained from Chapter Seven will be discussed and summarised within the final concluding Chapter. The highlighted box below revisits the research questions and objectives tackled within these Chapters.

Chapter Seven and Eight: Research Questions

- 1. What are the links between travel behaviour and wellbeing?*
- 2. What are the perceived and actual constraints to walking and cycling among households and individuals?*
- 3. How does transport mode impact on individual moment-to-moment moods and what are the spill-over effects from transport mode on everyday activities?*
- 4. What lessons can be learned and what policy implications may arise from using a longitudinal, mixed-method approach when examining changes in travel behaviour and the subjective experiences of travel?*

Chapter Seven and Eight: Objectives

- 3. Measure and evaluate participants' subjective experiences of travel and the effects that travel has on mood and emotions over time, and on overall subjective wellbeing, through an adapted methodology; the Day Reconstruction Method.*
- 4. Develop a novel approach to identify and evaluate the case for "a greater understanding of context"; apply mixed-methods within a case study context in Cardiff and Penarth, Wales.*

Overreliance on single-method, cross-sectional designs and the use of narrow measures that provide only a partial assessment of subjective wellbeing and behaviours, have combined to limit the generality of the findings from individual studies. Combining qualitative interviews with the quantitative survey provided a powerful scenario for understanding the wider context and the deeper nuances behind the data. There are many studies which quantitatively measure travel behaviour and as Pavot (2008) states, interviews can also provide sufficient information for the assessment of subjective wellbeing so careful pairing of methods can provide robust evidence in themselves. It can be seen that there is a lack of dialogue between qualitative and quantitative researchers and also

traditional transport geographers and mobilities researchers. It is important to engage with both schools of thoughts, the research styles undertaken, the philosophical underpinnings of the study, and the literature produced in an attempt to support the wider conceptualisations and understanding of the relationships between the two research areas. The “handling and interweaving of just applying multiple methods in research is in itself, one of the most severe challenges to the researcher” (Graham, 1999:83).

Mixed-method research increasingly aims to achieve both breadth and depth to address the research problem. This analysis permits the probing behind survey responses and allows contextual data and explanations to be sought and verified (Guell *et al.*, 2013). It is important to understand and measure the where, the why, the how and the when but it is also quite clear that there is as much value in measuring and understanding how people feel during travel, the impacts and consequences of experiences, and how people are affected by travel. Exploring understandings and experiences of travel behaviour and subjective wellbeing using qualitative and quantitative research is valuable in its own right and it also improves the accuracy of measurement. Mixed-methods can make measures more comprehensible and relevant to respondents and provide contextual information to explain particular outcomes (Camfield *et al.*, 2009). The existing body of research on this topic is still quite small, therefore there are many opportunities to expand research in this area in order to provide useful ways to inform future policy decisions (Delbosc, 2012).

Chapter Eight - Conclusions

This final chapter will now summarise the main findings of the thesis and reflect on its wider contributions, addressing both methodological and theoretical literatures. On the basis of these findings and contributions, it will also stipulate some recommendations for policy and for future research. The overall aim of this research was to investigate the interactions of travel behaviour and wellbeing through a mixed-methods case study of Penarth and Cardiff, Wales. To address this aim the study's approach collected, analysed, interpreted and evaluated empirical data and evidence gathered across two years, in 2011 and 2012. The newly built Pont-y-Werin, the local transport intervention under scrutiny, provided a suitable platform to conduct this research as it was posited to not only change and improve the physical landscape of the area, but also to improve utility and leisure travel, and thus the "liveability" of the two urban areas.

The following three sections now set out, in turn: 1) the D.Phil. study's main findings; 2) its wider contributions to methodological and theoretical literatures; and 3) a series of recommendations for policy and for future research.

8.1 Findings of the study

Underneath the overarching aim outlined above, the thesis sought to address four specific research questions. These were:

1. *What are the links between travel behaviour and wellbeing?*
2. *What are the perceived and actual constraints to walking and cycling among households and individuals?*
3. *How does transport mode impact on individual moment-to-moment moods and what are the spill-over effects from transport mode on everyday activities?*
4. *What lessons can be learned and what policy implications may arise from using a longitudinal, mixed-method approach when examining changes in travel behaviour and the subjective experiences of travel?*

Table 8.1 outlines how the individual chapters of the thesis correspond with these four research questions, and also indicates the methods that were employed in each case.

	Research question	Method employed
Chapter Four (Paper One)	One	Literature Review
Chapter Five (Paper Two)	One; Two	Qualitative Interviewing
Chapter Six (Paper Three)	One; Three; Four	Quantitative Survey (DRM)
Chapter Seven (Paper Four)	One; Two; Three; Four	Longitudinal Mixed- Methods Survey and Interview

Table 8.1: Revisiting the thesis structure

Question One: *What are the links between travel behaviour and wellbeing?*

The research conducted offers new evidence of the links between travel experiences and wellbeing, and suggests that travel does impact happiness over time and throughout moment-to-moment moods. The literature review presented in Chapter Four highlighted a lack of studies examining travel behaviour and wellbeing in a case study setting. It also highlighted a lack of empirical studies holistically exploring all three elements of wellbeing (i.e. evaluations; experiences; eudæmonia). The review further emphasised how many of the current theories and models used in transport and mobilities research are out-dated, with some authors advising that certain concepts are no longer fit for purpose. Under particular scrutiny were the Theory of Planned Behaviour, rejected by Metcalfe and Dolan (2012), and the Attitude-Behaviour-Choice model, rebuffed by Shove (2010).

The analysis presented in Chapter Five highlighted a lack of studies examining transport interventions and their impact at the household level. In particular, the findings emphasised the impacts that the Pont-y-Werin had on young adults (and therefore the whole family), as well as the now increased levels of independence and freedom experienced by all, due to the safer routes between Penarth and Cardiff. These findings confirm the presence of important relationships and linkages between travel behaviour and wellbeing (i.e. improved opportunities for increased life and day satisfaction, improved experiences and activities, and importantly greater opportunities for personal flourishing).

Question Two: What are the perceived and actual constraints to walking and cycling among households and individuals?

Question Two of the thesis sought to examine individual and household travel behaviour in a case study context, to identify factors affecting travel choices. In order to answer this question, it was necessary to examine individual and household travel behaviour in the case study area and to explore perceptions of constraints to increasing active travel levels. The analysis of qualitative interviews presented in Chapter Five demonstrates that respondents generally favour the increased introduction of behaviour change measures. These included greater information provision as well as more hard measures, such as the introduction of better cycle parking facilities. This combination of measures was perceived by respondents as essential in helping households and individuals overcome their perceived (and sometimes actual) constraints to active travel. Additional findings highlighted the crucial role played by intra-household dynamics in constructing active travel as a viable (or unviable) transport mode. Specifically within some households, cycling in particular was seen as a last option, with respondents exhibiting a large degree of pessimism, contradiction and cynicism. Beyond this, the analysis also highlighted the trade-off that parents perceive between fostering independent mobility and ensuring their children's safety. This was contrary to the "freedoms" that the Pont-y-Werin offered to young adults for instance.

Question Three: How does transport mode impact on individual moment-to-moment moods and what are the spill-over effects from transport mode on everyday activities?

Question Three of the thesis sought to measure how transport mode impacts on individual moment-to-moment moods and to determine the spill-over effects from transport mode on everyday activities. In order to answer this question, it was necessary to measure and evaluate participants' subjective experiences of travel and the effects that travel has on mood and emotions over time. The application of the DRM to this case study, documented in Chapter Six, is new to transport research, with relatively few studies (Schwanen and Wang, 2014) published to date and no studies examining the time-use aspect through spill-over analysis. The analysis presented in this chapter demonstrated that people experience far less pleasant emotions whilst travelling than when undertaking other daily life activities. Moreover, they demonstrate that rush hour active travellers experience for 15% of the time more pleasant emotions compared to users of public transport. The main findings from the spill-over analysis are that drivers have 32% higher happiness than public transport users after the transport activity. Furthermore, levels of relaxation reported before and after a transport episode by drivers were significantly lower than those reported by walkers, cyclists and public transport users. Additionally, public transport users perceive activities undertaken after a transport activity to be 22% less worthwhile and meaningful when compared to drivers. Data from waves two and three of the study were subsequently pooled to identify whether a larger sample would

replicate these findings. Overall, whilst the pooling of the data did reduce the magnitude of the effects of public transport episodes observed in wave two, mean levels of happiness, relaxation, engagement, focus, competence, and worth and meaningfulness generally remained lower for public transport users in the episodes after their transport activity than for drivers.

Question Four: What lessons can be learned and what policy implications arise from the use of a longitudinal, mixed-method approach to examine changes in travel behaviour and the subjective experiences of travel?

Question Four of the thesis sought to understand what lessons can be learned and what policy implications arise from the use of a longitudinal, mixed-method approach to examine travel behaviour and the subjective experiences of travel. In order to answer this question, it was necessary to identify and evaluate the case for a “greater understanding of context” using alternative, non-traditional transport research methods in a mixed-methods approach. Chapter Four answers Research Question Four with the main findings demonstrating that more interdisciplinary, cross-cutting research is vitally important. This is because the theories, methods and frameworks applied within and across other disciplines may be able to significantly contribute to the theories and understandings within one’s own academic discipline. Importantly, findings from Chapter Four demonstrate that mixed-methods have the ability to expose a wider set of literatures as well as more opportunities to influence policy-making within the UK.

Using the findings from Chapters Five and Six allowed Chapter Seven to appropriately tackle Research Question Four. Its main findings indicate that combining methods, methodologies and frameworks provides greater insight into the contexts and nuances behind quantitative outcomes (and thus qualitative outcomes). The successful measurement and evaluation of eudæmonics (i.e. rewards) for example allowed for differences to be reflected between belief-based generic judgments and specific episodic reports alongside supporting interview data to determine underlining contexts. This acknowledges and improves the understandings of personal flourishing and the rewards behind activities; where doing something that is thought of as not particularly enjoyable (e.g. picking up sibling's children from school) has high rewards and in the long run makes a person happy. For instance, some respondents across the 2011 and 2012 datasets drastically changed their travel behaviours, or their wellbeing levels altered from one year to the next. Additionally the use of mixed methods allowed for an improved measurement of how wellbeing changes over time and from moment-to-moment. For example, if a longitudinal DRM study indicates that a respondent who drives to work and was extremely satisfied at the outset of a study began to travel to work by bus and became dissatisfied, only a qualitative interview with that individual would be able to confirm exactly why this had occurred. In the absence of that interview the researcher would be unable to tell whether such a change had been brought about by the rising cost of fuel, a change in the individual's medical circumstances, or through a conscious effort to reduce their environmental impact when travelling to work.

8.2 Methodological and Theoretical Contributions

This section now moves on to explicitly outline how this D.Phil. has contributed to existing academic literatures relevant to the research, both methodological and theoretical.

Methodological contributions

One of the major contributions of this thesis is to existing knowledge of the strengths and weaknesses of different methodological approaches to research problems in the sphere of transport and wellbeing. Reflecting on the value of different research methods, the selection of the most appropriate combination of methods was vital to the success of this research project. The use of the Day Reconstruction Method, for instance, crucially permitted the measurement and comparison of a large array of subjective variables across a diverse sample of respondents. Moreover, in providing a framework through which such variables could be measured periodically throughout a single day, this method facilitated the identification of broad patterns and trends in the time-based relationships between individuals' travel behaviour choices, other everyday activities, and their subjective wellbeing. Such patterns could be inferred, on the surface, as evidence either supporting or questioning the veracity of existing theories and hypotheses relating to wellbeing as a whole.

However, taken alone, the quantitative data supplied by the Day Reconstruction Method provides little insight into the meanings, beliefs and deeper experiences of the research's respondents. Understanding these intangible meanings, beliefs and values was vital in that it enabled the research to generate more nuanced

interpretations of the underlying causes of the broad patterns and trends in wellbeing which were identified by the DRM (such as those outlined in chapter seven for the two respondents, Poppy and Henry). Consequently, the research's combination of qualitative household interviews with the DRM serves as a potentially instructive example of the benefits of using a mixed-methods approach in transport and wellbeing research, both to triangulate individual findings, and to enhance the overall explanatory power of the analysis by supplying additional layers of contextual detail where possible. This DPhil has, moreover, demonstrated additional advantages to deploying such a mixed-methods approach in a case study setting, most notably that the approach is robust in the face of changing sample sizes over time, and also that it permits the weaknesses and shortcomings of individual methods to be partially overcome.

Despite these advantages, conducting a mixed-methods study is time consuming and philosophically quite complicated. This thesis has however demonstrated that the application of the pragmatism paradigm can enable researchers to overcome the potential inconsistencies and contradictions between qualitative and quantitative methods. In contrast to more methodologically prescriptive approaches such as interpretivism, positivism or constructivism, the pragmatism paradigm enables the researcher to focus in on the processes and phenomena which are of most interest and value to them, using methods and analytical techniques that they deem appropriate, guided by their overall desire to produce socially useful knowledge (Tashakkori and Tefflie, 1998). As such, this research offers a potentially useful case of the application of this paradigm both as a

rationale for formal research design, and as a means of enabling a more grounded approach to data generation and analysis (Feilzer, 2010).

The application of a mixed-methods approach in this case, however, also yields a number of cautionary lessons that it is important to reflect upon. For instance, conclusions based on the quantitative data generated by the DRM were limited by the relatively small sample size for users representing certain transport modes (especially public transport users, and also to some degree cyclists), and this effect was still present even after the pooling of multiple data sets. Under these circumstances, analysing DRM data and articulating the many possibilities stemming from it was problematic, as even though some results were inconclusive and not significant, it did not mean that the findings were unusable. Adequate representation and a more equal balance between all modes is therefore required, so that understandings of the effects public transport has on happiness whilst travelling for example can be considered as robust and credible as possible.

A further point to reiterate concerns the ability of this mixed-methods approach to verify the permanence of observed temporal trends in transport behaviour and wellbeing. At the day-to-day level for instance, this potential weakness could be improved by extending the spill-over analysis beyond two activities before and after travel, which would allow for a greater set of data helping to explain and better understand the impact of travel experiences on mood over time. At longer timescales, identifying the most appropriate number of research waves for a study is a critical part of the research strategy. In this case, the opportunity to

measure travel behaviour and wellbeing before the infrastructure intervention had occurred would have further improved the overall study. Pre-intervention data would improve study robustness and further follow up data after the initial study (i.e. 2013 onwards) would provide superior insights into the long-term effects of travel on wellbeing and of the impact of interventions on travel behaviour, travel behaviour change and the sustainability of any change.

Finally, whilst the value of qualitative data has clearly been demonstrated by this research – most obviously because it enabled respondents to properly tell their story or their journey – it is also important to draw attention to the significant additional demands that are placed on the researcher by the obligation to combine such data with in-depth quantitative analysis in a mixed-methods study. Whilst training in research skills was useful in the case of this research, the specific circumstances under which the design of the project evolved (from an exclusively qualitative project in the first instance) nonetheless brought about limitations in the extent to which the qualitative and quantitative components of the analysis were fully complementary. For instance, it might have been beneficial to more carefully tailor interview schedule questions to address outcomes such as satisfaction with travel, experiences with travel, and rewards, such that they corresponded more directly with the focus of the DRM. This approach could then have been explicitly combined with the interview questions on satisfaction with local travel and questions examining feelings during activities. The final methodological contribution of this research is therefore to affirm the importance of ensuring that qualitative and quantitative methods are

given equal weight from the outset of the research design process, as opposed to advocating for a mixed-methods approach in which qualitative methods are introduced only following the design of a quantitative project, or vice versa.

Theoretical Contributions

The literature review undertaken in Chapter Four identified a number of existing knowledge gaps in the realm of transport and wellbeing research. These included a paucity of research into the relationships linking subjective wellbeing and travel behaviour, a lack of evidence of longitudinal variations in subjective wellbeing, and a lack of research examining the spillover effects that specific transport behaviour choices might have on antecedent or subsequent levels of subjective wellbeing. At an empirical level, this D.Phil. research has importantly built on and extended the results of the broader iConnect study by examining and measuring wellbeing, an element which is not part of the core iConnect methodology or theoretical framework. However, in empirically measuring and evaluating travel behaviour and wellbeing over time, the thesis has also added to wider debates on the impacts that everyday travel, and indeed other activities, have on subjective moods and emotions.

Firstly, whilst the overall value of measuring and evaluating the relationships between transport behaviour and subjective wellbeing is evident, understanding how travel behaviours impact on subjective wellbeing in real-time for all transport modes is as important. The DRM analysis for instance demonstrates effects by revealing any differences in reported wellbeing during transport episodes and also average overall reported wellbeing across the day. The

qualitative interviews however reveal that the relationships between transport behaviours and subjective wellbeing are not intrinsic to individual transport modes and instead, the impacts that travel behaviours have on wellbeing are always context-dependent (e.g. public transport is perceived by some as unreliable and grubby, whilst many cyclists are happier not just because they enjoy the experience of cycling as a form of mobility, but also because they want to be healthier, contribute to a wider environmental cause, and save money). Therefore the first theoretical contribution from this research is the suggestion that the relationships between transport behaviour and subjective wellbeing should be understood as governed not only by affective experiences of mobility, but also by the wider structures of meaning within which respondents interpret the nature and characteristics of the transport mode itself.

Secondly, the lack of evidence of longitudinal variations in subjective wellbeing within and across studies has meant that questions such as “why does subjective wellbeing change over time?” have not been adequately addressed. This study has gone some way towards revealing the impacts of major life events (e.g. moving house, moving jobs, starting a family), and the direct affects that such events can have on transport *and* wellbeing over time. In turn, causality linking transport choices with wellbeing is therefore difficult to identify clearly over long term timescales, because both variables can be influenced by an array of wider independent variables. Consequently, the longer-term impacts of infrastructure interventions, and the resulting effects on travel behaviour and wellbeing, require further attention. To take an example from this research, on the surface the data

collected and presented within this thesis agree with the findings of the iConnect study as a whole, in particular that the overall scheme allows sustained usage of the intervention, but there is a dominance of recreational trips (Goodman et al., 2013). However, this research also demonstrates that young adults in particular benefitted from the infrastructure intervention, specifically through the manner in which it enhanced mobility, leading to accelerated personal flourishing. Moreover, the qualitative interviews further demonstrated that these impacts were not constrained solely to the individuals using the infrastructure; benefits experienced by younger members of households led to further benefits at the household level (e.g. parents were subsequently able to spend less time providing a “taxi service” for their children, and also gained psychological benefits from seeing their children gain greater independence). Therefore a second theoretical contribution of the research is the suggestion that when studying long-term variations in subjective wellbeing, it is crucial to recognise the multiplicity of variables impacting both on wellbeing and transport behaviour choices. Moreover, it must also be recognised that wellbeing changes experienced by individuals can have important effects on the wellbeing of others (therefore in the case of transport research, studies should broaden out to examine not just the immediate wellbeing consequences of infrastructure interventions, but their wider ramifications beyond the individuals who use them).

Finally, the lack of research examining the spillover effects of travel behaviours on wellbeing is stark. The research conducted within this D.Phil. thesis suggests that public transport in particular had a negative effect on people’s happiness,

levels of relaxation, engagement, focus, competence and the worthwhile and meaningfulness of activities when compared to other modes. This finding suggests that travel behaviours do impact wellbeing and that the effect is not solely witnessed as a result of the transport activity but that it impacts general wellbeing before, during and after transport and therefore effects overall moment-to-moment moods and emotions. Therefore the third theoretical contribution is the suggestion that research should further explore the wider lifestyles and daily routines within which specific transport choices are embedded. This is in order to better understand the wellbeing consequences and impacts of particular transport modes. For example, research might explore whether people who cycle are more productive at work, or whether the loss of control over time, and the lack of freedom of mobility implied in using public transport, is in fact amplified by a corresponding drop in psychological wellbeing (which further impedes individuals' ability to form strong social networks).

8.3 Policy and future research recommendations

The evidence presented within this thesis and evidence from both the psychology and transport research literatures suggests that clear connections between travel and wellbeing do exist. It can be seen however that there is still much scope not just to expand this emerging field of research, but also to more productively apply the insights which it is generating in the realm of urban planning and transport policy as well. Currently, transport academics', planners' and policymakers' awareness of wellbeing theory and wellbeing research is relatively limited. Yet the findings presented in Chapter Six of this thesis demonstrate that

important relationships exist between travel behaviour and wellbeing, and suggest that travel behaviour change measures should be advocate not solely for environmental reasons but also as a means of improving everyday mobility and experiences. Dissemination of findings from research in the vein to these communities, and the incorporation of relevant contents in the curriculum of academic and professional studies in transport, is therefore advocated as a means of raising awareness of the importance and usefulness of wellbeing research in applied transport contexts. Beyond this however, actually demonstrating the power and importance of wellbeing research to practitioners and policymakers will require wellbeing measures to be systematically integrated into travel programme and infrastructure intervention evaluations in the future. Focusing particularly on the impact of change on individual-level travel behaviour and wellbeing, for instance, could be useful when assessing the case for behaviour change interventions (Avineri, 2012; Delbosc, 2012; Martin *et al.*, 2014). Providing this evidence, guidance and access to the multiple frameworks, methodologies and methods deployed by wellbeing researchers, would allow such professionals to instigate the links between behavioural economic theory for instance, and to better understand how travel behaviours might be altered whilst at the same time bringing about improvements in wellbeing and happiness whilst travelling.

In terms of specific policy applications, providing information about the subjective wellbeing implications of transport modes could be useful as even if an activity is making a person unhappy, breaking and changing habits is often very difficult. Reardon and Abdallah (2013) argue that the most effective use of

wellbeing evidence for the transport sector may be to try to minimise the negative effects on wellbeing caused by policy outcomes. This thesis however advocates a set of integrated policies where the relationship between transport and wellbeing is considered in conjunction with other associations that impact wellbeing, such as housing, employment, (fear of) crime and public service provision. The overarching policy implications of the study are useful for national, regional and local development policy, with a focus on the relationship between travel and wellbeing, and how travel behaviour interventions can affect happiness levels, now and in the future.

Improving infrastructure is fundamental to encouraging the widespread uptake of active travel but as Aldred *et al.* (2015) suggest, policymakers need to study and respond to the infrastructural preferences of women, older people and other under-represented groups in the battle for transport equality. Matching these diverse preferences with infrastructure design and implementation is something which Sustrans for example needs to ensure that its future travel programmes seek to consider more fully. Implementing dedicated infrastructure for female, older or disabled cyclists could be the means to increasing the diversity of cycling as it cannot be assumed that any growth in UK cycling levels will automatically increase the gender and age diversity of cyclists. However, there is still little evidence that specific provision of this kind leads to a significant increase in sustainable travel practices (Ogilvie *et al.* 2004; Ogilvie *et al.*, 2012) and in turn, the opportunities to understand the effects that infrastructure provision and different modes have on levels of happiness and wellbeing is reduced. For

instance, the lack of credible evidence on the effects of infrastructural interventions on household levels of walking and cycling and wellbeing is still stark. It was important to measure and evaluate this relationship to add to the discourse on whether such interventions actually have a tangible impact on communities, whether they are financially viable, and whether they should be repeated in the future, but more research is still needed.

Future research needs to further examine spill-over effects and the wider affects that moods whilst travelling have on everyday activities. Regression analysis could seek to compare the affect certain variables such as weather, time of day of the episode and day of the week surveyed have on individual wellbeing. Additionally, examining the impact of density and spatial configurations is also an area which requires future work. According to Ritsema van Eck *et al.* (2005), individuals living in high-density environments are better able to realise their daily activities than those in low-density suburbs (for all modes of transport) due to shorter distances and greater accessibility. This might positively affect individual wellbeing for people in high-density settings with higher hedonic and eudæmonic wellbeing given that they can fulfil their everyday obligations (e.g. dropping children to and from school) with less effort. Additionally, they access a greater range of rewarding leisure activities enabling personal growth and flourishing, such as meeting friends and other social contacts (de Vos, *et al.*, 2013). By contrast however, Dolan *et al.*'s. (2008) study demonstrates that life satisfaction tends to be lower in larger cities characterised by greater density and diversity. It is therefore suggested that future research could usefully examine the

influence of residential location and urban form on individuals' transport behaviour and subjective wellbeing.

Future research could also seek to conduct field experiments which examine opportunities for Personal Travel Planning and the implementation of other *soft* measures of travel behaviour change (Bamberg *et al.*, 2011). Identifying the impacts of providing individual, personalised travel information for example, to a randomised control group between wave two and wave three of longitudinal data collection, would raise new questions. It would also be a relatively cheap and easily administered intervention. Personalised Travel Planning would help not only to raise awareness of new schemes, and to promote the various modal opportunities across a case study site (as it is a targeted marketing technique), but would also provide opportunities to further interrogate the assumptions underpinning theoretical frameworks within behavioural psychology that seek to better understand individual decision-making processes, such as “nudge”. By introducing a further method into the mixed-methods approach, it would again help provide more context to research findings, introduce a further “behaviour change intervention”, and would promote voluntary choice without restricting freedoms (Meloni *et al.*, 2012; Bartle and Avineri, 2014).

Finally, measurements of subjective wellbeing must be directly conducted at the individual level, which complements small, local-level transport projects (Delbosc, 2012). Attempts to reorganise the traffic system in a way that produces less environmental impact can only succeed if the supply is organised corresponding to the needs and desires of travellers. The more variable and

complex peoples' behaviour is, the more flexible the supply needs to be (Schlich and Axhausen, 2003). Even when travel is related to a destination (i.e. directed travel), people do not necessarily minimise their travel time or always choose the most cost efficient mode or route (in terms of time, money and effort) (Anable and Gatersleben, 2005:163). Jakobsson Bergstad *et al.*, (2010) indeed suggest that a reduction in car use is likely to lead to a reduction in satisfaction and thus to a reduction in subjective wellbeing. Therefore the entire complex system of interventions aiming to change travel behaviours away from motorised modes and the outcomes and impacts on wellbeing needs development and requires further future research.

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Appendix A: Day Reconstruction Method (*Truncated here*)

Diary page

Please describe your day. Think of these hours as a continuous series of scenes or episodes in a film that covers all of this time. Give each episode a brief name that will help you remember it. Write down the approximate times at which each episode began and ended. Try to remember each episode in detail, and write a few words that will remind you of exactly what was going on. What you write only has to make sense to you, to help you remember what happened when you are answering the later questions.

Episode Name	Time it Began	Time it Ended	Notes to <u>yourself</u> : What happened?
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

First episode

Please look at your list of episodes and select the earliest episode you noted, right after you woke up. Please try to remember the times as precisely as you can.

This episode began at _____ and ended at _____.

1) Who were you with? (check all that apply)

☐ Alone	☐ Friends
☐ Spouse, significant other	☐ Colleagues/co-workers
☐ Children	☐ Boss
☐ Parents	☐ Clients/customers
☐ Brother/sister	☐ Pets (e.g. dog)

2) What were you doing? (check all that apply)

☐ Getting ready/self-care	☐ Going to/from work	☐ Relaxing/napping
☐ Cooking / preparing food	☐ Take children to/from school	☐ Watching TV
☐ Eating	☐ Working	☐ Reading /using internet
☐ Walking	☐ Housework	☐ Listening to music
☐ Driving	☐ Shopping	☐ Socializing
☐ On train	☐ Voluntary work	☐ Praying/meditating
☐ On bus	☐ Exercising/Doing sport	☐ Intimate relations
☐ Cycling		
Other activity not listed (please specify) _____		

3) How did you feel during this episode?

Please rate each feeling on the scale given. A 0 means that you did not experience that feeling at all. A 6 means that you experienced that feeling very strongly.

	Not at all				Very much			
Happy	0	1	2	3	4	5	6	
Relaxed	0	1	2	3	4	5	6	
Frustrated	0	1	2	3	4	5	6	
Sad	0	1	2	3	4	5	6	
Anxious	0	1	2	3	4	5	6	
Impatient for it to end	0	1	2	3	4	5	6	
Engaged	0	1	2	3	4	5	6	
Focused	0	1	2	3	4	5	6	
Competent	0	1	2	3	4	5	6	
Worthwhile or meaningful	0	1	2	3	4	5	6	
Benefited someone else	0	1	2	3	4	5	6	
Helped achieve goals	0	1	2	3	4	5	6	

N.B Twelve episode pages are available for participants to complete

Your overall summary of the day

Now that you have told us about your day in detail, we have a few more general questions.

1) Now we would like to know overall how you felt yesterday. What percentage of the time were you

in a bad mood _____ %

in neither a good nor bad mood _____ %

in a good mood _____ %

Sum 100%

2) Overall, how satisfied are you with your day yesterday?

___ very satisfied, ___ satisfied, ___ not very satisfied, ___ not at all satisfied

3) Overall, compared to a typical day, yesterday was....

Much
Worse
1

Somewhat
Worse
2

Pretty
Typical
3

Somewhat
Better
4

Much
Better
5

4) Overall, how satisfied are you with your life as a whole?

Not satisfied at all
Completely Satisfied

0	1	2	3	4	5	6	7	8	9	10

Appendix B: Study Semi-Structured Interview Topic Guide

Connecting Communities: The Connect2 Cardiff Study Interview Topic Guide

Thank you for taking part in this interview for my doctoral research. I would like to ask you a series of open-ended questions about the Connect2 project and you travel and activities in and around your local area. There won't be any questions of a sensitive nature and the interview will last approximately one hour.

If it is ok, I would like to audio record this interview to help me analyse my data when I return to Oxford.

About your household:

Can you tell me a little bit about your household?

- Who lives here?
 - o Could you describe your relationship to one another?
- How long have you lived at this house and in the area?
- Can you tell me briefly what you do for a living? <for each member of the household>

Household travel:

Can you tell me about the journeys you make during a typical week?

- <Establish similarly for other household members>

[Focus] Journey to Work/School

How do (or did if retired/unemployed/on medical leave) you usually travel to and from work/school?

- How long does the journey take by this means?
- Do you think it would be possible to travel there on foot or by bicycle (perhaps in combination with public transport?)
 - o Why do you say that?
- Have you ever contemplated using a different method of getting to and from work/school?

[Focus] Moving around Cardiff and Penarth

How do you usually travel around your local area?

- How long do these journeys take?

- Do you think it would be possible to travel there on foot or by bicycle (perhaps in combination with public transport?)
 - Why do you say that?
- Have you ever contemplated using a different method to move around your local area?

How satisfied are you with the travel conditions in and around Cardiff and Penarth?

<Get them to explain their reasoning>

- Is there much walking and cycling in Penarth and Cardiff?
- What about the provisions and facilities made for walking and cycling?
- What do you think about the people who do it every day?
- How would you feel if your partner or children decided to increase their levels of walking and cycling?
 - Are you ok with this?
 - What would put you off?

Connect2 Cardiff

Can you tell me what you know about the Connect2 Cardiff project?

- What are your thoughts on how the scheme might affect walking and cycling in Cardiff and Penarth?
- How do you think the scheme will affect your household travel and activities?
- Have you seen many people use the bridge and the route?
 - What do you think they are using it for?
 - What do you think of those people?
- How do you think the Connect2 scheme will benefit residents living in and around this area and along the route? <What themes have emerged?>
- What more would you like to see done to support walking and cycling in your area? <explain reasoning>

Household intentions to walk and cycle more

[Directed to main respondent] In the original survey you mentioned you intend to do more walking and cycling to get around or for recreation over the coming months.

- Could you tell more a little bit more about your reasons behind you response to that question? <listen for motivation and types and frequencies of journeys>
- To what extent will the Connect2 project play a part in that? <extent C2 is a catalyst and reasons why>

- What about other members of the household?
 - o Can you tell me whether you plan to walk and cycle more over the coming months?
 - o What role does the Connect2 project play a part in that?
- What are your thoughts more generally on the opportunities that the Connect2 Cardiff scheme provides for residents of Cardiff, Penarth and beyond? <general views on purpose, who scheme will serve, what types of journeys>

Household car use

Can you tell me a little about access to vehicles at your household?

- How many cars are at the household? <establish whether private/company>
- Who has access to those vehicles?
- Any plans to reduce or increase this stock of vehicles?
- How many bicycles are in the household?

Final questions

I want you to imagine that there was another fuel shortage, petrol was rationed and you household had to think about using the car less.

- How would you go about doing this?
- How (if at all) would you adjust/change your current travel behaviour?
- Can you create a picture in your mind, when, where and how you might walk or cycle around Cardiff and Penarth as a way to get fit, save money on fuel or as a means of reducing your carbon footprint?

Appendix C: Invitation Letter

Ms Anon
21 Jones Point House
Grangetown
Cardiff



SCHOOL OF GEOGRAPHY
AND THE ENVIRONMENT



10th March, 2011

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Dear Ms Anon

Connecting Communities: The case of Connect2 Cardiff, Pont y Werin.

During April or May 2010 you or someone in your household completed and returned an iConnect questionnaire which sought to gauge your views of the local area and how you generally move around your local neighbourhood. This was part of a national research study to assess the Connect2 scheme in your area - the new walking and cycling bridge over the River Ely, Pont y Werin. On the questionnaire you indicated that you would be willing to take part in further research.

As part of our Doctoral studies at the University of Oxford we are conducting follow-up research which involves gathering opinions about the scheme and assessing how it might have affected household activities. **We would like to invite you to take part whether or not you use the Connect2 scheme. As compensation for your time we would provide the opportunity to receive up to £40 in high street vouchers.** The information sheet enclosed provides further details about the study. We will be visiting the area to conduct our research between the 14th March and the 11th April. If you are interested in taking part **please complete and return the attached postcard in the pre-paid self-addressed envelope as soon as you are able.** If you wish to find out more before you decide whether or not to take part, please contact Lucy Mahoney or Andre Neves on **01865285167** or email at **lucy.mahoney@ouce.ox.ac.uk** or **andre.neves@ouce.ox.ac.uk**.

This research has met University Ethics approval but if you have any concerns you may write to the IDREC Officer; Dr. Chris Ballinger, Social Sciences Division, Hayes House, 75 George Street, Oxford, OX1 2BQ or email: ethics@socsci.ox.ac.uk reference: SSD/CUREC1A/11-014 or SSD/CUREC1A/11-029

Thank you for considering this invitation.

Yours sincerely,

Lucy Mahoney and Andre Neves

PhD Students and Researchers of the iConnect study at University of Oxford

EPSRC Engineering and Physical Sciences
Research Council



Ms Anon
21 Jones Point House
Grangetown
Cardiff



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Mawrth 10 eg 2011

Annwyl Ms Anon

Cysylltu Cymunedau: Achos Cysylltu Connect2 Caerdydd, Pont y Werin.

Yn ystod Mis Ebrill neu fis Mai 2010 fe wnaethoch chi neu rywun yn eich teulu gwblhau a dychwelid holiadur iConnect, yn mynegi eich barn am eich ardal leol a sut yr ydych yn symud o amgylch yr ardal honno. Roedd hwn yn rhan o Astudiaeth Ymchwil Cenedlaethol i asesu Cynllun Connect2 yn eich ardal - y pont gerdded a'r bont beicio dros Afon Eli, Pont y Werin. Yn eich holiadur fe wnaethoch chi fodloni i gymryd rhan mewn ymchwil pellach.

Fel rhan o'n hastudiaethau Doethuriaeth ym Mhrifysgol Rhydychen rydym yn gwneud ymchwil pellach, sy'n cynnwys casglu barn pobol am y cynllun ac asesu os ydy e wedi cael effaith ar weithgareddau eich teulu. **Rydym am eich gwahodd i gymryd rhan, hyd yn oed os nod ydych yn defnyddio Cynllun Connect2. Am eich amser fe fyddwn yn rhoi'r cyfle i chi gael lan i £40 mewn talebau siopau'r stryd fawr.** Mae'r daflen wybodaeth amgaedig yn rhoi fwy o fanylion am yr ymchwiliad. Fe fyddwn yn ymweld 'r ardal i wneud ein hymchwil rhwng mis Mawrth y 14dddeg a'r 11dddeg o fis Ebrill. Os oes diddordeb gennych i gymryd rhan **a wnewch chi gwblhau a dychwelid y garden bost yn yr amlen, mor gynted a phosibl.** Os ydych am fwy o fanylion cyn gwneud eich penderfyniad ynglyn a chymryd rhan, mae croeso i chi gysylltu a Lucy Mahoney neu Andre Neves ar **01865 285167** neu ar ebost **lucy.mahoney@ouce.ox.ac.uk** neu **andre.neves@ouce.ox.ac.uk**.

Mae'r ymchwil hwn yn cwrdd a chymeradwyaeth ethigs y Brifysgol, ond os oes gennych unrhyw bryderon ysgrifennwch at Swyddog IDREC: Dr. Chris Ballinger, Social Sciences Division, Hayes House, 75 George Street, Oxford OX1 2BQ o ebost **ethics@socsci.ox.ac.uk** cyfeiriad: SSD/CUREC1A/11-014 o SSD/CUREC1A/11-029 Diolch yn fawr iawn am ystyried ein gwahoddiad.

Yr eiddoch yn gywir,

Lucy Mahoney and Andre Neves

Myfyrwyr ac ymchwilwyr PhD cynllun iConnect ym Mhrifysgol Rhydychen



Engineering and Physical Sciences
Research Council



Appendix D: Participant information booklet

WHAT WILL HAPPEN IF I CHOOSE TO TAKE PART?

There are two methods by which we wish to understand more about travel and activity patterns in and around the Connect2 Cardiff, the Ely River Connection project site what we are calling

module a and/ or module b

Ideally, we would like you to take part in both modules. However, if you choose to participate in the study, you may choose to take part in only one module.

WHAT ARE THE BENEFITS AND RISKS IN MY TAKING PART?

As well as assisting Lucy and Andre in their Doctorate studies, the information collected during this study will provide a better understanding of the links between transport, health and the environment. We hope this will help to improve policy making in your local area. There are no risks involved in taking part. We are only asking you to take part in an interview and/or activity monitoring.

WHAT HAPPENS IF I CHANGE MY MIND?

You are free to withdraw from the study at any time and without giving a reason. If you do decide to withdraw, or if you are no longer able to take part in the study, we will use the data collected up to the time of your withdrawal.



MODULE

a

For this module we would like to conduct an interview with you and people at your household about the local Connect2 Cardiff project site.

The interview will take place at a time and place that is convenient for you and other household members and will last approximately one hour. During the interview you will be asked a series of open-ended questions about the Connect2 project and your travel and activities in and around the local area. You will not be asked questions of a sensitive or personal nature.



MODULE

b

For this module we would like to ask you to wear a GPS and an actigraph monitor over a period of 4 days so that we can measure your travel behaviour and physical activity during this period.

Both the devices are unobtrusive (about the size of a match box) and are simple to use.

Full instructions will be provided.



To compensate you for your time **gift vouchers** up to a value of **£10** gift will be given per household interview (**module a**) and a **£10** gift voucher per householder for wearing a GPS + actigraph for a period of 7 days (**module b**) i.e. a total of **£20** is offered for **taking part in both modules**.

WHAT THE RESEARCH IS ABOUT?

You may be aware that there is a national programme called Connect2 that is currently underway which involves constructing new links for walking and cycling at 79 sites around the UK. One of the Connect2 projects is being implemented in your local area and is known locally as Connect2 Cardiff, the Ely River Connection.

A study to measure and evaluate the travel, physical activity and carbon impacts of the Connect2 programme is also taking place.

The study is called iConnect and is being funded by the Engineering and Physical Sciences Research Council (EPSRC).

The Connect2 Cardiff project has been selected for in-depth research as part of the wider iConnect study to understand the impact of this particular programme on the local community in this particular geographical location.



WHY HAVE I BEEN CHOSEN?

A postal questionnaire survey of residents in Penarth and surrounding area was conducted in Spring 2010 by the iConnect study team. You kindly completed and returned this survey and indicated on the form that you would be interested in taking part in future studies on this subject.

The next phase of the study is to understand more about the travel and physical activity patterns in and around the Connect2 Cardiff project site as part of two Doctorate studies being conducted by **Lucy Mahoney** and **Andre Neves** of the School of Geography and the Environment, University of Oxford (contact details below).

We are asking whether you would be interested in taking part in this next phase. **Below we explain what this will involve.**

WILL MY PARTICIPATION BE CONFIDENTIAL?

The information you provide will be held and used in accordance with the Data Protection Act 1998. All information that is collected about you during the course of the research will be kept strictly confidential and stored securely at the University of Oxford or another secure data storage facility.

You will be identified by an ID number and any recordings or transcripts related to you will have your name and address removed so that you cannot be recognised from it. We may quote parts of your interview in our research reports and publications to illustrate the findings of our research, but these quotations will not be attributable to you personally.

WHAT HAPPENS IF SOMETHING GOES WRONG?

If you have any questions about any aspect of this study, in the first instance you should contact either **Lucy Mahoney** (about Module 1) or **Andre Neves** (about Module 2). They are the Doctorate candidates conducting this part of the iConnect study.

WHERE TO GET MORE INFORMATION?

about the iConnect Study www.iconnect.ac.uk
about Connect 2 www.sutransconnect2.org.uk



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Andre Neves

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Engineering and Physical Sciences
Research Council



Connecting Communities:
The Connect2 Cardiff:
the Ely River Connection
Information about this study



We would like to **invite you** to take part in a study titled
Connecting Communities:
The Case of Connect2 Cardiff
that is being conducted by researchers at the University of Oxford.

This information sheet explains what the research is about and what it involves should you wish to take part.

Appendix E: Disaggregated Public Transport average times

Public Transport Average Time Spent in Episode	
Episode One	0:10
Episode Two	0:30
Episode Three	3:00
Episode Four	1:00
Episode Five	0:35
Episode Six	0:30
Episode Seven	0:30
Episode Eight	0:30
Episode Nine	3:00
Episode Ten	4:50