Public Attitudes to Long Distance Travel and Perceptions of High Speed Rail

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Abstract

Predicted increasing demand for long-distance travel raises the potential for considerable capacity impacts on the existing transport network. HS2, a proposed high speed rail (HSR) line in Britain bypassing existing routes, is being advanced by Government and might impact on mode choice and planned travel behaviour.

Given predicted increasing long-distance travel demand, improving understanding of the underlying attitudinal, perceptual and behavioural issues is important. This thesis investigates attitudes to long-distance travel, perceptions of HSR, and willingness-to-pay for travel time reductions by determining the effects of social characteristics.

Following focus groups to examine the wider domain of long-distance travel and mode choice, a questionnaire was developed to measure attitudes to long-distance travel and perceptions of HSR. A Principal Components Analysis of 46 travel-related attitude items generated six attitude factors, relating to; travel security, unsustainable transport improvements, perceived prestige of HSR, negative attitudes to HSR, importance of travel comfort, and travel time use.

Attitudes differed by demographics and travel behaviour, implying focus is needed on younger age groups to attract travellers to HSR unless development timescales can be reduced. Proximity to a proposed HS2 station had no impact on attitudes, although proximity to the route was predictive of negative attitudes (the only aspect that was a predictor of negative attitudes to HSR). Factors such as cost, the environment, comfort and convenience are discussed in light of theories of attitudes, cognitive and affective reasoning and mode choice. Willingness-to-pay for travel time savings under two trip scenarios revealed a valuation broadly similar to that used in the HS2 economic case for commuters and leisure trips, but substantially lower than that used for business travel.

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Chapter 1. Introduction to research

1.1 Introduction

This chapter sets out the key definitions that are to be used throughout this thesis as well as providing the transport context against which this research is set. The identified research problem is outlined, as are the associated aims and objectives. The scope and constraints of the research, and the full thesis structure are also presented.

1.2 Key definitions

The research in this thesis relates to long-distance travel (LDT) and high speed rail (HSR), for which the following definitions are used. This thesis uses the European Union definition of high speed rail as referring to conventional wheel-on-track train services, operating above speeds of 200km/h (124mph) on upgraded lines, or 250km/h (155mph) on new purpose built railway lines. In line with many examples of previous research, this thesis defines travel to be 'long-distance' where a trip exceeds a distance of 50 miles (80km) in one direction and with a single main purpose. As a number of alternative definitions exist, justification for the definitions used is provided in Section 2.2 of Chapter 2.

1.3 Background to the research

Governments around the world are developing their transport infrastructure by investing in high speed rail. In some countries, this has been a response to capacity issues on existing routes (e.g. the Japanese Shinkansen), while in others, improving national connectivity. In both cases, high speed rail has been responsible for reducing travel times and shrinking distances, providing a new alternative mode for long distance travel. Recent travel trends and forecasts highlight the increasing presence of long distance travellers and a growing long distance travel market. Understanding long distance travellers and their characteristics will encourage or discourage use of different modes for long distance journeys. The importance of these characteristics is debatable, as the relative importance of each can differ depending on individual circumstances. Better understanding of long distance travel behaviour will be important in ensuring the delivery of high quality transport services to meet demand in this market.

In Britain, spare capacity has meant that in the past there was little reason to develop new inter-city routes, whereas other countries with congestion on existing routes had a stronger justification for bypassing these routes with new high speed rail lines. As a consequence, Britain has comparatively little high speed rail relative to other developed countries (Edwards, 2006; Odel and Pickard, 2012). Since the 1950s, rail has faced increased competition from the private car for both passengers and freight. Declining passenger numbers led to closures and rationalisations in an attempt to improve profitability; however, this reduced the capacity available. Despite these efforts, railway revenues continued to decline, leading to a 'funding gap' between what was needed and what money was available (Department for Transport, 2007). However, this decline has reversed since the 1990s, leading to unprecedented growth putting capacity pressure on the rail infrastructure and increasing overcrowded services (Department for Transport, 2007; Department for Transport, 2011b). It is possible that services will decline in quality and reliability as a result which may impact negatively on economic growth (Eddington, 2006; Independent Transport Comission, 2010). Extensive modernisation of the West Coast Main Line has taken place, intended to improve journey times and generate additional capacity (Rowson, 2008; Railway Technology, ND). Despite this, the section of the line between London and Birmingham is set to reach its capacity. Virgin Trains (2010), the current long-distance train operating company on the West Coast Main Line expect that the route will be full by the end of the current decade. Other estimates suggest that trains will be full and overcrowding will become severe towards 2030, probably by the mid-2020s (Atkins, 2010; Department for Transport, 2011b; Network Rail, 2011). By 2025 the Department for Transport (2009a) claim the line south of the West Midlands will have become overloaded, meaning the case for high speed rail in Britain to solve capacity constraints is therefore much stronger now than in the 1980s, when spare route capacity was available (Steer Davies Gleave, 2004). Despite the economic recession, a third of the predicted long distance rail demand growth up to 2043 has been achieved in three years (HS2, 2012). As a result, the need for the new capacity on the West Coast Main Line can be seen, and forms a significant part of the government's justification for developing high speed rail in Britain.

Alternative solutions considered include improvements to signalling and lengthening trains (Department for Transport, 2007). Despite this, a strong case emerged for developing High Speed Two (now HS2), a new high speed rail route from London to Birmingham in the West Midlands (Network Rail, 2011). Capacity enhancements of

existing infrastructure as an alternative would be extremely disruptive to both passengers (Atkins, 2010), and freight trains and would not provide the travel time benefits of HS2 (Department for Transport, 2012). Economic justifications for HS2 have been used alongside the need for capacity, as congestion of the existing transport network is considered a threat to economic competitiveness (Eddington, 2006; Greengauge 21, 2009). Furthermore, it is argued that the reductions in travel time offered by high speed rail line compared to a conventional rail route (<200km/h / 124mph) can revolutionise regional accessibility, benefit regions economically, and redress imbalances between the south east of England and more peripheral regions (Greengauge 21, 2009; The Northern Way, 2009; HS2, 2012). However, these economic benefits have been contested and opposition groups have suggested that there is no business case for high speed rail (Marshall, 2010).

1.4 Research gaps

The research gaps in this thesis are centred upon two key themes; these being the lack of existing attitudinal long-distance travel research, and the need for fuller understanding of long-distance travel due to expected growth in this area. Given there is still considerable disagreement over the need for a HSR line in Britain, and where it should serve, existing research in this field does not provide a definitive answer as to how people feel about such a development, and offer an explanation as to why this is the case.

Lack of attitudinal long distance travel research

Literature concerning the economic impacts of HS2 is extensive and fairly widespread in terms of its impact on travel demand. Demand modelling for high speed rail is also a well-developed area of research. In comparison, literature concerning attitudes to and perceptions of the introduction of high speed rail services such as HS2 is more limited. Where research has been conducted examining attitudes to high speed rail within Britain, it provides a useful knowledge base on which this thesis builds. Dargay and Clark (2012) used the limited existing knowledge of long-distance travel in Britain as a motive for their research, stating that relatively few studies have concentrated mainly on long-distance travel. Loo (2009) states that there is little research concerning the impacts on perceptions and behavioural responses of people where a transport improvement has taken place. Much of the existing research covers highway extensions, and is potentially different to the introduction of a rail service (*ibid.*).

A need to better understand how attitudes to long-distance travel are formed

Given predictions that long-distance travel will become increasingly prevalent, and the possible introduction of Britain's first inter-city high speed rail line, it is important to fill gaps in knowledge to better understand the mode-choice decisions involved in making long-distance journeys. While investing in HSR shortens travel time and brings some places together, it is contentious and we do not fully understand how people think about this. Topham (2012) suggests the focus of HS2 is too much on those with fears about the proposal, and that publicising its benefits has proven to be a struggle. As long-distance travel and average trip length have increased over recent decades, how long-distance travel develops in the future will have important implications for the environment and for congestion. This is especially the case as it accounts for the highest share of energy used and emitted pollutants, despite being a small proportion of the travel market (Dargay and Clark, 2012; Pfaffenbichler *et al.*, 2012). The prospect of increasing long-distance travel also means further research concerning travel of this type is needed (Independent Transport Comission, 2010), especially since long-distance travel is underrepresented in transport modelling (Pfaffenbichler *et al.*, 2012).

Understanding the potential future long-distance travel market in which high speed rail is an alternative mode, will highlight the importance of travel time reductions relative to other factors considered to be important when making travel choices. Differences in personal characteristics such as occupation, demographics and location may also indicate who is most likely or unlikely to choose to travel by high speed rail, why they have made that choice, and how much they would be willing-to-pay for travel time reductions. This research will ascertain the prevalence of both positive and negative attitudes to high speed rail. Understanding attitudes to long-distance travel and responses to the potential changes in travel times resulting from the development of high speed rail will allow future transport services to be tailored to meet the needs of users in the increasingly important long distance passenger market.

1.5 Research aims and objectives

The general aim of this research is to develop and test hypotheses to investigate public attitudes involved in long distance travel, the perceptions of potential travel time reductions by high speed rail, and the relative importance of the factors considered in making long distance travel. Understanding these attitudes and perceptions will be

relevant in future long distance travel service provision. The detailed objectives of this research are;

1. to review literature of travel behaviour theory, issues affecting mode choice, and previous research of long distance travel and HS2;

2. to obtain and analyse qualitative data of the attitudes and perceptions of long distance travel and HS2 to inform the quantitative data collection;

3. to obtain and analyse quantitative data of the attitudes and perceptions towards long distance travel, high speed rail, and willingness-to-pay for travel time reductions offered by both a high speed railway (HS2) and an alternative of a faster Magnetic levitation train (proposed by UK Ultraspeed);

4. to analyse the influence of location, age group, gender, occupation and their previous travel behaviour on attitudes to long distance travel and perceptions of high speed rail;

5. to identify the effect of knowledge of high speed rail on attitudes and perceptions of that mode;

6. to ascertain the extent to which these attitudes and perceptions impact on the willingness-to-pay for travel time reductions;

7. to report the conclusions and their implications for future long distance travel policy for the government, transport planners and service operators.

1.6 Scope and constraints of the study

At the time of writing, the second stage of the proposed HS2 rail line had just been announced by the government, amidst considerable public and media debate. Given the considerable public debate, attitudes to the proposed HS2 scheme are disparate, and the reasons behind these attitudes require further exploration. Political support for HS2 has also changed since the project was announced, with increasing voices questioning the economic case and the affordability of the scheme.

This research studies attitudes and perceptions towards long-distance travel, and the potential introduction of a high speed rail service. In terms of the scope of this research, members of the general public were approached through focus groups and a nationally distributed online questionnaire survey. The data collected were cross-sectional and not of repeated measures design. The research therefore provides a single-point analysis of attitudes and perceptions of high speed rail, as well as an analysis of attitudes to, and determinants of long distance travel. Willingness-to-pay for travel time savings are also analysed on two trips, with two travel time reductions offered. The lack of existing long-distance high speed rail infrastructure in Britain is a constraint which means that revealed preference techniques cannot be used, and responses to the willingness-to-pay questions are therefore based on planned behaviour.

This research does not model future long-distance travel demand, nor is it to make arguments in favour of or in opposition to high speed rail development in Britain. Further, this thesis does not provide an economic assessment of HS2, but is an attitudinal study designed to contribute to an under-represented, yet increasingly important field of long distance travel research. This research is not a longitudinal study, as the timescale of the PhD research meant that re-testing after a period of time, such as after the start of construction of HS2 would not be possible. Data were collected anonymously, but attitudes and perceptions at the aggregate level enable comparative analysis, which future research may wish to visit to determine the effects of the construction or opening of HS2.

Time and budgetary constraints partially determined the methods used in this research (Chapter Three). Surveying at stations, airports, and on trains across Britain was considered, but would have proven expensive and problematic due to the time constraints of passengers in transit. Rail passengers typically arrive at the station five or ten minutes prior to the departure of their train, and commuters spend even less time at the station (Association of Train Operating Companies *et al.*, 2009). The sample would also be unrepresentative due to the prevalence of rail and air users over users of other modes. Furthermore, respondents in transit might base their attitudes on their experiences on that particular day, which significantly differ in the event of a delay or having to stand for example.

1.7 Thesis structure

This chapter has provided the context of the growth of long-distance travel in Britain, and the potential problems facing the transport system as a result of continuing growth.

Chapter two reviews the literature setting out the policy context, current trends and mode-share in the long-distance travel market, including the position of HSR in this. Further literature on travel choice theories including mode choice and planned behaviour, and factors affecting long-distance travel behaviour is also reviewed. The chapter concludes by presenting the research questions of this thesis, and by reviewing previous research of attitudes to HS2. The chapter concludes by introducing the Demographic, Travel behaviour, Situational, Willingness-to-pay, Modal and General, research hypotheses.

Chapter three describes the method of data collection used to test the research hypotheses. The chapter also details the development and distribution of the questionnaire, including the background design work. The chapter also includes details of the questionnaire sample composition, and the data reduction method adopted to create a more manageable dataset for analysis.

Chapter four presents the testing of the research hypotheses by statistical analysis of the data collected, to determine relationships between attitudes, willingness-to-pay, and the demographic characteristics of the respondents.

Chapter five is a discussion of the results in Chapter four with regard to the literature in Chapter two.

Chapter six presents the research findings, and makes recommendations for future policy-makers and long-distance travel service providers. Suggestions for improvements to long-distance travel services, and consultation exercises for future large infrastructure projects, are also made.

Chapter 2. Literature review

2.1 Introduction to literature review

The first section of this literature review sets the contextual background of the research including the research definitions, contemporary policy and trends in long distance travel, and the justification for the research. The second section relates to long distance travel mode share. The third section reviews literature for the formation of attitudes, perceptions and views. The fourth section presents literature of travel behaviour theories, while the fifth section relates to factors in travel behaviour decision making. The penultimate section of this chapter reviews previous attitudinal research of HS2, while the final section sets out the research hypotheses. Literature regarding data collection is included in Chapter three covers the period to the 1st of September, 2013.

2.2 Context

2.2.1 *Research definitions*

As this thesis concerns attitudes and perceptions of long distance travel and high speed rail, it is important to define these terms.

High speed rail

While no standard definition of high speed rail exists, a widely accepted definition is railway lines either upgraded to carry services above 200km/h or newly built lines designed to deliver service speeds exceeding 250km/h (European Union, 1996; Nash, ND). High speed rail generally refers to wheel-on-track trains, though technologies with similar characteristics such as Magnetic levitation trains (Maglevs) are emerging, operating along fixed routes at speeds exceeding 200km/h and with stations as access points. Closely-spaced stations on a high speed rail route would make reaching top operating speeds difficult, and would negate the time saving benefits of high speed rail. Lines are therefore designed with large distances between stations, and the market for high speed rail therefore predominantly comprises of long distance travellers (HS2, 2011).

Long-distance travel

The boundaries between long-distance travel and local travel are not well defined and perceptions of long-distance vary by geographical locations and prevailing social and economic conditions (Beecroft *et al.*, 2003). For example, between countries with developed infrastructure and those without, and trips in congested cities where physical distances may be short but the travel times are not.

In Britain, the Department for Transport use a definition of trips of 50 miles (80km) or more in one direction and with a single main purpose (Department for Transport, 2010a). The United States also uses a definition of a one way-trip of 50 miles (80km) or more, and France's National Travel Survey uses a 50 mile (80km) 'crow-fly' distance (Frei, 2008). In addition to being used in government policies pertaining to long distance travel, the 50 mile (80km) definition of long distance travel is commonly used in academic research (e.g. Fowkes *et al.*, 1985; Rickard, 1988; Rofique *et al.*, 2011; Dargay and Clark, 2012). Given that the research aims here to make a contribution to government policy in Britain, the 50 mile (80km) definition is used so that findings can be applied in the context of the Department for Transports' long-distance travel policies.

However, other definitions of long-distance travel exist and vary considerably. The DATELINE project defines long-distance as 62 miles (100km) 'crow-fly' to the farthest destination (Brog *et al.*, 2003). Mallett (1999) defined a long-distance trip (intercity) as a roundtrip to a destination at least 100 miles (161km) or more from home, while the KITE project used a 46.6 mile (75 km) cut off point to define long-distance travel (Frei, 2008). However, Germany and Switzerland use time-based definitions of long-distance travel. Germany's European Tourism Demand Statistic MiD uses a definition of journeys with at least one overnight stay, while the Microcensus of Switzerland also use this definition, plus excursions of over three hours (including time at destination) per-person per-year (Frei, 2008). The use of these time based definitions challenges the assumption that long-distance travel must be defined by distance.

Time-based versus distance-based definitions

Distance also contains a mental element, and the presence of a subconscious connection between distance and time was identified by Khisty and Zeitler (2001). Cognitive distances are based on individual belief about the distance between places not visible from each other, while for perceived distances places are visible from one another

(Montello, 1991). Over distances greater than 50 miles the destination is unlikely to be visible, thus the cognitive element is likely to be greater than perceived distance for long distance travel. While cognitive distance has been found to be more related to travel time than objective distance in small urban areas where the automobile is the mode of transport, it is suggested that at the inter-urban rather than intra-urban scale, objective distance is likely to have the greatest influence on cognitive distance, rather than travel time (MacEachren, 1980). As this thesis regards long-distance travel (mainly inter-urban), use of a distance based definition is supported.

However, the explanation provided is that on inter-urban journeys, gasoline costs on car trips are likely to impact more on cognitive distance than travel time. As fuel use is related to objective distance (fuel consumption) this assertion appears reasonable. Whether this also applies to rail is unclear, as travel time is relevant on a timetabled service. While a good case exists for using a time-based definition for long-distance travel, congestion can affect travel time considerably. Rickard (1988) used a 50 mile (80km) definition for long-distance travel in order to rule out intra-urban trips. London is approximately 35 miles (65km) from east to west, so a trip within London cannot exceed 50 miles (80km) by its most direct route. London's situation also differs from the rest of Britain in that travelling across the city by car can take three hours (Beecroft *et al.*, 2003), despite this being less than 35 miles (65km). Compared with trips to other European cities over 50 miles away, the travel time by air or high speed rail can be less than the time taken to travel across London in congested conditions. Thus, a problem exists with time-based definitions of long distance travel; large amounts of time spent travelling on a local trip would be classed as long-distance, while an international trip by a faster mode would not. Furthermore, how additional delay caused by congestion is dealt with is a further limitation for using travel time rather than objective distance as a measure of long-distance travel. For these reasons, this thesis uses the 50 mile minimum distance based definition of a long-distance trip.

Current measures of long distance travel

The National Travel Survey (NTS) in Britain collects data of personal travel patterns and household characteristics, and is used to inform government policy. NTS data are collected through face-to-face interviews, followed immediately by a travel week in which a seven day travel diary record is kept. For long-distance journeys (defined in the NTS as trips of 50 miles or more within Great Britain), respondents were previously

asked about such journeys in the previous three weeks, this has since reduced to one week (prior to the main travel diary week) to reduce cognitive burden. Those surveyed are asked about long-distance journeys made in the last seven days. The related questions include origin and destination, purpose, total distance, and mode used (Taylor *et al.*, 2013). A limitation to the data collection methods used in the NTS is using face-to-face interviews potentially risks an interviewer effect, in which responses may be moderated or biased to be more acceptable to the interviewer. A limitation of the assessment of long-distance journeys in the NTS is that it does not collect attitudinal information (e.g. satisfaction). Furthermore the short-period of recall of relevant long-distance trips means that only those within the last seven days are measured, meaning that anything prior is excluded. The accuracy of the measurement of long-distance travel in the NTS is therefore questionable, as individuals travelling long-distance frequently in the weeks preceding the week immediate to data collection, would be recorded as making no long-distance trips. The long-distance travel survey element of the NTS measures the number of trips and respondent demographics. However, it does not measure attitudinal aspects of long-distance travel, such as perceived satisfaction with provision, and thus does not provide data relating to the research area of this thesis.

Defining trips and journeys

Use of 'trips' and 'journeys' in the definitions is complex. Brog *et al.* (2003) defined a journey as a series of trips starting and ending at home or a temporary location (reference locations) that include a destination more than 62 miles (100km) from the reference location. A trip connects two activities and can start and end at any location, such as an overnight location or a temporary stop as shown in Figure 2.1.

Figure 2.1: Trip components of a journey

2.2.2 *Contemporary travel trends (to date)*

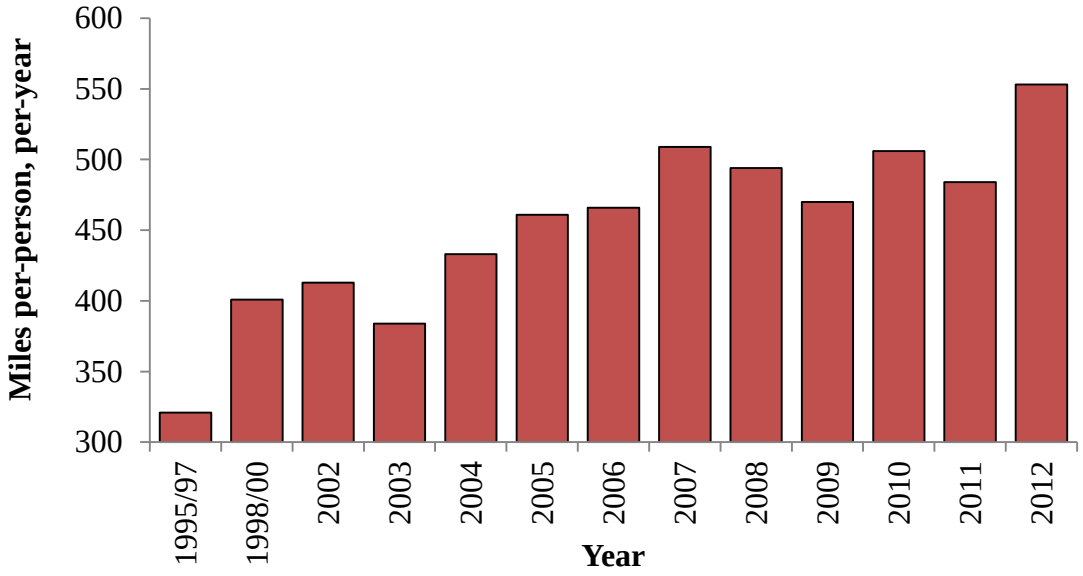
Following a decline in the number of passenger journeys by rail in the 1960s, 1970s and the early 1980s, the number of journeys has increased generally every year with a small drop in the early 1990s (Department for Transport, 2010b). Between 1994/95 and 2009/10 there has been a 71% increase in the number of journeys made by rail within

Britain (Department for Transport, 2010c). This renaissance in rail travel is expected to continue in favourable economic conditions (Department for Transport, 2009a; Pfaffenbichler *et al.*, 2012; Network Rail, ND). Section 2.2.4 expands on why predictions of future long-distance travel growth have developed.

Long distance travel makes up a small part of the contemporary travel market (excepting air). For car, rail and coach much of the mileage travelled is accounted for by long distance travel, despite a small proportion of trips by these modes being long distance. Of the total number of trips, those that classed as long-distance were 3% for car, 15% for coach, 15% for rail, and 100% by air. The percentage share of the total mileage for each mode classed as long-distance is 29% for car, 54% for rail, 68% for coach and 100% for air. In total, 3% of all trips are classed as long distance, while the long distance travel mileage accounts for 31% of all millage travelled (Independent Transport Comission, 2010). Department for Transport (2009c) interviews revealed that 39% of adults had not made long-distance journeys by any mode in the previous 12 months, while 24% had made regular long-distance journeys. Half did not make them using rail, and 15% made more than half of their long distance journeys by rail.

Despite being a small proportion of the overall distance travelled, long-distance journeys have more than doubled between 1994/95 and 2009/10 (Department for Transport, 2011b). The 2010 National Travel Survey indicated that the average number of trips had increased by 61% and the distance travelled by surface rail had increased overall by 58% in the period between 1995/97 and 2010 (Department for Transport, 2011c). Both distance travelled and average trip length have increased over the past decade, demonstrating an increasing presence of long-distance travel in the domestic travel market (Dargay and Clark, 2012). Although the total distance travelled has levelled in recent years, average trip length has continued to increase (HS2, 2011). Figure 2.2 shows the average miles per person travelled by surface rail since 1995/97. The average distance travelled per person per year has increased since the middle of the 1990s, this either means that people are making more trips, or that the average length of trip is increasing.

Figure 2.2: Average distance travelled by surface rail (miles per-person per-year)
Source: (Department for Transport, 2013a)



Over the next 20 years the number of long-distance journeys is predicted to continue to increase. Such forecast increases are made on the basis that population and income growth are strongly associated with the amount of travel, as well as wider economic factors (Pfaffenbichler *et al.*, 2012). A rise in Gross Domestic Product of 2.5% increases long distance travel demand by 34%, while a rise of 1.25% increases long distance travel demand by 18% (Independent Transport Comission, 2010). HS2 (2011) forecast that an average person will make 61% more long-distance rail trips (over 100 miles) per year in 2043 than at present.

2.2.3 *Long-distance travel and transport policy context*

Achieving greater mobility and greater accessibility is currently regarded as a desired goal for society, which has led to the development of new transport infrastructure designed to maximise mobility (Khisty and Zeitler, 2001). It is believed that meeting this desire will enhance social progress. However, in the in last few decades, this expansion has been questioned for its impact on quality of life and ecological sustainability in pursuing these objectives (Khisty and Zeitler, 2001). Increased calls for demand management have emerged due to growing recognition that past increases in personal mobility (by any mode) cannot be continued (Givoni and Banister, 2012).

Economy versus environment

Former British Prime Minister Tony Blair wrote in 2004 that whilst good transport was necessary for a successful economy and society, it was not possible to build our way out of problems. It was alleged that further building would be environmentally irresponsible, so increasingly efficient existing transport was preferable (Department for Transport, 2004). As a result, no reference was made to developing high speed rail infrastructure, in comparison to the current situation, where plans for high speed rail in Britain have survived a change of government and demonstrate an acknowledgement that some new infrastructure is required. The acknowledged importance of transport to the economy is of particular interest when considered alongside the challenging contemporary economic conditions. Developing new infrastructure can be a way of stimulating the economy, and transport and the economy are closely linked. Banister and Berechman (2001) indicate a close correlation between demand for freight and passenger traffic, and economic growth – although the causality link is questionable. They also argue strongly for 'de-coupling' transport from economic growth, so that economic growth does not necessarily lead to growth in demand for transport, citing strong efficiency and environmental arguments for such a policy (Banister and Berechman, 2001). Using a 'glocal' approach of local production for local markets in the freight market is a suggested means of breaking the transport/economic growth link. However, Banister and Berechman (2001) accept that for the passenger sector, 'decoupling' is difficult considering increasing affluence and leisure time. Instead it is suggested that reducing travel, using more efficient modes, or establishing localised travel patterns of production and consumption, offers more opportunity for stabilisation of demand. This can be self-motivated, or alternatively may require coercion.

Travel demand management

Distinctions in coerciveness of travel demand management (TDM) measures can be made, depending largely on the extent to which these can be evaded (Gärling and Schuitema, 2007). Enforcing travel restrictions or TDM measures is likely to prove unpopular, both politically and socially. Issues of public acceptability exist towards enforced (coercive or 'stick') measures, generally less acceptable compared with incentivised ('carrot') means of travel demand (Thorpe *et al.*, 2000). Gärling and Schuitema (2007) concluded that TDM measures are acceptable if they do not limit freedom (to drive) and effectively meet the aim of reducing the problem in question. Greater compensation of any negative impacts resulting from travel demand measures

are also found to increase acceptability – for example reinvesting in public transport (Thorpe *et al.*, 2000). Public acceptability has a political aspect in that it is tied to voters and politicians are sensitive to public opposition, which may be greater for coercive travel demand management measures (Gärling and Schuitema, 2007). Recent transport policy suggests efforts to meet demand rather than reduce it as seen in new infrastructure plans, for which public acceptability is likely to be an issue.

2.2.4 *The increasing importance of long-distance travel*

Long-distance commuting

It has been suggested that the public are becoming more accustomed to travelling further, and over the next 20 to 30 years, people are less likely to be tied to the location of their jobs and more willing to travel further to achieve higher living standards (Department for Transport, 2004). Commuting is an example of this, in that few people live adjacent to their place of work, and are therefore willing to travel further, to live in an environment they perceive to be more pleasant. However, while commuters are a small element of long-distance travellers, and data is limited, it is becoming increasingly commonplace, especially to London where some people commute daily from York and Manchester (Network Rail, 2013; Tighe, 2014).

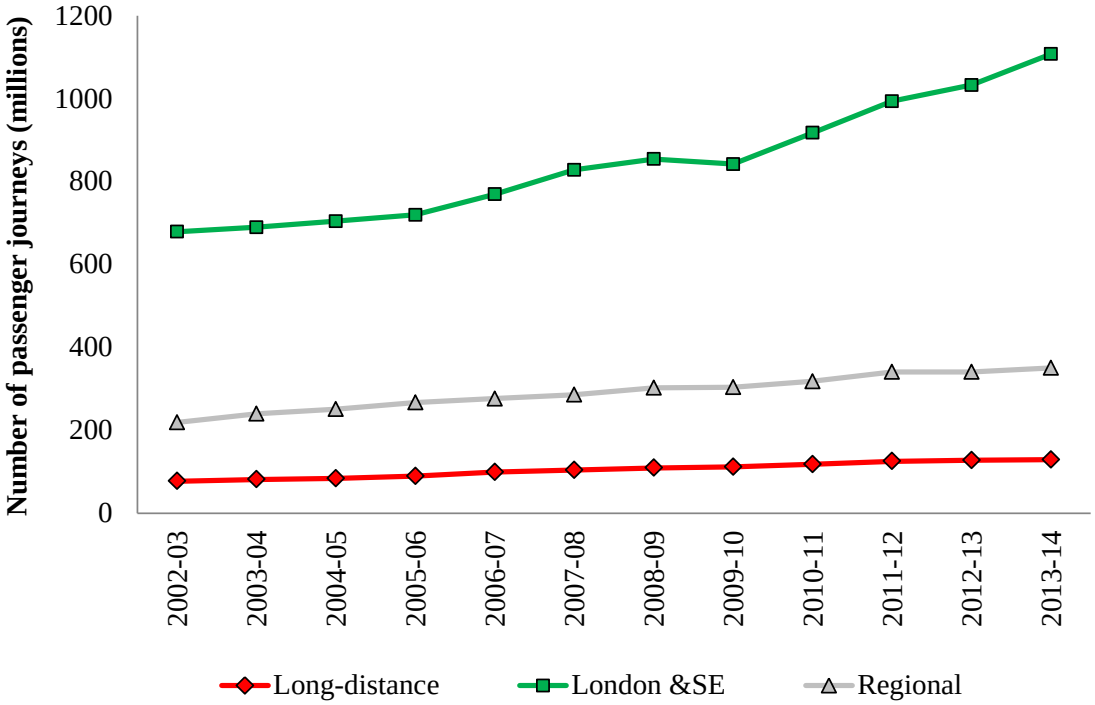
Changes in travel time can affect accessibility, allowing more distant destinations to be reached in the time available (Masson and Petiot, 2009). Past developments in transport technology have provided wider access to activities once limited to that which could be accessed on foot, then by horse, and later by railway, car and finally by air (Banister, 2011). As speeds increased, the daily travel distance also increased, from 1km per day in 1900, to 10km in 1960, and finally to around 50km in 2000 (Banister, 2011). Urry (2007) suggests that being mobile has become a way-of-life and transport infrastructure development has transformed spatial arrangements such as working patterns, through the compression of space and acceleration of time (Khisty and Zeitler, 2001). This may mean that with future transport developments, commuting from greater distances becomes increasingly possible within accepted timeframes.

Importance of long-distance rail travel

Previous infrastructure development has been shown to transform spatial arrangements (Khisty and Zeitler, 2001), and HSR may continue this through improved accessibility to more distant locations within a given time budget (Janic, 2003). This makes reaching

these areas easier and therefore increasingly common. Average trip length has been growing; An average rate-of-growth exceeding three percent per-year has been recorded since 1994, although the rate-of-growth has slowed during the recession (HS2, 2011; Network Rail, 2013). Figure 2.3 shows quarterly trend data for rail trips within Great Britain, split by passenger sector.

Figure 2.3: Number of long-distance passenger journeys made by rail (in millions)
Source: Office of Rail Regulation (2014)



As Figure 2.3 shows, there has been an increase in the number of passenger journeys in the three passenger rail sectors. Long-distance operators make up the smallest share of rail passenger journeys, though these type of journeys have been increasing in number. However, the data in Figure 2.3 does show that long-distance travel makes up a small proportion (less than 10%) of the total amount of rail travel in Britain. This criticism has been made of the UK government's justification for developing HSR, arguing that the growth in rail travel in Britain is primarily commuter journeys, rather than long-distance ones (StopHS2, 2014).

Forecast changes to long-distance travel in Britain

In the last 30 years, rising incomes have lead to increasing suburban living, and growth in car ownership, especially amongst the poorest fifth of British households. As a result, since the late 1970s the distance travelled by the average Briton has risen. However, the growth of car-use reduced in the 1990s, and ceased to grow following 2000

(Independent Transport Comission, 2010). Such data suggests that 'peak-car' may have been reached. Goodwin (2012) suggests car use and ownership either remain in long-term growth with temporary interruptions, have reached their peak and will show no further growth, or are have passed a turning-point and are now in decline. The DfT approach to reduced growth or reduced traffic is that this is a result of temporarily unfavourable circumstances, and economic recovery will mean a recovery in demand. Despite a recent slowing in rail passenger growth, it is predicted that economic recovery and increasingly favourable economic conditions, will mean continuation of the renaissance in rail travel (Department for Transport, 2009a; Network Rail, ND). However, Goodwin (2012) indicates that this approach has constantly over-predicted traffic growth since the late-1980s. As predictions of future growth are unclear, uncertainty about the future direction of travel remains, and the policy implication is that it is preferential to avoid committing vast amounts of money to infrastructure, and to manage demand instead. As appears to be happening to car-use in the 'peak car' debate, it is possible that growth in rail travel demand will not continue, and may 'peak' – bringing into focus the wisdom of investing in vast amounts of HSR infrastructure.

Studies have forecast increasing long-distance travel demand; The Independent Transport Comission (2010) used scenarios to predict long-distance travel demand up to the 2030s, and found that income was important in determining the amount of travel by rail – thus linking rail demand to the wider economy. However, while GDP growth of 2.5% per annum up to 2030 led to long-distance rail demand growth of 35%, a more modest GDP growth of 1.25% per annum, meant long-distance rail demand fell. Using a scenario-based approach, research by Network Rail (2009b) determined that economic growth had a particular impact on forecast long-distance passenger demand growth. Forecast growth in long-distance passenger rail demand is greatest where the UK remains an economic global player (economically centralised on London), and where sustainability is a key agenda. Thus if the current economic dominance of London continues, and the sustainability agenda continues to be prioritised, demand on long-distance rail corridors will grow strongly, compared to a decentralised economy with unabated consumption (Network Rail, 2009b). Given that London is the main destination for long-distance rail trips in the UK (Network Rail, 2009b; Independent Transport Comission, 2010), and rail is the most sustainable long-distance travel mode (compared to road and air), the results appear logical when viewed critically. However, a long-distance market study by Network Rail (2013) revealed that employment

distribution can influence demand for long-distance rail travel – especially if focused on cities. Attempts to spread London's economic success across the country (decentralising), means that travel between urban areas may increase.

Pfaffenbichler *et al.* (2012) suggest that economic development increases the demand for long-distance travel. However, their evidence also points to decreasing long-distance travel demand for rail, but increases for air and car on journeys exceeding 1,000km. In a scenario where GDP was 25% higher than the baseline, rail mode share fell, relatively, accounted-for by growth in car traffic resulting from rising GDP. This clearly demonstrates that the relationship between economic growth and rising long-distance travel does not necessarily mean that long-distance rail travel will grow.

In summary, the claims of continual rises in demand for rail travel are not robust, and the critique of this view, summarised in this section raises some questions over the claims used to justify developing new long-distance HSR infrastructure. Firstly there is the issue of 'peak' demand, secondly that predictions are based on trends continuing – despite an increase of remote-working and teleconferencing. Previous demand forecasts have not necessarily proved accurate, and forecasts of stagnating rail patronage, made in the 1980s, have not followed expectations (Network Rail, 2013). Nonetheless, in light of government focus and proposed investment in long-distance travel infrastructure, this type of travel is relevant and important for research, despite comprising a small part of the wider transport market.

Demand by journey purpose

Recent research suggests that of long-distance journeys made by rail, 32% were made for business purposes and 59% for leisure, the remainder being for commuting (Network Rail, 2013). Significantly, much business activity occurs in large urban areas, where rail has a competitive advantage over other long-distance modes. Business travel demand is focused on busy 'peak' periods, while leisure travel demand is largely focused at weekends (around 80% of leisure travel) (Network Rail, 2013). Demand for air travel for leisure and business journeys is predicted to increase on both domestic and international routes, though domestic demand for air is comparatively more evenly split between the two purposes (Department for Transport, 2013b). Network Rail (2009b) used a scenario-based approach to predict future long-distance rail demand, and found that on strategic corridors, growth was greatest on long-distance business trips, and was

slower for commuting trips. Elsewhere, distance travelled for business is predicted to increase by 42%, and for leisure by 26%, in the period to 2030 (Dargay, 2010). It is also predicted that demand induced by the completion of HS2 will lead to an additional 33,000 newly generated business (37%) and leisure (59%) trips by 2043 (HS2, 2011). It is interesting that the demand forecasts have predicted larger leisure than business shares, as much of the support and justification for HS2 has been made on business grounds (Cecil, 2012; Channel Four News, 2012; Millward, 2012a).

European demand forecasts

Despite expansion of the HSR network across Europe, international services remain fragmented with different organisational and technological frameworks, leading to potential delays at border crossings (Finger *et al.*, 2014). Long-distance travel shows no sign of decoupling from economic growth in Europe, and remains a challenge to policy-makers targeting reductions in oil consumption and CO_2 emissions. Schippl *et al.* (2008) suggested three possible means of dealing with travel demand in Europe; Decoupling economic growth from travel, using new transport technologies, or shifts to modes with lower CO_2 emissions. The 'business-as-usual' approach would mean that by 2050, long-distance rail travel would grow by 50%, car use would double, and air use would more than treble compared to 2005 levels. Using three possible scenarios for Europe in 2050, Schippl *et al.* (2008) found that an integrated EU economic block with widespread use of road-pricing and intelligent transport systems (ITS) would see rail demand increase by 190% by 2050. Were Europe to focus more on comfort than speed, rail would see more modest growth of 75% - reflecting a diminished importance of HSR. Table 2.1 indicates how mode share might change up to 2050, demonstrating that mode share for long-distance rail across Europe would be greatest where Europe acted as a cohesive block, and high-technology transport solutions such as road pricing and ITS were adopted (Schippl *et al.*, 2008).

Table 2.1: Predicted mode share by 2050, possible scenarios (Schippl *et al.*, 2008).

	Air (intra-EU)	Rail	Private vehicle
2005 mode share	32%	6%	60%
2050 baseline	46%	4%	48%
2050: Strong, high-tech Europe	42%	10%	46%
2050: Slow, reflexive Europe	46%	6%	51%
2050: Low growth, expensive energy Europe	32%	6%	60%

Note: some other modes have been omitted (inland navigation)

Sessa and Enei (2009) found that by 2030, the average passenger trip would be longer and more intra-European, with relatively fewer regional and domestic trips. They also

predict that by 2030 passenger trips will increase by car (31.2%), air (34.6%) and by rail (0.3%). However, despite the modest rail increase, passenger km travelled across Europe is predicted to increase by 56%, thus meaning more long-distance trips. Further considerations for future long-distance travel demand in Europe, include an ageing population where older people travel more than previous generations. This could mean more medium-distance trips by car and air for leisure, and more short urban trips, as older people tend to live away from city centres. Sessa and Enei (2009) suggest ICT developments could impact on future travel demand in contrasting ways. ICT could substitute some travel (e.g. homeworking or teleconferencing), but may stimulate demand through targeted transport services, making it easier to find information and book travel.

2.2.5 *Contextual literature section summary*

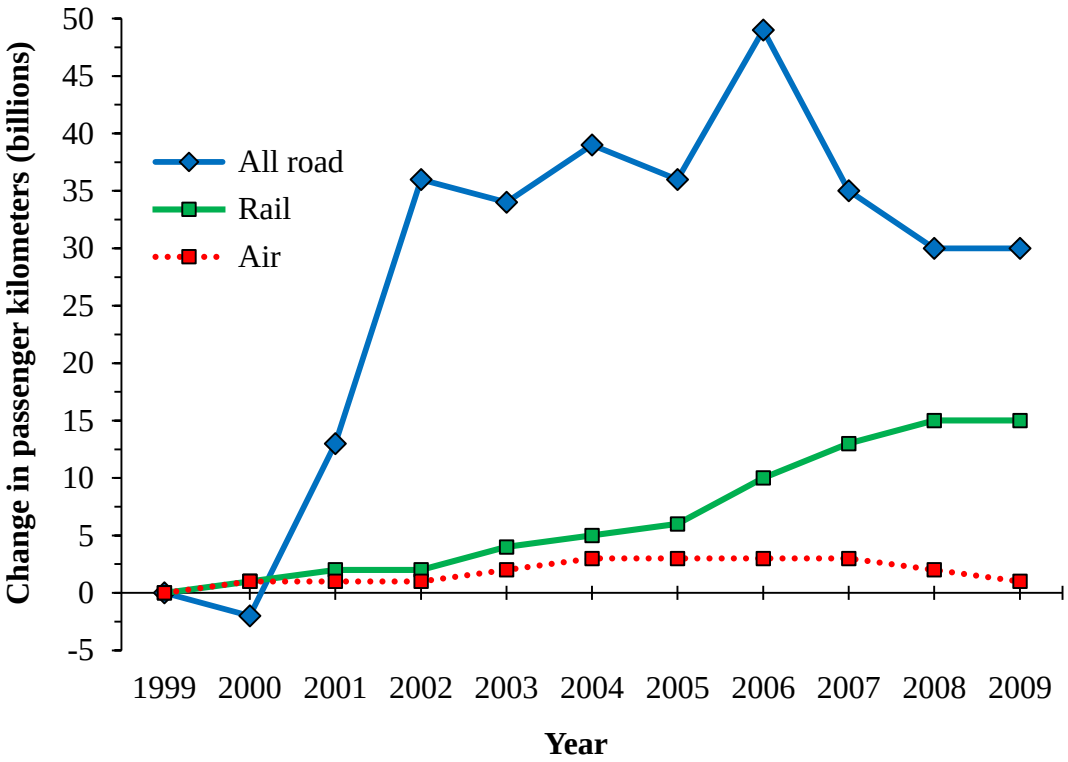
This section has defined both long-distance travel and HSR using reviewed literature. The literature reviewed has described the reasons for developing high speed rail in Britain, namely increasing demand, and capacity constraints. The average distance travelled per-person per-year is also increasing and debate continues regarding predicted increases in demand for long-distance travel. Travel demand growth is forecast in the UK and Europe, but the accuracy of predictions is questionable given possible economic, demographic and technological changes that may occur.

2.3 Long-distance travel mode share

Some transport modes are more suited to long-distance travel than others, and conversely some are more suited to shorter trips. Generally, aviation competes in the long distance travel market with flights between airports over 50 miles (80 kilometres) apart. Depending on service characteristics (e.g. intercity and regional routes, compared to commuter rail and branch lines) rail can also be a long-distance travel mode. High speed rail is predominantly a long-distance travel mode, due to the infrequency of stations needed to maintain high operating speeds. Coaches can be used for long-distance travel serving intercity routes and international airports, while most service bus routes do not serve destinations over 50 miles apart. Private vehicles are often used for long-distance travel and cars largely dominate the proportion of long-distance journeys (Beecroft *et al.,* 2003).

Figure 2.4 shows the yearly change in the number of passenger kilometres travelled by each mode (in billions) from a base distance of zero in 1999. The distance travelled by road fell in 2000 before increasing relative to the 1999 level and remaining above the 1999 figure thereafter. The overall distance travelled by air showed a comparatively modest increase (3 billion more passenger kilometres in 2004 compared with 1999, although by 2009 this had fallen back towards the 1999 figure. Passenger travel by rail has increased every year since 1999 with an additional 15 billion passenger kilometres travelled by rail by 2009. Recent air demand forecasts predict increases of 1-3% per-year to 2050 - a slowdown of the previous growth rate of 5%. The reason given is the end of declining air fares, which have been seen over the last 20 years (Department for Transport, 2013b). A further prediction is that airports will reach capacity in South East England by 2030, and at larger non-London airports by 2040. Without new airport infrastructure, demand that cannot be met may shift to the rail network instead.

Figure 2.4: Non-cumulative change in passenger travel by mode compared to 1999
Source: (Office for National Statistics, 2012)



Shaw *et al.* (2003) suggest increases in rail travel are accounted for by an unexpected mode share gain from road, although road traffic has also continued to increase. The increase in passenger kilometres travelled by rail supports the assertion that rail travel in

Britain has undergone a renaissance. Further explanations for this include heavy investment in track and station modernisation, new trains and new service routes, as well as improved railway ticketing and marketing techniques (Independent Transport Comission, 2010; Lindop, 2014). Furthermore, improved journey times and service frequencies have generated new trips, and increased the rail share against air, notably on the London to Manchester route (Department for Transport, 2009a; HS2, 2011).

While road transport remains the largest mode by distance travelled, the overall amount of travel by rail (measured by distance) has increased in comparison with air travel, which has remained comparatively consistent.

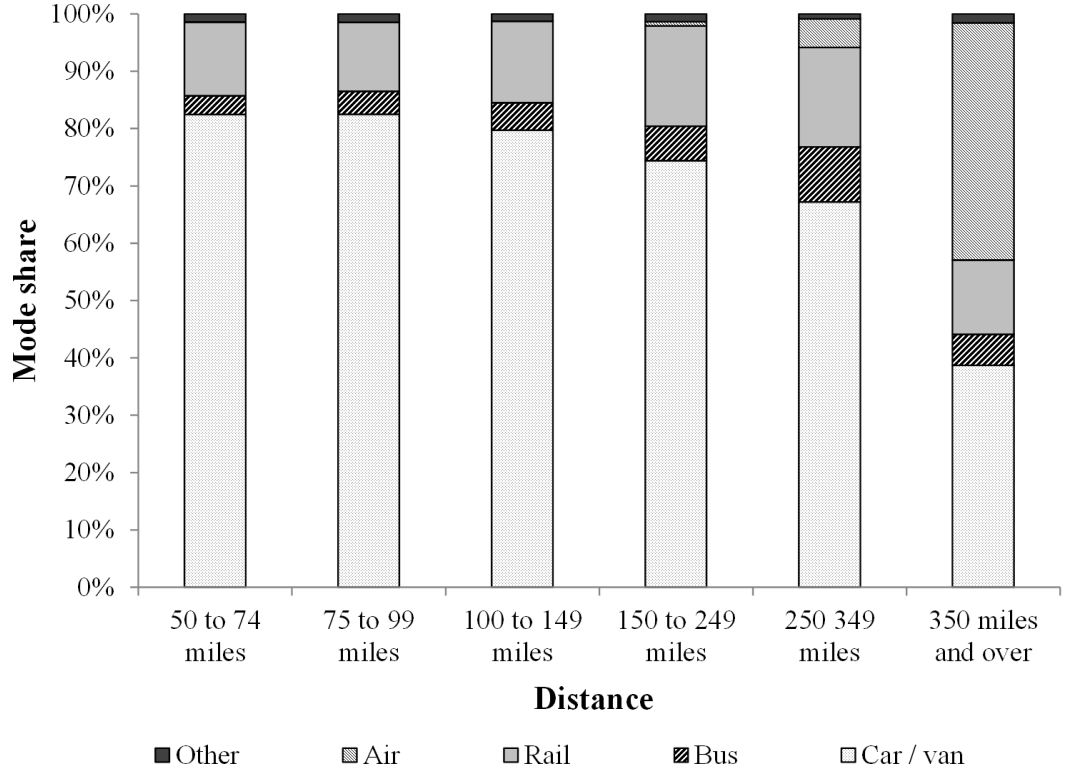
2.3.1 *Mode share for long distance travel*

Beecroft *et al.* (2003) stated that cars largely dominate the long distance travel market. However, between distances of 50 and 249 miles (80 to 401 kilometres), private car has an 80% mode share of trips, and it is only on trips of over 350 miles (563 kilometres) in length that car does not form a majority of the mode share. Car travel makes up by far the largest percentage of trips on distances of less than 350 miles (563 kilometres), while the share of air trips beyond this distance increases and car decreases, trips by car remain the largest percentage. For public transport trips beyond 350 miles (563 kilometres), air makes up a larger proportion of trips than rail (*ibid.*).

Mode competition by distance

Figure 2.5 shows the percentage of trips made by each mode by distance category as of 2013. The share of trips made by rail remains broadly similar across all distance categories, while the market share for air grows substantially at distances beyond 250 miles, where it is more difficult for rail to compete. Beyond 150 miles (241 kilometres) the car begins to lose market share, and there is a substantial fall in the percentage of trips over 350 miles (563 kilometres) made by car. For international trips from Britain, air travel is likely to be relatively unopposed as the car cannot compete with aviation journey times to most international destinations (except between northern France and south-eastern England). All international trips from Great Britain using road and rail involve boarding and waiting times (including rail, ferries and car-carrier trains), losing the competitive advantage over air, and explaining the high share for air on trips exceeding 350 miles (563 kilometres).

Figure 2.5: Long-distance trips within Great Britain by main mode and length: 2008/12
Source: National Travel Survey (2013)



As Figure 2.5 shows, beyond 350 miles rail has a smaller market share than air, due to its inability to compete with trip times by air, despite the waiting times associated with air. However, as Britain does not currently have any high speed rail lines between cities the rail figures refer to a network of largely non-high speed trains. Including a high speed rail line in the figures for rail might increase its share given the shorter time required to reach greater distances, providing greater competition with other modes.

On trips of less than 200 kilometres (124 miles), short access to network times give cars an advantage over both rail and air (Vickerman, 1997). High speed rail in in particular is of little benefit on journeys under 150-200 kilometres (93 to 124 miles) (Steer Davies Gleave, 2004). Given that the point-to-point distance between London and Birmingham is 163 kilometres (101 miles), it is within the potential zone of little benefit from high speed rail. This is a strong argument against high speed rail to Birmingham (only), and makes a stronger case for faster links to other cities further away from London. Between 200 and 800 kilometres (124 to 497 miles) high speed rail competes well with alternative modes (air and car) in terms of trip time (Vickerman *et al.*, 1999; Steer Davies Gleave, 2004; Vickerman and Ulied, 2009). Between these distances, high speed rail can compete with car by overcoming the local access advantages of that mode on

trips of between 200 and 400 kilometres (124 and 248 miles) (Vickerman *et al.*, 1999). 800 kilometres (497 miles) is widely accepted to be the upper distance boundary at which high speed rail can compete with air travel (Vickerman, 1997; Steer Davies Gleave, 2004). Beyond 800 kilometres, faster speeds by air travel compared with high speed rail can overcome the waiting and access time (reaching the airport) limitations of air travel. Experience on the French TGV-Sud Est high speed rail line showed that high speed rail was dominant over air travel for distances of between 400 and 450 kilometres (248 to 280 miles) and was even competitive with air over distances of 600 to 800 kilometres (373 to 497 miles) (Vickerman and Ulied, 2009). De Rus (2008) also provides evidence of high speed rails competitiveness with air within the 800 kilometre (497 mile) threshold.

As for conventional rail, HSR cannot overcome the faster speed of aviation over longer distances (regardless of airport waiting times). However, these distance thresholds may change as technology develops and HSR becomes faster and more competitive with air beyond 800 kilometres (497 miles) due to reduced travel times. The fast speed of air may not be able to overcome the aviation waiting times and therefore take longer than the trip time by faster, very high speed rail (VHSR) services.

Competition with aviation

Existing rail services in Britain can compete for passengers with domestic aviation, especially on trips of between two and three hours. Once rail travel time exceeds three hours, air services on the same route can usually overcome the airport time penalties (e.g. check-in) and reach the destination before the train. However, this depends on the directness of the journey and the origin and destination relative to the potential modes. Between one and three hours, high speed rail has a clear competitive advantage (Vickerman, 1997). Aviation loses between 30 and 50% of market share competing with a three hour rail travel time, falling to between 15 and 30% with a four hour travel time, and less than 20% with a competing rail travel time of more than six hours (Institute of Air Transport, 1991).

Compared to neighbouring European Countries Britain has little HSR, the only route being the 67 mile Channel Tunnel Rail Link. Despite this, the economic geography of Britain means that between city-pairs, rail is often quicker than air - except between Southern England and Scotland (Network Rail, 2013). The same is true in continental

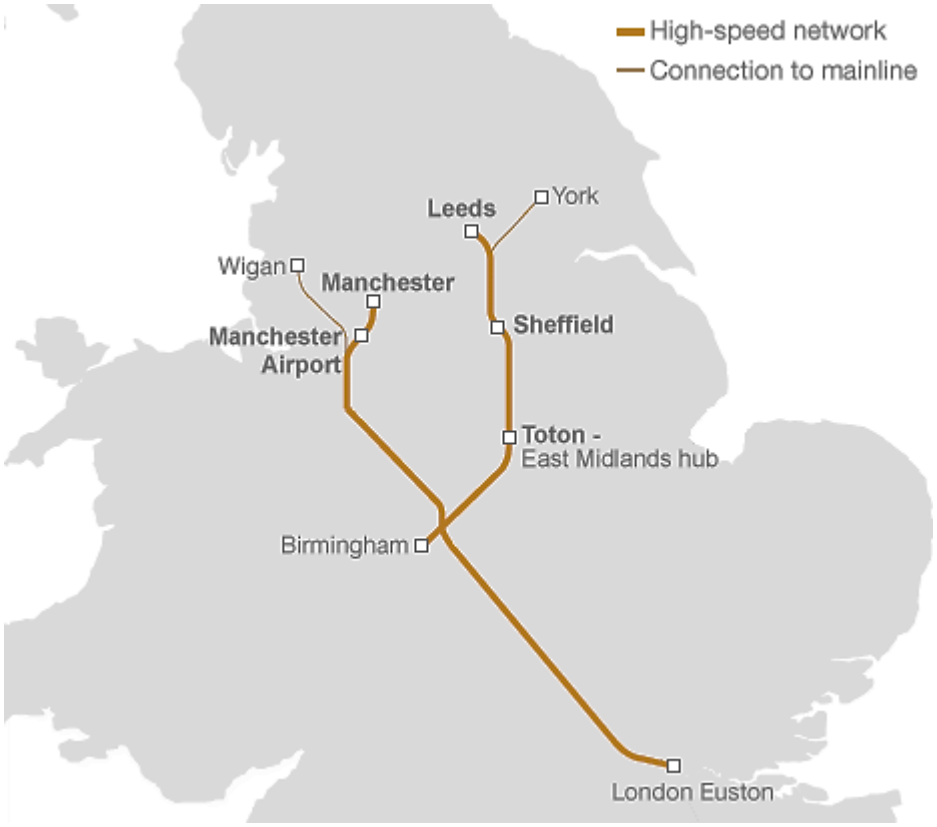
Europe, where rail is the favoured choice for city connections - for example on the Madrid-Seville and Paris-Brussels corridors (Finger *et al.*, 2014). Liberalisation of the European aviation market led to the introduction and expansion of low-cost airlines, and even where such carriers are present, rail is still the favoured city-to-city mode. Despite passenger numbers between Paris, Brussels and London (via the Channel Tunnel), not meeting forecast demand, rail accounted for over 70% of the rail-air market (Vickerman and Ulied, 2009). More recent figures suggest rail has an 81% share of the rail-air market between London and Paris (Finger *et al.*, 2014). On the 600km (373 mile) AVE HSR route between Madrid and Barcelona, three months after opening, airlines between the two cities that had carried 5 million passengers-per-year, were losing traffic at a rate of 1.2 million passenger-trips per year (De Rus, 2008). However, introduction of low-cost air services on the Hamburg-Cologne corridor in 2002 resulted in a decrease in rail passengers, though this later recovered following price reforms (Finger *et al.*, 2014).

High speed rail adds a new alternative mode to decision-making for long-distance travel in Britain, for which time and distance are predictors of mode competition. However, service characteristics beyond travel time are involved in mode choice, including schedule and frequency, ticket price, on-board comfort, access to airport or station, and punctuality and reliability (Gao *et al.*, 2012). These additional factors are therefore a considerable part of the travel decision process, reviewed in section 2.6.

High Speed Two (HS2)

As of 2013, the HS2 proposal for a high speed rail line is divided into two phases. Phase one between London (Euston) and Birmingham (Curzon Street) is planned to open in 2026, and phase two, with separate lines northwards from Birmingham towards Leeds and Manchester, is expected to open in about 2032. The development of HS2 has been justified by the government in that it will improve connections across Britain, and also assist in dealing with crowding on rail services, especially on the West Coast Main Line route between London and Birmingham. The HSR network proposed for development is roughly ‘Y’ shaped (Figure 2.6)

Figure 2.6: Map of HS2 rail line between London and the north (BBC News, 2013e)



The completed HS2 network is expected to cut journey times between London and Birmingham from 1h 21m to 0h 49m, between Manchester and Birmingham from 1h 28m to 0h 41m, and between Edinburgh and London from 4h 23m to 3h 38m (HS2, 2014). The time savings made possible by HS2 have formed a key justification for the scheme, though there is disagreement about whether the time savings will be worth the considerable expense on the project (around £50 billion).

Critique of the business case for HS2

Despite the business case put forward for the scheme, there has been considerable criticism from objective sources. In 2013 the economic benefits of HS2 were revised downwards by a recalculation of the number of business users, and the amount of the journey they spend working (Channel Four News, 2013). Criticisms levelled at the case for HS2 have been made on several grounds. Firstly on overly-optimistic demand forecasts, uncertainty over the future demand for HS2 and the performance of the wider economy, the level of subsidy likely to be required by HS2, and lastly, the value of the travel time reductions.

The long-term HS2 demand forecasts predict a substantial increase in passenger demand for rail, which will begin to impact on the West Coast Main Line within the next 20

years. This demand increase is driving the case for HS2. However, previous passenger demand predictions on the Channel Tunnel Rail Link (HS1) failed to meet expectations, and objective assessments of the HS2 business case have agreed these are both uncertain and optimistic (Aizlewood and Wellings, 2011; Hawkins, 2011). A further criticism is that HS2 will require a substantial public subsidy, and that the scheme is political rather than economic, with projected costs far outweighing the likely returns. Hawkins (2011) states it is difficult to see how HS2 could generate a commercial return, especially if revenues fell below projections. Given the increasing propensity for the use of the internet for work and the ability to work at home, this might affect the market for HS2; People may choose to no longer travel to work daily or do so outside peak hours, thereby affecting working patterns. Assumptions that the demand projections for HS2 are robust are questionable, especially given previous experience and the way rival modes could react in terms of their pricing (Hawkins, 2011). Should revenues fall below expectations for these reasons, the cost-benefit ratio would decline, potentially jeopardising the case for developing HS2.

Intangible wider economic benefits (e.g. narrowing the North-South divide, regeneration) are included in the HS2 financial case, and removing these from the analysis reduces the amount of benefit obtained per cost-unit. Aizlewood and Wellings (2011) suggest that elements of HS2 are 'gold-plated'; For example the route not following existing transport infrastructure – instead seeking to save time, and the considerable cost of the final few miles into London Euston, which save little time. Furthermore, they argue that should HS2 demand predictions be reached, it would be necessary to upgrade surrounding infrastructure, further adding to the project costs.

Value of time for HS2 business case

As part of the economic case for HS2, monetary amounts have been used to determine the value of the travel time saved. HS2 (2013) provides the most up-to-date value of time figures available at the time of this research. For the HS2 business case, the government has used a WebTAG appraisal approach which provides a monetary valuation of the impacts of a transport investment such as HS2. WebTAG travel time valuations are for three main journey purposes, business, commuting and leisure. However, the value of time used in WebTAG differs for HSR due to differences in characteristics compared to conventional rail, and the fact that it serves a longer-distance travel market. Length of journey has been found to have a strong influence on

travel time valuation. HS2 (2013) has therefore used the following travel time valuations in the HS2 economic case. For long-distance business trips, the value is £44.66 per hour, for long-distance commuting it is £12.31, while for long-distance leisure trips it is £10.72. The use of three different valuations is due to journey purpose having a strong influence on travel time valuation, as those travelling for business are willing-to-pay considerably more to save travel time. As HS2 will serve a city-to-city market, it is likely that the majority of users will be business travellers. As travel time reductions are the most visible aspect of a HSR system, these valuations of the time spent on board (and therefore any savings) are a significant part of the business case. However, the business case has been critiqued on the grounds that it assumes travel time saved would be valued highly, as minimisation is always sought.

Critique of travel time valuation in the HS2 business case

The travel time assumptions in the business case, and how these are valued have been questioned. Firstly, the location of the new stations may negate any time saved due to the need to travel to/from a different station. Secondly, a major flaw in the HS2 economic case is that reducing the travel time saves unproductive time – this assumes that time spent travelling by rail is not used for any purpose, ergo it is unproductive. This has been described as the 'zero productivity assumption' (Batley *et al.*, 2012). Hawkins (2011) states that while many benefits of HS2 relate to business passengers, time spent travelling in a railway carriage is not necessarily wasted, and can be used with laptops or other tools. Likewise, Aizlewood and Wellings (2011) indicate that much of the economic case for HS2 is seriously exaggerated, and assumes travel time spent on-board a train is wasted. The calculated case of HS2 argues that time-saved is converted to additional productive time, and also assumes leisure travellers would pay for a faster journey.

Criticism has been made of the HS2 model assumption of a business traveller salary of £70,000 (Aizlewood and Wellings, 2011), arguably higher than a realistic representation of actual users wages. As this is used to calculate the value of the savings, it is possible that these are being overestimated. Furthermore, debate continues as to whether the time saved is unproductive, and productive time may be being reduced by saving travel time (Lyons, 2008). While other research has suggested that time-saving is not always a priority, and instead is traded-off with costs (Nijkamp and Baaijens, 1999). Importance of travel time savings relative to other factors is covered in greater depth in section 2.6.2.

In conclusion, independent assessment of the HS2 business case has revealed deficiencies in terms of the usefulness (value) of the travel time reductions, and a reliance on long-term demand forecasts that have previously proven overly optimistic in other projects. It is therefore important to recognise that HS2 is not certain to have the impacts on travel behaviour or mode-choice that proponents of the project envisage.

2.3.2 *Section summary*

The literature reviewed in this section demonstrates that modes compete with each other over differing distances and journey times. Over shorter distances private car dominates mode share, while at greater distances there is a significant increase in mode share for air. Rail can compete with air for passengers on some trips, as despite trains being slower than planes, the time penalties of air travel (boarding, check-in etc.) are not present for rail travel. High speed rail can have a substantial impact on air routes, as evidence from Spain and France, and the Channel Tunnel has shown. High speed trains operate at higher speeds than conventional rail, and can erode the faster speeds of planes, especially where air travel involves waiting times.

2.4 Formation of attitudes and perceptions in decision-making

This section reviews literature regarding travel choice, the determinants involved in making choices and decisions regarding long-distance travel, and the components of planned behaviour theories. Section 2.4.1 provides a definition for a travel choice, while section 2.4.2 presents travel choice modelling theories, including the formation of attitudes and perceptions in decision-making, and choice set evaluation. Section 2.4.3 presents a review of media representations of HS2, followed by section 2.4.4 which presents risk theory, and section 2.4.5 which presents world view theory.

2.4.1 *Travel choice definition*

Ben-Akiva and Lerman (1985) define choice as a sequential decision-making process. This involves firstly defining the choice problem, then generating the alternative choices that are available, next evaluating the attributes of each alternative, making a decision based upon that, and implementing that choice.

However, travel behaviour is not always the result of a choice, as it can be performed without conscious awareness (such as a routine) and in other cases where there is no

alternative mode, the choice-set is empty (Gärling *et al.*, 1998). In choice-modelling it is therefore important to determine whether the traveller makes a choice. Questions remain over what qualifies as a choice, as it can be argued whether this requires the choice of one alternative (e.g. travel or don't travel) or whether several choices are necessary, for example a number of alternative modes (Gärling *et al.*, 1998). Ben-Akiva and Lerman (1985) describe a choice as being made from a non-empty set of alternatives, therefore some alternative action needs to be available in order to make a discrete choice.

2.4.2 *Travel choice modelling theories*

This section reviews travel choice theories to provide a literary grounding for the factors involved in decision-making for long distance travel. These theories demonstrate that decision making is not necessarily rational due to psychological or cognitive issues. While it is not an aim of this research to model travel mode choices relating to high speed rail (i.e. forecasting future demand), it is necessary to understand the decision process in travel choice as this links to the attitudinal elements of the research through behavioural theory.

Rationality in choice theory

Rationality generally describes a consistent process of decision-making in-line with the decision maker's objectives. However, rationality as a useful concept in describing individual behaviour has been questioned (Ben-Akiva and Lerman, 1985). In economics, rationality is based on the assumption that individuals make choices to maximise their utility, and can be predicted by risk attitudes and budgetary restrictions. This forms the basis for normative decision theories such as Microeconomic (utility) Theory (Gärling *et al.*, 1998). However, in practice classic economic rationality can be violated by errors in perceptions and judgement (McFadden, D. in Gärling *et al.*, 1998). Thus, rationality can be either perfect or bounded.

In perfect rationality, individuals make consistent decisions through the calculation of large amounts of information; full rationality requires unlimited cognitive capabilities (Gigerenzer and Selten, 2001). De Palma, A in Gärling *et al.* (1998) claims that behaviour can be perfectly rational if it is formally justifiable, and follows several key assumptions. These are that the individual; knows their own preferences and the alternatives, is able measure the variables related to their preference, has a global representation of their preferences and the variables involved, can grasp the concepts

and tools necessary to formulate and solve their problem, can optimally choose the coarseness required for the measurements and computations, has a perfect ability to store and retrieve the information and is able to qualitatively explain the various dimensions underlying the problem. However, full rationality is widely believed to be beyond human capabilities as no person has unlimited cognitive capacity, and the decision-making process uses both logical and emotional (typically irrational) elements (De Palma, A in Gärling *et al.*, 1998; Gigerenzer and Selten, 2001; Kahneman, 2012).

An adaptation of rational choice theory is that rather than rationality being perfect, it is constrained (bounded) by cognitive limitations and emotions. Emotional bounds may be present where a choice is made that is considered rational, but then is not acted upon. Bounded rationality is not irrational decision-making, it is optimised decision-making under limitations such as cognitive bounds (Gigerenzer and Selten, 2001). Bounded rationality recognises that choices are made within decision-making constraints (knowledge limits, and attitudes) and individuals are therefore not perfectly rational.

Normative decision theory (Utility theory / Microeconomic theory)

Normative decision theory describes optimal decision-making, where the decision-maker is fully informed of the options available, can calculate the decision accurately, and be fully rational. Microeconomic theory is a form of normative decision theory based on the economic behaviour of individuals, determining all available choice alternatives and evaluating the economic consequences in a rational way, and maximising the utility of their choices given knowledge of the risk attributes and budgetary restrictions (Gärling *et al.*, 1998).

In transport, the consumer might attempt to maximise utility by choosing a mode with the best combination of travel time, financial cost and comfort. However, comfort may not be considered rational, and therefore the rationality is, in reality, perceived. However, a more costly mode may be chosen if it compensates by offering a better service (Ben-Akiva and Lerman, 1985). Desire to maximise utility is a key aspect of human behaviour, and in travel, this is through the desire to maximise mobility and the territory that can be accessed (Ausubel and Marchetti, 2001; Khisty and Zeitler, 2001; Beecroft et al., 2003). Previous research suggests travel time is invariant at around one hour per day globally (Ausubel and Marchetti, 2001; Metz, 2004; Metz, 2007; Urry, 2007). Assuming utility maximising behaviour, the best possible use of the one hour of

travel time will be sought, for example by using this time to travel further (maximising mobility), thus choosing a mode allowing the greatest distance to be reached in that time.

However, as with rationality, the assumption that consumers have perfect knowledge of all choice alternatives and the consequences of all possible choice decisions is a major limitation of Microeconomic theory. Fully rational decision-making is not possible, as humans cannot achieve the necessary logical coherence. Defining rationality as coherent is impossibly restrictive as it demands adhering to logic in a way that a finite mind cannot (Kahneman, 2012). No person has perfect knowledge of all options and their consequences. Furthermore, although humans can adapt to the circumstances, they can approximate solutions to complex choice problems by adopting heuristics to reduce complexities and thus the cognitive burden (Tversky and Kahneman, 2000). For example, substituting a complex question with a simpler one which can be answered adequately, but often imperfectly (Kahneman, 2012). Heuristics can indicate a lack of knowledge about a subject, or alternatively be a result of laziness (e.g. not wanting to exert oneself answering a complex question). Kahneman (2012) describes a 'mental shotgun' of imprecise control of targeted responses in answering questions heuristically.

Random utility theory

While Microeconomic theory does not account for heuristics or for differences in perceived utility, a central assumption of Random utility theory is the presence of individual differences such as characteristics and taste meaning differences in the weighing-up of alternative choices. Individuals face different choice situations and have differing tastes, these individual differences in the decision-making process must be treated explicitly (Ben-Akiva and Lerman, 1985). A universal choice set describes all possible alternatives for the decision-maker in a discrete choice set - such an example of a discrete choice being a choice of travel mode (Ben-Akiva and Bierlaire, 1999). Lack of awareness or knowledge of possible alternatives can restrict the choice set, while the feasibility of the alternative choices can be defined by budgetary constraints, time availability and the physical availability of the alternative (Ben-Akiva and Lerman, 1985; Gärling *et al.*, 1998).

Behavioural Decision theory

While normative decision theories are a structured approach to decision making, microeconomic theory says little about the choice-making process (Gärling *et al.*, 1998).

In contrast to the full-rationality-based normative decision theory, much of the conceptual framework for Behavioural decision theory is provided by bounded rationality, centred upon the constraints of the decision-making process due to the information processing limitations of human problem solvers (Ben-Akiva and Lerman, 1985). Behavioural decision theory relates to the psychological areas of human judgement and decision-making and to cognitive psychology. The theory focuses on understanding how choices are made in decision-making, and diverges from human problem-solving and language understanding in that its emphasis is on tasks involving the integration of subjective judgements (Lehner and Adelman, 1990). As in normative decision theory, a good choice in behavioural decision theory gives the greatest satisfaction to the consumer in meeting their objectives (Gärling *et al.*, 1998).

Research into human judgements and decision-making and whether these conformed to normative ideals indicated inconsistencies with utility theory - the principles of expected utility can be said to have been violated by human judgements (Lehner and Adelman, 1990; Gärling *et al.*, 1998). Experiments by Tversky and Kahneman (2000) found human judgements and decision-making to be characterised by cognitive biases and judgments based on heuristics. Familiarity, salience and the effectiveness of the search set were found to affect choice and decision-making. In a test, respondents incorrectly considered the gender set with more famous members was more numerous (familiarity); while retrievability such as first-hand experience has more impact than a secondary account (salience). The search set example indicated a heuristic, as respondents asked to find words using either the first or third letter were more likely to attempt to find words beginning with a letter (considered easier) even if there were more words with the third letter (Tversky and Kahneman, 2000). Presence of such heuristics in decision-making supports behavioural decision theory as these are not overlooked as in normative theory.

Gärling *et al.* (1998) suggest that the nature of travel choice models is changing, and while an empirical approach to decision-making as elegant a theory as a normative decision theory (e.g. Microeconomic theory) is unlikely, they question how a theory is quantitative if it fails to make accurate quantitative predictions. Increasingly, approaches do not require Microeconomic Theory (utility-maximisation) assumptions as a precondition, but instead are empirical in attempting to disentangle the factors affecting aspects of travel behaviour (as Behavioural Decision theory). Gärling *et al.*

(1998) suggest an important contribution of behavioural decision theory to the analysis of travel choice, is that it focuses attention on the fact that decisions preceding travel choices are made in many different ways and are contingent with situational and personal factors. The planning, design and management of transport systems also requires knowledge of factors affecting consumer satisfaction. Microeconomic theory and behavioural decision theory provide an incomplete theoretical foundation for empirical travel-demand studies, and should include psychological theories of human motivation and value priorities (Gärling *et al.*, 1998).

Constructivism and social construction theory

The terms constructivism and social constructionism have tended to be used interchangeably, and in some cases the generic term 'constructivism' is used (Andrews, 2012). Constructivism has an individual focus where the world of experience is personally constructed through cognitive processes, while social constructionism has a more social focus (Andrews, 2012). In constructivism, values about an object are personally constructed rather than by the qualities of the object itself. Thus constructivism violates normative decision theory as perceived utility can differ between individuals, as can the knowledge and experiential elements of rationality.

Social construction theory considers how objects develop in social contexts based on contingent aspects of our social selves, instead of the object's inherent qualities. Naturally existing objects can exist independent of society, while socially constructed objects cannot exist without society, examples include money and citizenship (Boghossian, 2001). Behaviour can be socialised through habituation (repetition of an activity), which allows freedom from the burdens of decision-making. Habitual routines are added to the individual's stock of knowledge, and can be added to further by acquiring new experiences and knowledge (Berger and Luckmann, 1966). Habituation can lead to institutionalisation, whereby a specific actor performs a specific action or behaviour, removing unpredictability by providing a historically-based pattern of conduct. When the motives of others actions are no longer considered dangerous or threatening, the activity has become institutionalised and thus socially controlled. When the behavioural method is transmitted to others, it becomes historic and reinforces the socially accepted way of behaving, or a role (Berger and Luckmann, 1966).

Humans develop a relationship with their environment (both natural and human), the human aspect of which introduces the social environment, mediated by significant others (members of society with influence). As infants, humans are dependent on social arrangements and are influenced by their surrounding environment. The stock of knowledge socially constructed through interactions during childhood is the primary stage of social construction. This is described by Berger and Luckmann (1966) as the sum total of what everyone knows about the social world, an assembly of maxims, morals, wisdom values and beliefs. As no choices are involved in the primary stage (children cannot choose their parents) the first 'world' of the individual is constructed by others, can be filtered, and the child can receive their world perspectives. Secondary socialisation generally takes place away from the home, in education or employment for example. Through secondary socialisation values and behaviour can be learned from a smaller segment of society, building on the already internalised reality from primary socialisation (Berger and Luckmann, 1966).

Social construction theory is not limited to objects and can be applied to beliefs and ideas about these objects. Hacking (1999) suggests that rather than ideas inhabiting a vacuum, they exist in a social setting and can be proposed, criticised, entertained or rejected. Furthermore, there is disagreement of whether socially constructed emotions are pan-cultural and determined by evolution, or are specific to social and linguistic groups. Berger and Luckmann (1966) suggest people exist in what they consider to be the real world, and are aware with differing degrees of confidence that it possesses particular characteristics. However, reality and knowledge pertain to specific social conditions can differ considerably between societies and cultures. Findings by James R Averill in Harré and Parrott (1996) indicate that emotions are specific to social and linguistic groups, having found emotional variations between hope in Americans, and the equivalent Korean emotion of '*himang*'. Americans generally demonstrated materialistic and deterministic traits by primarily hoping for material goods and social relationships. In contrast, Korean Confucianism and Collectivism meant hope for hedonistic pursuits and freedom from social obligations were most prominent. A moralistic norm was present in Korean '*himang*' by not wishing to go against social values and convention. For Americans, prudential norms were the main reason for not hoping, such as an objective being considered unrealistic. This supports that social construction can differ between societies and by individual's life experiences.

In travel decision-making social construction of attitudes may offer an explanation for differences. Ajzen and Fishbein (1980) give an example of beliefs about Toyota vehicles. To explain why one individual is more positive than another, it is suggested that personal life-experiences lead to forming particular beliefs, through direct observation, by accepting outside sources, and self-inference. Similar effects might be present between modes in travel choice decision-making.

Social construction closely relates to social norms in that attitudes are positioned with respect to significant others in society. Previous research indicates that personal norms, social value orientation and trust in the cooperative behaviour of others were factors influencing car use (Anable, 2005). Soft measures were considered capable of reinforcing favourable attitudes already held in terms of the benefits of travelling by a particular mode. Attitudes and views formed through social construction can therefore influence mode choice decisions.

Social representation theory

Similarly to Social Construction, the concept that values, perceptions and beliefs are shared within groups or in wider society, is central to Social representation theory. Dickinson and Dickinson (2006) define a social representation as a shared perception of the social realities we inhabit, constituting the widely accepted knowledge and beliefs on which our attitudes are based. Sources of representation include direct experience, mass media and social interactions. Through social interaction, an object is assigned meaning and takes on specific social characteristics through cooperative construction and through discourse between groups with specific views. As objects are socially constructed entities in social representation theory, the theory is a social constructivist approach (Wagner *et al.*, 1999).

Communication between groups with similar views and opinions is preferable (including reading newspapers likely to confirm ones beliefs), rather than those with conflicting views (Wagner *et al.*, 1999). Groups not open to conflicting views can develop their own interpretations of unfamiliar phenomena (objectification). Closed groups might develop a perception of a new transport mode without being open to alternative views. However, Wagner *et al.* (1999) point out that distinct group identities do not exist in isolation from other groups or natural forces. Group reactions to unfamiliar events or objects can differ by social conditions, such as socio-structural,

historical, cultural or sub-cultural, intergenerational or differences in education (Wagner *et al.*, 1999). Dealing with unfamiliar phenomenon can involve anchoring, which is using approximate existing representations to help understand it.

Dickinson and Dickinson (2006) suggest that stakeholders bring multiple social realities to transport debates, citing restrictions on car use as an example. A political objective to enact access charges to restrict car use was opposed by local businesses (a group) equating car use with their livelihood. A further example relating to alternatives to car use in tourist areas found a perception from residents that tourists were the problem causers and they should change behaviour. Furthermore, promoting alternatives to car use appeared difficult, as current users of alternatives derive their representations from experience, while for car users these come from limited experience, the media, and social interactions. Dickinson and Dickinson (2006) identified powerful sectors of the community that held an entrenched view that car use cannot be restricted and perpetuated this through social interaction and public meetings.

Extensive media coverage and presence of groups supporting and opposing HS2, mean it is likely that attitudes and transport decisions will be largely influenced by social representations as few will have experience of travelling by high speed rail. Dickinson and Dickinson (2006) advise social researchers to consider the challenges of contextual influence of the dominant social representations and media portrayals in their questionnaire responses

Social representation context of high speed rail

The lack of an intercity high speed rail line in Britain means any direct experiences will be based on international experiences. However, high speed rail has received considerable representation through social interactions and the media, especially since the establishment of HS2. Through shared discourse, opposing, neutral and supportive HS2 narratives have emerged. These diverging views of the HS2 proposal indicate its presence as a major social and political issue at the local, regional and national level.

2.4.3 *Media representations of HS2*

High speed rail has received considerable media attention, especially since the establishment of HS2 in 2009. The following section chronologically reviews the media coverage of HS2 up to September 2013.

Prior to HS2

A well-publicised government-commissioned study of the British transport system, suggested negative public perceptions of the U.K. transport system, although the picture was more encouraging when compared against other countries (Eddington, 2006). The report concluded that high speed rail would not significantly change regional economic connectivity and cheaper alternatives might provide equivalent capacity benefits. Care was also suggested regarding the environmental credentials and mode shift potential. Millward (2013) has since described these conclusions as 'lukewarm to high speed rail'. In 2008, media reports indicated that high speed rail was under consideration by both the Labour government and the Conservative opposition (BBC News, 2008b; BBC News, 2008a). Concurrently, several proponents researched and set out their own vision for high speed rail in Britain (Greengauge 21, 2009; Network Rail, 2009a). A Network Rail proposal was justified by economic benefits, capacity and improved connectivity. However, controversy due to the route omitting Newcastle and Leeds, led to suggestions that Yorkshire was being neglected (BBC News, 2009b).

Establishment of HS2

On the 15th January 2009, the government announced the establishment of HS2 alongside plans for a third runway at Heathrow Airport. Believing it would modernise the British transport system, the Scottish Chamber of Commerce reacted favourably (BBC News, 2009a). However, scheme cost and environmental concerns emerged, with suggestions made over the line's route (Garnett, 2009). While no final route had been announced, concerns emerged, including perceptions that some regions may lose out (BBC News, 2009b; Pearson, 2010). The preferred Y-shaped HS2 route was announced in March 2010 alongside positive press coverage of the economic benefits and the route bringing Britain in line with other countries in Europe and Asia (Schofield, 2010). However, a published detailed map of the London to Birmingham route emphasised high speed rail being in someone's back yard, confirming expectation of considerable controversy (BBC News, 2010). Despite a change of government in May 2010, HS2 remained part of government transport policy. However, by the end of 2010, considerable opposition to HS2 led to route alterations. The media reported concerns about homes and countryside, and emerging political concerns in constituencies along the route (Castle, 2010; Channel Four News, 2010).

HS2 media cover prior and during data collection

Data were collected for this research between March 2011 and June 2012, and the potential for representation by the prevailing media attitudes should be considered.

HS2 received well-publicised support from business people, unions, economists and politicians (Cecil, 2012; Channel Four News, 2012; Express and Star, 2012b; Millward, 2012a; Odel and Pickard, 2012; Rickman, 2012). However, polarised views regarding the impacts and economic credentials of HS2 were also acknowledged (Volkery, 2012).

Televised debates between opponents and supporters of HS2 represented the conflict, such as a heated debate between rail enthusiast Pete Waterman and StopHS2 campaigner Joe Rukin (Channel Four Television, 2011). Negative press of HS2 has included claims that the project case is 'completely off the rails' (Kite, 2012), and reported attempts to block the project through legal challenges by opposition groups and local government (Express and Star, 2012a; Millward, 2012b; Woodman, 2012). Both the government and opposition support developing high speed rail in Britain. However, some Members of Parliament are reportedly under pressure to oppose HS2, especially those with constituencies on the proposed route (BBC News, 2011b; Landale, 2011; BBC News, 2012a; Channel Four News, 2012).

Britain's lack of high speed rail is described as an embarrassment in some news articles (BBC News, 2012a; Express and Star, 2012b). However, whether national pride is sufficient justification for high speed rail in Britain, has been questioned (Channel Four Television, 2011).Some media reports have described HS2 as a means to solve the need for capacity and to bring about economic growth, while it has been justified by the growth in demand for travel and the overcrowding of existing routes (Hennessy, 2011; BBC News, 2012a; Millward, 2012b; Woodman, 2012). However, potentially cheaper alternatives to high speed rail for generating capacity, have been acknowledged in the media (Channel Four Television, 2011; Kite, 2012). In Hennessy (2011) it is claimed that passenger projections are too high, and improving existing services could provide the additional capacity needed more quickly and cheaply. However, other sources suggest that alternatives cannot deliver the same capacity benefits (BBC News, 2012b; Topham, 2012).

Economic benefits and helping to overcome the north-south economic divide are further published justifications for HS2 (Hammond, 2011; Hennessy, 2011; Landale, 2011; BBC News, 2012a; BBC News, 2012c). However, uncertainty over these claims has also been reported (Channel Four Television, 2011; Hennessy, 2011; BBC News, 2012c). Suggestions have been made in the West Midlands press that locations without a HS2 station will lose out and be left with fewer trains (Express and Star, 2011; Express and Star, 2012b). Claims that HS2 is a vanity project, will deliver minimal financial benefits, be unaffordable for many, and risks London benefitting at the expense of other cities on the route, have also been reported (BBC News, 2011a; Sky News, 2012). The unaffordability of use issue has further appeared in BBC News (2012c). In light of the economic conditions since 2008, opponents have questioned the wisdom of spending to construct the multi-billion pound high speed rail link (BBC News, 2011b; Landale, 2011; Sky News, 2012)

Claimed environmental benefits of HS2 in decarbonising transport has received media attention (BBC News, 2012c). However, other reports have challenged these claims (Black, 2012). Coverage of the local environmental impacts of HS2 has presented the concerns of local councils and those living in areas close the line about potential damage and loss of countryside (BBC News, 2011b; Channel Four Television, 2011; Express and Star, 2011; BBC News, 2012b; BBC News, 2012c; Express and Star, 2012b; Sky News, 2012). Concerns about property blight for those close to the HS2 route have also been indicated (ITV Central News, 2012). However, reports of government attempts to mitigate environmental impacts along the route have been made (BBC News, 2012c; ITV Central News, 2012; Millward, 2012b; Sky News, 2012).

The HS2 representations balance national and local interests (BBC News, 2011b; BBC News, 2011a; Landale, 2011). While suggestions have been made of the presence of local NIMBYism (Landale, 2011), a reported survey by Birmingham City Council of those living within one kilometre of the route, were favourable towards HS2 in a slight majority (BBC News, 2011c). (NIMBY-An acronym for the phrase ‘Not In My Back Yard’)

Media sources link local opposition to HS2 with NIMBYism (BBC News, 2011a; Landale, 2011). In some sources, such attitudes have been criticised and presented as economically privileged opponents against those further away and not in the same

privileged position, who would benefit (BBC News, 2011a)**.** However criticism of such attitudes is not universal; Landale (2011) points out that most people care about where they live, and thus are NIMBYs themselves. Labelling anti-HS2 campaigners as NIMBYs politically weakens their argument giving an appearance of prioritising their own circumstances over the public good. However, were opposition to HS2 to become a national issue no longer tied to NIMBYism, Landale (2011) suggests the proposal would become increasingly difficult for the Transport Secretary

In summary, extensive media representation of issues surrounding the development of HS2 have been disseminated to the public during the data collection period. Attitudinal data obtained might reflect the publicised debates of costs, economic and environmental credentials and limitations, and the political context. These representations might influence attitudes, perceptions and beliefs, the findings of this thesis should thus be considered in light of these (Dickinson and Dickinson, 2006).

HS2 in the media since data collection

The HS2 debate has evolved, and while many of the same issues remain (such as local opposition, questions of the economic case and the potential for environmental damage), political support now appears much less certain than when the data were collected. Some news articles have questioned whether support for HS2 is waning in the opposition Labour party (Millward, 2013). Lord Mandelson opined in The Financial Times that he feared HS2 would be an expensive mistake, questioned the certainty of the project funding, and suggested that all parties should think twice about binding themselves to the scheme. Discussing the Labour government, he added that insufficient attention was paid to potential disruption as it was believed such modernisation was in the national interest. Assumptions used to justify the scheme (future rail capacity, creation of economic growth and jobs, rebalancing the economy and contributing to a low-carbon future) were never proven and alternatives were not actively considered (Mandelson, 2013). Uncertainty regarding the project has been reported amongst senior political figures, including that the case for its development is still being made (Lyons, 2013). Prime Minister David Cameron publically backed HS2 at the 2013 G20 summit, but claimed a need to "step up" arguments to rescue the scheme from sceptics and opponents (Murphy, 2013), while Chancellor George Osborne stated that he is "passionate" about HS2 (BBC News, 2013a). However, former Chancellor Alistair Darling changed his mind on HS2, primarily due to cost, raising the potential for a

"nightmare" on Britain's existing lines. This was due to money not being available for other lines if HS2 was built (BBC News, 2013c). Thus, political support for HS2 is not ubiquitous, some Members of Parliament represent constituencies considerably opposed to it (BBC Television, 2013; ITV Calendar News, 2013). There have been televised disagreements regarding HS2, for example Conservative Members of Parliament Cheryl Gillan and Stuart Andrew (BBC Television, 2013).

HS2 has been described in the media as 'a white elephant' and challenged the merits of the scheme (Hennessy, 2013; Warner, 2013). The New Economics Foundation claimed that a wider range of transport investments would be a better way to spend the HS2 money, while the National Audit Office reported an overestimation of the demand case for HS2 (BBC News, 2013d). Furthermore, the Director General of the Confederation of British Industry is reported suggesting that the HS2 money would be better spent boosting West Coast Main Line capacity and would be better value for money – a claim repudiated by Network Rail (Leftly, 2013).

Planning Professor John Tomaney believes the London economy may be boosted at the expense of the regions and that the claimed economic benefits to northeast England will not be delivered. However, despite changing public opinion, the government will continue with the plan (Willis, 2013). Since the data collection for this thesis, the anticipated cost of HS2 has risen from £32.7billion to £42.5billion (Beattie, 2013; The Economist, 2013). Announcement of the HS2 phase two northwards from Birmingham to Manchester and Leeds has also been made (BBC News, 2013f). These changes are not reflected in the data analysis.

HS2 has continued to be a controversial issue and the case for its development is claimed to be irrational, while the three main political parties are under pressure to drop their support (McDermott, 2013). Amidst this controversy, some media sources have reported that HS2 is at risk, and might not be built (Fitzpatrick, 2013). However, despite growing resistance to HS2, confidence for its completion remains, as the government is sensitive to perceptions of insufficient investment in infrastructure and northern cities (The Economist, 2013). A recent legal challenge by residents' groups and councils requesting further assessment of HS2, was dismissed by the Court of Appeal (BBC News, 2013b). Wright (2013) suggests historical parallels between HS2 and previous major infrastructure projects in Britain, in that while, like HS2, these had many critics,

yet upon completion, complaints waned. Furthermore, Wright (2013) identifies the problem in selling HS2 is that this is primarily being done on speed, rather than using the capacity reasons, and also notes that the cost increase is a contingency fund. Suggestions were made that were the issues surrounding HS2 to go beyond NIMBYism and become a national issue, this might prove problematic (Landale, 2011). This appears to have come about as the opposing argument is in the ascendency and has gone from a NIMBYish argument to a substantive economic argument (Wright, 2013). While HS2 is currently set to be built, the considerable uncertainty remaining should be noted.

2.4.4 *World Views*

World views are a collection of beliefs held by groups and individuals giving an indication of their overall perspective of the world. World views are schema, that is a large abstract structure of knowledge used by people to organise what they know, and to make sense of any new information they acquire (Grunig and White, 1992). Some people adopt world views without much thought, while others question and critique these in attempt to clarify and define them.

There is increasing recognition of subjectivity (where scientific method was once believed able to remove it) leading to abandonment of 'logical positivism' - belief that a representation of reality can be verified through objective observations (Grunig and White, 1992). World view evaluation should be based on nine criteria, in three categories; Objective, Subjective and Inter-subjective criteria; World views are best when these nine criteria are fulfilled (Vidal, 2012)

Objective components of world views

To meet the Objective criteria the world view must not be in conflict with the outside world. The Objective criteria comprises three criteria; Objective Consistency, Scientificity, and Scope. Objective Consistency requires the individual's world view to be a consistently logical and rational way of understanding and acting in the world, thus responses should not be contradictory by context. Scientificity requires the world view to be compatible with scientific knowledge, but not overly reliant on scientific techniques. World views are better where they take a wider range of issues into account (larger scope), should extend across the domains of human experience and to the extremities of the levels of each (scope of level depth), and should not take into account

a narrow consideration of issues (scope of agenda). Vidal (2012) suggests that while balance is needed between scope and objective consistency, it is difficult as wider scope makes being consistent increasingly difficult.

Subjective components of world views

To meet the Subjective criteria, the world view should not conflict with the individuals' common knowledge. Subjective components include Subjective consistency, Personal utility and Emotionality (Vidal, 2012). World views should correspond with existing knowledge and experiences to meet the subjective consistency criteria. To satisfy Personal utility a world view should provide goals and values to allow choice between alternatives, as without goals, individuals become environmentally-driven rather than value-driven (being reactive rather than proactive). However, this can lead to individualism, where world views are centred on self-gain, whereas to fulfil the scope criterion, other individuals' goals also need to be taken into account (collective utility). A rational world view is unemotional, but emotions can considerably influence world views. As basic cognitive mechanisms, emotions can be triggered by the surrounding environment (subjective) or by others interacting with us (inter-subjective). As emotions can direct attention, motivate behaviour and mobilise action, omitting them misses out a major aspect of cognition and can lead to world views that are unengaged. However, emotions can sometimes overtake rational thinking (Vidal, 2012).

Inter-subjective components of world views

For a world view to meet the Inter-subjective criteria, it should minimise friction and conflict between other individuals, consistently reflecting integration of all concerns present. Inter-subjective components of world views include Inter-subjective consistency, Collective utility and Narrativity. Individuals that agree on preferences should also do so on their reasoning for an inter-subjectively rational situation to emerge. However, regardless of whether individuals agree or disagree, the perspectives of their reasoning should be justifiable. Niemeyer and Dryzek (2007) state that those with similar subjective positions, agreeing on values and beliefs, should also agree on their preferences. Conversely, if they disagree on values and beliefs it is expected that they should also disagree on action. Vidal (2012) states that to meet the inter-subjective consistency criterion, a world view should reduce conflict between individuals. However, conflict can cause reforms and social learning, without which traditional thinking will hinder creativity.

The importance of an individual goal is set out in Personal utility criterion in the Subjective category. However, prioritising personal utility risks forming individualistic goals and thus a Collective utility element is also important in forming world views. A world view should be balanced by not being purely egoistic, but also not purely altruistic. Therefore, personal visions should be integrated to give a beneficial outlook for both the individual and wider organisations, such as family, social network, country and at the widest scope, humanity (Vidal, 2012). Coordinated action through social norms and collaboration should be employed to meet the collective utility element of a good world view. Such an example of coordinated action exists in the web-based 'Collaboratorium' decision platform, which provides a means for collaborative deliberation of issues. It allows geographically-dispersed groups to explore, evaluate and make decisions on complex issues using logic based mapped arguments (Iandoli *et al.*, 2007; Klein and Iandoli, 2008).

As the final criterion of the Inter-subjective category of world view best-practice, Narrativity communicates world views through stories, allowing them to be emotional and motivating; as such, Narrativity is inter-subjective. Violation of the narrativity criterion removes the emotional element of a world view, leaving facts that can be emotionally insipid and therefore difficult to understand (Vidal, 2012). As part of narrativity, individuals determine its legitimacy by testing the values and reasoning therein through checks of coherence and fidelity (Fisher, 1994). Coherence checks test whether the story 'holds together' by comparing it with other stories to discern factual errors, omissions and other distortions, and to verifying the intelligence, integrity and goodwill of the author. Fidelity checks the believability of the narrative, whether the messages therein are fact-based, whether any facts have been omitted or misrepresented, whether the views can be validated and whether the values fostered constitute a humane basis for conduct (Fisher, 1994). In the context of the discourse and representations made regarding HS2, individual's world views may determine their perspective of the project. Some may adopt a view based on any information they receive, while others may critique what they acquire, perhaps by testing the legitimacy of the narrative they receive from others through social representation. In relation to HS2, balancing a world view on collective utility could occur between self-interest, and the interests of others (BBC News, 2011a).

2.4.5 *Risk perception*

While risk is traditionally considered a measure of hazard, giving the likelihood of some adverse effect, it can be defined more neutrally as the probability of a future event, and is conceptualised as costs and benefits, both financial and human (Short. Jr, 1984). Risk theory is predominantly based around technology, and opposition to it has been a source of frustration to regulators (Short. Jr, 1984; Slovic, 2000). Perceived risk derives from other disciplines including economics, cognitive psychology and decision analysis (Short. Jr, 1984). It is no longer the case that the expert views will be trusted and accepted unquestioningly. Wildavsky (1979) claims expert opinion was the usual way to resolve disputes of the effects of technology. However, rather than reaching a solution, experts can perpetuate disputes by disagreeing; indeed experts cannot currently agree on the merits and demerits of HS2. Wildavsky (1979) and Slovic (2000) identify public recognition that expert's judgements are opinion-based and as prone to bias as those of the public, meaning less willingness to depend on these.

The media links scientific, political and other communities, thus acting as part of the social fabric. Biases in risk perception can be explained by media documenting threats and raising public awareness of risks (Short. Jr, 1984; Slovic, 2000). Given the substantial media coverage of HS2, this should be considered as reporting can heavily influence public perception of the scheme and the associated risks (financial and environmental).

Finally, where affect and world views differ, their role in assessing risk can lead to disagreements about risk. Strong views can make individuals resistant to change. For example, new evidence confirming ones own beliefs is considered reliable, while evidence which does not, can be perceived as erroneous or unrepresentative (Slovic, 2000). World views therefore can strongly influence perceived risk where new information arises.

2.4.6 *Personality types and traits*

Personality traits are a characteristic of an individual which exerts an influence on relevant responses, these being behavioural manifestations of the underlying personality trait. Ajzen (2005) describes similarities between traits and attitudes, as both are latent hypothetical constructs that manifest themselves as observable responses. However, an important distinction is that traits are individually focused rather than externally, and are

not necessarily evaluative, while attitudes describe an individual's evaluation of an object.

Personality traits can be categorised into five dimensions, these being; Agreeableness, Neuroticism, Openness, Conscientiousness, and Extraversion. Agreeableness describes personalities exhibiting generosity, trust and appreciation, and can be measured by altruism. Neuroticism describes personalities displaying anxiety, worry, self-pity, and emotional instability, and can be measures by levels of hostility, anxiety and impulsiveness. Openness defines artistic, imaginative and curious personalities, and can be measured in terms of aesthetics, feelings and values. Conscientious personalities are efficient, thorough and organised, and tend towards-goal directed behaviour. Conscientiousness can be measured by competence, self-discipline and order. Extraversion describes personalities that are outgoing and enthusiastic, and are measurable in terms of their positive emotions, excitement seeking and assertiveness (McCrae and John, 1992). Those with agreeable personality traits would be expected to be more trusting of the proposition of HS2, while evaluating it in terms of its effects on others above oneself. Those with open personalities would be expected to be more emotional, feeling and curious of HS2, while conscientious people would be more considering and evaluative of the scheme in terms of its end results. It is possible that those with extravert personalities would view a new high speed rail system as exciting, if their evaluation was negative, their assertiveness would indicate this.

Personality types provide an alternative means of psychological classification. Jungian Typology differentiates eight typological groups, formed of two personality attitudes (extraversion and introversion) and four functions of orientation (Sharp, 1987). These four fundamental functions represent conscious orientation, these being; sensation types, thinking types, feeling types and intuitive types (Jung, 1991). The four functions are split into rational 'judging' functions (thinking and feeling) and irrational 'perceiving' functions (sensation and intuition). Judging functions are based on a reflective linear process leading to a particular judgement, while the irrational functions perceive, sensation being the external world and intuition the inner world (Sharp, 1987). The two personality attitudes are fundamentally opposite, as while introversion is directed towards the inner world, extraversion is directed toward the outer world (Sharp, 1987). While the unfamiliar is alluring to extroverts, introverts are more reflective, hold defensive attitudes and treat the unknown with fear and mistrust (Jung, 1991). While

extraverts like to travel, meet new people and see new places, introverts are more conservative, preferring familiar surroundings (Sharp, 1987). Extraverts may therefore value the new experiences and accessibility afforded by HS2 more highly.

2.4.7 Cultural theory

Cultural theory assumes the existence of four forms of social organisation, these being; Fatalists, Hierarchists, Individualists and Egalitarian. These social organisations are formed along the two axes; 'Group' – the importance of the group compared with the individual, and 'grid' – the level of freedom of relationships between individuals. In a high 'group' society, the values of groups are prevalent over those of individuals, while for a low 'group' society, the opposite is true. In high 'grid' societies, interactions between individuals are constrained and insulated, while for low 'grid' societies transactions between people are free and unconstrained (Jackson, 2005; Meader *et al.*, 2006). Individualist societies pursue the best interests of the individual, while egalitarian societies act in the interests of the group. Furthermore, Jackson (2005) suggests that the different cultural models can also be associated with individuals, who have different preferable kinds of social organisation; Heirarchists adhere to established traditions and institutions, and resist social change; Individualists prefer individual choice and personal freedom; Egalitarians are against formality and reject authoritarian institutions; and Fatalists who avoid friendships and social groups. It has been suggested that the four social organisation forms in cultural theory, correspond to worldviews (Jackson, 2005; Meader *et al.*, 2006). The social organisation forms in cultural theory are also associated with attitudes to the environment, and travel behaviour. Previous research in this field determined that cultural world views were discriminate in respect of attitudes to car use. Egalitarianism related to the proposition of serious consequences and costs for the biosphere, resulting from car use. Pro-environmental attitudes were stronger for egalitarians compared to other worldviews. Fatalists and individualists rejected the detrimental consequences of car use, while heirarchists recognised both the costs and benefits of car use (Meader *et al.*, 2006). As cultural theory types indicate differing attitudes to car use, it is reasonable to expect that similar effects may be present for other modes also.

Section summary

Beliefs in utility maximisation theory have been questioned due to violations, and this led to the development of other theories of decision making, such as behavioural

decision theory. Choice modelling theories now recognise that decision-making is constrained and not perfectly rational, instead decisions are made in different ways depending on personal and situational factors. The influence of context has also been discussed in relation to social construction and representation, in that 'significant others' and social institutions can convey views. In this context, media representations of HS2 around the time of data collection displayed the conflicting views and arguments, with the potential for influencing attitudes. World views were discussed alongside risk, over which they have an influence and can determine perceived risk. Finally, personality traits literature was summarised to provide a link to travel behaviour theories.

2.5 Travel behaviour

2.5.1 *Travel behaviour theories*

The literature reviewed in the previous section has determined that travel choice decision-making is not necessarily rational or about maximising utility. Behavioural decision theory ended the 1960s view of decision-making following expected utility, and introduced the presence of cognitive biases, situational and personal factors, and subjective judgements.

The following section develops the cognitive aspects of decision making already discussed; these being utility theories, rationality and the formation values and world views (attitudes) through social processes. The section presents theories of how the cognitive aspects of decision making (attitudes, social norms and perceptions of control) lead to intentions of behaviour, that are not necessarily utility maximising, and not necessarily fully rational (pure rationality). In contrast to section 2.4 which focused on how values and beliefs are formed, this section defines attitudes and how they fit in travel behaviour theory.

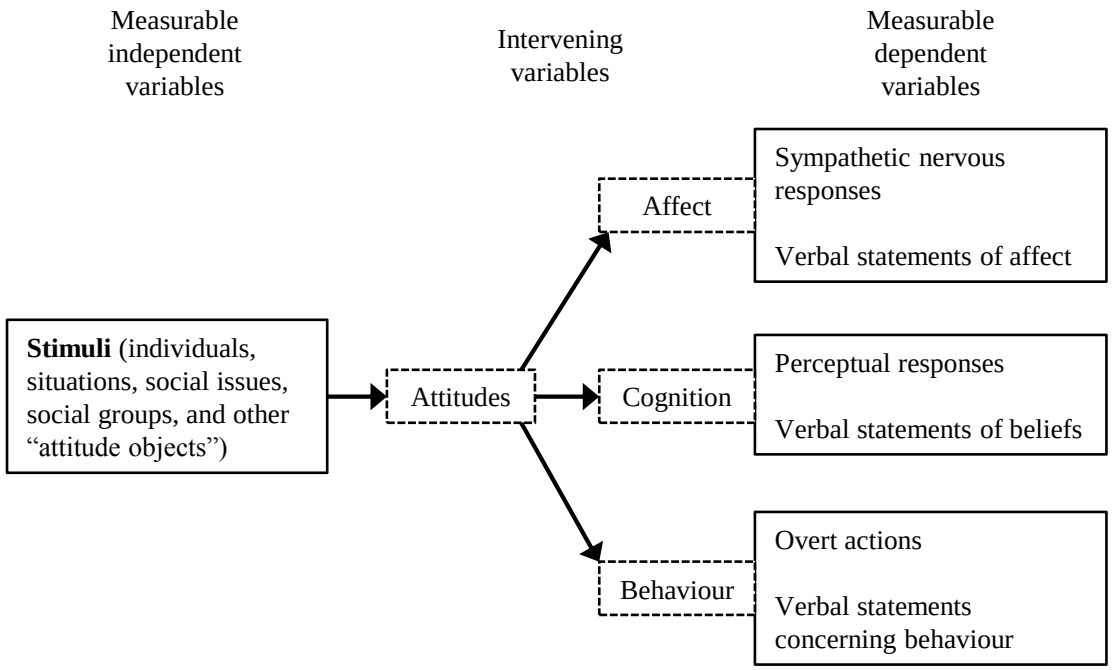
Attitude structure

Attitudes are dispositions to respond favourably or unfavourably to an object, person, institution or event, and it is agreed by most contemporary social psychologists that attitudes are evaluative (Ostrom, 1969; Eagly and Chaiken, 1998; Ajzen, 2005). Attitudes exist in a state that is internal to a person and while not directly observable, by observing responses, psychologists can infer these attitudes (Eagly and Chaiken, 1998; Ajzen, 2005). The evaluation which takes place in order to form the attitude has both a

positive and negative pole. An individual with a moderately pro attitude will make moderately positive evaluations on average, but occasionally these can be extremely pro, neutral, or even anti responses (Ostrom, 1969). These positive and negative poles form the basis of the attitude scales used in the data collection for this research.

Attitudes are part of a hierarchical model. The first stage of their formation are the specific beliefs, which go on to form the next stage of the hierarchy, these being cognitive responses, affective responses, and conative responses; Together these form the multicomponent view of attitude (Day, 1972; Ajzen and Fishbein, 1980). Individuals' favourable or unfavourable attitudes towards an object (such as a high speed rail route) can be inferred by these cognitive, affective or conative responses. Research by Ostrom (1969) indicates that the three components of attitude are distinct, thus there are independent causal factors underlying the responses in each of the components. More contemporary research maintains the concept that most evaluations incorporate both affect and cognitive elements as components of attitudes, and research has determined that having a cognitive or affective focus can lead to forming different attitudes (Van den Berg *et al.*, 2006). Figure 2.7 shows the three components of attitude (Rosenberg *et al.*, 1960) cited in Ajzen and Fishbein (1980).

Figure 2.7: Rosenberg and Hovland's (1960) schematic representation of the three-component view of attitude (from Ajzen and Fishbein (1980)).



Cognitive component

The cognitive component of attitude reflects perceptions and thoughts about the target object, expressed in the form of belief in the objects existence, or evaluative beliefs about that object (Day, 1972; Ajzen, 2005). These evaluative beliefs provide information, on which a judgement is made, can be desirable or undesirable (as per the positive-negative pole) and reflect the attributes of the object and how this relates to the individual evaluating it. These beliefs can be forward-looking, such as towards the likely characteristics of something on the future time horizon. This is important for this research where perceptions of a future high speed rail line are being investigated.

Affect component

The affective response element of the attitude structure is emotionally based, consisting of feelings, moods and emotions towards an object (Day, 1972). It has been suggested that 'gut reaction' can convey the spirit of affect (Ostrom, 1969). As well as verbal manifestations of affect, individuals can also exhibit physical indicators, such as reactions of the sympathetic nervous-system (Ajzen, 2005). Such sympathetic nervous-system activity may be experienced in relation to an object and subsequently is associated (Eagly and Chaiken, 1998). Compared to cognitive components of attitudes, affect has been found to permit faster evaluative judgements, reflecting greater accessibility of evaluations in affect (Van den Berg *et al.*, 2006).

Conative (behavioural) component

Conative responses are sometimes described as the behavioural aspect of the attitudinal structure (Eagly and Chaiken, 1998), referring to behavioural inclinations or intentions towards the attitude object (Ajzen, 2005). These can be statements of both past action, future intentions and predicted behaviour in hypothesised situations (Ostrom, 1969). For example, a conative response would be that a person intends or does not intend to do something, (for example to use a high speed rail service if it was introduced). Conative responses do not necessarily translate into actual behaviour; they are behavioural intentions or plans of what a person would do in the right circumstances (Ajzen, 2005). For example, a person may have no intention of using proposed new transport infrastructure (due to opposition) but later view it as beneficial and choose to use it.

Attitude consistency

In Ajzen (2005), there is a presupposition of coherence of thoughts, feelings and actions in dispositional explanations of human behaviour. If personal reactions towards an object were inconsistent by time and context then attributing them to stable dispositions such as attitudes or traits, would not be possible. Coherence and consistency are therefore essential for prediction and understanding, as inconsistencies between beliefs, feelings, or actions, makes realignment necessary for internal consistency. Once a consistent view is established, this tends to resist change, although gradual shifts in view can occur over time (Ajzen, 2005). This research is not a longitudinal study; however, a future study conducted under longitudinal conditions may provide an opportunity to study attitude consistency relative to new information or new stimuli.

It is expected that if a positive attitude is held towards a form of behaviour, then that behaviour will be carried out (action), providing there are no limitations or barriers present. These assumptions are held for both the Theory of Reasoned Action, and the Theory of Planned Behaviour (Ajzen, 2005).

The Theory of Reasoned Action

The Theory of Reasoned Action is an approach to predicting planned behaviour which is a predecessor of the Theory of Planned Behaviour. An assumption of the Theory of Reasoned action, is that people are rational and will think and act in logical ways, making use of the information available to them in a systematic manner (Ajzen and Fishbein, 1980; Ajzen, 2005). By assuming rational decision-making, Ajzen and Fishbein (1980) do not view social behaviour as being controlled by desires or motives, instead actions are considered in terms of their implications before reaching a decision on carrying out a behaviour. The Theory of Reasoned Action comprises three constructs; Intention, Attitudes towards the behaviour and the Subjective Norm. Intention is a function of the other two constructs; Attitudes which are based on a persons beliefs (and their salience) and an evaluation of the intended behaviour, and Subjective Norm, which reflects social influences (such as social representation theory and social construction). If Attitudes and Subjective Norms result in a behavioural intention to perform certain behaviour, then it is expected that the intended behaviour will be performed.

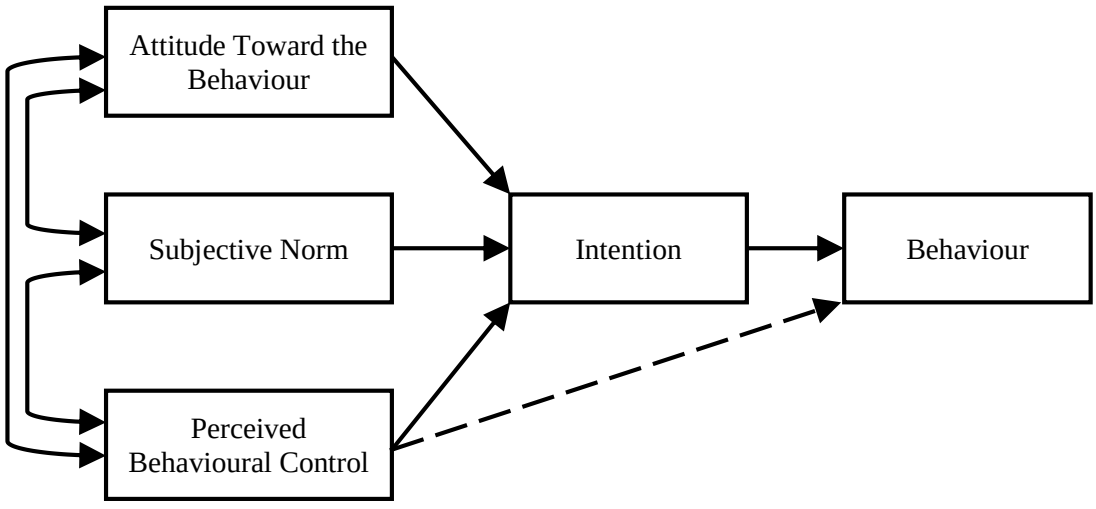
However, the Theory of Reasoned Action is limited to volitional behaviours (behaviour that can be freely performed at will) in suggesting that behaviour is solely controlled by

intention, i.e. that a once a person decides to behave in a certain way (intention), they can perform this behaviour freely. In fact, most behaviour requires certain skills, resources, or opportunities, and if these are not available, the behaviour becomes non-volitional (Ajzen, 1991). The Theory of Reasoned Action is therefore limited in dealing with behaviours where individuals have incomplete volitional control. To overcome this, the Theory of Planned Behaviour extends the Theory of Reasoned Action, by incorporating Perceived Behavioural Control (Ajzen, 1991).

The Theory of planned behaviour

The Theory of Planned Behaviour is similar to the Theory of Reasoned Action in that it attempts to provide an explanation of the informational and motivational influences on behaviour. Like the Theory of Reasoned Action, it includes Attitude and Subjective Norms, but extends the Theory of Reasoned Action by adding a Perceived Behavioural Control construct to the predictors of behavioural intention (Ajzen, 1991). The Theory of Planned Behaviour suggests the presence of three component factors which determine the individual's intention as an antecedent of performing a behaviour; the model proposed by Professor Icek Ajzen is shown in Figure 2.8. The dotted line represents that where perceptions of behavioural control are accurate, they may directly affect behaviour. Perceived Behavioural control can also moderate the intention–behaviour relationship (Wall *et al.*, 2008).

Figure 2.8: The Theory of Planned Behaviour
(own image based on (Ajzen, 1991; Ajzen, 2005))



As in the Theory of Reasoned Action, the assumption behind the Theory of Planned Behaviour is that decision-makers behave in a sensible manner. The theory proposes

that intentions are the closest antecedents of behaviour, which are predicted by three components; Attitude, Subjective Norm and Perceived Behavioural Control (Ajzen, 1991; Bamberg *et al.*, 2003; Ajzen, 2005). These components in turn are determined by salient beliefs for each component, and evaluations of the behavioural beliefs for attitudes, normative beliefs for social norms, and control beliefs for Perceived Behavioural Control (Heath and Gifford, 2002). In combination, these three determinants result in a behavioural intention, which is the readiness of the decision-maker to perform the behaviour in question. Generally, the more favourable the Attitude and Subjective Norm, and the greater the Perceived Behavioural Control, the stronger the intention to perform the behaviour in question (Bamberg *et al.*, 2003).

Attitude toward the behaviour

Attitudes are formed based on an evaluation of a particular subject or object, expressed as likes and dislikes along a positive-negative pole. Attitudes comprise affect, cognitive and conative components. In the Theory of Planned Behaviour, attitude is based on an individual's favourable or unfavourable evaluation of the behaviour. These attitudes reflect the cognitive beliefs about the intended behaviour (behavioural intention) based on the evaluation of gained knowledge. The statement "My usual form of transport is pleasant" is an example of attitude as it evaluates the positive or negative aspect of the behaviour, based on knowledge (Wall *et al.*, 2008). Attitudes may include the perceived quality of the attributes of the object in question. In this thesis, these might include perceived utility of a high speed rail scheme (cognition), fear or enthusiasm about high speed rail development (affect) and belief that the individual will use the service (conative). Beliefs are one of the formative variables of attitudes and can be influenced by significant others (social construction), for example by being proposed, criticised, entertained or rejected in a social setting (Hacking, 1999).

Subjective Norms

Subjective Norms are preceded by Normative Beliefs and are the second antecedent of behavioural intention in the Theory of Planned Behaviour. Subjective Norms refer to perceived social pressures to perform or not perform a behaviour (Ajzen and Fishbein, 1980; Conner and Armitage, 1998). 'Norms' are socially agreed upon (thus socially constructed) rules to define what is 'right and proper' (Ajzen and Fishbein, 1980). Inter-subjective factors are important in the formation of world views; while significant others can also influence these through social construction. Going against socially

accepted convention, is a violation of a subjective norm. In a study of travel-mode choice by Wall *et al.* (2008), the statement "My friends at DMU think I shouldn't drive to get to University" had the greatest loading on a Subjective Norm factor, recognising that the statement takes into account the views of significant others in relation to performing a particular behaviour. Individuals whose preferences about the person's behaviour are perceived to be important (significant others) can influence the choices made (Ajzen and Fishbein, 1980). For example, a subjective norm opposing drinking and driving might deter acting upon such a behavioural intention, while a person living along the proposed HS2 route or who knows people likely to be affected may perceive a social pressure to be unfavourable.

While Conner and Armitage (1998) cited previous research that found Subjective Norms to be the weakest predictor of intention in both the Theory of Reasoned Action and the Theory of Planned Behaviour, they noted this might be the result of failure to 'tap' the appropriate components of normative influence. Indeed extensions to the normative component of the Theory of Planned Behaviour have been suggested. The addition of moral norms has been suggested as a useful addition to the Theory of Planned Behaviour, adding an individuals own normative moral evaluation of performing a behaviour and whether it is acceptable (Ajzen, 1991). Moral norms were accurate predictors of bus use intention in Heath and Gifford (2002) and where individuals had a high moral obligation to reduce car use, the stronger their intention to do so (Abrahamse *et al.*, 2009). Use of descriptive norms (what is typical for people to do in a particular situation) offered good predictive validity for students' public transport use (Heath and Gifford, 2002).

However, Social Norms may not be influential compared to perceived behavioural control and attitudes, as an egoistic person would place less importance on a societal norm, and would be more focused on their own interests when forming a behavioural intention. The remaining two components of the Theory of Planned Behaviour would therefore be considered more important in forming a behavioural intention.

Perceived Behavioural Control

The third antecedent of behavioural intention in the Theory of Planned Behaviour is Perceived Behavioural Control. This describes an individual's perception of their Actual Behavioural Control, which is ascertained by the presence of resources likely to

determine the actual achievement of the behaviour. Perceived Behavioural Control is the perception of whether the person has the resources necessary to perform the behavioural intention, and the level of ease or difficulty in doing so. This is based on experiences as well as anticipated obstacles to performing the intended behaviour (Ajzen, 1991). A continuum of control exists, with easily executed behaviours at one end (volitional), and more difficult behavioural goals which demand resources, opportunities and specialised skills at the other (Conner and Armitage, 1998).

Perceived Behavioural Control is based on perceptions of factors that may permit or restrict performance of the behaviour (control beliefs) which can be either internal or external factors. Internal factors include emotion or knowledge, while external factors refer to resources or barriers (such as time or cost). An example of low Perceived Behavioural Control was present in Wall *et al.* (2008), where perceived difficulty in reducing car use was identified. In long distance travel decisions, the perceived level of affordability may mean mode options are not considered, even if attitudes towards them are positive and the action adheres to norms. The lack of perceived behavioural control can mean that the action is not considered possible or realistic. That Perceived Behavioural Control often has the biggest influence on travel behaviour intention, has been proven in previous research (Tsai, 2010). In Heath and Gifford (2002), it accounted for over 70% of variance in students public transport use.

Applications of the Theory of Planned Behaviour in transport research

The Theory of Planned Behaviour has been applied in previous research to examine travel behaviour. Heath and Gifford (2002) used the Theory of Planned Behaviour to predict public transport use before and after the introduction of a concessionary bus pass and found it to be a valid predictor of intention to use public transport. The predictions of the Theory of Planned Behaviour were further improved by adding descriptive norms (what most individuals do in a given situation). Bamberg *et al.* (2003) investigated the effects of introducing a prepaid bus ticket on bus use, using the Theory of Planned Behaviour. The theory was found to be successful in predicting travel-mode choice and understanding the effects of an intervention, while the three components influenced travel intentions and predicted behaviour accurately. Tsai (2010) studied independent travel behaviour using the Theory of Planned Behaviour, and found that the three components had significant effects on behavioural intention, the greatest of which was Perceived Behavioural Control.

Behavioural intention to use a new high speed rail service was investigated by Hsiao and Yang (2010), using the Theory of Planned Behaviour, and adding trust and novelty seeking. Novelty is an attitude, a belief that something is new and therefore interesting. Trust can be favourable or unfavourable leading to confidence or fear – perhaps in terms of high speed rail safety. Favourable attitudes to high speed rail drove behavioural intention, while novelty seeking had an indirect significant influence on students' intention to take high speed rail via their attitude towards it. Trust also had a significant impact on intention to use high speed rail, via the Attitude, Subjective Norm and Perceived Behavioural Control. Feelings and emotions in affect were therefore seen to influence mode choice, and the intention to travel in the context of the introduction of a high speed rail service. The emotional response of novelty towards the new service indicates enthusiasm and stimulation in respondents, who therefore formed an intention to use the service.

Wall *et al.* (2008) found that Perceived Behavioural Control moderated the effect of personal norms on intentions, as the relationship between personal norms and intentions was stronger for drivers with high Perceived Behavioural Control compared to those with low Perceived Behavioural Control. In situations where individuals felt a personal normative motivation to reduce car use, they could not form an intention do so as no alternatives to driving were seen. A lack of control was evident which necessitated car use, some respondents indicating they had no choice, while for others there were time constraints and work requirements. Alongside this many participants described driving as morally problematic (personal-norm). However, lack of control prevented use of alternatives to the car, though changes of context did increase choice and control.

Anable (2005) used a questionnaire based on the Theory of Planned Behaviour to segment visitors to National Trust properties using psychological and attitudinal variables to determine propensity to use alternatives to the car. While using the basic behavioural beliefs (attitudes), normative beliefs and control beliefs, additional factors were included. These included, Moral norms, Environmental attitudes worldviews and knowledge, Efficacy; Identity; and Habit. Anable (2005) used a Principal Components Analysis to generate factors including moral norms, attitudes towards the car, environmental beliefs, social and behavioural norms, and Perceived Behavioural control. The identification of constraints on intentions and behaviour (Perceived Behavioural

Control) proved useful by explaining inconsistencies between attitudes and behaviour in the analysis. For example, between two segments with similar patterns of current behaviour, despite very different attitudes and intentions for future travel behaviour. 'Malcontented Motorists' were felt negative towards car travel (but violate these as motorists), but felt low Perceived Behavioural Control as a result of obstacles to using alternative modes. 'Complacent Car Addicts' were less influenced by low Perceived Behavioural Control, instead lacking moral norms for a need to use alternatives to the car. 'Die Hard Drivers' attitudes to non-car alternatives are so negative that intention to use alternatives is low, regardless of perceived control. The environmental concerns and moral norms also accounted for variance in attitudes, intentions and behaviour; For example, 'Aspiring Environmentalists' who have a greater environmental concern and sense of responsibility, compared to the other car-owning groups. (Anable, 2005) concludes, that the behavioural intentions of the segments can be interpreted by the Theory of Planned Behaviour, again proving the use of the theory in travel behaviour. The addition moral norm is also recognised as a requirement of the Theory of Planned Behaviour in relation to mode choice. The results of the study also indicate that same behaviour can take place for different reasons, and different behaviour can result from the same attitudes.

Alternative attitude / behaviour theories

Alternatives to the Theory of Planned Behaviour were considered, at the individual, interpersonal and community levels. Anable *et al.* (2006) reviewed attitude and behaviour theories including; the Deficit model, Rational choice theory, Norm Activation theory, Value Belief Norm Theory and the Theory of Planned Behaviour.

The Deficit model is based on an expectation that when more informed, people will act in accordance with their knowledge. However, the stage between attitude and behaviour does not appear to be well defined, and is problematic in that a particular behaviour does not necessarily follow a particular attitude (Anable, 2005). Linear links between attitudes and transport give inadequate consideration of other psychological and contextual factors. Anable *et al.* (2006) citied Hounsham (2006); that lifestyle decisions are not made based on rational considerations of the facts, but are made by emotions, values, norms and personal preferences.

Rational choice theory expects that individuals will aim to maximise benefits, and is constructed of costs and benefits, knowledge and behaviour. Anable *et al.* (2006) note that prediction of behaviour on economic grounds is rarely adequate, as several assumptions of the model are rarely met. These include gaps in the information available, that human cognition and motivation differ from utility maximising, and neglect of the social ecology surrounding people. As the earlier sections on rationality have indicated, the utility maximisation has been challenged, and rationality is bounded.

Norm Activation Theory provides a framework for pro-social and altruistic behaviour. Where anothers welfare is valued, and personal actions are believed to have consequences for others, and a responsibility for these is felt, a moral obligation to protect the welfare is sensed (Anable *et al.*, 2006). Jackson (2005) comments that while rational choice models avoid moral behaviour and assume self-interest, the addition of moral beliefs improves predictive power. In the Norm Activation Model, behaviour is preceded by personal norm, which differs from subjective norms in that they are expressions of internal values rather than social conventions. Previous travel behaviour research determined personal norms to be significant predictors of car and bus use, while strong moral obligations were associated with strong intentions to reduce car use (Abrahamse *et al.*, 2009). While the main constructs of Norm Activation Theory are awareness of consequences, and responsibility denial (Schwartz, 1977),Value Belief Norm Theory modifies this by replacing responsibility denial, with ascription of responsibility. In contrast to the Theory of Planned Behaviour, Value Belief Norm Theory emphasises altruism and internal normative influences, while the Theory of Planned Behaviour focuses on external norms (Anable *et al.*, 2006).

The Theory of Planned Behaviour is the most common and influential theory and has been widely-used in the exploration of attitudes and behaviour in the social and environmental fields. In previous research it has been suggested that the Theory of Planned Behaviour is more powerful than Norm Activation Theory for explaining car use (Abrahamse *et al.*, 2009). However, the literature pertaining to attitudes and behaviour, indicates that both the Theory of Planned Behaviour, and Norm Activation Theory have complementary constructs (Anable *et al.*, 2006). While Norm Activation Theory is focussed internally (personal norms) and relates to altruism, norms are focussed externally in the Theory of Planned Behaviour (social norms). As the HS2 project has received a considerable amount of media coverage, the inclusion of social

norms in shaping behavioural intention is important, especially as the project has become a widely-discussed issue. It should also be noted that there is a potential for altruism also, especially for those in locations that may not benefit, but may allow others to do so. However, social norms have been found to often overlap with personal norms (Schwartz, 1977), and therefore the Theory of Planned Behaviour includes personal norms, in addition to the perceived behavioural control element, not present in Value Belief Norm Theory. While there is criticism of the theory, it is acknowledged that the Theory of Planned Behaviour has also received extensive support, and is a useful starting point for examining attitudes (Anable *et al.*, 2006). Therefore, while the findings of the attitudinal research conducted during this thesis will be framed in terms of the Theory of Planned Behaviour, personal norms from the Norm Activation Theory are also considered to be of value, as suggested in Abrahamse *et al.* (2009).

2.5.2 Factors in decision making for travel behaviour

The need to travel

Gärling *et al.* (1998) in discussing the motivation to travel, distinguish between the choices motivated by need and those based on trip characteristics. The activities available determine the travel demand and the choices made to satisfy that demand. Motivation to travel can be based on the need to make a trip for a useful outcome, or to achieve an objective. However, the necessity of travel can be questioned if the same ends can be achieved without making a trip, for example using video-conferencing in business. With telecommunications development (e.g. the internet), a reasonable hypothesis is a diminishing need for business-related travel. Economic theory suggests that decreasing telecommunications costs and increasing costs of travel would lead to substitution of travel. The development of faster, and more reliable telecommunications, should have resulted in measurable decreases in travel. However, this has not happened (Mokhtarian, 2002; Storper and Venables, 2004). Long distance travel for business has grown despite the increasing complexity of information that can be communicated near instantly. Mokhtarian (2002) suggests that telecommunications can actually generate trips by increasing our contact set and allowing opportunities to arrange face-to-face contact. Storper and Venables (2004) suggest that deal-making, evaluation and relationship adjustment are heavily dependent on face-to-face contact. The importance of face-to-face contact in establishing trust, is the crucial nature of facial and vocal expressions, postures and gestures, especially if these contradict what is being said (Mehrabian, 1981). Developing a relationship through co-presence builds trust and

indicates willingness to embark on a repeated relationship, and to incur time and money costs in order to do so. Using an email avoids these costs, but also can destroy the value of the message (Storper and Venables, 2004). Thus it is important for humans to have actual contact in establishing relationships and trust, and as people can currently only be face-to-face by travelling to meet, the need to travel is likely to remain, until technology permits point to point 'teleportation'.

2.5.3 *Variables in long distance travel behaviour*

Van Goeverden (2009) suggests two types of explanatory variables act as factors explaining choices for train travel; background variables relating to the traveller, household or the journey, and quality variables relating to service levels on the train system and its alternatives.

Background variables (Demographics)

The presence of background variables in the travel decision processes have been identified in previous research (Zumkeller, 2005; Román et al., 2008; Van Goeverden, 2009). These are socio-economic and demographic factors such as car ownership or place of origin, but they do not include service attributes of the modes available, which are quality variables. Dargay and Clark (2012) found demographic determinants in making decisions about long distance travel such as gender, age, and household composition. Employment status and income level were also found to be a major determinant, with greater long distance travel for those on higher incomes and an increased probability of making more long distance trips. The employed and students also made more long-distance trips than those not employed: this is unsurprising as income is dependent on employment status. Income also made a difference to mode choice, with those on lowest incomes using coach, followed by car, then rail, and finally air travellers being on the highest incomes. Van Goeverden (2009) found differences in inclination to use rail between nationalities (low inclination for the Irish, Spanish and Portuguese, and high for Swiss and Belgian travellers). Employment status (occupation) was the most influential personal variable, with those in full time employment less likely to use the train, while those in education or looking for work were more likely. Probability of using the train also differed by distance and gender (women were more inclined than men). Thus, demographic background variables account for some of the differences in existing travel behaviour.

Quality Variables

Beecroft *et al.* (2003) identified a series of primary considerations present when considering options for long distance travel, including the levels of comfort, cost, time, and the reliability of the service. Convenience is not referred to as a primary consideration by Beecroft *et al*., although it is mentioned as a barrier to public transport use in accessing airports. Improving convenience and flexibility as a means of encouraging use of alternatives to the car is mentioned, and should be considered in mode choice. High speed rail as a mode is considered to have considerable potential to affect the generalised costs of travelling (Gonzalez-Savignat, 2004). As an attribute, comfort is a journey-based affect, based on experience of a journey (Mann and Abraham, 2006). Comfort can be described as travelling in a non-noisy environment, with possibilities for resting, working and moving around (Johansson *et al.*, 2006). It has been determined that comfort attributes can influence mode choice (Beecroft *et al.*, 2003; Johansson *et al.*, 2006; Gao *et al.*, 2012). Making an evaluation of the comfort of mode can mean that a mode is chosen based on its comfort attributes, and transport services have promoted their standards of comfort as a means to gain potential customers (Lancaster and Taylor, 1988).

Mode completion analysis between high speed rail (the Spanish AVE) and alternative modes was undertaken by Román *et al.* (2008). The alternatives were defined by service attributes (quality variables) and the individual socio-economic characteristics (background variables). Where reductions in travel time occurred alongside the penalisation of car alternatives (through increased costs), substantial gains for the market share of high speed rail were predicted. There was little change in market share without the travel time reductions. On the Madrid to Barcelona corridor high speed rail demand was sensitive to air travel time, and the time penalties involved. Travel times and costs, can therefore be seen to influence mode choice and market share. Cost penalisation of one mode can increase the attractiveness of an alternative, while relatively longer travel times on one mode compared to an alternative can make the former relatively less attractive. Experience therefore suggests that reduced travel times can attract users, and as such HS2 may capture long-distance travel demand from alternative modes. However, a market remains for longer travel times, where cost savings can be made (see section 2.6.2 on ‘Slow motion behaviour’(Nijkamp and Baaijens, 1999)). Therefore, some long-distance travellers may choose slower travel

options if these provide financial savings, and assumptions of demand for travel time reduction over all other attributes, may not be accurate.

2.6 Attitudes to long distance travel and high speed rail

2.6.1 *Situational effects*

Large gaps between stations, necessary to maintain high speeds can result in a 'tunnel effect' where the line offers little benefit to its surroundings, other than those concentrated around the access points (stations), essentially the ends of the tunnel (Martínez Sánchez-Mateos and Givoni, 2011). Bonnafous (1987) describes the French TGV High speed rail network as an 'airline route' due to the distances between stations and the lack of intermediate stops. This 'tunnel effect' of inaccessibility to the surroundings of the line raises questions over the beneficiaries. Martínez Sánchez-Mateos and Givoni (2011) suggest beneficiaries and non-beneficiaries of high speed rail, accepting that improved access will be afforded to some areas, while others become relatively less accessible and gain little from such a development. This may be in the form of towns bypassed or omitted by the new line. For HS2, this could be Bristol or Cardiff. Member of Parliament for North West Leicestershire, Andrew Bridgen suggested that his own constituents would have "all the pain and none of the gain" as a result of the HS2 route proposal (BBC News, 2013g). Previous indications are that those living along the route are likely to oppose proposals due to perceived negative impacts (Schaap, 1996). Whether altruism in the form of perceiving high speed rail as a project for the greater good regardless of the impact is also present in the local area is of interest, and is investigated in this thesis.

2.6.2 *Travel time savings*

Travel time is fundamental in the shaping of transport and society, and its valuation has been used to estimate value of time for investment in transport schemes (Lyons, 2008). Greater mobility is regarded as a desired societal goal, and has led to transport infrastructure designed to maximise mobility by reducing travel time – this can transform spatial arrangements (Khisty and Zeitler, 2001). For planned behaviour, perceptions of locations that were once considered too distant may change, thus giving improved perception of behavioural control. Given increasing amounts of long-distance travel, trip time reductions could afford additional access to more distant locations.

In terms of utility, Masson and Petiot (2009) suggest trips are costs, yielding negative benefit. Thus choosing a closer destination or a faster mode reduces the time cost and permits utility maximisation by spending more time at the destination. The conventional view in transport has been that travelling is a derived demand (means to an end) where benefits at the destination outweigh the costs of reaching them. The utility of travel has therefore been viewed to be derived from improved accessibility to activities at the destination.

If travel time is perceived as a disutility, it might be expected that reducing journey times would be a priority in order to improve the utility, as per the theory of utility maximisation (normative decision theory). However, this prioritisation depends on the relevance and importance of other factors. Among these other factors affecting the importance of travel time, are the journey purpose, length and frequency. The generalised-cost equation sums the monetary (fare) and non-monetary aspects (frequency, distance to network access point) of a trip. This trade-off includes travel time, and enables a calculation to be made considering other attributes (comfort, interchange penalties) so that a mode may be chosen. Travel time is therefore traded with other journey attributes, and is valued in relation to them. Research by Wardman (1998) determined valuation of travel time to be related to journey duration, and has also been found to increase with distance; Long-distance travellers have a higher propensity to choose a time-saving option, compared to those making short-distance trips (Mackie *et al.*, 2003). Furthermore, travel time was valued more highly by those travelling on business, compared to those travelling for leisure. Within the business travellers, the valuation was highest for those travelling in first-class, which was explained by these travellers being more senior than those in standard class, thus having greater time-pressures.

Whether people actually minimise their travel time is a complex issue and has been questioned (Banister, 2011). Long-distance travel trends suggest distances are increasing rather than travel times reducing, and evidence from the 2012 NTS suggests that time spent travelling has remained static at around an hour per day (Melbourne, 2013). Therefore, rather than reducing travel time, the evidence indicates that people are using the time to travel further (Khisty and Zeitler, 2001; HS2, 2011; Dargay and Clark, 2012).

Research has indicated that reducing journey times is not a high priority for passengers (Department for Transport, 2007), contradicting studies suggesting that travel time is a major influence on mode choice (Mandel *et al.*, 1997; Gonzalez-Savignat, 2004). Mandel et al. (*ibid.*) suggest a threshold exists, after which further travel time reductions provoke growth in the mode share. Gonzalez-Savignat (2004) found that travel time (and also fares) for high speed rail influences shift from air to high speed rail. Other research contradicts this, finding no significant influence of travel time in mode choice (Zumkeller, 2005). Comfort also influences the desire to reduce travel time, and is important in perceptions of travel time – acting as a major factor in the trade-off between travel time and willingness-to-pay to reduce it. Wardman (1998) found travel time was valued higher for business compared to leisure trips, 35% higher in London and the Southeast and 14% in the rest of Britain. A possible explanation was that poor travel conditions in London meant people on business trips would be willing-to-pay considerably more money to reduce their travel time, compared to those travelling in other parts of Britain. Difficulty undertaking work or other useful activity on crowded transport may also mean that the time is perceived as wasted, and therefore travellers are keen to trade-off money to reduce this time.

Assumptions that all travel time is wasted time have been challenged (Mokhtarian and Saloman, 2001; Lyons and Jain, 2005; Lyons, 2008). Lyons (2008) challenges the assumption that travel time saved is automatically converted from non-productive to productive time, arguing that travel time may be split into blocks of partially-productive, or unproductive time. This raises the issue of how travellers regard their travel time: it can provide 'time-out', but can also be used for work - especially where individuals can remain connected through telecommunications. Lyon's raises the possibility that travel time savings might be reducing productive time. Lyon's contribution to the travel time literature raises questions about whether travel time is wasted, whether reductions should be sought, and whether investment should be to make travel time more productive and useful, rather than reducing it.

Mokhtarian and Saloman (2001) have challenged an even more fundamental issue, being whether travel is an absolute derived demand. They refer to 'undirected travel', whereby travel is not a by-product of the activity, but constitutes the activity itself (e.g. joyriding, recreational cycling, walking, travelling holidays, etc.), in contrast to utilitarian travel, where the activity at the destination is the priority (e.g. a medical

appointment). If the travel itself is considered as an activity (e.g. looking at the view), then an individual might choose a slower land based mode over air. Enjoyment of the views while travelling thus becomes part of the activity and minimisation of travel time is therefore not prioritised. Nijkamp and Baaijens (1999) challenge the travel time minimisation assumption through the 'Slow motion behaviour' paradigm, manifested by acceptance of longer travel times to save travel costs, thus prioritising cost over travel time. This section has shown that assumptions that travel is a means to an end and that time reductions are always sought is not necessarily true; some may find utility in travel, while others do not consider time savings a priority. The literature reviewed here has also demonstrated that travel time exists in a two-way trade-off with cost; For some, travel time minimisation will be sought at a cost, while others prioritise cost and are willing to accept a longer travel time if the cost-savings outweigh the value of time.

2.6.3 *Willingness-to-pay*

Willingness-to-pay provides a monetary measure of changes in utility as a result of changes in attribute (Román *et al.,* 2008). Such attributes can include improvements to comfort, and also travel times. A further attribute is trip purpose, as in general willingness-to-pay for travel time savings is greater for mandatory trips (such as for business) compared with other trip purposes. Román *et al.* (2008) found that on various modes along the Madrid to Barcelona corridor, the valuation of time saved was higher for mandatory trips or where the level of comfort was lower.

Attitudes to the cost of travel are important as they provide an indication of willingness-to-pay, which can determine mode choice or whether intended travel behaviour is considered affordable. This may be linked to disposable income, such that if they do not have the means to pay for a change in attributes, then they may be unable to do so. An individual with the means to pay may not consider the additional cost for the change in attributes to be acceptable, and is therefore unwilling-to-pay. Where discounts are available, options that were previously considered unaffordable, may become more appealing. Therefore, possession of discounts may improve perceived affordability and permit behaviour not possible without such privileges.

People are increasingly using rail (see Figure 2.4), which can be partially explained by rising motoring costs, meaning that people are less likely to automatically choose to make trips by car (Railnews, 2012). A quarter of rail users switched from car for at least

one journey over the last few months, a third of which had switched due to petrol prices (Association of Train Operating Companies, 2012). Despite passengers switching from car to rail, a substantially larger number of people travel by car compared to rail. The results of the research indicate that an unwillingness to pay for rising petrol prices can lead to modal shift. However, travelling by car was generally perceived as cheaper than public transport in Thornton *et al.* (2010). For people travelling in groups, the cost of travelling by car remains similar, whereas rail often requires additional tickets to be purchased. Furthermore, while ticket costs and fuel costs are salient, annual charges such as insurance and road tax may not be perceived for car when comparing with rail.

Mokhtarian (2002) suggests substitutability of telecommunications will increase if travel costs rise. For example, if the purpose of the trip can be achieved through telecommunications, thereby avoiding the travel costs, then the telecommunications option may be chosen. Cost has been identified as a barrier to rail travel and although it is not necessarily the biggest barrier to using rail, it remains a significant issue. Thornton *et al.* (2010) found that 66% of those surveyed considered 'travelling by train expensive'. The single most common reason given for stopping travelling by public transport was financial (45% saying it was too expensive). Attitudinally, the cost of making a journey is an important factor when choosing to travel, as an element of the generalised cost of travel (Hsu *et al.*, 2010). Suggestions of a high speed rail levy on rail fares to help meet the costs of HS2 (Hayman, 2010), might impact on passengers' willingness-to-pay. The 'Slow Motion Behaviour' paradigm demonstrated that willingness-to-pay can be multi-directional (Nijkamp and Baaijens, 1999). That is, rather than being willing to pay more to reduce travel time, some will accept a longer travel time provided it is cheaper. Willingness-to-pay is attitudinal and links to perceived behavioural control, thus it is included in this thesis research.

2.6.4 *Trip or journey purpose*

Beecroft *et al.* (2003) and Gonzalez-Savignat (2004) indicated that journey purpose was an important influence in decision-making for long distance trips. Individual travellers can weigh-up their decision based on their own trade-offs between attitudinal elements such as transport service quality and travel times, in addition to background attributes such as income or car ownership. Business travel has an additional stage; the transport policy of the organisation, which can constrain the choice of the individual. For example senior management can choose domestic air or first class rail travel and be

reimbursed for the costs, while those constrained by a reimbursement policy with freedom to choose their own mode would be more likely to choose the car or rail (Fowkes *et al.*, 1986). Business travel is also often time constrained, while leisure travellers may perceive fewer constraints, and can travel at an 'off-peak' time or take a 'scenic route'. However, leisure travellers are likely to perceive the costs of travel differently, as unlike business travellers they are responsible for these costs. Whether someone else is paying for the travel to be undertaken may have a significant impact on the attributes of the travel, for example a choice of a more expensive mode might be made if another person is responsible for the fare costs. Therefore, leisure travellers may avoid a faster mode if it is perceived to be expensive, while business users may use the faster mode if they are not responsible for the costs of doing so.

2.6.5 *Travel frequency*

Attitudes to long distance travel in general or a specific mode can be based on how frequently that person has travelled in that manner and as such can predict future behaviour. A commuter compared to an infrequent traveller can be an example of this. Bamberg *et al.* (2003) state that under certain conditions the frequency of previous behaviour will be a powerful predictor of later behaviour. For example, being a regular bus user can indicate a positive value on public transport, the convenience of bus stops, a lack of alternatives etc. There is no reason for behaviour to change so long as these factors remain unchanged and later behaviour will therefore resemble earlier behaviour (Bamberg *et al.*, 2003). Repetition of behaviour as a form of habit may also explain why later behaviour often follows previous behaviour, freeing individuals from having to make a decision (Berger and Luckmann, 1966).

The difference between frequent and infrequent travellers can be in attitudes towards how the time spent travelling is used. Lyons *et al.* (2007), indicate that commuters are more likely to consider their time use while travelling to be wasted when compared with business or leisure travellers. An attitudinal difference can therefore be seen and it is reasonable to predict that the utility of high speed rail through the travel time reductions will be perceived differently from less frequent travellers.

2.6.6 *Environmental impacts of travel*

Given the widespread public knowledge of the impacts of transport on the environment (Thornton *et al.*, 2010), it is reasonable to expect that attitudes about the environment

would be a significant determinant of travel behaviour. However, this is not necessarily the case as research by Cafferkey and Caulfield (2011) have indicated in a study of long distance travel in Ireland. A lack of consideration for the environment when making decisions about long distance travel was found in 22.5% of respondents, while only 7.9% of the respondents considered it to be a major concern. This suggests a degree of egoism or self-interest, with little concern for the impact of behaviour on the surrounding environment and others. The lack of perceived importance of environmental impacts in travel decisions as suggested by Cafferkey and Caulfield (2011), is supported by a conjoint analysis of the valuation of different features on supermarket shopping, leisure and regular work trips (Thornton *et al.*, 2010). CO_2 emissions were of low importance in the decision-making process, compared to mode, time and cost, and the importance of CO_2 emissions increased very slightly on longer trips. The lack of importance placed on environmental considerations when making transport decisions, has been paralleled by both declining concern about climate change and the contribution of transport to climate change (Department for Transport, 2011d). It follows therefore, that the environment is not perceived to be important compared to other factors when making decisions about travel.

Previous attitudinal research by the Department for Transport (2011a) demonstrated that while the environmental effects of a high speed rail project are important at a personal level, they appear to be of low salience. Asked spontaneously how they felt a high speed rail scheme would impact on them personally, the environmental impacts were not raised. However, when provided with a predefined list of options, 71% of respondents indicated the environment to be the issue of greatest importance to them (Department for Transport, 2011a). The 'environment' is not defined when assaying its importance to respondents personally (is this the natural environment, emissions, noise or visual?). Given that the environment was the issue with the greatest importance to respondents, the issue requires further investigation. Eleini (2010) reported that 76% of adults expressed concern about climate change and the issue was one of the top three most important issues facing Britain, which supports the research findings of the Department for Transport (2011a). Around three-quarters of those surveyed said they would be prepared to change their behaviour to help to limit climate change, although the results indicated that smaller changes were more likely. For example, recycling and using energy saving light bulbs were the top activities, while changes in travel behaviour and mode choice came much lower down the list. Intention to behave in a more

environmentally way does not necessarily translate to behaviour. It has been found that even when the environment is perceived to be important, it does not necessarily result in more sustainable behaviour (Anable, 2005).

The lack of importance placed on environmental considerations when making transport decisions suggests that the impact of transport on the environment is not concerning people enough to make radical changes to travel behaviour. Declining concern about climate change and the contribution of transport to climate change suggests that this may be the case (Department for Transport, 2011d). It follows therefore, that while the climate change and the environment in general is perceived to be important, it is unlikely to influence decisions about travel (Thornton *et al.*, 2010; Cafferkey and Caulfield, 2011).

Do people lack information about the environmental impacts of travel?

Providing information about the environmental impacts of travel as part of the transport-related attributes such as travel time and costs, may be a means to change travel behaviour (Avineri and Waygood, 2013). As such, the UK national journey planner provides a calculation of Carbon Dioxide (CO_2) for the planned travel. Providing such information on greenhouse gas emissions by transport can be a measure to increase the likelihood of acting appropriately – a normative effect (Avineri and Waygood, 2013). However, a lack of experience and knowledge can affect an individuals ability to judge differences in CO_2 emissions. Eurostar ceased carbon offsetting after it was found through research and discussions with various stakeholders, that the concept was not well understood (Otley, 2011). In attitudinal research of the potential impacts of HS2, 49% of respondents were unsure about the proposition that 'High speed rail would not save any carbon' (Department for Transport, 2011a). This again points towards ambiguity and uncertainty concerning carbon and perceptions of the environmental impact of transport schemes. Perception of environmental issues and impacts in travel mode choice is therefore both complex and ambiguous for members of the public, and this should be recognised.

Avineri and Waygood (2013) hypothesised variation in the perceived difference of emissions (CO_2) between two modes depending on the way in which the differences were termed. They found that 'negative framing' (providing comparisons in the form of losses) was more effectively perceived than positive framing. For example, saying that

car travel emits more CO_2 than walking, was more effective than saying that walking emits less CO_2 than car. How the information is presented in terms of the environmental attributes of the alternative modes can therefore be seen to influence how each is perceived, and thus affect mode choice. The literature reviewed in this section underlines that environmental issues are not ordinarily taken into account, and that how they are framed is critical.

2.6.7 *Previous Attitudinal Research*

Research conducted in the 1980s concerning the introduction of British Rail's 201km/h Intercity 125 High Speed Train investigated differences in the perceptions of the Intercity 125 among different groups within the domestic transport market (Lancaster and Taylor, 1988). Although the time savings made possible by the Intercity 125 were well publicised, the efforts to persuade potential users of the benefits of the train over other modes (air and road) due to its superior comfort, facilities and the location of stations did not appear to be successful. This was explained by the problem of conveying experiences of service innovations to potential users. While useful, the age of the research limits its applicability in contemporary transport, especially given developments in telecommunications such as mobile telephones and Wi-Fi.

High Speed Rail Scheme: survey of all adults aged 16+ in Great Britain

In February 2011, TNS-BMRB conducted a study on behalf of the Department for Transport (2011a). This study aimed to measure the knowledge and understanding of the impacts of HS2 and the attitudes towards the scheme. The research did not mention specific details of the HS2 proposal journey times. Initial plans for HS2 were announced in March 2010, yet around one year later in February 2011 (when the research surveys took place), knowledge of the proposal was limited to around half of those interviewed and 47% stated that they had heard and seen nothing about the scheme.

Since this research was conducted, details of the route were announced and received a considerable amount of media attention. Given this publicity, it is likely that the proportion of those respondents with knowledge of the scheme would have increased. New information is central to forming new attitudes and perceptions, or altering those in existence. Given that those with knowledge of the scheme were the most likely to have decided in favour or against the proposed scheme (Department for Transport, 2011a) broadening knowledge could have an impact on favourability. The study concerned the

perceived potential impact of the scheme at both the national and personal level. 69% of those interviewed said that they thought the high speed rail scheme would have no impact on them. Respondents in Wales, the South West and the North more likely to perceive no personal impact compared to those in Greater London and the North West.

Respondents were also asked what they expected the impact of the HS2 development to be at both a national and personal level. Respondents expected a positive impact on journey times, followed by a positive impact on business opportunities and on employment levels. 61% of participants believed that HS2 would have a positive impact on road traffic congestion, while the impact of the line on the cost of tickets and noise levels were considered to be negative as was the cost to the government. The line was considered to have a negative impact on the environment overall, but 30% of respondents believed a positive impact on the environment would result. It is therefore clear that while some positive impacts of HS2 are perceived, some negative impacts are also. How these perceptions are weighted by individuals may therefore impact on their overall evaluation of the scheme.

Having identified respondents' predicted impacts of HS2 at the national level, the research next considered the attitudes of the respondents themselves, presenting a predefined list of the same options and asking the personal importance of each issue. Noise levels, which might be expected to be associated with the environmental impacts of the transport scheme, were considered the least important issue at the individual level. That none of the participants in the study lived in postcodes directly affected by the development of HS2 may offer an explanation. If more respondents were included living closer to the proposed route of HS2, or close to stations that will receive a HS2 service, the results might have been different.

2.6.8 *Potential effects of travel time reductions on travel behaviour*

Laird *et al.* (2005) refer to 'Network Effects' as the potential outcomes from a 'transport initiative' through a process of reaction to stimuli (such as the opening of a new rail route). Such an impact is in trip re-timing due to the shorter travel time, allowing later departures or earlier return arrivals. Increased ability to complete return journeys in a single day as a result of the shorter travel times might also be an outcome, a decline in overnight business stays was recorded following the introduction of the French TGV high speed rail service (Bonnafous, 1987). It is therefore possible, that a new transport

initiative, such as the opening of a high speed rail line, could act as the stimulus to change distances travelled, assuming the invariant travel time budget (Ausubel and Marchetti, 2001; Metz, 2004; Metz, 2007; Urry, 2007). The reduced travel time might also mean that day-return trips are easier, reducing the need to stay overnight, as was found following the opening of the French TGV services. Investigating the perceived benefits of high speed rail for those that have needed to make overnight stays previously therefore forms part of this research.

2.6.9 Section summary

In this section attitudes to long distance travel and high speed rail have been considered in the context of literature. Previous research has suggested that location relative to the route can influence attitudes by means of whether an individual perceives that they will benefit or be negatively affected. A further issue is that of altruism, and whether those in affected locations will accept a high speed rail development in the interests of others. Whether time savings resulting from high speed rail will be positively evaluated is also questionable, as the time saved is not necessarily wasted, and some individuals prefer slower travel times, and prioritise other considerations. Willingness-to-pay relates to time savings, in that some individuals choose slower modes in order to save travel costs, while the purpose of the trip and who is paying are also important. Leisure travellers are responsible for the cost of travel, and may perceive these differently from business travellers, who can be reimbursed. Those that travel frequently may evaluate new transport opportunities differently to infrequent travellers. For example those that travel long distance frequently may evaluate further opportunities for long distance travel differently, based on their experiences. The environment is an issue of low salience and in some cases is not considered in travel decision making. Where intentions to behave in a more environmentally friendly way are present, these are not necessarily acted upon. Previous attitudinal research has indicated the presence of geographic differences and knowledge differences in attitudes to high speed rail.

2.7 Research questions and hypotheses

This research aims to study public attitudes to long distance travel and perceptions of high speed rail. Research questions have been devised to meet the aims of the research, based on the literature reviewed. This section sets out the research questions, and provides a justification for their inclusion in the research.

2.7.1 *Demographic effects*

What are the effects of demographic variables (such as age, gender, occupation) on attitudes to long distance travel and high speed rail, and on attitudes to the environment?

Dargay and Clark (2012) identified that income, gender, age, employment status and household composition were important in determining long distance travel behaviour. Attitudes to performing a behaviour are influenced strongly by confidence in the ability to perform it which can include income and occupational level. Occupation status may therefore impact on perceptions and attitudes as greater wealth has been found to be related to higher mobility levels (Lleras *et al.*, 2003). Previous research has identified associations between age and the environment (Cottrell, 2003; Arnocky and Stroink, 2010) and differences in the perceived importance of the environment by occupation (Scott and Willits (1991) cited in Cottrell (2003)). Other research has identified that educational level (linked to occupation) is also associated with environmental concerns (Van Liere and Dunlap, 1980). As environmental attitudes do not necessarily result in sustainable travel behaviour (Anable, 2005), definition of the link between travel behaviour and attitudes to the environment was sought. Low salience of the environment in previous research has prompted a hypothesis that attitudes towards it might differ by demographics or by previous travel behaviour.

Demographic effects hypotheses

H1– Attitudes to both long distance travel and high speed rail will differ by respondents' age, occupation, and gender.

H2– Environmental conscience will differ by respondent demographics and their previous travel behaviour.

2.7.2 *Travel behaviour effects*

How does previous travel behaviour affect attitudes and perceptions of long distance travel and high speed rail?

Attitude has been shown to be a determinant of behavioural intention and previous travel behaviour may impact on attitudes and can be used to predict future behaviour (Bamberg *et al.*, 2003). As air travel is both complementary and competitive with high speed rail, it will compete with users in the same travel market (De Rus and Inglada, 1997; Román *et al.*, 2008). The same competition applies for other modes over certain

distances (see Chapter Two for data). Given that previous travel behaviour can predict future behavioural intention, and this may be habitual (Berger and Luckmann, 1966), the use of previous modes alternative to high speed rail are examined, in terms of attitudes to long distance travel services, and high speed rail. Possession of travel discounts have also been argued to be a good predictor of travel frequency (Carbajo, 1988), while commuting determines frequency and regularity of travel behaviour, and has been found to explain differences in travel perceptions, in previous research (Costa *et al.*, 1988). Previous research has also indicated an effect on overnight stays following the introduction of high speed rail. In France for example, overnight business stays declined following the introduction of the French TGV high speed rail service (Bonnafous, 1987). Previous long-distance travel behaviour is therefore hypothesised to influence attitudes to long-distance travel and perceptions of high speed rail.

Travel behaviour effects hypotheses

H3– Previous travel behaviour is associated with attitudes towards high speed rail.

H4– Attitudes to long distance travel and high speed rail will be associated with regularity of travel such as commuting.

H5– Attitudes to long distance travel and high speed rail will be associated with possession of travel discounts.

H6– Attitudes towards high speed rail will be associated with the time since respondents last had to stay overnight on a journey.

2.7.3 *Situational effects*

What situational effects are present on attitudes towards high speed rail?

Martínez Sánchez-Mateos and Givoni (2011) found limits to the distribution of accessibility benefits from the potential HS2 route, with most benefits accruing to locations around access points (Vickerman, 1997). The perception that one may benefit or be disadvantaged by high speed rail development is therefore likely to influence attitudes towards HS2. Previous research has found negative attitudes to manifest in locations through which the route is likely to pass (Schaap, 1996). The subjective norms element of the Theory of Planned Behaviour (Ajzen, 1991) may also act in that social pressures for those living close to the route may be present in the form of opposition. Regional differences in attitudes to proposed high speed rail schemes have also been found in research (Department for Transport, 2011a). Location relative to an HS2

station, the HS2 line and the region of residence are therefore hypothesised to be associated with perceptions of the proposed HS2 scheme.

Hypothesised situational effects

H7: Proximity of living to a station on the proposed HS2 route is directly related to perceived benefits;

H8: Proximity of living to the HS2 route is inversely related to attitudes to high speed rail;

H9: Attitudes and perceptions towards high speed rail will differ by situational factors such as the respondent's region.

2.7.4 *Willingness-to-pay effects*

How do attitudes affect Willingness-to-pay for travel time savings?

It has been theorised that people seek to maximise the utility of their travel, by minimising the time spent travelling, as this is often considered to be a cost. However, the belief that travel time minimisation is always sought has been questioned (Nijkamp and Baaijens, 1999; Banister, 2011). What people would pay to minimise the travel time is therefore not always consistent, in that some may have little desire to minimise travel time (preferring to minimise cost), while others may be willing to pay large amounts to reduce the time spent travelling. How a person evaluates their time spent travelling can influence their desire to minimise it, as some consider the travel itself to be intrinsically beneficial. Willingness-to-pay is also related to income in terms of affordability, and has been found to be related to age (Brownstone *et al.*, 2003). Other demographics might also influence willingness-to-pay, and are therefore tested here. Previous travel behaviour may also be associated with willingness-to-pay, as those using modes more frequently for long distance may mean greater desire to reduce travel time. Lyons *et al.* (2007) have suggested that commuters are more likely to consider time to be wasted while travelling, compared with business or leisure travellers. As such, frequency of long-distance travel may be associated with willingness-to-pay, in that those making more frequent trips may wish to minimise their travel time, especially if this is perceived as wasted.

Hypothesised willingness-to-pay effects

H10A: Willingness-to-pay for travel time will be positively associated with attitudes to high speed rail,

H10B: The importance of useful travel time will be unrelated to willingness-to-pay for travel time reductions,

H10C: The association between attitudes and willingness-to-pay for the travel time savings will differ by trip length,

H10D Willingness-to-pay will differ significantly by demographics.

H10E: Willingness-to-pay will be associated with previous travel behaviour.

2.7.5 *Amount of time saved hypothesis*

Do attitudes and perceptions differ significantly depending on the amount of travel time reduction offered by HSR?

The level of time savings may impact on willingness-to-pay to reduce the travel time, and also on the perceptions of the new mode. It would be expected that willingness-to-pay for travel time savings would be greater for a larger saving.

Hypothesised differences between modes

H11 predicts that willingness-to-pay for travel time savings will be greater for the larger time saving.

2.7.6 *Determinants of long-distance travel behaviour*

The importance of the environment in general was found to be very important in previous studies (Department for Transport, 2011a), this is inconsistent with other research in which the issue was not considered important in travel decision making (Thornton *et al.*, 2010; Cafferkey and Caulfield, 2011). This may be due to the presence of an interviewer bias (Colombotos, 1969; Oppenheim, 2001) due to the methods employed. Previous research has indicated that travel time is a major determinant of mode choice (Mandel *et al.*, 1997; Gonzalez-Savignat, 2004), while the cost of travel is widely reported as an important determinant (Anable and Gatersleben, 2005). The following hypotheses test how cost, travel time and environment are traded in decision-making for long-distance travel. Demographic differences in the importance of the environment are also considered, in light of previous evidence (Cottrell, 2003; Arnocky and Stroink, 2010)

H12– The environmental impact of travel will be perceived as the issue of least importance compared to other determinants of long distance travel, when planning trips.

H13– Determinants of planned long distance travel behaviour will be associated and will be mode specific.

H14A– Cost of travel (fare) will be considered more important than environmental impacts in determining intended travel behaviour.

H14B– Travel time will be considered more important than environmental impacts when making decisions about planned travel behaviour.

H15 – The importance of the environment in behavioural intention for travel will differ significantly by age, gender and occupation.

Chapter 3. Data Collection

3.1 Chapter introduction

The following chapter introduces the data collection methods employed as part of this thesis. Firstly, the options considered for data collection are presented, and justification is given for the choices made. This Data Collection chapter also contains method and results of the Principal Components Analysis, performed on the data obtained, as a means of reducing these to a more manageable and reliable set of factors.

3.2 Justification of methods

The aim of this research is to investigate attitudes and perceptions to long distance travel and high speed rail, and to determine what demographic, behavioural and situational differences are present. This follows the suggestion by Anable (2005) that the travel choices made by distinctive groups, based on a combination of instrumental, situational and psychological factors, are overlooked in travel research.

This research investigates attitudes and perceptions to long distance travel and a potential high speed rail system (HS2). Views differ between individuals and are partly a result of their social environment (Berger and Luckmann, 1966; Ben-Akiva and Lerman, 1985; Harré and Parrott, 1996). The research therefore required up-to-date qualitative data concerning the personal attitudes, experiences and beliefs of members of the public in relation to long-distance travel, and the salient factors involved in decision-making for long-distance trips. Data were therefore collected from focus groups, the results of which were used to design a questionnaire.

3.3 Stages of data collection

3.3.1 *Stage one*

The hypotheses detailed in Chapter Two aim to test how attitudes to long distance travel differ by respondent characteristics, including basic demographics, previous travel behaviour and the location of respondents. The research also aims to test hypotheses relating to perceptions of high speed rail, and willingness-to-pay. In order to collect perceptions of a high speed rail service and willingness-to-pay for it, information about the scheme and its journey times, needed to be provided to participants. To collect these

attitudinal and perception data, it was necessary to use a method that would allow for collection of undefined, open-ended responses. Providing a framework of answers risked the potential not only for interviewer bias, but also for respondents to give heuristic attitudes and perceptions by following the framework of responses to reach 'easy answers', rather than thinking about the issue in greater depth (Kahneman, 2012).

Methods considered for use in Stage one, included; telephone interviews, individual face-to-face interviews and mail-back questionnaires, which were considered alongside the chosen method, focus groups. Evaluations of these methods were made based on financial cost, speed of distribution and collection, completion time, the level of possible detail, the potential for bias and the distribution area.

Telephone interviewing

Telephone interviews allow minimisation of time and financial costs, as no transport costs are involved and a wide geographic area of responses can be obtained from a single point. Time committed can also be reduced by allowing quick identification of non-participants (Oppenheim, 2001). However, telephone interviewing does not allow the imparting of substantial amounts of information, and cold-calling is unpopular, and might have resulted in a low response rate.

Face-to-face interviews

Face-to-face interviews allow significant amounts of information to be imparted, and queries to be dealt with. Interviewing in the home involves committing time to travel, and arranging interviews, but allows targeted responses. On-street face-to-face interviews are limited in that considerable detail cannot be reached due to the need to be brief, and they also increase the potential for interviewer bias. Interviewing incurs a considerable time cost for individual interviewers, and if teams of interviewers are used, this raises a problem of interpretation (Oppenheim, 2001). For wider and more dispersed samples, the time and monetary costs increase. Face-to-face interviews at transport facilities would raise two problems; firstly the need to be brief, and secondly the potential to skew the sample towards existing long-distance travellers.

Mail-back questionnaires

Mail-back questionnaires enable distribution to a wide geographic area, and a substantial amount of detail. The completion time issue is less as responses can be made

at participants' convenience. However, the lack of an interviewer means that problems or queries about questions cannot be dealt with.

Focus groups

Focus groups introduce the potential for discussing the issues covered, in greater depth than is possible in a mail-back questionnaire. Oppenheim (2001) suggests that new ideas will emerge as respondents 'spark off new ideas'. However, he notes the risk of bias in that one respondent attempts to dominate, or the group fractures into subgroups. Another risk is that of interviewer bias, though as Oppenheim (2001) notes, it is the responsibility of the group leader to be non-directive, while maintaining control and encouraging quiet people to speak. As attitudes and perceptions were required in order to test the hypotheses, use of focus groups meant that data could be collected over a longer period than face-to-face or telephone interviews, minimising the potential for heuristic attitudes and perceptions.

3.3.2 *Stage two*

The research hypotheses cover demographic, behavioural and situational effects on attitudes to long distance travel and on perceptions of high speed rail, including willingness-to-pay to save travel time using such infrastructure on long distance trips. In order to test these hypotheses the following information was required;

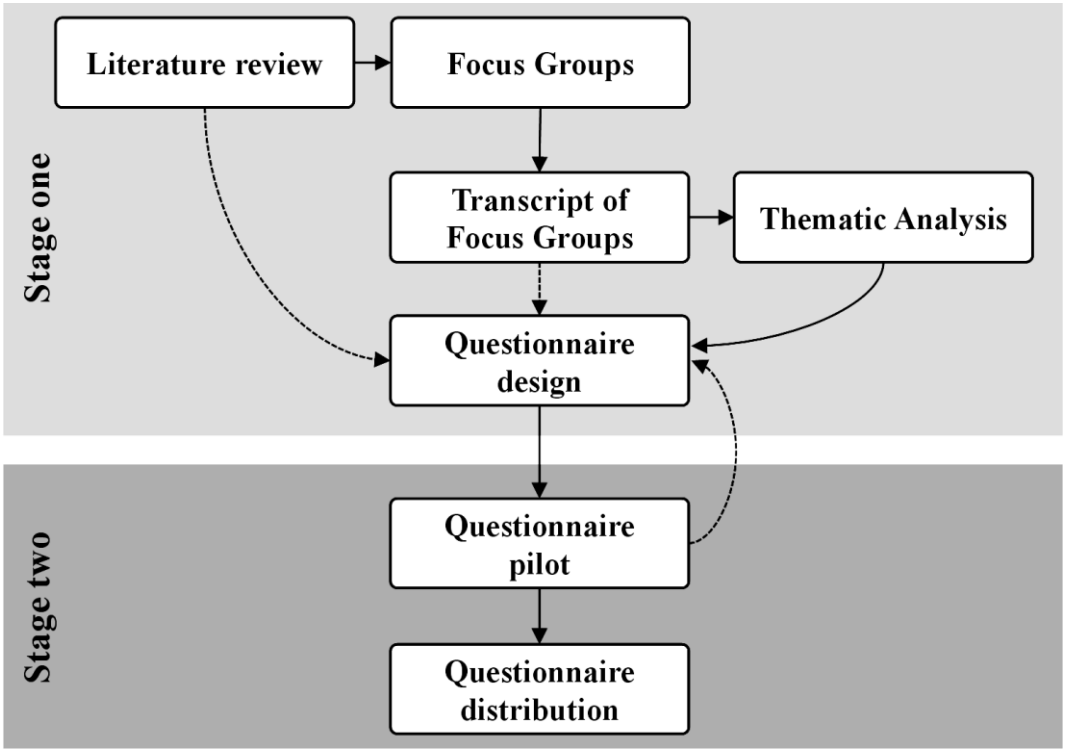
- Attitudes to long distance travel and perceptions of high speed rail,
- Demographics (age, gender, occupation),
- Travel behaviour (use of travel modes, commuting behaviour, overnight stays necessitated by long distance travel),
- Situational factors (geographic location, country of residence),
- Willingness-to-pay for travel time savings,
- Determinants of long-distance travel choices.

A self-completion questionnaire method was used in order to generate quantitative and comparable data. Use of a self-completion questionnaire minimised the potential for interviewer bias, allowed the collection of a large amount of data, and was not time limited for respondents. An online self-completion data collection method was used to maximise the number of responses.

3.3.3 *Summary of stages of data collection*

Figure 3.1 shows the two stages of the data collection method outlined in section 3.3.1 and 3.3.2.

Figure 3.1: Diagram of data collection stages



3.4 Focus groups

3.4.1 *Aims of the Focus groups*

The general aim of the focus groups was to collect attitudes and perceptions of long distance travel and high speed rail, so that these could be used to design a questionnaire. The previous attitudinal research of the perceived impacts and benefits of HS2 (Department for Transport, 2011a) did not present details of the travel time reductions offered. To collect attitudes to high speed rail without considering the travel time reductions overlooks the most visible benefit of high speed rail development in terms of its ability to reduce travel times. Focus group participants were therefore presented with travel time reductions offered on long distance trips by rail, towards the end of the group interview. As the previous attitudinal research of HS2 (Department for Transport, 2011a) omitted details of the scheme, such as fares, environmental impacts and the journey times, the focus groups were needed to add depth to the questionnaire. Following a review of the literature, the following details were sought from the focus group participants;

- Views, and experiences of current long-distance travel in Britain,
- The perceived positive and negative aspects of long distance travel, and potential areas for improvement,
- How mode choices have been made, and what the advantages and disadvantages are of the mode options available,
- Views and opinions about High Speed Rail, including any previous experience,
- Opinions of the potential introduction of a high speed rail service,
- Perceived usefulness of the proposed HS2 high speed rail service.

To ensure that the aims of the focus groups were met, a semi-structured format was used, outlining loosely defined discussion topics. At the appropriate time, participants were also provided with details of the proposed HS2 and an alternative Maglev route with indicative journey times compared with present air and classic rail services. The topics were loosely defined to avoid any biases by leading. The loose structure was as follows;

What participants considered to be a long trip,

This was used to determine how participants perceived a long distance trip, and the opportunity was taken to define such journeys for the purposes of the research.

Previous experiences of travelling long distance,

This section allowed attitudes and perceptions of long-distance travel to be collected from respondent's cognitive experiences.

Choosing between different modes for long distance travel,

In this section, respondents were given the opportunity to state what aspects of travel they determined to be important in decision-making for a long distance trip, including mode choice and routing.

Views on current long distance transport services,

This section was used to determine current attitudes and perceptions of participants towards long-distance travel in Britain, what were considered to be the main attributes of long distance travel, and what improvements respondents would like to see.

Travel time use effects on mode choice,

As there has been considerable debate about travel time use, respondents were asked how they used their time when travelling, and how they considered travel time in decision-making when planning long-distance trips.

Reduced travel times impacts on travel behaviour,

How participants envisioned their travel behaviour might change if travel times were reduced, for example by changing modes for certain trips, departing later, or making new trips.

Fare pricing impacts on likely use of the high speed rail service,

It was intended that this section would provide respondents with an opportunity to discuss how they felt pricing of a new high speed rail service would affect their likelihood to use it. Focus group participants were given the opportunity to state what they would be willing-to-pay for travel time reductions.

Impacts of reduced travel times on journey duration,

This section was used to determine whether respondents might make more 'day-visits' to areas currently perceived to be too far away. The intention was to determine whether the assumed constant travel time (Metz, 2004) would lead to travelling to greater distances.

3.4.2 *Conducting the focus groups*

Before commencing with the focus groups, it was necessary to recruit members - this proved difficult. The author attempted to approach focus group panels within the university, but found that those accessible were specific user groups (e.g. older drivers). As the intention was to find out the views on long-distance travel of the general population, rather than from specific user groups – it was decided that focus group participants would be invited through the author's professional and social circle. The author approached a transport user panel on Tyneside, though only group member attended. It was possible to recruit additional focus group participants from a range of backgrounds. In total, 17 participants attended six focus groups of between 60 and 90 minutes duration, examining the salient attitudes, perceptions and experiences of long distance travel. The 17 participants were divided across 6 focus group meetings, with groups ranging from five, to a single attendee at one focus group session (data

collection followed an interview procedure in this instance). Group members included retired people, professionals, students, the unemployed, and were mixed in both age and gender.

The North East of England was chosen as rail and air services to London (the likely destination for most high speed rail trips) are very similar when check-in times for air are included. Due to the trip time similarity, participants were likely to have made long distance trips by air, rail, and even car. Therefore, choices between air and classic rail would be more likely to be based on factors other than the travel time. Collecting data where broadly similar journey time alternatives existed, meant the other issues involved in the decision making process were not overlooked.

The author acknowledges 17 to be a small number of participants, and accepts that ethnic minorities, those aged under 21 and those from unskilled occupations were under-represented. However, given that the questionnaire was the main means of data collection, the limitations of the focus group research should not be over-emphasised.

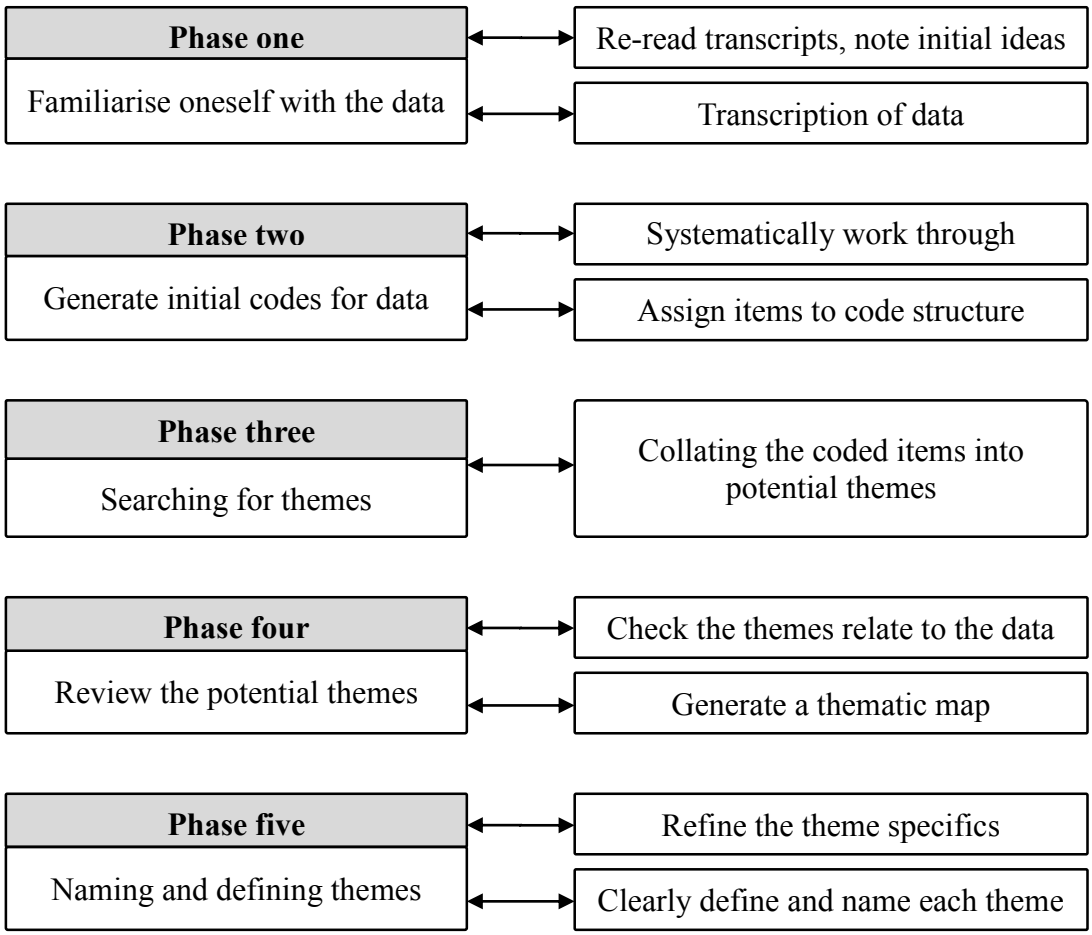
3.4.3 *Thematic analysis method for focus groups*

The focus groups were audio-recorded with permission, and held for later transcription. When transcribed, all participants were given anonymity so that they could express their views and attitudes without attribution. The qualitative, open-ended nature of focus groups is beneficial in allowing freedom of response as the answers given do not have to adhere to a framework. A limitation of the focus group method is that responses are open, and can prove difficult, as they need to be coded to permit statistical analysis (Oppenheim, 2001).

Alternatives to thematic analysis were considered, such as using Discourse Analysis to examine the focus group transcripts. However, thematic analysis was chosen as it studies the data without being linked to theoretical frameworks, in contrast to other methods such as Discourse Analysis, Conversation Analysis and Grounded Theory (Braun and Clarke, 2006). As a flexible and accessible, non-complex form of analysis, thematic analysis was chosen. Thematic Analysis is a suitable technique for identifying and analysing patterns in ambiguous data, and therefore is an appropriate solution to the problem of a transcript lacking definition of the issues therein.

Despite being a popular method in the social sciences, there is no clear and concise procedure for determining the strength ('keyness') of the themes identified. However, thematic analysis can provide a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex, account of data (Braun and Clarke, 2006). Thematic analysis permits themes embedded throughout the data to be 'discovered'. Braun and Clarke (2006) suggest that a theme should be defined as capturing "something important about the data in relation to the research question, and represents some level of patterned response or meaning within the data set". Thematic analysis should take place across the whole dataset, and therefore the six focus group transcripts were merged so that this was possible. The thematic analysis procedure proposed in Braun and Clarke (2006) was used (Figure 3.2).

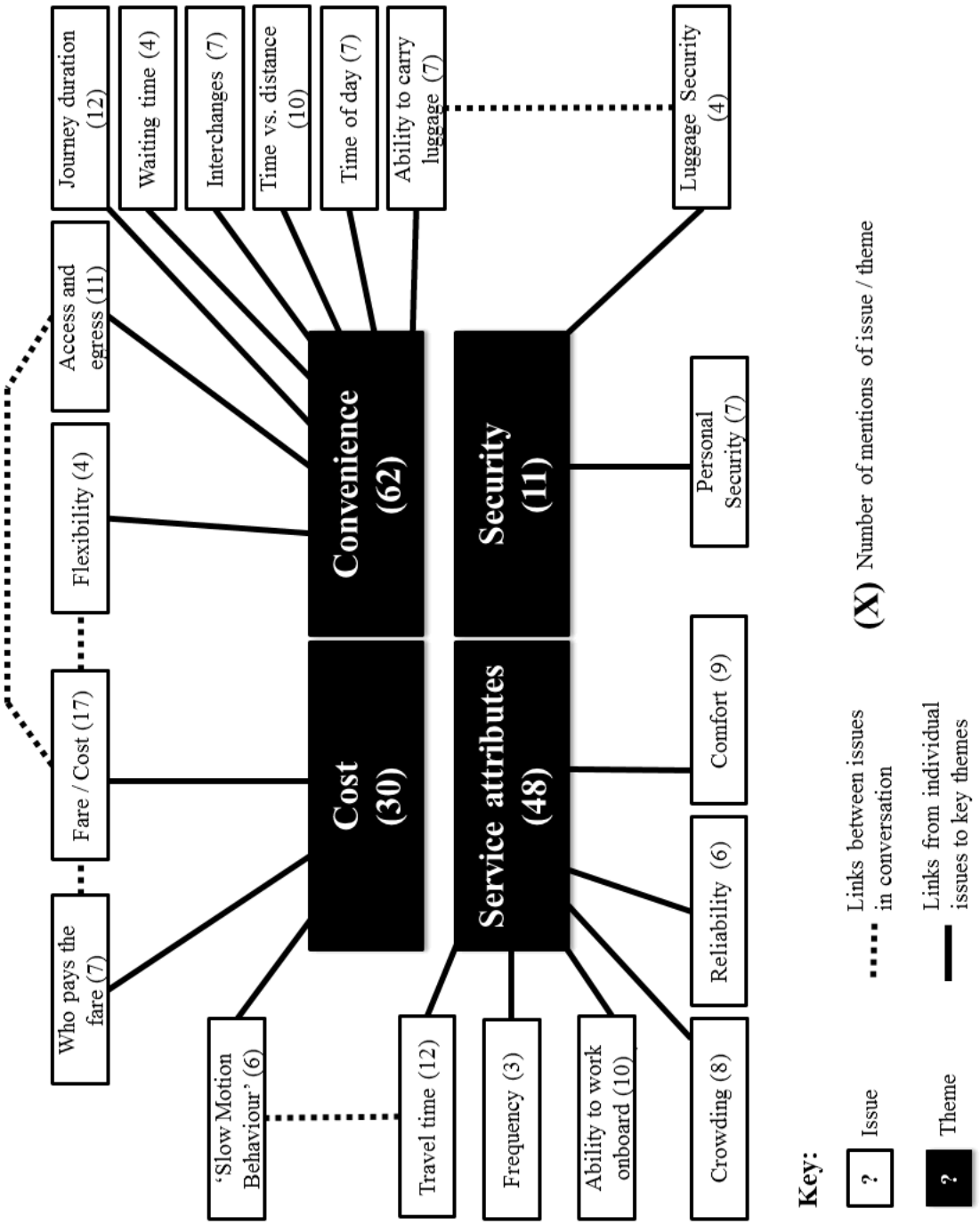
Figure 3.2: Phases of thematic analysis (Based on Braun and Clarke (2006))



The Thematic Analysis procedure begins by becoming familiar with the data through transcription re-checking of transcripts. The second stage is the generation of the initial codes and coding these across the dataset by working systematically through the transcripts and highlighting the potential codes. In some cases items did not fit into a single code, but could be assigned to one of several. In the third stage, the coded items are collated into potential themes (candidate themes) by moving these between theme classifications to see how they fit together. This was done by considering how the coded items fitted into the potential aggregated themes.

A thematic map was then used to display the relationship between the different codes and between the different themes. The third stage resulted in the identification of six potential themes, these being; Cost, Convenience, Quality of Service, Security, The Environment, and Miscellaneous. In the fourth stage the themes were reviewed, and the miscellaneous theme was removed as the items in it were too diverse to be meaningful. The environment theme was also removed from the thematic map following review as it had too few mentions to be an emergent theme. Braun and Clarke (2006) state that once satisfied that the candidate themes adequately capture the contours of the coded data, a candidate thematic map can be produced, this is then reviewed until it provides a satisfactory representation. The fifth stage is to refine the specifics of the identified themes to define what each is about, and then to assign names. Figure 3.3 shows the final thematic map.

Figure 3.3: Final Thematic map (own image)



3.4.4 *Description of focus group themes from thematic analysis method*

Cost theme

Cost was raised in relation to previous travel experiences, as an issue involved in the current travel decision making process, and in relation to how much costs might be to use a new high speed rail system. All 17 respondents mentioned fares as an issue involved in travel decisions, and in most instances linked the cost with mode choice. Eight respondents specifically referred to costs of rail travel in Britain as being too expensive, and there was debate as to whether rail or air fares were most expensive. Further comments included whether high speed rail was affordable in the current economic climate, but this issue may be transient and change in improved economic conditions. Six participants demonstrated characteristics of 'slow motion behaviour' (Nijkamp and Baaijens, 1999) considering making slower journeys to reduce costs. This links cost to the travel time issue of the service attributes theme. Highlighting the importance of costs and concerns about high fares may also be indicative of low Perceived Behavioural Control (PBC). Focus group participants may perceive long-distance travel to be expensive, and may feel that they lack choice and are forced to choose based on not having the resources. However, the focus groups did not measure income or occupation, and determining this effect is difficult.

Convenience theme

Convenience relates to practical issues with making a journey, and these were generally time issues such as waiting time, duration of the journey and the time of day. 12 respondents mentioned total journey duration as an important issue including concerns of how the journey would fit into the day. 11 respondents indicated that they perceived a 'long distance journey' in terms of time rather than distance. A further item here was accessibility, where 11 respondents mentioned access and egress to be a major issue when making long journeys. The ability to carry luggage with fewer restrictions (e.g. weight limits and liquids regulations) was mentioned by seven respondents as a key issue in favour of non-air transport modes. Despite luggage carriage on trains being easier there were concerns about luggage security, which links to luggage security in the security theme. Interchanges was mentioned by seven participants in relation to a preference for more direct journeys, especially where these changes involved heavy luggage or changing platforms at unfamiliar stations. Again, it is possible that this links

to PBC, as the challenges of interchange and carrying luggage were considered greatest by older female focus group members. A perceived inability to deal easily with carrying luggage and making interchanges, may force travel-choices to be made that minimise these factors. For example, being influenced towards car travel due to perceived difficulty in making a public transport interchange, or choosing direct services due to a perceived interchange difficulty. In the flexibility issue, four respondents favoured car travel due to the flexibility in choice of departure time and routing. Three participants wished to minimise waiting time, while one enjoyed the waiting time if there was a comfortable pub near the station. Time of day was mentioned by seven participants, with issues such as early departure times being considered an inconvenience.

Service Attribute theme

Service attributes comprised issues relating to the characteristics of the transport service provided. Travel time (12 respondents) was the issue mentioned by the highest number of participants in this theme - this is exclusive of waiting or transfer times which were classified under the 'total journey duration'. Current travel times were generally considered to be acceptable; however savings were welcomed, especially on slow routes. Acceptable travel times links to the cost versus time trade-off involved in 'Slow Motion Behaviour', where participants might remain on existing rail services if they are cheaper than the faster alternatives. Ability to be productive whilst travelling was mentioned by 10 respondents as an important issue when making long distance journeys, particularly as an advantage of rail travel. Comfort (nine respondents) was important, particularly in relation to the availability of seats on busy train services. The comfort item was linked to overcrowding by eight respondents, relating to rail travel, and had considerable impacts on comfort. The threshold at which the level of crowding had an effect on comfort was not raised specifically. Reliability of service was mentioned by six participants. There appeared to be a relationship between the importance of reliability and the occupation of the participant; those that were not in full-time employment did not consider reliability an important issue. Service frequency was mentioned by three respondents and links to the four respondents mentioning waiting time as an important issue, as an infrequent service extends the potential waiting time.

Security theme

Seven respondents considered personal security an issue when travelling by rail, mainly in relation to anti-social behaviour and occupation of a respondent's reserved seat.

Several respondents mentioned the lack of a visible staff presence as an issue. This was not mentioned in reference to air, possibly due to the more visible presence of aircrew on flights. Luggage security was an issue for four respondents in terms of being able to 'keep an eye' on luggage while travelling. Concerns about the potential for terrorism by not having a check-in procedure for baggage were also expressed. However, this contrasts with indications that more relaxed baggage rules for train travel are an advantage over aviation. Security fears may influence individuals' transport choices where they do not feel in control of their personal safety (e.g. travelling with others). This may discourage public transport use, and favour environments with a greater degree of control (e.g. a car).

Environment theme (removed)

The environment was mentioned by only four participants, on one occasion each. Of those, two respondents did not know whether high speed rail was better or worse for the environment than other forms of transport. Two respondents stated that they would not pay to offset any environmental impacts of their air travel, commenting that they had already paid for their flight and that they considered fares to be already too high. As a controversial issue, those placing great importance on social norms would be unlikely to have made such comments. However, two participants felt the same way regarding the environment-versus-cost trade-off. Social norms (more likely to be pro-environmental than cost focused) may be considered less important when views are shared. Some focus group participants knew each other, which may mean they felt more comfortable expressing views compared to within a group of strangers. Focus Groups can exacerbate social norms, as it may be felt that controversial views cannot be expressed freely in the presence of others. This limitation is present for interviews, though anonymous data collection can overcome this.

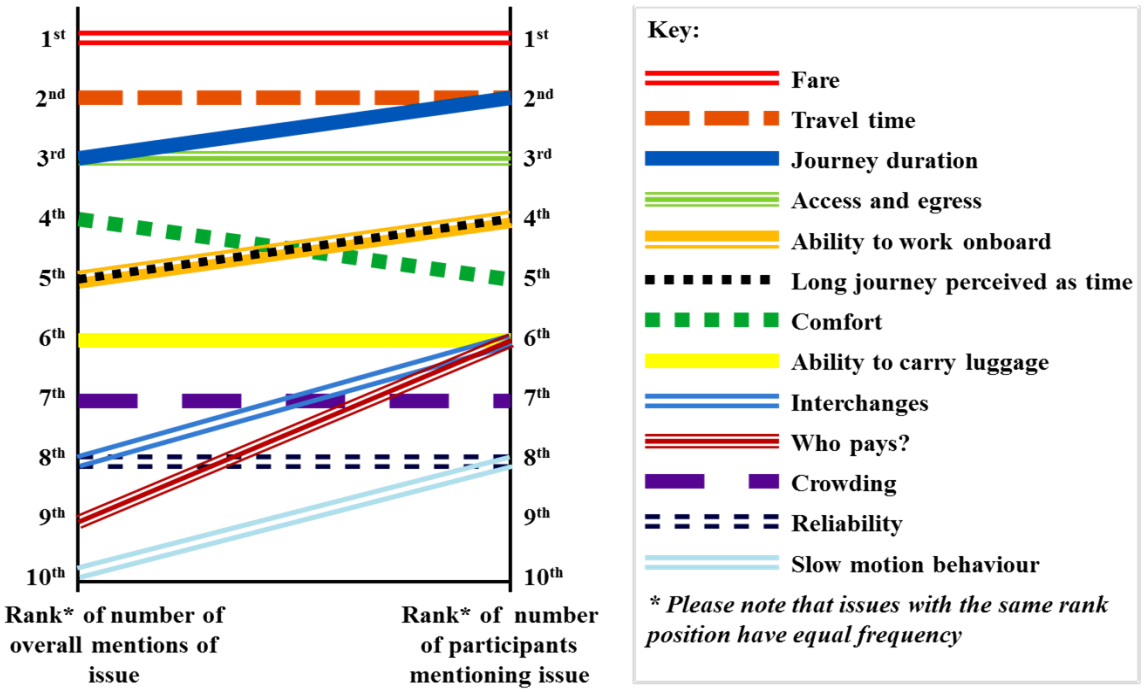
No focus group participants lived in areas affected by the construction of HS2. The focus groups did not demonstrate altruistic behaviour, as no negative personal HS2 impacts were likely - NIMBYism was not present for the same reason. Hostility towards HS2 was low in the focus groups, though in areas adjacent to the proposed route, focus groups may have felt differently.

3.4.5 *Prevalence of themes and issues*

Prevalence of a theme or issue is difficult to define and measure and can be determined by counting the number of focus group participants that mentioned an item in a particular theme, or by the number of individual occurrences of the item throughout the transcript. As long as the method of counting is consistent there is no correct or incorrect way of identifying theme prevalence (Braun and Clarke, 2006). For this research, the choice was made to count the number of respondents that had mentioned one of the issues during the focus groups. While more mentions of an issue might have indicated greater salience, there was a possibility that one individual (e.g. a dominant character) might have repeated the same point several times, for example in reference to their area of interest. This would mean that that issue would be scored as being of greater importance compared to others, though this would reflect one individual's views.

Figure 3.4 shows a comparison of issue prevalence rank for the top ten items, using alternative methods for counting frequency. As Figure 3.4 demonstrates, there is little impact on the rank position of the item depending on the method of counting the frequency with which an issue was mentioned.

Figure 3.4: Rank comparison of overall mentions of issue versus number of participants mentioning an issue (own image).



When the scores for the items are aggregated to their themes, the rank is identical as shown in Table 3.1. The decision to count by the number of participants mentioned has been shown to have little impact on the rank of the issues in the themes. This decision allows conclusions to be drawn using a quantified measure: for example, the numbers of respondents can be compared more easily than the number of mentions, and this also avoids the potential for repetition.

Table 3.1: Focus group themes, ranked by number of times constituent issues were mentioned overall during focus groups, and number of participants mentioning an issue in the theme

Theme	Overall number of times issues in the theme were mentioned	Rank	Number of participants that mentioned an issue in the theme	Rank
Cost	67	(3rd)	30	(3rd)
Convenience	108	(2nd)	37	(2nd)
Service attributes	126	(1st)	48	(1st)

3.5 Self-completion questionnaire

3.5.1 *Questionnaire aims*

The self-completion questionnaire forms stage two of the data collection methodology. The aim of the questionnaire was to collect data on attitudes and perceptions of long distance travel and the proposal for high speed rail, including demographic differences. Previous long-distance travel behaviour information was also sought in terms of commuting behaviour, and the time elapsed since the most recent long-distance trip by rail, air, car and coach. The survey aimed to collect quantitative data for analysis using statistical techniques. These would then be used to test the hypotheses outlined in Chapter two. Finally, the intention was that the survey would gather responses from a broad spectrum of the population and across a substantial response area.

3.5.2 *Questionnaire design*

The questionnaire design was based upon the results of the Focus Groups in Stage One of the methodology. The questionnaire used the following structure;

- Attitudinal statements,
- Previous travel behaviour questions,
- Mode choice determinant questions,
- Willingness-to-pay scenarios,
- Respondent characteristic items (demographics and location).

The thematic analysis was conducted on the transcripts, much of which regarded attitudes to long distance travel and determinants of mode choice. High speed rail specific questions were prompted, and are primarily based on the general attributes of high speed rail obtained from both the focus groups and the literature review. Despite environmental issues being rarely mentioned, the need to test the environmental hypotheses necessitates their inclusion.

Attitudinal statements

Measures of attitudes to long distance travel and perceptions of high speed rail were obtained through 46 attitudinal statements. The attitudinal items on the questionnaire were of a seven point Likert scale type indicating the level of agreement (7) or disagreement (1). The themes obtained from the thematic analysis were used to produce the attitudinal statements in the four relevant themes; cost, convenience, quality of service, and security. The attitudinal statements were based on the items within the four themes, and were used to test attitudes to long-distance travel by respondent demographics (H1), previous travel behaviour (H4 and H5) and willingness-to-pay for travel time reductions (H10B and H10C).

Attitudinal statements relating to high speed rail were also designed using the data obtained in the focus groups. Such issues included knowledge and perceived impacts of high speed rail. These attitudinal statements were used to test hypothesised perceptions of high speed rail. Perceptions of high speed rail were analysed by respondent demographics (H1), previous travel behaviour (H3, H4, H5 and H6), geographic location (H7, H8, and H9) and willingness-to-pay (H10A)

As the research hypotheses H2 intended to investigate environmental attitudes, items from the environmental theme were reinstated, though these reflected attitudes that would indicate low salience and low regard for the environment, as had been found in the focus groups.

The attitudinal statements were developed by the four themes (plus the environment) and their component issues, using the transcripts and paraphrasing for ease of interpretation. A list of the attitudinal statements by issue is shown in Tables 3.2 to 3.6.

Table 3.2: Attitudinal statements in the cost theme, and their relevant issues

Attitudinal statement	Relevant item
I am prepared to pay extra to compensate for any environmental costs of my travel	*Fare / who pays*
Travelling by high speed rail would be more expensive compared to existing rail services	*Fare*

Initially, a 'who pays the fare' attitudinal statement was included. However, there was an issue of how those who had always paid the fare would be able to respond to this question. There is also the issue of whether someone else was paying the fare retrospectively, or at the point of purchase, and how to distinguish this in a questionnaire without adding several more questions. Furthermore, season ticket loan schemes can also complicate the issue of who is ultimately responsible for paying travel costs. For those travelling by car, an additional complication is that while someone else may pay for fuel (through fuel allowance) the other running costs such as insurance and road tax are already paid for by the traveller. For this reason the 'who pays the fare' question was omitted due to its complexity.

Table 3.3: Attitudinal statements in the service attributes theme, and their relevant issues

Attitudinal statement	Relevant item
I think current travel times by rail are acceptable	*Travel time*
I think current travel times by domestic air are acceptable	*Travel time*
Planes and airports allow productive use of travel time	*Ability to work onboard*
I always want to reach my destination as quickly as possible	*Travel time / Reliability*
Travelling by train would allow productive use of my time	*Ability to work onboard*
Travelling in standard class on the train can be generally unpleasant	*Comfort / Crowding*
Wi-Fi access would be important to me when travelling	*Ability to work onboard*
In the future, train services should be more frequent	*Frequency*
Being able to do something while travelling would be important to me	*Ability to work onboard*
I would always want to get to my destination as comfortably as possible	*Comfort*
I enjoy looking at the view while I am travelling	*Comfort*
Comfort is more important than journey time	*Comfort / Travel time*
Other people sitting nearby would disrupt or distract me if I was travelling on public transport	*Ability to work onboard / Comfort*
I would always want to have a reserved seat if travelling	*Comfort / Crowding*
If I knew that I would have to stand on a long trip, it would discourage me from using rail	*Comfort / Crowding*
I find travelling alone boring	*Travel time / Comfort*

Table 3.4: Attitudinal statements in the convenience theme, and their relevant issues

Attitudinal statement	Relevant item
Changing trains can be complicated	*Interchanges*
I would be discouraged from using high speed rail if it had weight and liquids luggage restrictions	*Ability to carry luggage*
If I was travelling long distance to a city centre, I would prefer to use the train	*Flexibility / Access*
If I had a lot to carry I would generally choose to travel by car	*Ability to carry luggage*
High speed rail would make return journeys easier to do in a single day	*Journey duration / Time vs. Distance*
I would worry about missing my transport connection if I could not travel directly	*Interchanges*
I would prefer a mode of transport that gave me flexibility about when I could leave	*Flexibility / Waiting time*
If I had to set off very early I would be anxious about oversleeping	*Time of day*

Table 3.5: Attitudinal statements in the security theme, and their relevant issues

Attitudinal statement	Relevant item
I think that theft of checked-in hold luggage on airlines is a problem	*Luggage security*
On a plane I would be concerned that my luggage might not arrive at my destination	*Luggage security*
If I was on a train, I would like to be able to see my luggage	*Luggage security*
I would worry about my personal safety if travelling by train	*Personal security*
I fear the potential for terrorism if travelling by air	*Personal security*
Security procedures would make me feel more comfortable if travelling on public transport	*Personal security*
Fear of terrorism would be a concern if travelling by rail	*Personal security*
Personal safety would be a worry on flights	*Personal security*
I am in favour of a visible security presence on trains	*Personal security*

Table 3.6: Attitudinal statements in the environment theme

Attitudinal statement	Relevant item
Capacity on existing roads should be increased by adding extra lanes	*Environment*
The road network should be expanded by building new roads	*Environment*
There should be more domestic flights in the future	*Environment*
I consider myself to be an environmentally friendly traveller	*Environment*

Items were included concerning the development of the high speed rail, and the possible alternatives; These questions were based on what respondents said about high speed rail, and were obtained during the focus groups, after respondents had received a map and indicative travel times for HS2 and the Maglev. The questions were developed from previous literature (e.g. Department for Transport, 2011a), and are shown in Table 3.7.

Table 3.7: Attitudinal statements relating to high speed rail

Attitudinal statement
In general, I do not know much about high speed rail
I think that high speed rail is a step forward for the future
I would feel proud if Britain had a new high speed rail network
High speed trains would generate more pollution than the trains we have now
High speed trains would be noisier than the ones we have now
High speed trains would use more energy than the trains we have now
Britain should be investing in high speed rail in the UK

Previous travel behaviour questions

To test hypotheses H3, H4, H5, H6 and H10E, the attitudinal statement questions required previous experiences of long distance travel. This forms a key element of the Theory of Planned Behaviour as experiences can form part of the evaluation of attitudes, these experiences may be very recent or distant. Respondents approximated the month and year of their most recent long distance trip by rail, car, air or coach. This can also give an indication of the frequency of travel, as recent journey implies travel more frequently.

The travel time reductions that high speed rail might offer may reduce the need for overnight stays where the current travel times make it impractical or impossible to complete the return journey in a single day. Respondents were asked the approximate month and year in which it had last been impractical or impossible to complete a return journey in a single day. This will allow confirmation or rejection of hypotheses H6, that attitudes towards high speed rail will be associated with the time since respondents last had to stay overnight on a journey.

To distinguish frequency of long distance trips, respondents were asked whether they commuted long distance by rail daily, or by air weekly (daily air commuting was considered highly unlikely). This question gives further indication of regularity of travel by rail and air.

Mode choice determinant questions

In order to test hypotheses H12, H13, H14A, H14B and H15, respondents were asked to indicate the perceived level of importance that they gave to factors in mode choice. These determinants of mode choice were ascertained from the focus group data and the

subsequent thematic analysis. These data allow investigation of the reasons for variations in mode choices by demographic or travel behaviour characteristics.

Willingness-to-pay scenarios

Hypotheses H10A, H10B, H10C, H10D, H10E and H11 required willingness-to-pay for travel time savings to be compared by perceptions of high speed rail, attitudes to long-distance travel, demographics, and previous travel behaviour. Part of the questionnaire design therefore involved a cost element whereby it was necessary to consider participants' likelihood of using the service under certain cost and time parameters; the latter were chosen based on time savings identified in the proposals for the HS2 and a faster HSR service. As no HS2 service is operational (or being constructed at the time of writing), its existence is hypothetical and cannot be examined directly through Revealed Preference dealing with 'real market choice behaviour'. Instead willingness-to-pay questions gave two example trip times, one of 3 hours and another of 90 minutes; for each of these, two travel time reduction options were provided. Table 3.8 shows the two trip scenarios with the two possible travel time savings.

Table 3.8: Willingness-to-pay for travel time savings - scenarios

A trip of 90 minutes		A trip of 3 hours	
HS2	Faster HSR	HS2	Faster HSR
Saving 45 minutes	Saving 60 minutes	Saving 30 minutes	Saving 90 minutes

Respondents were given a standard typical (in 2012) base fare and were asked to indicate how much more they would be willing to pay in order to gain the new travel times. On the trip of three hours, the initial fare was £100, and the price increased incrementally by £10, up to £200. On the trip of 90 minutes, an initial fare of £50 increased incrementally by £5 up to £100. As discounts might impact on the fare that people are prepared to pay, respondents were asked to indicate possession of any railcards or other travel discounts (see Appendix B for a list of discounts).

Respondent characteristic items

As the research hypothesised differences in attitudes and willingness-to-pay based on geo-demographics, questions to ascertain age group, gender, occupation and location were included. Respondents were asked which of seven age categories applied to them,

and also to indicate their gender. In both cases, non-response was an option. The age categories used were; 18 to 25 years, 26 to 35, 36 to 45, 46 to 55, 56 to 65, 66 to 75, and 76 years and above.

To determine occupation, a modified version of JICNARS based on the National Readership Survey was used to categorise respondents. Two further categories were included for improved definition of occupation, these being retired and students. Students and retired respondents do not generally have a great deal in common, and therefore should not be included together in a single category of 'not classifiable'. Students differ from other categories in that they may study and live in a different region to their home and therefore make frequent long distance trips to visit family or friends. Retired people may have a considerable amount of free time compared to those in full time work or study (JICNARS categories A to E). They could make many long distance trips in this spare time, or conversely they may make few journeys because they do not need to travel. The open ended questions were coded under the classifications shown in table 3.9.

Table 3.9: Occupation Classifications used

Grade	Description
A	Higher Managerial and Professional
B	Intermediate Managerial and Professional
C1	Junior Managerial and Clerical
C2	Skilled Manual workers
D	Semi-skilled and unskilled workers
E	Lowest grade workers
Student	Full and Part-time students
Retired	Full and Part-time retired

Hypothesis H7, H8 and H9 predicted that attitudes to long distance travel and perceptions of high speed rail were associated with geographic location variables. It was predicted that differences would be evident by location relative to a HS2 station, proximity to the proposed HS2 route, and the region of main residence in Great Britain. Respondents were asked for the first half of their main postcode only, to provide an indication of their location without involving issues of confidentiality. Where a United Kingdom postcode could not be provided, a main country of residence was requested from the respondents.

3.5.3 *Questionnaire piloting*

During the design stage, the questionnaire was tested initially on the authors supervisors, and later on fellow researchers – this was to identify any 'data collection' problems that might be present, such as poor scaling, irrelevant questions, leading-statements etc. Once the questionnaire had been through several iterations, it was ready to be tested on those without expertise in questionnaire-design or transport planning. This was to ensure that the questions could be understood by non-experts and that the language used was not overly-academic and more suited to public consultation. The author tested the questionnaire on non-experts, and feedback on the layout, phrasing and question types was received. Amendments were made to the questionnaire to ensure that it could be understood. Following another pilot, the questionnaire was ready for distribution.

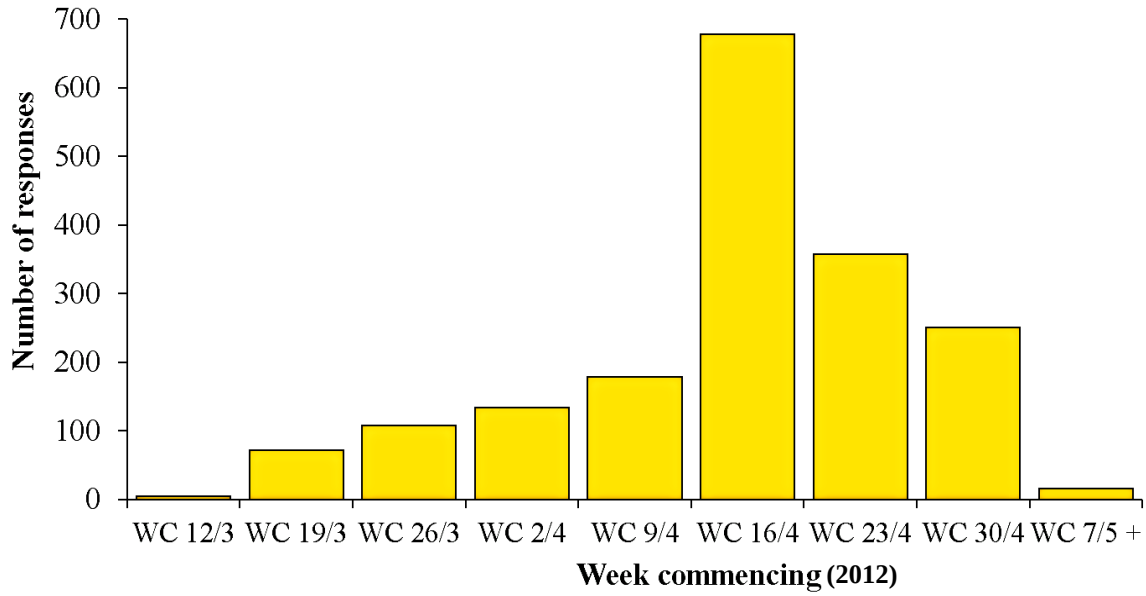
3.5.4 *Questionnaire distribution*

The questionnaire was disseminated online in order to maximise the geographic distribution. To provide access to the online questionnaire, an introductory email or post with a web-link was provided to potential respondents. Postings were made on forums relating to general interests in planning, sports-clubs, and on social media including LinkedIn and Facebook. Mailing lists accessible at Newcastle University were used, as were further national university mailing lists relating to subjects such as business studies, economics, planning and English literature. Finally, a link was included in the newsletter sent to AA members. A bias exists as responses from the AA mailing list, and the academic mailing lists are potentially a substantial proportion of the overall sample. However, respondents were not necessarily rail users or frequent long-distance travellers, and thus can represent wider groups in the population without a pro-rail bias. Targeting individuals on rail services or at stations would have resulted in a greater bias whereby the main beneficiaries of rail improvements would have been those answering – perhaps resulting in egoistic responses.

Completion of an online survey meant that respondents required access to a computer and, as a result, there is likely to be a higher proportion of computer users in the sample when compared with the general British population. The distribution strategy aimed to obtain responses from as wide a range of demographic sectors of the adult public as possible, as the attitudes and perceptions of respondents who had previously travelled long distance were sought regardless of background. The strategy did not target any specific geographic areas and as it was in an online format. Figure 3.5 shows the

response counts for the data collection period at weekly intervals. The number of responses peaked in the week commencing 4th April, which can be explained by the distribution of the survey web-link in the AA newsletter.

Figure 3.5: Questionnaire response rate



3.5.5 *Data cleaning*

By the end of the data collection period, over 1,800 responses had been obtained. Once these data were obtained, the next stage of the method was to ensure that collected data were reliable for analysis, through data cleaning and checking. Oppenheim (2001) describes range checking as part of data cleaning, that is ensuring all numeric scores obtained fit within the response options defined for the questions.

As part of the ethical approval of the questionnaire respondents were not required to answer all questions, some respondents discontinued after several items. Where substantial missing data were present, these responses were removed as they contributed little to the analysis.

Oppenheim (2001) indicates the necessity of coding the survey data, and suggests a code book should be produced comprising the original questionnaire and the assigned codes. Coding open-ended responses numerically, overcomes the problem of ambiguous responses. Several open-ended answers might have the same meaning, for example describing a country as the U.S., the U.S.A, America or The United States. Coding these

as a single category for analysis overcomes the ambiguity. However, when presented, the numeric codes were not used, and a full name was used instead.

3.5.6 *Questionnaire sample*

The data cleaning process reduced the initial number of responses to a total of 1,799 responses comprising of 956 males and 653 females (59.4% and 40.6% respectively, of those indicating their gender). 190 did not provide details of their gender. This compares to the 2013 United Kingdom gender figure for those over 18 years of age, of 49.3% males and 50.7% females. Thus, the population sample for this research over-represents males, and under-represents females compared to the 2013 population statistics.

1,613 respondents provided details their age category; these are shown in Figure 3.6, compared with the total adult population of the United Kingdom in 2013 (Office for National Statistics, 2013). It is possible that the smaller number of responses in the 18-25 category is due to this being a smaller age range (seven years rather than nine), whilst the small number of responses in the upper age categories (66-75 and 75+) may be due to the questionnaire being administered online.

Figure 3.6: Questionnaire respondents by age category

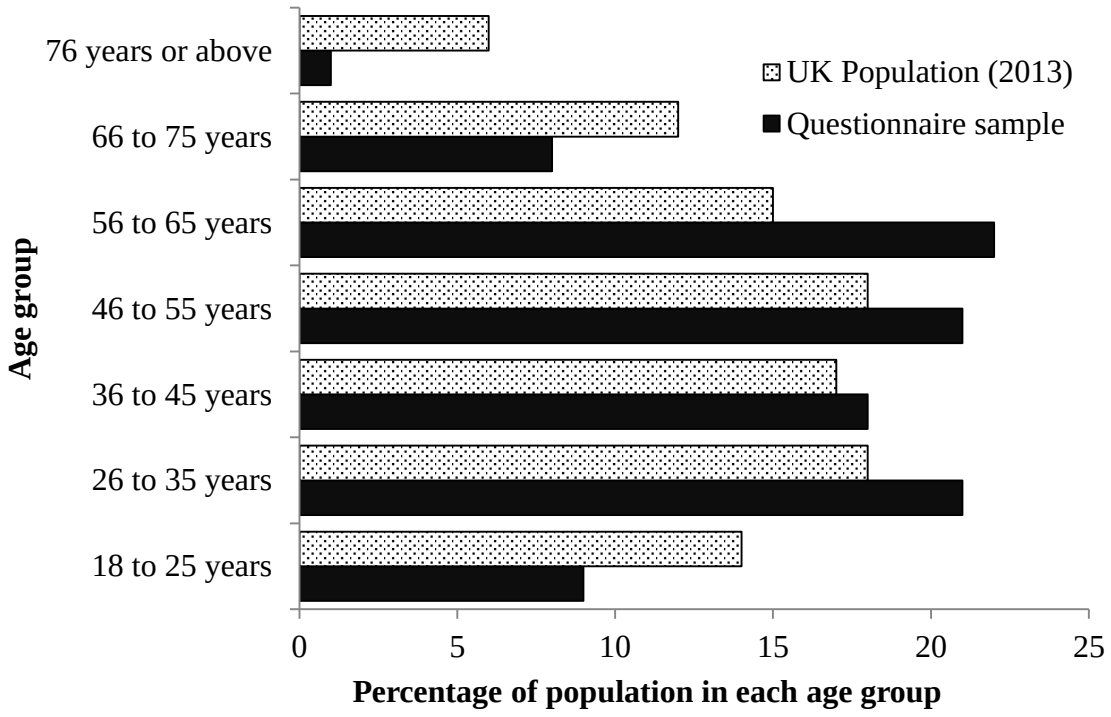
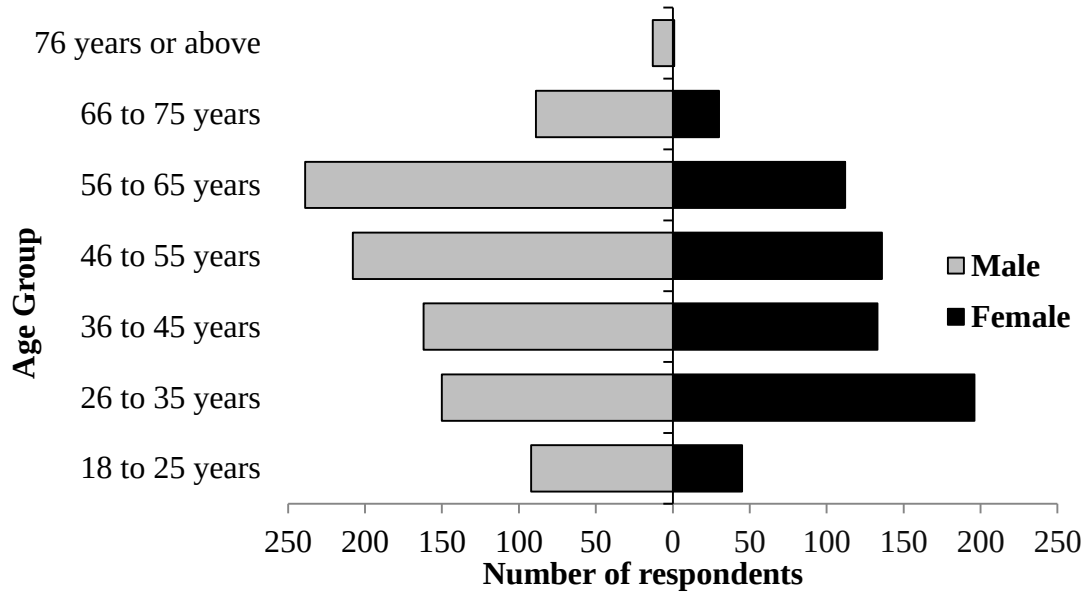


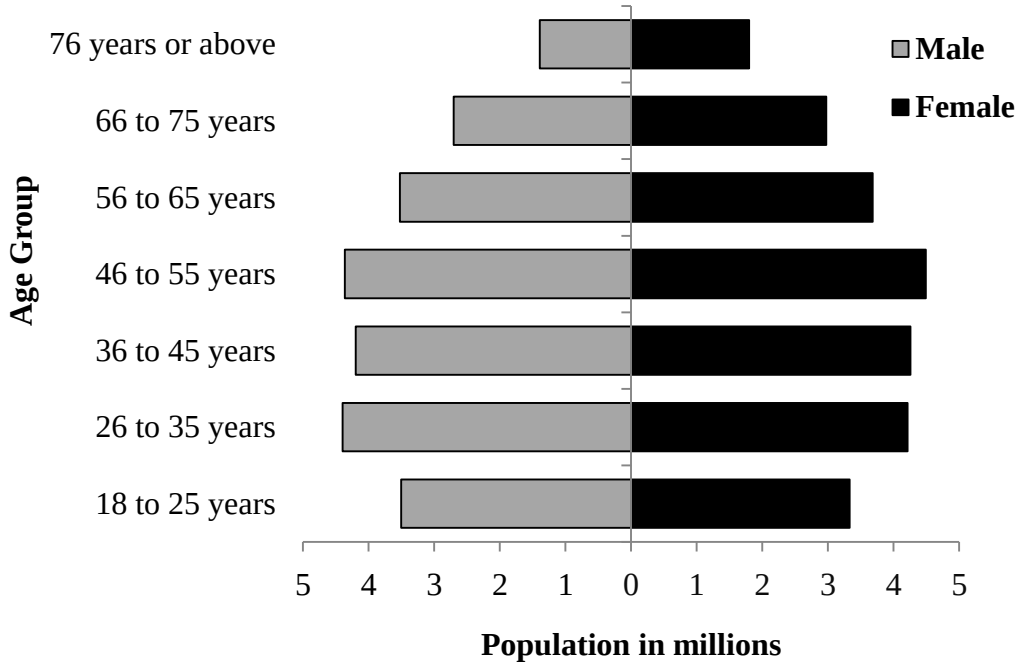
Figure 3.7 shows the age categories split by gender; it can be seen that the male group is larger in almost all cases, which can be explained by the earlier gender imbalance.

Figure 3.7: Population pyramid of age categories split by gender



By comparison, the 2013 UK adult population statistics (Office for National Statistics, 2013) indicate a more even distribution between the genders in each of the age categories (Figure 3.8).

Figure 3.8 2013 UK adult population by age group, split by gender.
Source: Office for National Statistics (2013)



There is a larger proportion of males compared to females except for 26 to 35 years. The older age groups have the greatest gender imbalance, with a significantly larger percentage of females compared to males, which contrasts with the more balanced gender percentages in the 2013 UK overall statistics. Table 3.10 demonstrates the differences between the 2013 UK statistics and the population sample are larger for the eldest age groups. There are substantial differences between all of the groups, with the 36 to 45 years old age group being closest to a representative sample with a difference of 5% compared with the UK population statistics.

Table 3.10: Percentage of sample and 2013 UK adult population per age group, split by gender

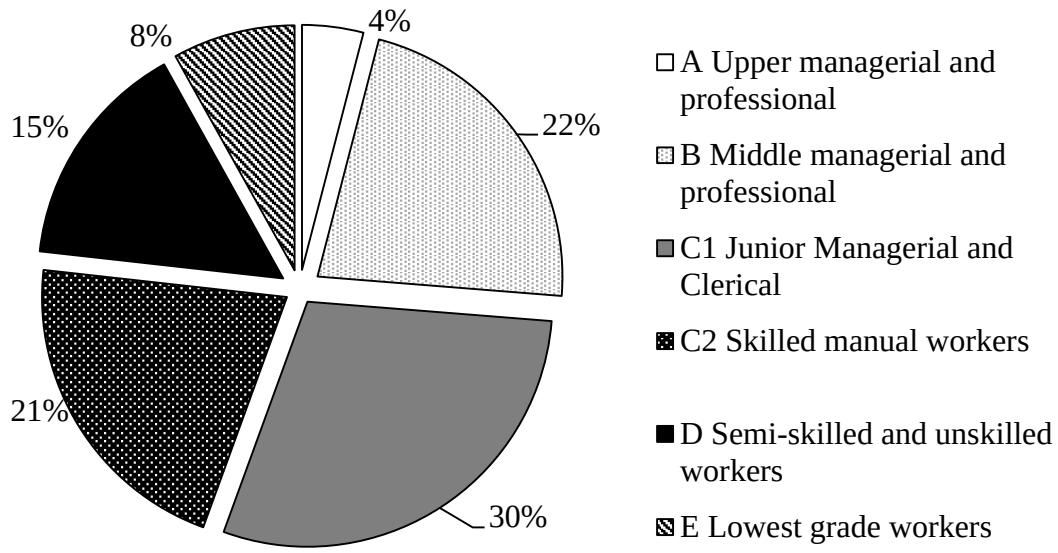
Age group	Males (%)			Females (%)		
	UK	Sample	Dif.	UK	Sample	Dif.
18 to 25 years	52	67	*+15*	48	33	*-15*
26 to 35 years	51	43	*-8*	49	57	*+8*
36 to 45 years	50	55	*+5*	50	45	*-5*
46 to 55 years	49	60	*+11*	51	40	*-11*
56 to 65 years	49	68	*+19*	51	32	*-19*
66 to 75 years	48	75	*+27*	52	25	*-27*
76 years or above	44	93	*+49*	56	7	*-49*

Notes: UK population statistics from Office for National Statistics (2013)
Dif = Difference between sample and UK total population

Thus, the sample of respondents for the questionnaire are not representative of the 2013 UK adult population in terms of gender balance in each age category.

1,593 responses to the occupation question were obtained and coded using the modified JICNARS classification described earlier in section 3.4.2. The sample for the National Readership Survey of 2010 with the division of occupations into the six JICNARS classifications can be seen in Figure 3.9. The Upper managerial professional occupations comprised the smallest percentage of the total UK population, while the largest groups are the Middle and Junior managerial along with the skilled manual workers.

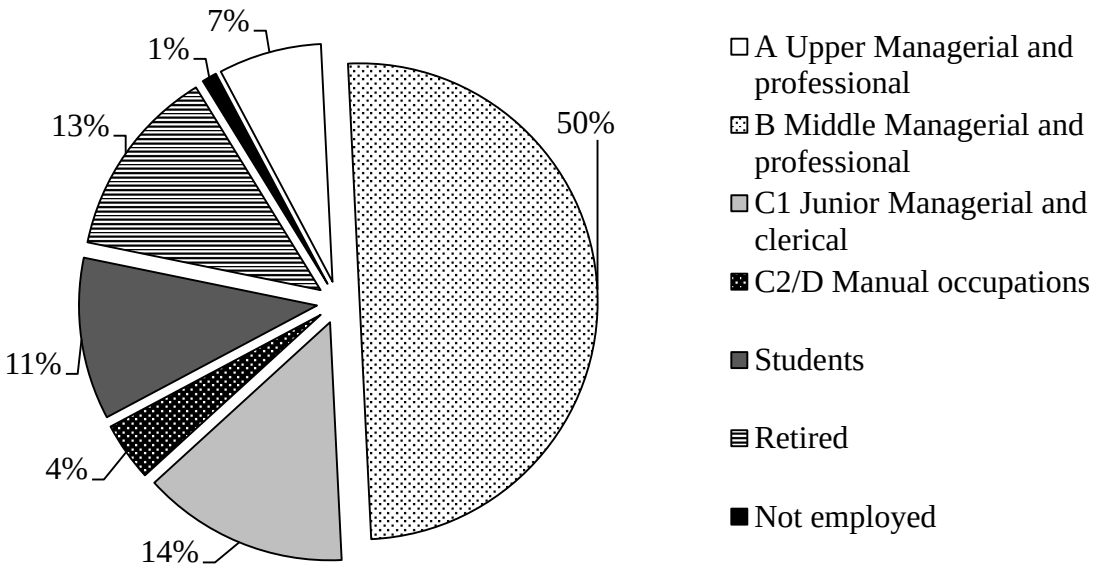
Figure 3.9: Social grade data from the National Readership Survey 2010
Source: National Readership Survey (2010)



It should be noted that as the occupation classifications used in this thesis are a modified version of the National Readership Survey economic classifications, by including students, retired and those not employed, a direct comparison of representativeness is not possible. It should also be noted that these statistics do not relate to rail users. However, the questionnaire was not targeted at rail users, and therefore the sample of responses to the questionnaire did not necessarily represent rail users.

As Figure 3.10 indicates, the largest group of respondents were in the middle managerial and professional classification (B) with this group comprising approximately 50% of the responses. Respondents in the C2 and D categories (Skilled and unskilled manual workers) were few in number, and were therefore combined into a single manual category (C2/D). There were no respondents in the E category, a substantial over-representation of Middle managerial and professional occupations (B), and also a considerable under-representation of C2/D occupations (4% in the sample compared to 36% in the National Readership Survey).

Figure 3.10: Classification of respondents by profession / occupation



Due to these differences, the sample population cannot be considered representative of the national population in terms of occupation. This may be due to the online distribution method employed, where those in more professional occupations may have more regular access to the internet compared to those in the manual occupations. The findings of this research should consider this occupation imbalance.

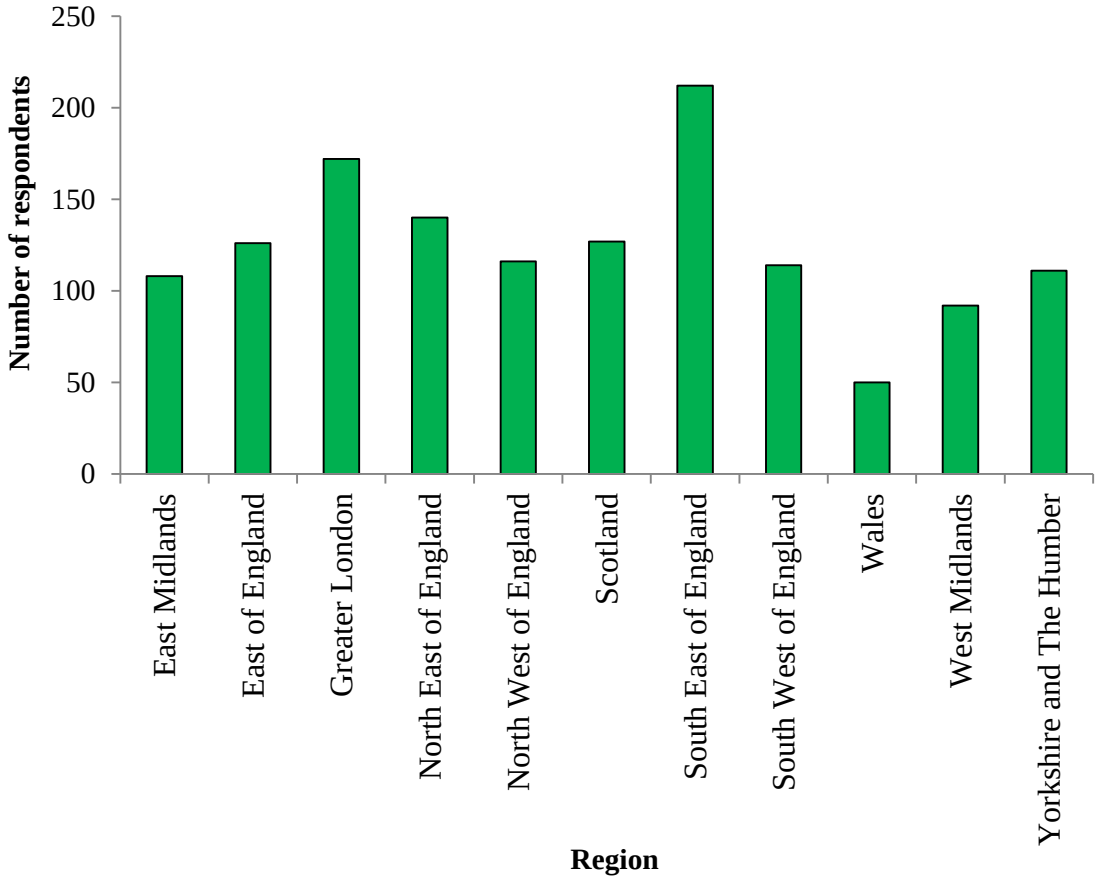
Respondents were asked the month and year of their most recent long distance trip by rail. 60.6% of 1,090 responses indicated a completed long distance rail trip in the first half of 2012 (note that the data collection period concluded in mid-2012). A further 20.8% had completed long distance rail trips in 2011, and 5.4% had made their most recent long distance trip by rail in 2010. Responses indicating the most recent long distance rail trip in each of the years before 2008 comprised less than 1% of the total for each year. Those that had made their most recent long distance trip by rail prior to 2008 comprised 9.8% of all responses, with the earliest trip being made in 1975.

For commuting patterns, 100 out of 1,654 respondents indicated that they commuted long distance by rail on a daily basis, being 6% of the total. Thus, most respondents do not commute long distance by rail daily; a differentiation can therefore be made between these travellers and those that travel by rail less frequently. Long distance weekly air commuting was confirmed by 8 respondents (0.4% of the total), indicating this is small part of the long distance travel market.

Only 674 respondents indicated that they had a railcard or travel discount for use on railways being 45.2% of those that answered the question but only 37.5% of the whole sample. Of the 674 respondents, 596 had one railcard, 72 had two, 4 had three railcards and 1 respondent possessed four railcards. Approximately one third of the questionnaire participants possessed a rail discount, of which the vast majority had one.

Responses were received from regions across Great Britain (see Appendix B). Figure 3.11 shows the number of respondents from each region of Britain. The largest regions by number of respondents were; the South East of England, London, and the North East of England. There were fewer respondents from the West Midlands and from Wales in particular. However, over 100 responses were received from most regions.

Figure 3.11: Number of respondents by region of Great Britain



3.5.7 *Questionnaire response adjustments*

Where small groups were present in the dataset, these added little to the analysis on their own and were therefore combined with other compatible groups.

Age category reduction

Only 14 respondents were aged 76 years and above, comprising 0.9% of the total. One outlying result in that age group could dramatically affect the analysis, and so this group was combined with the 66 to 75 years age group to create a larger upper age category. This new 66 years and above group comprised 8.4% of the total responses (135 people).

Occupation category reduction

No respondents were in the JICNARS E category and there were few respondents in either the occupation category C2 (Skilled and Semi-skilled manual occupations) or in category D (unskilled manual occupations). These groups were combined to create a merged Manual Occupations category (C2/D). Whereas prior to merging, C2 = 2.9% of the total occupations and D = 0.6%, the combined C2/D manual occupation group increased in size to 3.5% of the total occupation percentage. Since categories C2 and D were the only manual occupation groups in the dataset, combining them was appropriate.

Travel behaviour data management

Respondents were asked to indicate the month and year of their most recent long-distance trip. Detail beyond the monthly level might have proven difficult for respondent recall. These values were converted to a single 'months elapsed' figure for use in the analysis by calculating the difference between the indicated month and year and the date of questionnaire completion.

Because the responses were as months, a midpoint was used to enable time-elapsed to be calculated. As measurements were taken from the midpoint, the start of the next calendar month was 0.50, and the middle of the next month was 1. Subdivisions of 0.25 and 0.75 were used for the intervening period. A value of 0.10 was used for participants that had travelled long distance a few days previous to completing the questionnaire.

3.6 Evaluation of methods

The focus groups were successful in building up a picture of attitudes to long distance travel, perceptions of high speed rail, and the factors considered when making mode choices for long distance travel. The questionnaire itself was not targeted towards particular groups, only to those that had previously made a long distance trip at some point. There appeared to be little or no difficulty in completing the questionnaire.

Anonymity was maintained as per the ethical approval requirements, as IP addresses of the computers used were not recorded. An email address was provided for any concerned participants; at the time of writing no complaints have been received. One respondent did have problems displaying the questionnaire; however, after contacting the author the problem was resolved. The use of an online questionnaire successfully enabled responses to be received from a broad geographic area, including respondents living along the route of the HS2 proposal. As one might expect, some respondents did not complete the entire questionnaire (invalid responses), but the vast majority did.

3.7 Attitudinal statement reduction

3.7.1 *Comparison of Factor Analysis and Principal Components Analysis (PCA)*

Factor Analysis (FA) and Principal Components Analysis (PCA) methods are used to detect relationships between variables. Both are widely used in psychological studies attempting to explain correlations among a set of items. Despite similarities between the two approaches, there is an important distinction; FA is an approach to identifying the structure underlying the variables (or confirming a hypothesised structure), while PCA is a means of combining variables into a smaller set of composite factors (i.e. data reduction). Although many authors use the names interchangeably, Kim (2008), distinguishes them in that FA examines correlations between variables, whilst PCA is best used for summarising data into a smaller number of variables. Since the thematic analysis findings were too disparate and numerous to analyse effectively using FA and data reduction was needed, then a PCA was performed in this study.

3.7.2 *Data reduction for attitudinal statements*

A Principal Components Analysis was conducted to determine whether reliable factors existed, which could form the dependent variables to be tested for variations by demographic, situational and travel behaviour characteristics. Testing each attitudinal statement individually would be less reliable and more cumbersome. PCA is a parametric method which allows relevant information to be extracted from datasets, reducing complex data to lower dimensions and a more simplified structure (Shlens, 2005).

The PCA used a Varimax rotation method, with a Kaiser Normalisation – this orthogonal method maximises the variance detected, which helps to simplify the factor

structure where there is high-loading on some factors, and low-loading on others (Russell, 2002). This enables easier recognition of factors emerging from the data.

Using a PCA, the number of attitudinal items was reduced from 46 to five factors with reliabilities >.6. Using the point of inflection on the Scree plot (shown in full in Appendix D, Figure D1) the approximate number of factors that should be retained was identified as being at the seventh and ninth factor. Therefore, seven, eight and nine factor solutions were tested (Appendix D, Figures D2 and D3) to ascertain how the distribution of high-scoring items changed when the factor solution was less numerous.

Re-scaling negatively loaded items to create factor scores was necessary, as these affect the resulting alpha score (α) in SPSS. Such items were reverse-coded by introducing a new variable ($x - 8$, where x= the initial rating). This substitutes for the previous negative value in the reliability analysis (Pett *et al.*, 2003). The Cronbach's Alpha coefficients for the final factor solution can be seen in Table 3.11. The seventh factor (F7) was removed due to an unacceptably low alpha score (α= .449), meaning that this is now a six factor solution. Movement of items between factors did not improve the α sufficiently for F7. Factor six was also a candidate for removal, as it only comprised two items. However, the factor comprised issues relating to the utility of travel time, and therefore is retained, though any findings are treated with care.

3.7.3 Factor identification

The six reliable factors identified comprised of 35 of the initial 46 Likert Scale items in the questionnaire. Some items were omitted due to failing to load onto the factors at a level exceeding .35 or being in F7. Furthermore, some of the remaining items did not fit into the factor from a psychological perspective, and their removal improved the Cronbach's alpha coefficients. The components of each factor are discussed in further detail in section 3.7.4 factor characteristics.

Table 3.11: Principal Components Analysis – Six factor solution

Factor items	F1	F2	F3	F4	F5	F6
F1 Travel Security Concerns (8 items)						
35 I would worry about personal safety on flights	**.797**					
24 I fear potential for terrorism if travelling by air	**.773**					
11 Fear of terrorism if travelling by rail	**.700**					
31 Worry about my personal safety if travelling by train	**.675**					
33 Public transport more comfortable with security	**.644**					
30 Think hold luggage theft problem on airlines	**.607**					
36 Concerned my plane luggage may not arrive at destination	**.529**					
7 Favour security presence on trains	**.489**					
F2 Unsustainable Transport Improvements (8 items)						
22 New roads should be built		**.696**				
12 Should add extra lanes to existing roads		**.686**				
25 Travelling long distance to a city centre, I prefer the train		**-.617**				
19 I consider myself an environmentally friendly traveller		**-.604**				
6 Should be more domestic flights in the future		**.602**				
27 Train travel would allow productive use of my time		**-.596**				
15 Willing to pay to compensate environmental costs		**-.535**				
23 I always want to reach destination as quickly as possible		**.377**				
F3 High speed rail Prestige / Favourability (4 items)						
41 I think high speed rail is a step forward for the future			**.853**			
39 Britain should be investing in high speed rail			**.818**			
44 Would be proud of a new British high speed rail network			**.799**			
43 Day return trips would be easier by high speed rail			**.716**			
F4 Importance of Comfort (9 items)						
26 Always want to reach my destination comfortably as possible				**.661**		
13 Comfort is more important than journey time				**.563**		
18 Discouraged from using rail if I knew I would stand				**.487**		
20 If travelling I always want a reserved seat				**.484**		
8 Train standard class can be generally unpleasant				**.439**		
29 Worry about missing connections on air and rail if changing	**.382**			**.369**		
28 Would choose car if lots to carry		**.479**		**.367**		
16 I enjoy looking at the view when I am travelling		**-.355**		.332		
36 If travelling by rail, others would disrupt or distract me				.322		
F5 Perceived Negative Impact of high speed rail (4 items)						
40 High speed trains use more energy than current trains					**.793**	
45 Pollution from high speed trains greater than current trains					**.741**	
46 High speed trains would be noisier than current trains					**.633**	
38 High speed rail would be more expensive than current rail					**.488**	
F6 Importance of Useful Travel Time (2 items)						
10 It is important to do something while travelling						**.686**
9 Wi-Fi is important when travelling						**.683**
Alpha Coefficients	.832	.789	.852	.668	.700	.611
Eigenvalues	1.791	1.350	1.029	.718	.613	.499
Variance	71.097	67.120	23.127	48.739	12.917	7.455
Standard Deviation	8.432	8.193	4.809	6.981	3.594	2.730
Factor Mean	26.022	26.529	21.248	43.671	17.295	10.680
Standardised Factor Mean	3.253	3.316	5.312	4.852	4.324	5.340

Notes: Factor seven removed due to unacceptably low Cronbach's alpha score (.449)
Loadings exceeding .35 are in bold to denote highest factor loadings.

3.7.4 Factor characteristics

Factor one (F1) can be considered as a travel security concern factor comprising items relating to worries about travel security. The travel security concerns are in two distinct areas; Self-safety (the security of the person) including fear of terrorism and a desire for measures to mitigate this, and security of belongings, including fears about theft and luggage not arriving. The factor also contains items favouring the introduction of travel security measures, indicating a perceived problem regarding safety and security while travelling long distance by public transport.

Factor two (F2) comprises both positively and negatively loaded items. Items in this factor support improvements to the transport network such as creating new capacity and speeding up trips using unsustainable modes, such as road and air. Unwillingness-to-pay for environmental consequences of travel is also present, which may provide an indication of individual's environmental conscience in their responses to questions within this factor. In addition to the other items expressing favourability towards the expansion of road building and additional flights, this appears to be a reasonable assumption. Items concerning travel by rail and sustainability loaded negatively. F2 is therefore termed as an unsustainable transport improvements factor.

The component items of Factor three (F3) suggest high speed rail prestige and favourability. The items in F3 strongly support (α= >.8) investing in high speed rail, and considering it to be a step forward as well as making return trips easier to complete in a day. The prestige element of F3 is from the item indicating pride if such a rail system was introduced to Britain. F3 is a factor indicating a highly positive attitude to high speed rail.

Factor four (F4) includes desire for comfort, and placing preference for comfort (including a good view) over reduced travel times. A wish to avoid standing where possible is also present, while standard class facilities are perceived to be unpleasant. A concern about missing travel connections and choosing the car if carrying a substantial amount, indicates a desire to avoid changes and to not having to worry about carrying luggage, both of which relate to comfort. The item indicating that standard class is considered unpleasant is likely to mean that an upgrade to first class would be preferable. To summarise, this factor consists of items that place a substantial amount of

importance on being comfortable while travelling long distance, and seeking to maximise their personal comfort.

Factor five (F5) relates to perceived negative impacts of high speed rail. The items in the factor are all relative to the current rail service, and suggest a strong belief that its impacts will be negative compared to the current rail service. F5 includes an expectation that high speed rail will use more energy, cause more noise and pollution, and be more expensive to use than the existing rail system. As for F2, there is an environmental dimension to this factor, largely related to perceived impacts from the HS2 route.

Factor six (F6) consists of only two questionnaire items, these being the importance of being able to do something while travelling, and the importance of having access to the internet (Wi-Fi). There are only two items in F6, which may limit the validity of the factor, so it is used with care in the subsequent analysis and interpretation.

3.7.5 Associations between factors

A Pearson's correlation test was used to identify associations between the factors. Use of a Pearsons test is acceptable due to the large *N* in the sample size (*N=1,*799), and also due to the aggregated factors being close to a normal distribution. Table 3.12 shows the correlations between the factors.

Table 3.12 Pearson's correlation test for association between PCA factors.

	F1: Security	F2: Unsustainable	F3: HSR Prestige	F4: Comfort	F5: HSR Negative
F2: Unsustainable	**.318**				
F3: HSR Prestige	*ns*	*ns*			
F4: Comfort	**.501**	**.393**	.062		
F5: HSR Negative	*ns*	*ns*	**-.305**	.084	
F6: Travel Time	*ns*	-.100	.157	.090	*ns*

Notes: ns = Not significant, N=1,799

The results in table 3.12 do show that there are significant associations between the factors identified in the PCA. However, in many cases the correlations do not indicate a large amount of shared variance, and may be indicative of effect size. Those correlations bolded in Table 3.12 are those where a correlation exceeding .3 is present.

The greatest association is detected between F1 and F4 (.501), which is not surprising given that perceived levels of security are closely related to those of comfort. Those

with low concerns about travel security are also less likely to place great importance on levels of comfort. It is noteworthy that one item in the F1 security factor 'Public transport more comfortable with security' links with F4: Importance of comfort, thus confirming a relationship.

A significant association between F1: Travel security concerns, and F2: Unsustainable transport improvements, indicates that those more concerned about travel security are more favourable to developing unsustainable transport improvements. A possible explanation is that the unsustainable methods or transport (car/air) have either greater control over personal security (car), or more stringent security procedures (air), thus explaining why those with high security concerns are more favourable towards them. A similar association between F2 and F4 may also be explained by similar reasoning. Car affords control over personal comfort (temperature, music etc…) and air guarantees a seat. Thus those considering comfort to be more important are likely to favour these modes over sustainable means that do not offer this (e.g. rail).

A significant negative correlation was also present between perceived prestige of HSR (F3) and negative attitudes to HSR (F5). This is expected, as those perceiving HSR to be more prestigious, would have less negative attitudes to HSR. However, a considerable amount of variance still exists, and these two factors are sufficiently independent of each other to be considered separate.

The results indicate that while some statistically significant correlations exist between the factors identified in the PCA, there is still a considerable amount of variance. Thus the factor solution did not result in factors too similar to one another. The six factors are representative of different aspects of attitudes to long-distance travel, and perceptions of HSR.

Summary

Of the six factors obtained from the Principal Components Analysis, it should be noted that the two relate directly to perceptions of high speed rail, these being F3 (High speed rail Prestige / Favourability) and F5 (Perceived Negative Impacts of High speed rail). The remaining four factors (F1, F2, F4 and F6) relate more generally to aspects of making long distance trips and attitudes about these based on experiences and desires rather than perceived impacts.

To make the factors compatible with the 1 to 7 scale used in the attitudinal Likert scale questions, the scores were standardised by dividing the factor mean by the number of items in the factor. Each respondent was therefore scored on a seven point scale reflecting the items in combination. Once the factors were standardised these attitudinal statement data could be compared (See Chapter Four).

The Principal Components Analysis results will be used in the statistical analysis, as each factor is related to an element of attitudes to long distance travel, or a perception of high speed rail. These factors will therefore allow for more reliable testing of the hypotheses relating to these aspects, as will be investigated in the results section.

Chapter 4. Analysis of questionnaire data

4.1 Introduction

The aim of this chapter is to test the 15 hypotheses set out at the end of Chapter Two. As these hypotheses are structured in five categories, the results in this section shall also be presented in this structure. The six categories of hypotheses are; demographic, travel behaviour, situational, willingness-to-pay, mode and environment. Chapter Four described the derivation of six factors, which are listed in Table 4.1 and a description of each is provided.

Table 4.1: Summary of factors identified during principal components analysis

Factor name	Brief description of factor
F1: Travel security concerns	- Personal and possessions security important. - Concern about property. - Potential for terrorism a worry.
F2: Unsustainable transport improvements	- Want more roads and flights. - Unfavourable towards rail transport. - Low environmental concern.
F3: Perceived prestige of high speed rail	- Invest in high speed rail. - Would be proud of having such a system. - Would make certain trips easier.
F4: Comfort important	- Always want to be comfortable when travelling. - Want a good view, quiet surroundings and a seat. - Fewer changes better. - Amount of luggage can determine chosen mode.
F5: Negative perception of high speed rail	- More expensive, noisier, more polluting and less energy efficient.
F6: Useful travel time important	- Wish to be productive and have means to do so.

4.2 Application of statistical tests used

To test research hypotheses, it was necessary to look for associations and variations in attitudes to long-distance travel, willingness-to-pay for travel time savings, and the importance of factors in mode choice, by socio-demographic and geographic characteristics. A number of statistical techniques were applied to do so.

Kruskal-Wallis one-way analysis of variance

This test determines whether the factor scores (F1-F6) differ by the independent variables collected. These independent variables are categorical (age, occupation, region of the UK) and this test was used to determine whether significant attitudinal variation exists and can be accounted for by the independent variables.

Mann-Whitney U test

Whereas the Kruskal-Wallis test was used to test for variations where the independent variable was divided into more than two categories, Mann-Whitney *U* tests for associations between two populations; In this research these have included males and females, commuters and non-commuters, and those possessing travel discounts.

Spearman's Rho

Spearman's Rho was used to test for correlations between a dependent variable and a non-categorical independent variable. Uses included situations with a scale independent variable, for example time elapsed since the most recent long-distance trip by mode.

Friedman test

The Friedman test is used to determine differences using ranks. This test was rarely used in the thesis, but was used to test for differences between respondents' importance ratings for the determinants of travel choice.

ANOVA (one and two-way)

In some cases it was necessary to use a parametric test, where there was no non-parametric alternative. In other cases, the ANOVA has been used in conjunction with the Kruskal-Wallis test, due to the fact that it displays mean scores within the 7-point Likert scale, which makes visualisation of effects clearer and more interpretable.

4.3 Determination of tests used

This section describes how tests are selected for analyses. Parametric tests are more powerful than non-parametric due to their strength of assumptions and thus they are less likely to make type 1 errors that mistakenly reject true null hypotheses (Siegel and Castellan Jr, 1988). However, in order to use parametric tests, the data being tested need to meet several key assumptions, being that the data are of interval measurement, that the observations are drawn from a normally distributed population, that those observations are independent (Siegel and Castellan Jr, 1988) and that there is homogeneity of variance. Where these assumptions are violated, then non-parametric tests should be used.

The seven point Likert scale questions used to measure attitudes in this research is presented as linguistically ordered, anchored at both ends by strongly agree and strongly disagree. Thus they are ordinal and when translated into numbers for analysis it cannot be presumed that the seven points are of equal increments. Similarly, there is ample evidence of skewed, not normal, distributions of individual Likert-type items, In this study, the on-line nature of the questionnaire means that the sample is dependent on whichever groups and individuals are contacted, so is non-random and there may not be full independence of the 'observations' here. Whilst Jamieson (2004) has acknowledged that analysis of Likert Scale data has taken place using parametric analyses, Jamieson (2004) and Knapp (1990) also point out that where researchers have qualms about normality, they should not be concerned about losing power if using a nonparametric test, especially with large N such that the power of the test can actually be high.

In this study, the Likert items were aggregated into 6 factors, which reduces the issues associated with scaling. If it were to reduce the normality problem, then parametric tests may be more justifiable. The results of a Shapiro-Wilk test of normality on the six attitude factors are shown in Table 4.2 and indicate skewness and kurtosis in several factors.

Table 4.2: Shapiro-Wilk test of normality on six factors

Factor name	Statistic	*p*	Skewness	Kurtosis
F1: Travel security concerns	.989	<.001	0.37	-0.06
F2: Unsustainable transport improvements	.986	<.001	0.32	-0.29
F3: High speed rail prestige	.939	<.001	-0.91	0.83
F4: Comfort important	.996	<.001	-0.14	-0.12
F5: Negative perception of high speed rail	.976	<.001	0.01	0.88
F6: Useful travel time important	.914	<.001	-0.89	0.32

Notes: N = 1799

Thus, non-parametric tests are used throughout and parametric tests are not used unless there is no alternative; in the latter cases, they are used with caution. However, even where non-parametric tests are employed, means of standardised factor scores are also provided in several places as they illustrate both value and relative scale position.

4.4 Attitudes and perceptions: demographic hypotheses

The two demographic hypotheses are:

H1– Attitudes to both long distance travel and high speed rail will differ by respondents' age, occupation, and gender.

H2– Environmental conscience will differ by respondent demographics and their previous travel behaviour.

4.4.1 *Attitudes to long distance travel and high speed rail, age differences*

Table 4.3 shows the descriptive statistics for the six attitudinal factors, identified during the Principal Components Analysis.

Table 4.3: Descriptive statistics for the six attitudinal factors

Attitude	Mean	Standard deviation
F1: Travel security concerns	3.25	1.05
F2: Unsustainable transport improvements	3.32	1.02
F3: High speed rail prestige	5.31	1.20
F4: Comfort important	4.85	0.78
F5: Negative perception of high speed rail	4.32	0.90
F6: Useful travel time important	5.34	1.37

Notes: N=1799

It is predicted that there will be differences in attitudes to long distance travel and high speed rail by age group, as at least some factors are U-shaped distributions and therefore non-linear. For example with travel security concerns (F1) greatest for those in the youngest and eldest age groups. In addition, the importance of useful travel time is similarly predicted to show a curvilinear relationship with those in the middle (most economically active) groups likely to consider the issue more important than those in the younger and older age groups.

H1 and H2 thus predict that the difference in attitudes to long distance travel and high speed rail will be non-linear, probably U-shaped for F1 travel security and possibly also so for F2, F3, F4 and F5. Thus a Kruskal-Wallis non parametric analysis of variance is used to test for significant attitudinal differences between age groups. Table 4.4 provides the statistics for the Kruskal-Wallis analysis.

The results in Table 4.4 show that there are statistically significant differences between the age categories for attitudes F1, F3, F4 and F6, so H1 can be accepted for all factors except F2 and F5.

Table 4.4: Kruskal-Wallis one-way analysis of variance between attitudes and age group, summary table of statistics

Age category	*N*	Attitude factor (mean rank)					
		F1	F2	F3	F4	F5	F6
18 to 25 years	137	745.35	828.47	895.64	738.41	808.84	814.46
26 to 35 years	346	708.25	768.28	869.93	737.19	842.43	934.39
36 to 45 years	296	757.21	775.62	805.30	726.37	785.78	905.00
46 to 55 years	346	814.54	813.54	774.10	825.70	806.54	819.06
56 to 65 years	353	905.04	825.69	777.18	906.09	757.88	705.43
66 years and over	135	956.14	887.61	721.77	925.27	890.48	492.76
χ^2		50.96	8.72	19.07	44.92	11.01	119.66
p		<.001	*ns*	.002	<.001	*ns*	<.001

Notes: df=5
F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative Perception HSR, F6: Useful Travel Time Important

The results of the Kruskal-Wallis analysis confirm H1, that statistically significant differences in attitude exist when split by age. Table 4.5 is a table of attitude means for the six attitude factors by age group. Perceived prestige of high speed rail (F3) decreases as age increases overall, while Comfort importance (F4) increases with age, though the differences in attitude mean between age categories is greater in the upper age groups.

Table 4.5: Table of means for attitude factors, by age group

Age category	Attitude factor means (standard deviations)					
	F1	F2	F3	F4	F5	F6
18 to 25 years	3.12 (0.95)	3.34 (0.96)	5.57 (1.06)	4.68 (0.86)	4.29 (0.98)	5.36 (1.31)
26 to 35 years	3.03 (1.03)	3.22 (0.95)	5.50 (1.09)	4.75 (0.77)	4.35 (0.82)	5.69 (1.17)
36 to 45 years	3.13 (1.04)	3.23 (1.01)	5.34 (1.16)	4.74 (0.71)	4.27 (0.87)	5.62 (1.21)
46 to 55 years	3.25 (1.06)	3.33 (1.07)	5.23 (1.24)	4.87 (0.74)	4.35 (0.89)	5.38 (1.28)
56 to 65 years	3.46 (1.01)	3.34 (1.03)	5.22 (1.29)	5.00 (0.79)	4.25 (0.94)	4.99 (1.49)
66 years and over	3.58 (0.99)	3.47 (0.98)	5.06 (1.33)	5.06 (0.69)	4.44 (0.86)	4.33 (1.47)

Notes: df=5, N=1613
F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative Perception HSR, F6: Useful Travel Time Important

For the youngest three age categories (18 to 25, 26 to 35 and 36 to 45) the perceived importance of comfort does not differ significantly. Beyond these age groups, the importance of comfort increases continually by each group on the age scale. The importance of useful travel time (F6) shows a significant curvilinear association with age, increasing between the 18 to 25 age group and the 26 to 35 group, after which the attitude mean rank declines significantly, and at increasing intervals. Plots for the four significant factors indicated a degree of linearity, although there were deviations and an element of curvilinearity in F4 and F6 particularly. To reduce the potential for a Type I error, Bonferroni tests were made on the Mann-Whitney tests on the pairs of age groups to ascertain the significance of differences between these for the four significant attitude

factors. As there are six age groups, the number of Pairwise comparisons is 15. The Pairwise comparisons are shown in Appendix E, Table E1. The results of the Pairwise comparisons indicate a curvilinear association for F1, and particularly for F4 and F6, while F3 appears to indicate a linear association with age.

4.4.2 *Attitudes to long distance travel and high speed rail, occupation differences*

Differences in attitudes were predicted between occupation categories. Unlike age, occupation is a nominal variable, whilst Siegel and Castellan Jr. (1988) have suggested that socioeconomic classifications can be ordinal, more modern occupations are difficult to categorise this way as there are status and pay issues which would yield different orders, thus the classification is nominal in this study. As stated in the methodology chapter, occupational categories C2 and D are merged into 'Manual' (C2/D).

Table 4.6 summarises the results of the Kruskal-Wallis test for differences in attitudes to long distance travel and high speed rail by occupation. F1 (Travel Security Concerns), F2 (Unsustainable Transport Improvements), F4 (Comfort importance) and F6 (Importance of Useful Travel time) differ significantly between occupation categories. However, neither F3 (Perceived prestige of HSR), nor F5 (Negative attitudes to HSR) differ significantly by occupation.

Table 4.6: Kruskal-Wallis one-way analysis of variance between attitudes and occupation category, summary table of statistics

Occupation	*N*	Attitude factor (mean rank)					
		F1	F2	F3	F4	F5	F6
A	114	762.34	812.66	820.93	820.51	754.73	951.57
B	797	721.09	698.99	772.54	738.46	791.91	840.33
C1	214	900.96	871.38	783.34	800.28	736.24	730.77
C2/D	56	937.21	1026.97	809.37	857.36	809.71	610.67
Student	172	691.28	783.05	820.32	687.93	756.23	857.71
Retired	204	917.14	904.37	733.08	947.16	797.74	473.38
χ^2		61.93	67.90	5.04	45.30	4.03	144.14
p		<.001	<.001	*ns*	<.001	*ns*	<.001

Notes: df=5,
F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR Prestige, F4: Comfort Important, F5: Negative Perception HSR, F6: Useful Travel Time Important
A=Upper Managerial and Professional B= Middle Managerial and Professional
C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students
R= Retired and Part Retired

H1 is accepted for attitudes to long distance travel (F1, F2, F4 and F6) and is rejected for attitudes to high speed rail (F3 and F5). Table 4.7 shows the attitude means for the

six attitude factors by occupation category. The means confirm the presence of significant differences in attitudes between occupation categories. The means in Table 4.7 show that F1: Travel Security Concerns are greater for those in manual occupations (C2/D), those in junior managerial and professional occupations (C1), and retired participants. F1: Perceived Travel Security Concerns were least for Students, followed by those in middle managerial and professional occupations (B) and those in upper managerial and professional occupations (A).

Table 4.7: Table of means for attitude factors, by occupation category

Age category	Attitude factor means (standard deviations)					
	F1	F2	F3	F4	F5	F6
A	3.21 (1.09)	3.38 (1.01)	5.47 (1.05)	4.92 (0.73)	4.28 (0.85)	5.83 (1.08)
B	3.10 (1.00)	3.11 (0.98)	5.32 (1.18)	4.77 (0.74)	4.33 (0.87)	5.52 (1.25)
C1	3.53 (1.01)	3.49 (0.97)	5.36 (1.14)	4.88 (0.84)	4.21 (0.87)	5.21 (1.35)
C2/D	3.61 (1.18)	3.90 (1.09)	5.30 (1.50)	4.92 (0.84)	4.37 (1.08)	4.83 (1.44)
Student	3.05 (1.00)	3.29 (0.95)	5.46 (1.12)	4.69 (0.74)	4.23 (0.92)	5.55 (1.30)
Retired	3.56 (1.02)	3.57 (1.02)	5.17 (1.32)	5.13 (0.69)	4.35 (0.91)	4.32 (1.49)

Notes: df=5, N=1557
F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR Prestige, F4: Comfort Important, F5: Negative Perception HSR, F6: Useful Travel Time Important
A=Upper Managerial and Professional B= Middle Managerial and Professional
C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students
R= Retired and Part Retired

F2: Preference for Unsustainable Improvements to Transport was considerably greater for those in manual occupations (C2/D), while Students and those in Middle managerial and professional occupations (B) were the least agreeable. F4: Importance of Comfort was perceived to be more important to retired respondents and least important to students – this appears to link to the age differences identified in Table 4.5. For the remaining occupation categories, the perceived importance of comfort was similar. F6: Importance of Useful Travel Time was greatest for those in Upper managerial and professional occupations (A), followed by Students and those in Middle managerial and professional occupations (B). F6 was considered much less important for retired people compared with all other occupations except manual (C2/D).

Pairwise comparisons were made between the six occupation categories (15 comparisons) for the four significant attitude factors and are shown in Table E2, Appendix E. The results of the Kruskal-Wallis test, support H1 for all attitude factors relating to perceptions of long distance travel (F1, F2, F4 and F6), but not for the perceptions of high speed rail (F3 and F5).

4.4.3 A*ttitudes to long distance travel and high speed rail, gender differences*

A Mann-Whitney *U* statistic was used to identify differences in attitudes between gender groups. Table 4.8 shows the results of the Mann-Whitney *U* statistic, which supports H1 for F1, F3 and F6. Compared to males, females perceive travel security (F1) and the importance of useful travel time (F6) as being of greater importance. Perceived prestige of high speed rail (F3) is significantly greater for males than females.

Table 4.8: Mann-Whitney *U* statistic for differences in attitudes, by gender

	Attitude factor					
	F1	F2	F3	F4	F5	F6
Male (mean rank)	775.63	812.35	845.49	787.11	817.28	743.39
Female (mean rank)	848.00	794.24	745.72	831.19	787.03	895.20
Z	-3.07	-0.77	-4.24	-1.87	-1.29	-6.50
p	.002	*ns*	<.001	*ns*	*ns*	<.001

Notes: df=5, N=1609
F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative Perception of HSR, F6: Useful Travel Time Important

Gender differences between attitudes by age group

A Kruskal-Wallis test was used to determine the presence of any gender differences between attitudes to long distance travel and high speed rail, by age group. Table 4.9 shows the results of the Kruskal-Wallis test, and the mean ranks for each of the attitude factors by age group and split by gender. Table 4.9 shows that the same attitude factors remain significantly different between age groups, for both genders. As a caveat, it should be noted that the genders in the Kruskal-Wallis test were unequal.

Table 4.9: Kruskal-Wallis test for differences in attitudes by age group, split by gender

Age group	Gender	*N*	Attitude factor					
			F1	F2	F3	F4	F5	F6
18 to 25 years	Male	92	408.62	468.31	548.40	428.50	501.17	492.51
	Female	45	353.24	364.82	323.10	313.72	288.17	331.12
26 to 35 years	Male	150	406.70	451.42	513.43	440.02	502.36	549.54
	Female	196	285.00	313.28	365.19	291.98	343.58	362.97
36 to 45 years	Male	162	452.89	471.91	482.63	427.89	462.01	535.10
	Female	133	301.94	306.26	322.63	295.91	318.77	361.61
46 to 55 years	Male	208	479.74	483.42	453.26	463.89	487.18	503.02
	Female	136	332.58	326.59	317.33	358.30	313.32	314.29
56 to 65 years	Male	239	526.36	484.46	470.06	538.64	436.13	436.86
	Female	112	384.63	337.87	287.59	370.44	325.98	269.80
66 years and over	Male	102	559.11	499.96	414.76	536.91	516.71	305.04
	Female	31	429.27	410.39	294.76	406.77	377.58	207.52
Male	χ^2		33.53	2.44	15.89	28.12	10.22	65.67
	p		<.001	ns	.007	<.001	ns	<.001
Female	χ^2		32.65	10.90	14.35	25.85	6.75	35.87
	p		<.001	ns	.014	<.001	ns	<.001

Notes: df=5, N=1606, Male total N=953, Female total N=653
F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative Perception of HSR, F6: Useful Travel Time Important

A two-way parametric ANOVA of attitudes by age and gender, identified significant differences between genders were present between F1: Travel security concerns, F3: Perceived prestige of high speed rail, F4: Comfort and F6: Importance of useful travel time (Table 4.10). This confirms the results of the Kruskal-Wallis one-way analysis of variance (Table 4.9) as significant differences in attitudes by age are present for F1, F3, F4 and F6, while significant differences between genders are present for the same attitude factors. None of the interactions are significant, indicating parallel relationships for both genders. Table 4.10 shows that F1: Travel Security Concerns increase with age for both genders, with females perceiving these to be more important, compared with males, in all age groups.

Table 4.10: ANOVA of attitudes with age and gender effects, including means

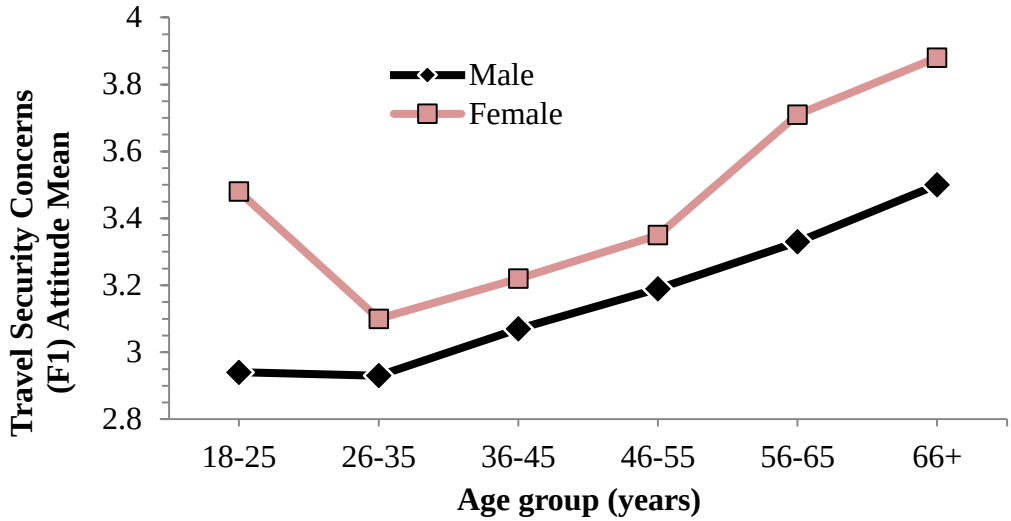
Age group	Gender	*N*	Attitude factor					
			F1	F2	F3	F4	F5	F6
18 to 25 years	Male	92	2.94	3.29	5.72	4.64	4.40	5.22
	Female	45	3.48	3.46	5.26	4.78	4.09	5.64
26 to 35 years	Male	150	2.93	3.23	5.58	4.72	4.39	5.48
	Female	196	3.10	3.21	5.44	4.77	4.31	5.86
36 to 45 years	Male	162	3.07	3.30	5.45	4.71	4.26	5.43
	Female	133	3.22	3.16	5.20	4.78	4.29	5.85
46 to 55 years	Male	208	3.19	3.38	5.29	4.77	4.41	5.27
	Female	136	3.35	3.25	5.15	5.01	4.26	5.54
56 to 65 years	Male	239	3.33	3.35	5.35	4.97	4.23	4.87
	Female	112	3.71	3.31	4.95	5.09	4.29	5.24
66 years and over	Male	102	3.50	3.41	5.08	5.00	4.45	4.20
	Female	31	3.88	3.65	5.02	5.23	4.45	4.74
Age	*F*		12.19	1.89	4.79	9.26	1.08	18.69
	p		<.001	*ns*	<.001	<.001	*ns*	<.001
Gender	*F*		24.86	0.06	11.67	10.44	2.01	26.80
	p		<.001	*ns*	.001	.001	*ns*	<.001
Interaction	*F*		1.18	0.90	0.83	0.76	1.05	0.22
	p		*ns*	*ns*	*ns*	*ns*	*ns*	*ns*

Notes: ns= Not significant N = 1606,
F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative Perception of HSR, F6: Useful Travel Time Important

The association between F1 and age is curvilinear for females, with F1 attitudes greater for younger and older respondents, than those in middle age categories (Figure 4.1). F3: Perceived prestige of high speed rail decreased as age increased, and males perceived high speed rail as more prestigious compared to females across all age groups (See Figure E7, Appendix E). F4: Importance of comfort increased with age, more so in the upper age groups. Compared to males, females considered the importance of comfort to be greater in all age categories (Figure E8, Appendix E). F6: Importance of useful travel time was consistently perceived to be more important to females compared with males. A curvilinear association between F6 and age was identified for both genders, as

younger and older respondents considered F6 less important compared with those in the middle age categories (Figure E9, Appendix E).

Figure 4.1: Travel Security Concerns (F1) attitude mean by age and gender



Gender differences between attitudes by occupation category

The Kruskal-Wallis test for differences indicated that attitudes to long distance travel were significantly different between occupations in both genders (F1, F2, F4 and F6). Perceived prestige of high speed rail (F3) did not differ significantly by occupation, while negative attitudes to high speed rail (F5) differed significantly by occupations for females, but not for males (Table 4.11)

Table 4.11: Kruskal-Wallis test for differences in attitudes by occupation, split by gender

			Factor					
Occupation	Gender	*N*	F1	F2	F3	F4	F5	F6
A	Male	72	435.54	506.16	474.74	520.22	468.49	583.97
	Female	42	327.40	294.90	335.05	292.58	274.35	362.87
B	Male	461	428.60	411.29	465.53	431.46	469.21	502.49
	Female	330	286.53	284.23	304.00	302.11	317.72	332.48
C1	Male	106	507.70	489.25	464.73	450.69	427.14	450.04
	Female	108	373.10	370.25	321.54	334.01	304.34	267.09
C2/D	Male	46	566.32	608.95	461.90	495.14	469.76	378.34
	Female	10	376.15	397.65	346.85	403.45	351.85	274.85
Student	Male	84	426.63	494.90	486.75	408.66	481.74	489.13
	Female	88	263.36	295.88	335.71	272.28	281.77	347.17
Retired	Male	155	533.55	515.23	433.30	555.58	451.37	306.21
	Female	46	423.08	409.08	279.77	411.87	379.29	171.66
Male	χ^2		30.71	41.16	2.78	32.83	2.95	85.36
	p		<.001	<.001	*ns*	<.001	*ns*	<.001
Female	χ^2		44.47	35.83	5.02	24.08	11.95	47.19
	p		<.001	<.001	*ns*	<.001	.035	<.001

Notes: df=5, Male total N=924, Female total N=624,
Occupations: A=Upper Managerial and Professional B= Middle Managerial and Professional C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students R= Retired and Part Retired. / Attitude factors: F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative perception of HSR, F6: Useful Travel Time Important

It is noticeable in Table 4.11, that the females in the manual occupations group (C2/D) are an extremely low count (N=10), and this could be a source of error. Merging the C2/D and C1 categories to overcome the low female count in manual occupations does not alter the overall significance of the results of the Kruskal-Wallis between attitudes and occupation, for males or females (Table 4.12). Thus, it remained the case that attitudes F1, F2, F4 and F6 did not differ significantly by occupations in both genders, while F3 did not differ significantly by occupation, while F5 differed for females, but not for males.

Table 4.12: Kruskal-Wallis test for differences in attitudes by occupation (with merged C1 and C2/D categories), split by gender

			Factor					
Occupation	Gender	*N*	F1	F2	F3	F4	F5	F6
A	Male	72	435.54	506.16	474.74	520.22	468.49	583.97
	Female	42	327.40	294.90	335.05	292.58	274.35	362.87
B	Male	461	428.60	411.29	465.53	431.46	469.21	502.49
	Female	330	286.53	284.23	304.00	302.11	317.72	332.48
C1/C2/D	Male	152	525.44	525.47	463.88	464.14	440.04	428.34
	Female	118	373.36	372.58	323.68	339.89	308.37	267.75
Student	Male	84	426.63	494.90	486.75	408.66	481.74	489.13
	Female	88	263.36	295.88	335.71	272.28	281.77	347.17
Retired	Male	155	533.55	515.23	433.30	555.58	451.37	306.21
	Female	46	423.08	409.08	279.77	411.87	379.29	171.66
Male	χ^2		29.17	34.70	2.78	31.94	2.13	83.01
	p		<.001	<.001	*ns*	<.001	*ns*	<.001
Female	χ^2		44.47	35.62	4.84	22.72	11.31	47.17
	p		<.001	<.001	*ns*	<.001	.023	<.001

Notes: df=4, Male total N=924, Female total N=624,
Occupations: A=Upper Managerial and Professional B= Middle Managerial and Professional C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students R= Retired and Part Retired,
Attitude factors: F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative perception of HSR, F6: Useful Travel Time Important

The two-way parametric ANOVA of attitude differences between occupations and genders indicated that attitudes to long distance travel (F1, F2, F4 and F6) differed significantly by occupation, while attitudes to high speed rail did not (F3 and F5). Significant differences between genders in each occupation group were present for F1, F4 and F6, but not the remaining factors. No significant interactions between age and occupation were present (Table 4.13).

F1: Travel Security Concerns were greater for females compared to males, with retired females most concerned, and males in A, B and student occupations least concerned. F2: Unsustainable Transport Improvements did not differ significantly by gender, though retired and manual respondents were most agreeable with F2, while those in A, B and

Student occupations were less agreeable. F4: Importance of comfort was greater for females in all occupations except A, and was considered most important for females in manual occupations, and the retired in both genders. F4 was considered comparatively

Table 4.13: ANOVA of attitudes with occupation and gender effects, including means

Occupation		Attitude factor					
		F1	F2	F3	F4	F5	F6
A	Male	3.08	3.48	5.52	4.99	4.38	5.73
	Female	3.43	3.21	5.38	4.80	4.11	6.01
B	Male	3.04	3.13	5.44	4.73	4.35	5.34
	Female	3.17	3.09	5.17	4.84	4.31	5.78
C1	Male	3.36	3.42	5.41	4.77	4.20	5.04
	Female	3.70	3.55	5.31	5.00	4.23	5.37
C2/D	Male	3.59	3.95	5.25	4.86	4.39	4.68
	Female	3.69	3.68	5.55	5.24	4.25	5.50
Student	Male	3.06	3.43	5.53	4.65	4.39	5.29
	Female	3.03	3.16	5.39	4.72	4.08	5.80
Retired	Male	3.45	3.52	5.22	5.08	4.31	4.32
	Female	3.99	3.74	5.05	5.31	4.52	4.59
Occupation	*F*	14.96	12.26	1.55	9.46	1.35	23.71
	p	<.001	<.001	*ns*	<.001	*ns*	<.001
Gender	*F*	8.60	1.17	0.77	5.33	1.52	19.47
	p	.003	*ns*	*ns*	.021	*ns*	<.001
Interaction	*F*	1.75	1.69	0.52	1.52	1.80	0.33
	p	*ns*	*ns*	*ns*	*ns*	*ns*	*ns*

Notes: ns= Not significant N = 1548, Occupations: A=Upper Managerial and Professional
B= Middle Managerial and Professional C1= Junior Managerial and Professional C2/D= Manual
S= Full and Part-time students R= Retired and Part Retired
Attitude factors: F1: Travel Security Concerns, F2: Unsustainable Transport Improvements, F3: HSR prestige, F4: Comfort Important, F5: Negative Perception of HSR, F6: Useful Travel Time Important

less important to Students in both genders. F6: Importance of useful travel time was more important for females compared with males, and for those in A and B occupations, plus students. F6 was least important for retired males and females. Neither Perceived prestige of high speed rail (F3) nor Negative attitudes to high speed rail (F5) differed significantly by gender or occupation.

4.4.4 Summary of demographic hypotheses

The results support the partial acceptance of H1 with the following caveat; Attitudes to long distance travel (F1, F4 and F6) and high speed rail (F3) differed significantly by age, while F2 and F5 did not. For occupation there was a significant difference in attitudes to long distance travel (F1, F2, F4 and F6), but not for attitudes to high speed rail (F3 and F5). Gender differences were present for F1, F3 and F6. H2 is partially accepted, as environmental conscience (represented by F2) differs significantly for occupation but not for age or gender. F2 comprises issues relating to the environment

and sustainability, with preference for development and expansion of road and aviation alongside perceived environmentally friendly behaviour and willingness-to-pay for environmental costs. As such, F2 can test respondents' environmental conscience.

4.5 Attitudes and perceptions: Travel behaviour

The following travel behaviour associations with attitudes to long distance travel and perceptions of high speed rail are hypothesised;

H3– Previous travel behaviour is associated with attitudes towards high speed rail.

H4– Attitudes to long distance travel and high speed rail will be associated with regularity of travel such as commuting.

H5– Attitudes to long distance travel and high speed rail will be associated with possession of travel discounts.

H6– Attitudes towards high speed rail will be associated with the time since respondents last had to stay overnight on a journey.

4.5.1 Differences in attitudes to long distance travel and high speed rail by previous long distance (>50 miles) travel behaviour.

H3 predicts that respondents' attitudes and perceptions of long distance travel and high speed rail will differ significantly by previous long distance travel behaviour. To do this, the 'time elapsed' values were calculated as described in Chapter Three, for all four modes. 1680 out of 1799 respondents provided data of the time elapsed in months since the most recent long distance rail trip. These data follow Poisson distributions for all four travel modes, as the greatest number of responses were within previous months. These distributions can be found in Appendix E (Figures E10 to E13). Table 4.14 provides the descriptive statistics for the time elapsed variable of the four modes. The mean time elapsed was greatest for coach, and 33.8% of the sample did not provide a time elapsed value for coach, compared to around 5% for the other modes. The time elapsed variable for coach is difficult to analyse, and is therefore used sparingly.

Table 4.14: Descriptive statistics for time elapsed variable.

Mode	Mean (time elapsed in weeks)	*N*	% of total sample
Time elapsed since last long distance rail trip	12.34	1680	93.39
Time elapsed since last long distance air trip	20.44	1708	94.94
Time elapsed since last long distance car trip	4.67	1688	93.83
Time elapsed since last long distance coach trip	74.29	1191	66.20

Notes: Sample N=1799

Associations between the attitude factors and the time elapsed since the most recent long distance trip by rail, air, car or road

To test H3, time elapsed for each mode was correlated with the attitude factors using a Spearman's rho (r_s), as shown in Table 4.13. Due to the large sample of responses tested, it is possible that some of the statistically significant effects are too small to draw conclusions from. Morris and Fritz (2013) note that almost any effect will become significant if a very large sample is tested, and this should be noted throughout these results. As Table 4.13 shows, some of the highly significant effects are low r_s values, indicating potential effect size issues.

Table 4.15 indicates several associations between attitude and time elapsed since the most recent long distance trip by rail. Those that had travelled long distance more recently by rail were less concerned about travel security (F1), were less favourable to making unsustainable transport improvements (F2) and perceived comfort to be less important (F4). More recent long distance travellers by air were also less concerned about travel security, but more concerned about making use of their travel time (F6). Recent long distance trip-makers by car held inverse attitudes to recent trip makers by rail. They were more concerned about travel security (F1), more supportive of unsustainable transport improvements (F2) and perceived comfort to be more important (F4). For coach travellers, those that had travelled long distance more recently, perceived the importance of useful travel time (F6) to be greater.

Table 4.15 Spearman's rho correlations between attitude and time elapsed since the most recent long distance trip by mode

Attitude factor	Mode							
	Rail		Air		Car		Coach	
	r_s	*p*	r_s	*p*	r_s	*p*	r_s	*p*
F1: Security	.220	<.001	.168	<.001	-.101	<.001	.070	.016
F2: Unsustainable	.295	<.001	-.044	*ns*	-.215	<.001	.035	*ns*
F3: HSR Prestige	-.098	<.001	-.048	.046	-.002	*ns*	-.044	*ns*
F4: Comfort	.225	<.001	.061	.012	-.138	<.001	.092	.001
F5: HSR Negative	-.008	*ns*	.048	.048	.045	*ns*	-.001	*ns*
F6: Useful	-.077	.002	-.270	<.001	.027	*ns*	-.141	<.001
	N = 1680		*N = 1708*		*N = 1688*		*N = 1191*	

Notes: ns= Not significant r_s=Spearman's rho correlation coefficient

Summary

H3 is partially accepted as the correlations confirm some associations between attitudes to high speed rail and time elapsed since the most recent trip by mode, particularly by rail. However, this may be indicative of an effect size issue. F5 is not associated with time elapsed at all.

4.5.2 Previous travel behaviour and demographics

As relationships between the attitude factors were analysed separately for the demographic and the time elapsed effects, it is possible that the travel behaviour (time elapsed) associations with attitudes to long distance travel behaviour might be linked to demographic differences. Kruskal-Wallis tests were used to determine differences between age categories as it was expected that there would be a curvilinear association between age and attitude. However, while this was true for F6: Importance of useful travel time in particular, the attitude mean ranks do indicate that correlations might be present. Age is positively correlated with time elapsed since the most recent long distance trip by rail (r_s=.206, p=<.001), coach (r_s=.202, p=<.001), and also by air (r_s=.097, p=<.001), though an effect size issue is possible. As age increases, time elapsed since the most recent long distance trip by those modes also increases. However, for car the negative correlation between time elapsed and age indicates that as age increases, time elapsed decreases (r_s=-.115, p=<.001)

4.5.3 Long distance commuting associations with respondent attitudes

H4 predicts that attitudes to long distance travel and high speed rail will be associated with regularity of travel such as commuting. Long distance commuting is a key element of travel behaviour for this research, providing an indication of regularity of long distance travel and a different trip purpose. Commuting was intended to refer to repeating the same long-distance trip at frequent and regular intervals, for example travelling over 50 miles by rail at a daily interval, or travelling by air at a weekly interval. However, due to ambiguous wording, and using 'intercity' rather than the 'over 50 miles' definition, the responses may not measure as intended. Respondents may believe intercity to refer only to long-distance trips between cities – which is not the intended measure. Furthermore, respondents may recall the intercity brand and only consider trips on routes that were formally operated by intercity under British Rail. This was not the intended definition, which was to refer to any trip on any type of train, between locations in rural areas and/or cities, of over 50 miles in length.

Whether respondents' familiarity with long distance travel through cognition of travelling regularly over long distances changes their attitudes significantly, is of interest to hypothesis H4. Mann-Whitney *U* tests were performed to determine whether attitudes to long distance travel and high speed rail were consistent between commuters

and non-commuters, or whether attitudes were associated with commuting behaviour. These results are shown in Table 4.16.

Table 4.16: Mann-Whitney *U* tests of attitude association with commuting

Attitude			Attitude mean rank	
	Z	*p*	Comm.	Non Comm.
F1: Travel Security Concerns	-2.41	.016	720.33	834.99
F2: Unsustainable transport improvements	-2.97	.003	695.67	836.71
F3: Perceived prestige of HSR	-0.42	*ns*	845.99	826.21
F4: Comfort Important	-4.35	<.001	634.25	841.00
F5: Negative attitudes to HSR	-0.77	*ns*	861.52	825.12
F6: Useful Travel Time	-2.83	.005	952.31	818.78
			N = 108	*N* = 1546

Notes: Significance is two-tailed, ns = Not significant

Table 4.16 indicates that the attitude factors relating to long distance travel are associated with whether a respondent is a commuter or not. Compared to commuters, non-commuters rate travel security (F1) and comfort (F4) as more important, and useful travel time as less important (F6). Commuters are also more concerned about sustainability (F2), while neither prestige nor negative attitudes to high speed rail (F3 and F5) differed significantly between the groups. When commuters were segmented to those that commuted long distance by rail on a daily basis (*N*=100), and those that commuted weekly by air (*N*=8), there were no statistically significant differences between the two commuting types in any of the attitude factors. Therefore, attitudes are not associated with the type of commuting.

H4 is accepted for associations between attitudes F1, F2, F4 and F6 and commuting behaviour, but is rejected for F3 and F5. Between types of commuting, H4 is rejected for all attitude factors. However, as referenced above, it is possible that the results do not measure long-distance commuting as intended, and any findings must therefore acknowledge this limitation.

4.5.4 Travel discount associations with respondent attitudes

During the focus groups, fare was identified as a particularly important issue for respondents in respect of long distance travel. H5 predicts that attitudes to long distance travel and high speed rail will be associated with personal possession of a travel discount. To compare attitudes to long distance travel and high speed rail between the two groups (those with discounts and those without) Mann-Whitney *U* tests were used; the results are shown in Table 4.17.

Table 4.17: Mann-Whitney *U* tests of attitude association with possession of travel discounts or free travel privileges

Attitude	*Z*	*p*	Attitude mean rank	
			Discount	No discount
F1: Travel Security Concerns	-4.82	<.001	823.80	945.65
F2: Unsustainable transport improvements	-10.01	<.001	741.74	994.82
F3: Perceived prestige of HSR	-3.87	<.001	961.14	863.37
F4: Comfort Important	-6.86	<.001	791.47	965.02
F5: Negative attitudes to HSR	-1.22	*ns*	919.22	888.48
F6: Useful Travel Time	-1.26	*ns*	880.22	911.85
			N = 674	*N* = 1125

Notes: Significance is two-tailed, ns = Not significant

The results of the Mann-Whitney *U* tests indicate significant differences in attitudes F1, F2, F3 and F4 between those in possession of travel discount, and those without. Possession of a travel discount did not result in significant differences in F5 or F6.

Table 4.17 shows that travel security (F1) and comfort (F4) are more important to those with no travel discount, while the perceived prestige of high speed rail (F3) is significantly greater for those respondents in possession of a travel discount, compared to those without. Favourability for unsustainable transport improvements (F2) is significantly higher for those without a travel discount, and the difference between the mean ranks is the largest for any attitude factor.

The results of the Mann-Whitney *U* tests indicate that attitudes to long distance travel and high speed rail varied significantly between those with and those without travel discounts for all factors except F5 (negative attitudes to high speed rail) and F6 (importance of useful travel time). For F1, F2, F3 and F4 statistically significant differences between those with or without travel discounts are present, and it is therefore possible to accept H5 for these attitude factors, supporting the presence of differences between groups. However, for F5 and F6 the lack of significant differences between groups means that H5 must be rejected.

4.5.5 Association between attitudes and last overnight stay

Long distance trips can sometimes require an overnight stay, especially if it is not reasonable or possible to make a return trip in the same day. H6 predicts an association between attitudes to high speed rail and the time elapsed since respondents last had to stay overnight on a journey. The predicted association is that those who have more recently stayed overnight would perceive the potential introduction of a high speed rail service more positively.

To test H6, respondents were asked to indicate the month and year when they had last been unable to complete a return trip in a single day (i.e. it had not been their choice to stay overnight) and a time elapsed in months value was calculated. The majority of the 1,282 respondents to the question had stayed overnight within the last 24 months, thus the distribution was Poisson, as Figure E14 shows in Appendix E.

Spearman's correlation statistics indicated that time elapsed since the most recent required overnight stay was significantly associated with F3 (r_s=-.073, p=.009), but not with F5 (r_s=.050, p=.072). However, it should be noted that the low correlation coefficient for F3 may indicate an effect size issue. These results indicate a pattern of declining perceived prestige of high speed rail (F3) as time elapsed since the most recent required overnight stay increases. When split by gender, the association between time elapsed since the most recent required overnight stay and F5 was not significant for either gender. For F3, the association was significant for females only (r_s=-.130, p=.005), while the correlation for males was not significant, perhaps indicating a curvilinear association.

The results confirm H6 as perceived prestige of high speed rail (F3) is significantly associated with time elapsed since the most recent required overnight stay. As time elapsed increases, perceived prestige of high speed rail decreases. However, H6 can only be accepted for female respondents, as the association between F3 and time elapsed since the most recent required overnight stay was not significantly correlated for males. Negative attitudes to high speed rail (F5) were not significantly associated with time elapsed since the most recent required overnight stay overall, or for both males and females.

4.6 Situational effects on attitudes to high speed rail

H7 predicts geographic differences will differentiate respondent's attitudes to high speed rail, and that these will exist in the context of the proposed HS2 high speed rail project. At the time of data collection, the route of the first stage of HS2 had been announced, as well as the locations of the proposed stations. It should be noted that these may have changed since these data were collected, and this will be considered in the conclusion chapter. Respondents were likely to be aware of the potential route and

station locations given the considerable media coverage the scheme received prior to and during data collection (see Chapter Two). Knowledge of the planned HS2 route might affect attitudes to high speed rail, as perceptions that such a scheme is in the national interest may be tempered by the knowledge that one might be affected by such a scheme, for example through NIMBYism (Landale, 2011). The hypotheses in this section are as follows;

H7: Proximity of living to a station on the proposed HS2 route is directly related to perceived benefits;
H8: Proximity of living to the HS2 route is inversely related to attitudes to high speed rail;
H9: Attitudes and perceptions towards high speed rail will differ by situational factors such as the respondent's region.

4.6.1 Proximity to HS2 station, relationship with attitudes

The termini of HS2 route announced at the time of data collection were Curzon Street in Birmingham and Euston Station in London. Testing H7 involved determining whether the distance respondents live from those stations was significantly related with perceived prestige of high speed rail (F3) and negative attitudes to high speed rail (F5). As previous experience suggests that benefits accrue to the access points to a high speed rail line (Martínez Sánchez-Mateos and Givoni, 2011), H7 predicts diminishing perceived prestige (F3) and increasingly negative attitudes (F5) towards high speed rail, with increasing distance from these access points (stations). As this relationship is predicted to be linear, a Spearman's rho correlation statistic was used. Distance was measured incrementally in a radius of 50 miles from a centroid at Euston station, and 50 miles from a centroid at Curzon Street – as the distance between London and Birmingham is approximately 100 miles, this means there is no overlapping.

Correlations between distance from a HS2 station and F3 were not significant for Curzon Street (r_s=-.091) or Euston (r_s=-.028), nor for F5 and distance from a HS2 station for both Curzon Street (r_s=-.043) and Euston (r_s=.021). No linear association is present between distance from the proposed HS2 stations at Birmingham and London Euston as hypothesised, however it was possible that a curvilinear correlation might be present. To test this, a Kruskal-Wallis analysis of variance was performed between

distance from a HS2 station and attitudes to high speed rail, the results of which are in Table 4.18.

Table 4.18: Kruskal-Wallis analysis of variance between attitudes to high speed rail and radial distance from a HS2 station.

Distance from HS2 station	Attitude Factor and HS2 station (Mean ranks)					
	Curzon Street (Birmingham)			Euston Station (London)		
	N	F3	F5	*N*	F3	F5
Less than 5 miles	16	91.28	69.69	68	200.05	184.19
Between 5 and 10 miles	16	68.09	88.31	66	183.33	177.10
Between 10 and 20 miles	24	86.50	75.94	53	193.16	204.03
Between 20 and 30 miles	23	64.78	82.41	67	167.74	182.56
Between 30 and 40 miles	36	78.50	71.15	52	206.32	203.89
Between 40 and 50 miles	36	70.39	74.13	69	182.50	183.17
Chi square (χ^2)		6.11	2.64		5.17	3.37
p		*ns*	*ns*		*ns*	*ns*

Notes: df=5, ns=not significant, F3=Perceived prestige of HSR, F5=Negative attitudes to HSR

The results in Table 4.18 indicate that perceived prestige of (F3) and negative attitudes to (F5) high speed rail, do not differ significantly by distance from either HS2 station. The mean ranks also confirm that there is no relationship between attitude and distance from the station, as the mean ranks decrease and increase inconsistently by incremental increases in distance. H7 is therefore rejected, as no significant association was found between distance from a HS2 station and attitudes to high speed rail (F3 and F5).

4.6.2 Effect of proximity to HS2 on attitudes to high speed rail

H8 predicts that proximity of living to the HS2 route is inversely related to attitudes to high speed rail. Postcodes through which HS2 will pass were identified, and those residing in affected postcodes (contiguous) were compared with the remaining respondents in non-contiguous postcodes using Mann-Whitney *U* tests for F3 and F5 (Table 4.19).

Table 4.19: Mann-Whitney *U* test of attitude association with proximity to the proposed HS2 route

Attitude	*Z*	*p*	Attitude mean rank	
			Contiguous	Non-contiguous
F3: Perceived prestige of HSR	-1.46	*ns*	600.03	705.40
F5: Negative attitudes to HSR	-2.47	.013	877.22	698.94
			N = 32	*N* = 1373

Notes: Significance is two-tailed, ns = Not significant

The results of the Mann-Whitney *U* test indicate statistically significant differences by proximity to HS2 for F5, but not for F3. Negative attitudes to high speed rail are significantly greater for those in postcodes contiguous to HS2. H8 can be supported for

F5 as negative attitudes to high speed rail are greater for those in close proximity to HS2, though it is not supported for perceived prestige of high speed rail (F3). A caveat for the Mann-Whitney *U* test is that there is a low *N* for contiguous postcodes, and a larger number of responses in that group might have meant greater significance. Despite this caveat, the results indicate that negative attitudes are more strongly associated with proximity to the HS2 route compared with positive attitudes.

4.6.3 Situational differences in attitudes to high speed rail

HS2 is proposed to link London to Birmingham in its initial phase of development, then later to continue northwards to serve Manchester and Liverpool in the North West, and Sheffield and Leeds in Yorkshire. Services are planned to connect to regions beyond the high speed line, while the route will not serve some regions. The benefits from HS2 are likely to decrease further away from the route, and in some regions such as Wales and South West England benefits are likely to be very limited. H9 therefore predicts that attitudes and perceptions of high speed rail will differ significantly by region. Respondents were organised by postcode into the 11 European Union regions in Great Britain (see Figure 4.2 for this distribution). A Kruskal-Wallis one-way analysis of variance was used to test differences in attitudes to high speed rail, by region (Table 4.20). While F5 attitudes did not differ by region, F3 attitudes did, being greatest for London and the South East of England, followed by the North East of England, Scotland and Yorkshire. High speed rail was considered least prestigious in the East Midlands, South West of England and the West Midlands.

Table 4.20: Kruskal-Wallis one-way analysis of variance of attitudes to high speed rail, by region

Region of Great Britain	*N*	Attitude Mean ranks for HSR factors	
		F3: Perceived prestige	F5: Negative attitudes
Greater London	172	760.91	702.79
South East of England	212	745.38	681.81
North East of England	140	724.69	683.41
Scotland	127	692.25	665.92
Yorkshire and The Humber	111	689.21	675.86
Wales	50	686.67	668.30
East of England	126	651.53	672.80
North West of England	116	647.97	696.10
West Midlands	92	620.31	757.68
South West of England	114	617.54	621.46
East Midlands	108	579.32	705.69
	χ^2	28.35	7.47
	p	.002	*ns*

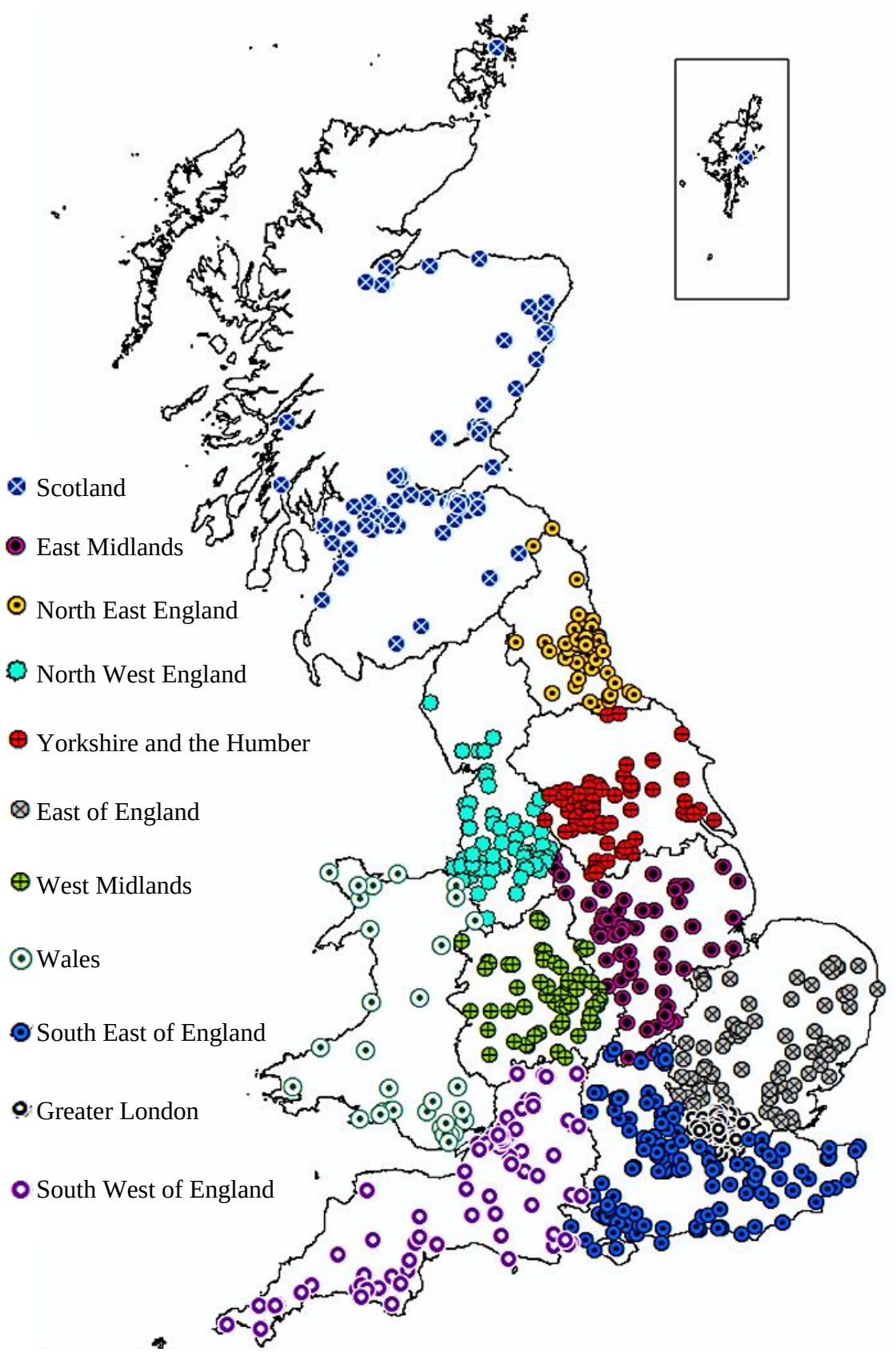
Notes: Regions ranked by descending order of F3 attitudes

The low F3 score in the West Midlands is unexpected as this is the region which will be linked to HS2 in the first phase of development. However, this might reflect the potential disruption caused by construction, or perceptions that HS2 might not have much impact on the region. F3 is greater for Wales and lower for the North West of England than expected. Low perceived prestige of high speed rail in Wales would be a reasonable expectation, as HS2 does not serve large areas of the country. Likewise, the North West of England is a destination of HS2, and high perceived prestige of high speed rail would be expected, as in Yorkshire and The Humber. Low respondent counts in Wales and the West Midlands might account for the low mean rank scores for F3. Negative attitudes to high speed rail (F5) did not differ by region and were consistent across the country. The region with the greatest F5 attitudes was the West Midlands, which is consistent with the low F3 value. However, as the sample population in some regions were unequal by age, it was possible that these differences might account for the regional attitudes differences.

A chi-squared cross-tabulation between age and region indicated a significant association between age and region (χ^2=113.89, p=<.001), indicating unequal age groups by region. The contingency coefficient indicated a significant association, but not at a particularly high level (C=.278, p=<.001).

Table 4.21 shows the mean age in each region of Britain, and indicates that the north east of England had the lowest average age, closely followed by Greater London, while the East Midlands had the greatest mean age. However, the region with the second greatest mean age was the south east of England, which had a high perceived prestige score (F3). Also, the West Midlands had the third lowest average age, but the third lowest perceived prestige of high speed rail.

Figure 4.2: Map of distribution of respondents by government region



Source of map: Ordnance Survey Boundary Line™ Data
Postcode data from: Ordnance Survey Code-Point Open (February 2013)

Table 4.21: Mean age by region of Great Britain

Rank	Region of Great Britain	*N*	*Mean age*	Standard deviation
1st	East Midlands	107	3.81	1.43
2nd	South East of England	211	3.79	1.43
3rd	Wales	49	3.78	1.56
=4th	East of England	125	3.71	1.31
=4th	North West of England	116	3.71	1.43
5th	Scotland	127	3.69	1.34
6th	South West of England	114	3.60	1.44
7th	Yorkshire and The Humber	110	3.51	1.57
8th	West Midlands	92	3.49	1.46
9th	Greater London	172	3.42	1.48
10th	North East of England	140	2.86	1.58

Notes: Regions ranked by mean age, Mean = 1=18-25 (years), 2=26-35, 3=36-45, 4=46-55, 5=56-65, 6=66 and over

This therefore suggests that the age profile for a region does not necessarily determine positive or negative perceptions of high speed rail, of that region.

Regional differences in attitudes to high speed rail, split by gender

Mann-Whitney *U* tests of differences between genders in perceived prestige of high speed rail (F3) by region were performed. The results in Table 4.22 indicate that significant differences between genders were present in the East of England and South East of England only, while for all other regions the differences were not significant. The Mann-Whitney *U* tests were repeated, to test for differences between genders in negative attitudes to high speed rail (F5), by region. No gender differences in negative attitudes to high speed rail were found in any of the regions (Table E4, Appendix E).

Table 4.22: Mann-Whitney *U* tests of gender differences in Perceived prestige of high speed rail (F3), between regions.

Region of Great Britain	Mann-Whitney *U* test		Attitude mean ranks			
	Z	*p*	*N*	Male	*N*	Females
East Midlands	-0.02	*ns*	65	54.05	42	53.92
East of England	-2.41	.016	73	68.40	50	52.66
Greater London	-1.47	*ns*	83	91.14	87	80.11
North East of England	-1.93	*ns*	80	76.21	60	62.88
North West of England	-0.88	*ns*	68	60.81	48	55.23
Scotland	-0.36	*ns*	83	64.85	44	62.40
South East of England	-2.79	.005	141	114.80	71	90.01
South West of England	-0.31	*ns*	66	57.81	47	55.86
Wales	-0.33	*ns*	29	25.55	20	24.20
West Midlands	-1.51	*ns*	58	49.71	34	41.03
Yorkshire and the Humber	-1.87	*ns*	79	59.63	32	47.05

Notes: df=10

A two-way parametric ANOVA was conducted between attitudes to high speed rail, regional location, and gender. The interaction between region and gender was not significant, while perceived prestige of high speed rail (F3) is significantly different by region (F=3.08, p=.001), and also between genders (F=8.79, p=.003). Negative attitudes to high speed rail (F5) were not significantly different by region, or between genders. Table 4.23 indicates that in all regions except the South West of England, F3 attitudes are greater for males than females. This confirms the presence of gender differences in F3 attitudes by region. Wales has a very low *N* for both male and females, and this should be considered in relation to these findings as a larger *N* would have improved the reliability for that region.

Table 4.23: Table of means for F3: Perceived prestige of high speed rail, between regions, split by gender

Region of Great Britain	Attitude means (and standard deviations)			
	N	Male	*N*	Females
East Midlands	65	5.06 (1.13)	42	4.87 (1.52)
East of England	73	5.38 (1.33)	50	4.95 (1.24)
Greater London	83	5.68 (1.06)	87	5.53 (0.96)
North East of England	80	5.60 (1.04)	60	5.29 (1.07)
North West of England	68	5.33 (1.19)	48	5.13 (1.15)
Scotland	83	5.30 (1.36)	44	5.28 (1.22)
South East of England	141	5.58 (1.32)	71	5.24 (1.11)
South West of England	66	5.08 (1.44)	47	5.10 (1.20)
Wales	29	5.44 (1.10)	20	5.23 (1.37)
West Midlands	58	5.16 (1.54)	34	4.88 (1.24)
Yorkshire and the Humber	79	5.38 (1.39)	32	5.11 (1.06)

Notes: df=10

4.6.4 Summary of attitude differences by situation

Proximity of living to a station on the proposed HS2 route was found to be unrelated to perceived benefits of high speed rail, thus rejecting H7. Negative attitudes to high speed rail (F5) were significantly greater for those in proximity to the HS2 route. However, perceived prestige of high speed rail (F3) was unrelated to proximity to the HS2 route, justifying the partial acceptance of H8. Significant interregional differences in perceived prestige of high speed rail (F3), but negative attitudes to high speed rail (F5) were consistent across all regions. H9 was therefore accepted for F3, but not F5. Differences between genders for F3 were significant when the regions were aggregated. However, when split by region, all but two regions indicated no significant attitude differences.

4.7 Willingness to pay for travel time reductions

The following hypothesised demographic effects on willingness to pay were tested;

H10A: Willingness-to-pay for travel time will be positively associated with attitudes to high speed rail,

H10B: The importance of useful travel time will be unrelated to willingness-to-pay for travel time reductions,

H10C: The association between attitudes and willingness-to-pay for the travel time savings will differ by trip length,

H10D: Willingness-to-pay will differ significantly by demographics,

H10E: Willingness-to-pay will be associated with previous travel behaviour.

4.7.1 Willingness-to-pay for travel time reductions by attitude

To ascertain associations between willingness-to-pay for travel time reductions and attitudes to long distance travel and high speed rail, Spearman's rho (r_s) correlation statistic were calculated. Willingness-to-pay had a higher count towards the lower end of the fare scale, signifying a Poisson distribution. Table 4.24 shows these results on four typical trips, one of three hours and another of one and-a-half hours duration, each by high speed rail (HSR) of differing speeds (including very high speed rail - VHSR). Significant correlations were found for all willingness-to-pay and attitude factors except F5 (Negative attitude to high speed rail). Table 4.24 shows clearly that willingness-to-pay for travel time savings is most strongly correlated with F3 for all four trip time savings. However, while this would be expected, the insignificance for F5 and willingness-to-pay is more surprising. The Importance of Useful Travel Time (F6) is significantly correlated with willingness-to-pay for all four trip time savings.

Table 4.24: Associations between willingness-to-pay for travel time savings and attitudes to long distance travel and high speed rail using Spearman's rho (r_s)

Attitude factor	3 hour trip, saving		1 ½ hours trip, saving	
	30 minutes	90 minutes	45 minutes	60 minutes
F1: Travel Security Concerns	-.012	-.101***	-.077**	- .119***
F2: Unsustainable transport	-.054*	-.056*	-.115***	- .104***
F3: Perceived prestige of HSR	.179***	.220***	.189***	.222***
F4: Comfort Important	-.046	-.051*	-.071**	-.076**
F5: Negative attitudes to HSR	-.026	-.037	-.035	-.049
F6: Useful Travel Time	.111***	.171***	.139***	.191***
N	*1568*	*1567*	*1560*	*1574*

*Notes: *** p=<.001, ** p=<.01, * p=<.05*

For the remaining attitude factors, the direction of the correlations with willingness-to-pay is consistent on both trips, and with the two possible trip time reductions for each.

However, level of association and significance are not consistent in all cases, and some potential exists for effect size issues.

Willingness-to-pay associations with attitudes and perceptions of high speed rail

H10A predicts that willingness-to-pay for travel time savings will be positively associated with attitudes to high speed rail. Perceived prestige of high speed rail (F3) is positively correlated with willingness-to-pay on both trips, and for both travel time reductions, indicating that as F3 attitudes increase, so does willingness-to-pay. Correlations between Negative attitudes to high speed rail (F5) and willingness-to-pay are non-significant, indicating no association. H10A is therefore accepted for F3, but cannot be accepted for F5.

Relationship between willingness-to-pay and importance of useful travel time

H10B predicts that F6: Importance of useful travel time will be unrelated to willingness-to-pay for travel time reductions. This hypothesis tests respondents' trade-off between useful time (while travelling) and trip time savings, by determining whether a low willingness-to-pay for travel time reductions is present as a result of considering useful travel time more important. The expectation is that individuals that prefer their travel time to be useful would not perceive reducing the travel time to be of great importance to them, thus their willingness-to-pay would be lower. In Table 4.24, it can be seen that F6 is positively correlated with willingness-to-pay on both trips and for both travel time reductions, indicating that those considering useful travel time to be more important, have a greater willingness-to-pay for the travel time savings. This does not support the prediction of H10B that those considering F6 to be of greater importance would not be willing-to-pay to reduce their travel time as they prefer to use their travel time productively. H10B cannot be accepted.

Attitudes and willingness-to-pay differences by trip length

H10C predicts that associations between attitudes and willingness-to-pay for the travel time savings made possible by high speed rail will differ significantly by trip length (travel time of trip). To test H10C, two Fisher *Z*-tests were conducted, one for the high speed rail travel time savings on both the three hour and one and-a-half hour trips and the other for the VHSR travel time savings on the same trips. Fisher *Z*-tests were then used to compare the high speed rail travel time reductions by the two initial trip times. The test was repeated to compare the VHSR travel time reductions between the two trip

times (three hours and one and-a-half hours). The Fisher *Z*-tests were all non-significant, indicating that the differences in the correlations between attitudes and willingness-to-pay did not differ by the initial length of trip. H10C cannot be confirmed and is rejected.

4.7.2 Willingness-to-pay for travel time reductions: Demographic differences

H10D predicts that willingness-to-pay will differ significantly by respondents' demographics, including age, gender, occupation and situation.

Willingness-to-pay: Age group differences

A Kruskal-Wallis analysis of variance was used to identify significant differences in willingness-to-pay for travel time savings by age group (see Table E5, Appendix E for full statistics). Significant differences in willingness-to-pay for travel time savings were present between age groups on three of the four trips. Willingness-to-pay for a saving of 45 minutes on a one and-a-half hour trip differed by age (χ^2=25.45, p=<.001), as did willingness to pay for a 60 minute saving on a one and-a-half hour trip (χ^2=38.13, p=<.001). On a three hour trip, willingness-to-pay differed between age groups for a 90 minute saving (χ^2=28.86, p=<.001), but not a 30 minute saving. Table 5.25 provides the mean willingness-to-pay for travel time savings on the four trips, for each age group. Willingness-to-pay for travel time savings is greatest in the 26 to 35 and 36 to 45 years age groups, and least in the older age groups. The base cost of the three hour trip is £100 with incremental fare rises of 10%, while the base cost of the one and-a-half hour trip is £50, again with incremental fare rises of 10%.

Table 4.25: Mean willingness-to-pay for travel time savings, split by age

Age group	30 minutes saved on 3 hour trip	45 minutes saved on 1½ hour trip	90 minutes saved on 3 hour trip	60 minutes saved on 1½ hour trip
18 to 25 years	106.18	56.14	121.24	61.69
26 to 35 years	106.47	57.53	123.20	63.08
36 to 45 years	106.70	57.48	123.62	62.82
46 to 55 years	105.97	56.22	120.45	60.76
56 to 65 years	105.33	55.60	118.68	59.80
66 years and over	105.60	54.96	115.32	58.62

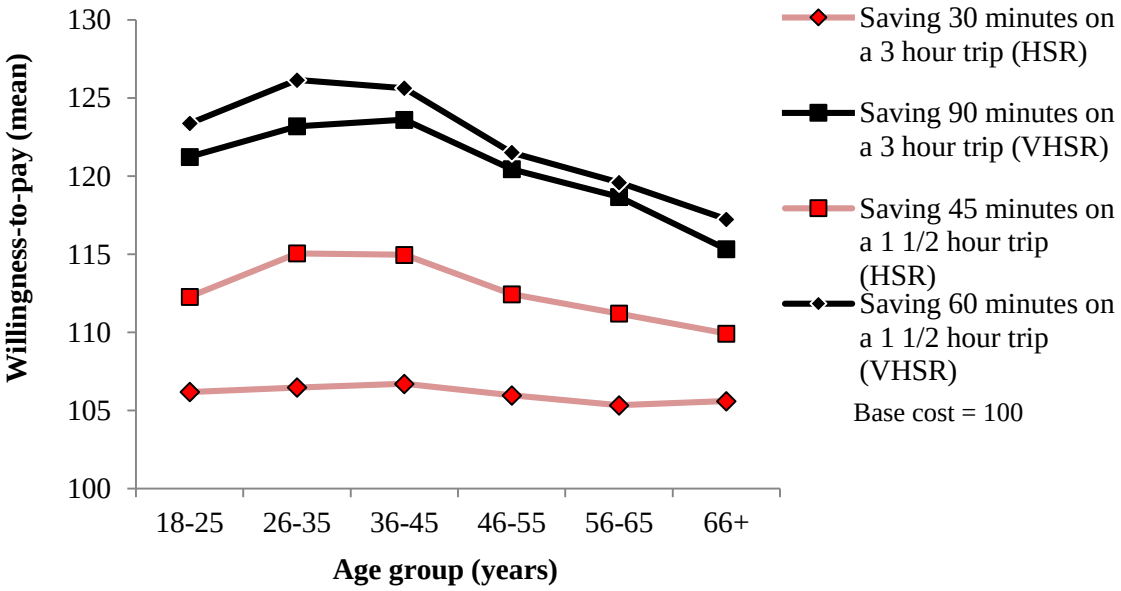
Notes: df=5, ns=not significant

Doubling the mean willingness-to-pay on the one-and-a half hour trip, allows direct comparison with those on the three hour trip, using a base mean cost of 100 (Figure 4.3). The incremental fare increases are a result of the time saved by using the new high speed rail services. Respondents were asked to indicate how much more they would be willing-to-pay in order to save a specific amount of time. This is an important

consideration in how respondents perceived the savings, as providing a new journey length (time) might be perceived differently to being provided an initial travel time and being offered an amount of time that can be saved. For this thesis, the willingness-to-pay questions were termed as an amount of time that could be subtracted from a defined total journey time.

Figure 4.3 shows that willingness-to-pay was greatest for the faster Very High Speed Rail (VHSR) service travel time savings on both the three hour and one and-a-half hour trip.

Figure 4.3: Willingness-to-pay for travel time reductions on a 3 hour and 1½ hour trip using high speed rail, by age (with adjusted means)



The faster VHSR service provides a 50% travel time saving on the three hour trip and a saving of 67% on the one and-a-half hour trip. By comparison, HSR offers a 17% reduction on a three hour trip, and a 50% travel time saving on the one and-a-half hour trip. Where the proportions of saved time are the same (50% for VHSR on the three hour trip and for high speed rail on the one and-a-half hour trip) willingness-to-pay is greater on the longer trip, as would be expected. Figure 5.3 also shows that except for the 30 minute high speed rail saving on a three hour trip, willingness-to-pay is increases from 18 to 25 to be greatest between the ages of 26 and 45, and declines beyond 45 years of age. The possibility that the greater willingness-to-pay for the two VHSR trips might be due to the figures of saved time being larger than for the HSR trips, rather than the new travel time, should be noted. While this research did not determine how the

travel time savings were perceived, it should be noted that presenting the travel times differently, for instance as a new trip time, might have resulted in differences in the amount individuals were willing-to-pay.

Willingness-to-pay: age group differences split by gender

A two-way parametric ANOVA was conducted, and indicated no significant interactions between age and gender, though significant differences were found between genders for the 45 minute saving by high speed rail and the 60 minute saving by VHSR (Table 4.26). Willingness-to-pay therefore differs by gender on the one and-a-half hour trip for both the VHSR and high speed rail.

Table 4.26: ANOVA of willingness-to-pay for travel time reductions by age and gender

	Age		Gender		Interaction	
High speed rail	*F*	*p*	*F*	*p*	*F*	*p*
30 minutes saved on 3 hour trip	2.02	*ns*	3.54	*ns*	1.61	*ns*
45 minutes saved on 1½ hour trip	6.65	<.001	8.36	.004	1.62	*ns*
Very high speed rail						
90 minutes saved on 3 hour trip	6.54	<.001	2.31	*ns*	1.51	*ns*
60 minutes saved on 1½ hour trip	8.20	<.001	9.93	.002	1.53	*ns*

When split by gender, the willingness-to-pay for travel time reductions is significantly different between age groups for the same trips and travel time savings as without the gender split, where the 30 minute saving on a three hour trip does not differ by age. Table 4.27 shows means for willingness-to-pay for travel time savings on each both of the trips, split by gender. Figure 4.5 shows a plot of the significant gender differences in willingness-to-pay for a 45 minute saving and a 60 minute saving on a one and-a-half hour trip.

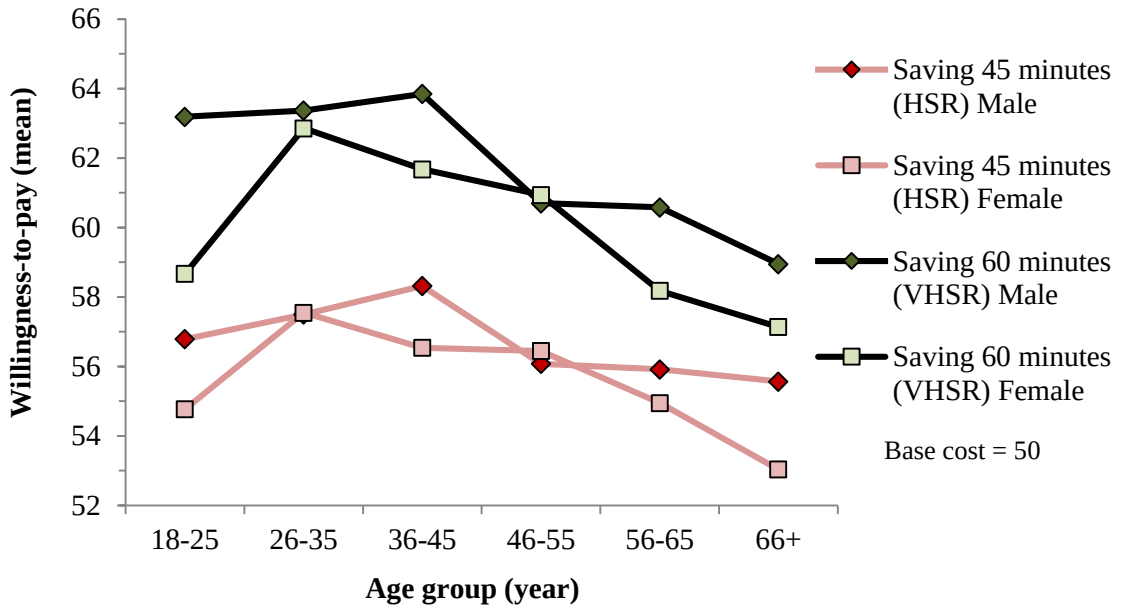
Table 4.27: Willingness-to-pay means for travel time savings by age, split by gender

		Travel time savings by HSR				Travel time savings by VHSR			
Age group (years)		30 minutes saved on 3 hour trip		45 minutes saved on 1½ hour trip		90 minutes saved on 3 hour trip		60 minutes saved on 1½ hour trip	
		N	mean	*N*	mean	*N*	mean	*N*	mean
18-25	Male	92	106.30	92	56.79	92	123.15	91	63.19
	Female	44	105.91	44	54.77	45	117.33	45	58.67
26-35	Male	149	106.17	148	57.50	147	123.40	147	63.37
	Female	191	106.70	192	57.55	190	123.05	192	62.86
36-45	Male	152	106.84	152	58.32	154	123.83	152	63.85
	Female	126	106.59	127	56.54	127	123.54	125	61.68
46-55	Male	202	105.79	200	56.08	200	119.30	199	60.70
	Female	127	106.14	128	56.45	129	122.17	128	60.94
56-65	Male	227	105.73	229	55.92	225	118.89	223	60.58
	Female	105	104.48	108	54.95	106	118.30	107	58.18
66+	Male	97	106.60	97	55.57	95	116.53	95	58.95
	Female	26	101.92	28	53.04	28	111.07	27	57.41

Notes: df=5,

Figure 4.4 shows that respondents are willing-to-pay more for a 60 minute saving than a 45 minute saving on a one and-a-half hour trip. The differences in willingness-to-pay by age are similar between genders for both the 45 and 60 minute savings. Willingness-to-pay declines overall with increasing age for both genders. However, females in the 18 to 25 and the 66 years and over age groups are willing-to-pay considerably less for travel time savings compared to males. Females perceived high speed rail as less prestigious, compared to males, especially in the 18 to 25 years old age group.

Figure 4.4: Willingness-to-pay for travel time reductions on a trip of 1½ hours by age group, split by gender.



Occupation differences in willingness-to-pay for travel time reductions

A two-way ANOVA for occupation differences in willingness-to-pay for travel time reductions indicated significant differences between occupations for all possible time saving and trip combinations (Table 4.28). However, neither gender, nor the interaction between occupation and gender were significantly different. The differences in the willingness-to-pay mean between genders were not sufficient to be significant for any of the possible travel time savings on either the three or one and-a-half hour trips.

Table 4.28: ANOVA of willingness-to-pay for travel time reductions by occupation and gender, including means.

Occupation		Travel time savings by HSR: 30 minutes saved on 3 hour trip		Travel time savings by HSR: 45 minutes saved on 1½ hour trip		Travel time savings by VHSR: 90 minutes saved on 3 hour trip		Travel time savings by VHSR: 60 minutes saved on 1½ hour trip	
		N	mean	*N*	mean	*N*	mean	*N*	mean
A	Male	68	107.50	70	57.86	67	125.37	65	63.69
	Female	37	105.14	38	57.50	39	125.13	39	63.33
B	Male	450	106.82	448	57.48	449	122.34	447	62.75
	Female	314	106.59	318	57.03	316	123.10	316	62.34
C1	Male	104	105.29	103	57.04	103	120.19	104	62.69
	Female	103	106.41	105	55.76	106	120.75	105	59.33
C2/D	Male	44	104.77	43	54.65	42	119.52	42	60.71
	Female	10	106.00	10	55.50	10	118.00	10	59.50
Student	Male	83	105.18	83	55.42	82	120.61	81	60.12
	Female	85	106.00	86	55.99	85	120.71	86	60.35
Retired	Male	149	105.10	149	54.26	147	114.49	146	57.67
	Female	44	102.27	44	53.64	44	112.05	43	56.63
Occupation		*F*	3.37	*F*	7.51	*F*	8.13	*F*	9.29
		p	.005	*p*	<.001	*p*	<.001	*p*	<.001
Gender		*F*	0.31	*F*	0.16	*F*	0.11	*F*	1.77
		p	*ns*	*p*	*ns*	*p*	*ns*	*p*	*ns*
Interaction		*F*	1.46	*F*	0.44	*F*	0.22	*F*	0.96
		p	*ns*	*p*	*ns*	*p*	*ns*	*p*	*ns*

Notes: df=5, ns=not significant, Occupations: A=Upper Managerial and Professional B= Middle Managerial and Professional C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students R= Retired and Part Retired

As no significant gender differences in willingness-to-pay by occupation were present, a one-way ANOVA was performed, the results of which are in Table 4.29. Willingness-to-pay was significantly different between occupation groups for both trip times and travel time saving options.

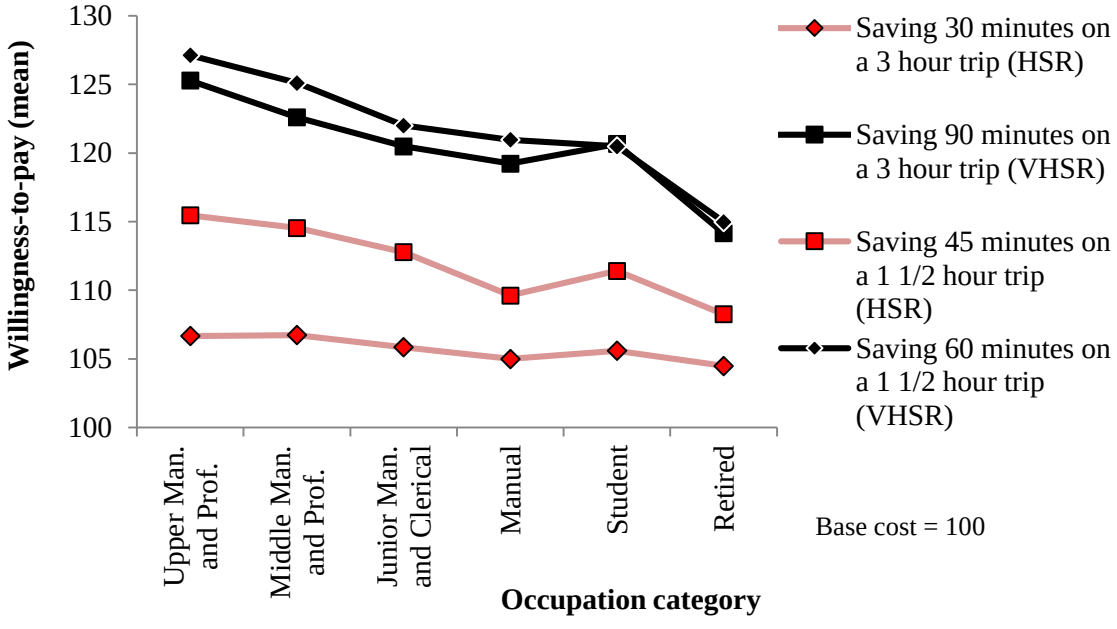
Table 4.29: One-way ANOVA for differences in willingness-to-pay for travel time savings, split by occupation category

Occupation	Travel time savings by HSR: 30 minutes saved on 3 hour trip		Travel time savings by HSR: 45 minutes saved on 1½ hour trip		Travel time savings by VHSR: 90 minutes saved on 3 hour trip		Travel time savings by VHSR: 60 minutes saved on 1½ hour trip	
	N	mean	*N*	mean	*N*	mean	*N*	mean
A	105	106.67	108	57.73	106	125.28	104	63.56
B	769	106.74	771	57.27	770	122.60	768	62.55
C1	207	105.85	208	56.39	209	120.48	209	61.00
C2/D	54	105.00	53	54.81	52	119.23	52	60.48
Student	168	105.60	169	55.71	167	120.66	167	60.24
Retired	169	104.49	196	54.13	193	114.15	191	57.49
F	2.87		9.29		8.84		10.70	
p	.014		<.001		<.001		<.001	

Notes: df=5, ns=not significant
Occupations: A=Upper Managerial and Professional B= Middle Managerial and Professional C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students R= Retired and Part Retired

To compare the willingness-to-pay for travel time reductions by HSR and VHSR on both the three hour and one and-a-half hour trips, the means for the latter were doubled from £50, to match the £100 base score on the three hour trip. Figure 4.5 shows the differences in willingness-to-pay for travel time savings, by occupation. Students and those in Managerial and Professional occupations (A, B, C1), were willing-to-pay more to save travel time compared with respondents in manual occupations (C2/D), and the retired. As for age differences in willingness-to-pay, the means indicate preparedness to pay a relatively greater amount for the time savings by VHSR, compared with those by high speed rail. For the smallest saving (30 minutes on a three hour trip), willingness-to-pay was least compared to the other time saving options. Willingness-to-pay for travel time savings differed significantly by demographics on most of the possible trip and time saving combinations. Statistically significant age differences in willingness-to-pay were present for both the high speed rail and VHSR travel time savings on the one and-a-half hour trip, and the VHSR travel time saving on the three hour trip. However willingness-to-pay for the 30 minute high speed rail travel time saving on the three hour trip did not differ by age. Gender differences by age were present for both travel time savings on the one and-a-half hour trip, but not the three hour trip. Willingness-to-pay for travel time savings differed significantly by occupation for both the high speed rail and VHSR travel time savings on the one and-a-half and three hour trips. However, the occupation differences in willingness-to-pay were less significant for the 30 minute high speed rail travel time saving on the three hour trip.

Figure 4.5: Willingness-to-pay for travel time reductions on a 3 hour and 1½ hour trip using VHSR and HSR, by occupation (with adjusted means)



H10D is accepted for age and occupation differences for both the VHSR and high speed rail travel time savings on the one and-a-half hour trip, and VHSR time savings on the three hour trip. However, for the 30 minute high speed rail travel time saving on the three hour trip, H10D is accepted for occupation, but rejected for age.

4.7.3 Willingness-to-pay differences by previous travel behaviour

H10E predicted that willingness-to-pay for travel time savings would be associated with previous travel behaviour, including the time elapsed since the most recent long distance trip by mode, commuting behaviour, and possession of a travel discount. Spearman's rho correlations between willingness-to-pay and the time elapsed, were only significant for air travel. The associations in Table 4.30 indicate that willingness to pay for travel time savings on high speed rail or VHSR is greater for more recent long distance travellers by air. For the remaining modes (rail, car and coach), the associations with willingness-to-pay are not significant. However, the negative correlations present were significant, but weak, indicating a potential effect size issue.

Table 4.30: Spearman's rho for association between willingness to pay and time elapsed since most recent long distance trip by air.

	Travel time savings by High speed rail				Travel time savings by VHSR			
Time elapsed	30 minutes saved on 3 hour trip		45 minutes saved on 1½ hour trip		90 minutes saved on 3 hour trip		60 minutes saved on 1½ hour trip	
	r_s	p	r_s	p	r_s	p	r_s	p
Air	-.076	.003	-.085	.001	-.139	<.001	-.099	<.001
N	1501		1505		1498		1492	

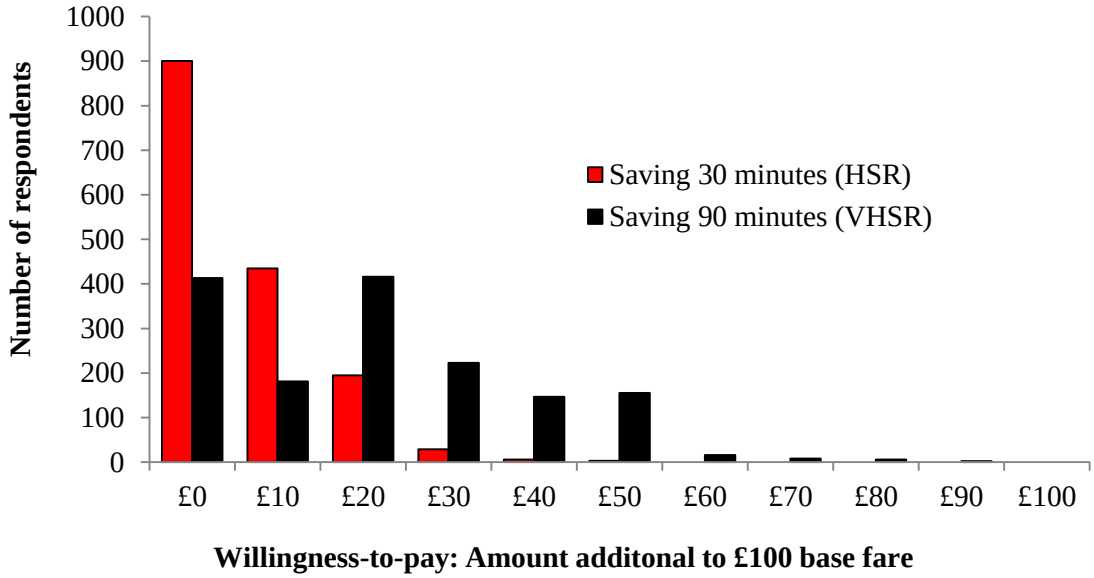
Mann Whitney *U* tests for differences in willingness-to-pay between commuters and non-commuters, and between those with travel discounts, and those without, indicated no statistically significant differences in willingness-to-pay for travel time reductions. H10E cannot be accepted for differences in willingness-to-pay for travel time savings by commuting behaviour or possession of travel discounts. H10E can be accepted for associations between previous travel behaviour and willingness-to-pay, but only for air, and with a caveat that the low correlation coefficients may be an effect size issue.

4.7.4 Willingness-to-pay differences between VHSR and HSR

H11 predicts willingness-to-pay for travel time savings will be greater for a faster high speed rail service. Demographic analysis of willingness-to-pay for travel time reductions by high speed rail (HSR) and a faster very high speed rail (VHSR) service indicated visual differences by mode, in support of H11 (Figure 4.3, 4.4 and 4.5).

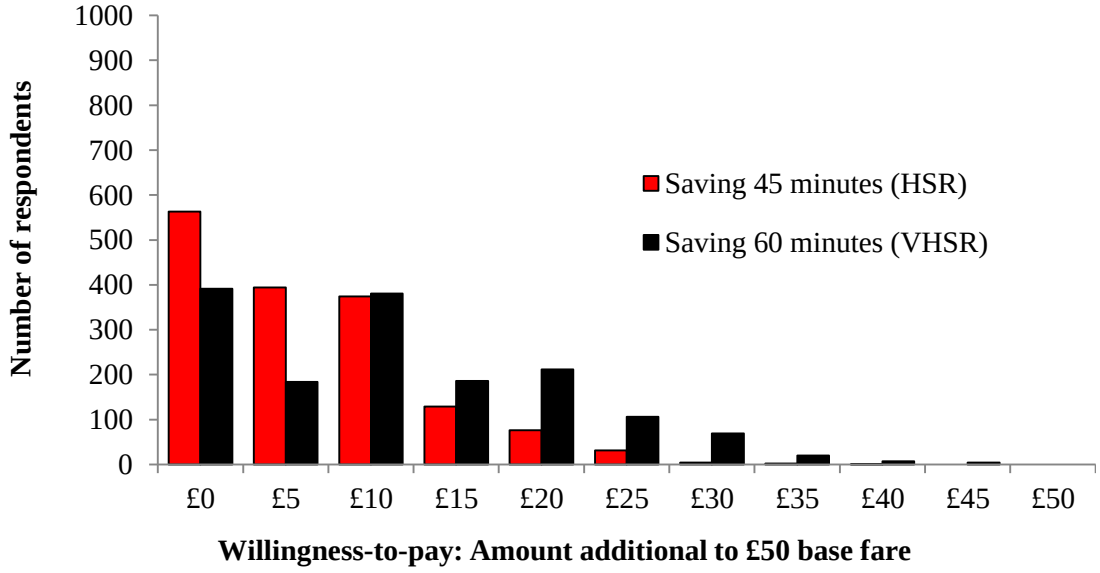
A Chi-square test for independence (χ^2) confirmed the presence of significant differences between high speed rail and VHSR in willingness-to-pay to reduce travel time on a three hour trip (χ^2 = 1337.00, p=<.001). The differences in willingness-to-pay between VHSR and HSR are shown in Figure 4.6.

Figure 4.6: Additional amount respondents are willing-to-pay to reduce travel time on a three hour trip with a base fare of £100



An additional Chi squared test confirmed the same to be the case on the one and-a-half hour trip (χ^2 = 2841.53, p=<.001). Figure 4.7 shows the differences in willingness-to-pay for travel time savings on a one and-a-half hour trip.

Figure 4.7: Additional amount respondents are willing-to-pay to reduce travel time on a one and-a-half hour trip with a base fare of £50



H11 is accepted on both the three hour trip and the one and-a-half hour trip, as the amounts respondents are willing-to-pay for the VHSR is greater than for HSR, indicating that willingness-to-pay is greater for the larger time saving. The Chi-square test results confirm that this difference in willingness-to-pay for the HSR and VHSR travel time reductions are significant.

4.8 Determinants of long distance travel behaviour

Respondents were asked to score out of ten, the importance of various factors determining travel behaviour. The following hypotheses are tested relating to the determinants of long distance travel behaviour;

H12– The environmental impact of travel will be perceived as the issue of least importance compared to other determinants of long distance travel, when planning trips.
H13– Determinants of planned long distance travel behaviour will be associated and will be mode specific.
H14A– Cost of travel (fare) will be considered more important than environmental impacts in determining intended travel behaviour.
H14B– Travel time will be considered more important than environmental impacts when making decisions about planned travel behaviour.
H15 – The importance of the environment in behavioural intention for travel will differ significantly by age, gender and occupation.

4.8.1 Overview of the determinants of long distance travel behaviour

Table 4.31 is a table of means for the importance of the determinants of travel behaviour in the long distance travel decision-making process, such as making a mode choice. The statistics in Table 4.31 indicate that in terms of the mean score given by the respondents, the environmental impact is the least important consideration when planning long-distance trips.

Table 4.31: Determinants of long distance travel decision-making: Friedman test

Rank	Determinant of long distance travel	Mean	Standard deviation	Friedman Mean ranks
1	Reliability of service	8.08	1.79	11.18
2	Fare / Cost of making the journey	7.90	2.15	10.66
3	The amount of crowding	7.44	2.12	9.59
4	Flexibility of the departure and/or arrival time	7.53	1.90	9.58
5	Total journey time	7.42	2.06	9.53
6	Ease of getting to the station or airport	7.30	2.10	9.06
7	The time of departure	7.42	2.06	8.56
8	Number of interchanges	6.97	2.48	8.53
9	Waiting time	7.00	2.12	8.20
10	Comfort	7.00	1.93	8.13
11	The amount of luggage I have	6.74	2.51	8.04
12	Frequency of service	6.86	2.12	7.94
13	Day of travel	6.54	2.85	7.91
14	Who is responsible for paying the fare / cost	5.83	3.49	7.28
15	Ability to work on-board	5.58	3.00	6.48
16	Environmental impact	5.10	2.93	5.32

Notes: N=1547, Ordered by Friedman mean rank

H12 is accepted as the environment is the least important determinant of travel behaviour.

Associations between determinants of long distance travel behaviour

To determine the presence of associations between the determinants of long distance travel behaviour, such as mode choice, tests for correlations were used to identify associations (i.e. greater importance of one resulting in diminished importance of another). H13 predicts the presence of associations between the determinants of long distance travel. The correlation matrix (Table 4.32) shows the associations between the perceived importance of issues in determining choices for long distance travel. Table 4.33 demonstrates the presence of significant correlations between determinants of long distance travel behaviour. As a large number of the correlations were significant, descriptions are only provided for those exceeding r_s=.500. Where moderate correlations (exceeding .500) were present, this indicated a considerable level of association between the items, thus a greater importance for one means greater importance for another.

Table 4.32: Matrix of Spearman's rho correlation between the determinants of travel behaviour

	Frequency	Journey time	Able to work	Day of travel	Crowding	Reliability	Comfort	Amount of luggage	Departure time	Interchange time	Waiting time	Ease of getting to	Who pays	Flexibility dep. / arr.	Environment
Total journey time	.445***														
Able to work on-board	.254***	.275***													
Day of travel	.356***	.381***	.208***												
Crowding amount	.431***	.277***	.080**	.301***											
Service reliability	.520***	.331***	.087***	.328***	.574***										
Comfort	.426***	.289***	.147***	318***	.573***	.546***									
Amount of luggage	.270***	.309***	.052*	.293***	.363***	.345***	.423***								
Time of departure	.417***	.442***	.147***	.452***	.357***	.395***	.402***	.418***							
Number of interchanges	.362***	.481***	.106***	.270***	.427***	.408***	.405***	.406***	.474***						
Waiting time	.470***	.474***	.170***	.302***	.410***	.459***	.431***	.368***	.487***	.593***					
Ease of getting to station/airport	.394***	.385***	.124***	.301***	.360***	.412***	.385***	.377***	.477***	.480***	.609***				
Who pays the fare	.133***	.227***	.199***	.143***	.145***	.101***	.124***	.176***	.176***	.185***	.224***	.279***			
Flexibility of departure/arrival	.427***	.377***	.067**	.305***	.315***	.357***	.320***	.319***	.498***	.378***	.480***	.479***	.126***		
Environmental impact	.300***	.100***	.336***	.111***	.082**	.136***	.137***	.024	.076**	.091***	.127***	.125***	.057*	.030	
Fare / cost of trip	.139***	.235***	.022	.139***	.140***	.144***	.092***	.194***	.224***	.176***	.225***	.312***	.338***	.279***	.021

*Notes: *** p=<.001, ** p=<.01, * p=<.05*

Frequency and reliability of service were closely associated, indicating that those who considered frequency of service to be an important determinant of decision-making on long distance travel also wanted a reliable service. It is reasonable to assume that such people may have high time-pressures and thus choose a mode that minimises potential disruptions, but also allows for a short-notice contingency means to travel. High importance of these items may suggest preference for car / commuter transport.

Reliability of service was also closely associated with the amount of crowding, and with comfort. High levels of crowding affect comfort, and unreliable services can also lead to additional crowding and reduce the perceived comfort of the trip. High perceived importance of these issues in decision-making for long distance travel mode choice again suggests a preference for car travel as a mode which can minimise crowding, be more comfortable and can be more reliable.

The number of interchanges and waiting time are also associated, as would be expected given that interchanges often incur a time-waiting penalty. Those perceiving both items as important are likely to make long distance travel decisions that can minimise the waiting time and number of interchanges, and choose a mode or route that suits these needs. Likewise, those that do not consider number of interchanges to be an issue of importance also consider waiting time to be less important.

Close association between the importance of waiting time and ease of getting to the station or airport suggests that respondents placing high importance on these issues would like to arrive at the station/airport close to departure time and thus be able to do so with ease. It is likely that such respondents would prefer to reach the station/airport by means other than public transport (e.g. car or taxi) as this would both minimise waiting time and make the trip easier for scheduling and carrying luggage.

The importance of environmental impacts has the lowest associations with other issues in the decision-making process for long distance travel planned behaviour. The lowest associations with environmental impacts are; the amount of luggage, who pays the fare, flexibility of departure, and the cost of making the journey. This means that where importance of the environment is high, it cannot predict high importance for the remaining issues.

H13 predicted that associations between the determinants of travel decision making for long distance travel would be associated and would be mode specific. The strongest associations present (r_s=>.5) indicate that there are associations present which might result in the use of a particular mode. H13 is accepted.

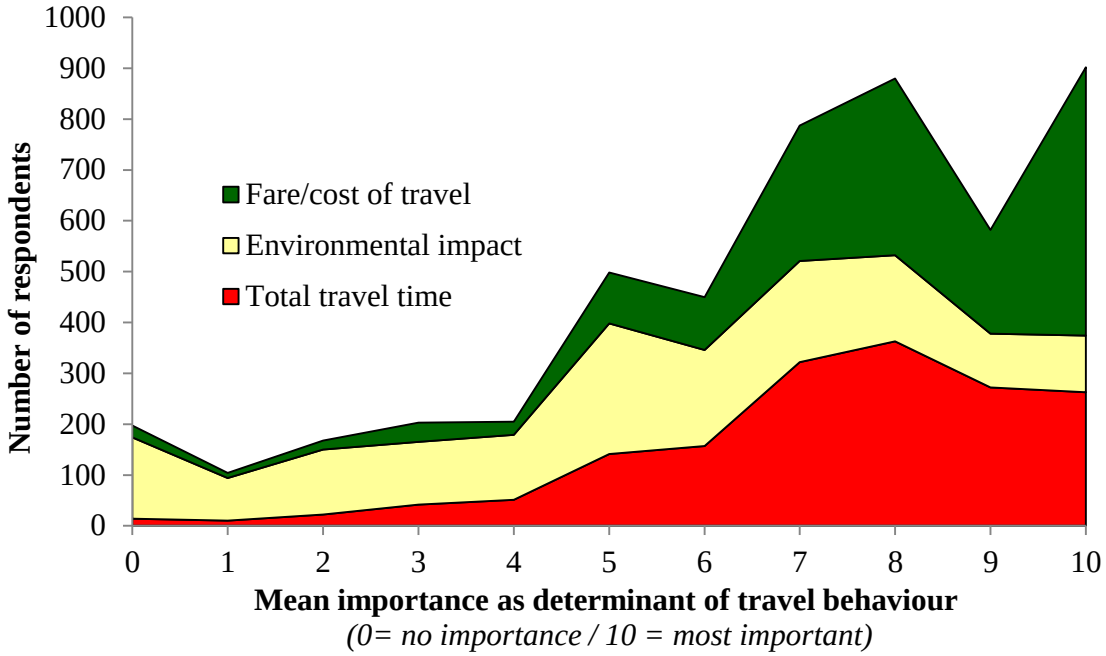
4.8.2 Importance of the environment compared to cost and travel time

H14A and H14B predicted that cost of travel (fare or cost of trip) and travel time would be considered to be more important than environmental impacts in determining intended travel behaviour on long distance trips. These hypotheses emerged from the focus groups in the data collection stage, in which the environment was mentioned very rarely compared with cost and travel time. Table 4.31 confirmed that the environment was considered to be of much less importance compared to cost of travel and journey time, as a determinant of mode choice for long distance travel.

A Friedman test was conducted to test for differences in perceived importance between cost of journey, total journey time and environmental impacts. Perceived importance was found to differ significantly between cost of journey and environmental impact (N=1650, χ^2=632.20, p=<.001) and also between total journey time and the environment (N=1646, χ^2=478.09, p=<.001). While the overall mean indicates that the environment is considered less important for long distance travel decision-making compared with journey time and travel cost/fare, it does not show how the scores are distributed across the population.

Figure 4.8 shows an area plot of frequencies for the importance of cost and time compared with the environmental scores. The area plot shows that the distribution of respondent's scores for the environment are more even, with a similar number considering the issue to be of little or no importance, compared to those that consider the issue more important. However, for fare/cost of travel, there is a clear indication that the majority of respondents consider the issue to be more important, as the majority scored the issues above 4 on the importance scale. The fare/cost of travel has a very large number of respondents that rated the issue as being most important (10).

Figure 4.8: Area plot of number of respondents in each attitude importance category for travel cost/fare, environmental importance and total travel time



To determine consistency across demographics, the importance of travel costs, travel time and the environment, as determinants of planned travel behaviour, was tested for age, gender and occupation differences (Table 4.33). Parametric ANOVAs are used to overcome the unequal group sizes for calculating mean ranks, thus caution is advised.

Table 4.33: ANOVA of cost, travel time and environment determinants, by age

		Cost of making journey		Total journey time		Environmental impact	
Age group	*N*	Mean	S.D.	Mean	S.D	Mean	S.D
18 to 25 years	136	8.65	1.43	6.94	2.31	4.21	2.98
26 to 35 years	343	8.59	1.73	7.61	1.93	5.14	2.87
36 to 45 years	290	8.11	2.04	7.60	1.99	5.31	2.88
46 to 55 years	345	7.69	2.12	7.41	2.00	5.18	2.96
56 to 65 years	353	7.41	2.26	7.32	2.03	5.18	2.95
66 years and over	134	7.06	2.63	7.11	2.28	4.95	2.80
F		20.98		3.28		3.07	
p		<.001		.006		.009	

Notes: S.D. = Standard Deviation, df = 5

The importance of all three determinants of long distance travel decision-making is significantly different between age groups. The means in Table 5.33 confirm that environmental impacts are consistently considered to be less important than both cost and journey time, as determinants of long distance travel, across all age groups. Significant differences in the importance of cost, time and the environment are present

between genders. The environment as a determinant is more important to females, though for both genders it is the least important of the three determinants in Table 4.34.

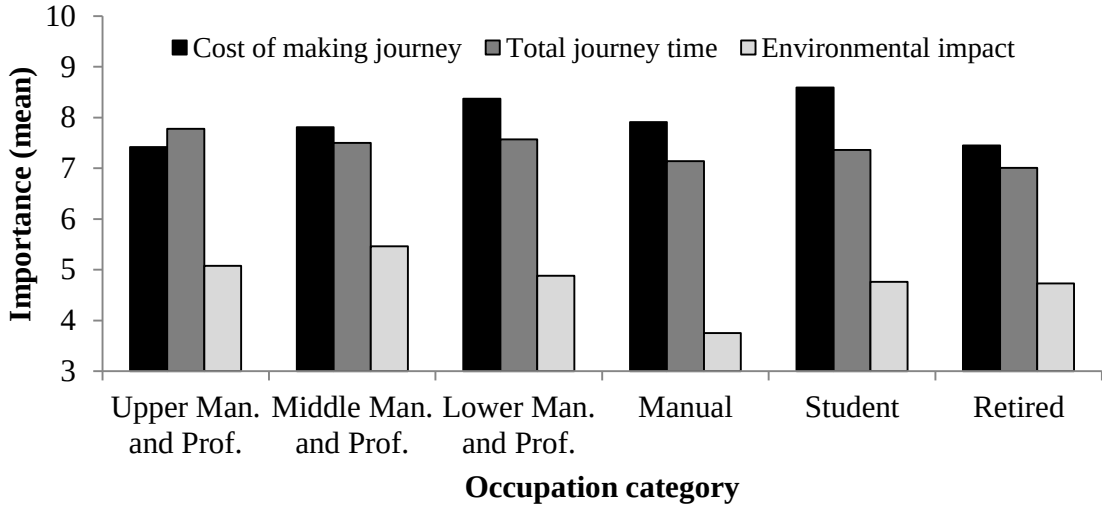
Table 4.34: ANOVA of cost, travel time and environment determinants, by gender

		Cost of making journey		Total journey time		Environmental impact	
Age group	*N*	Mean	S.D.	Mean	S.D	Mean	S.D
Male	947	7.71	2.21	7.14	2.10	4.67	2.92
Female	650	8.25	1.96	7.79	1.92	5.71	2.81
F		24.98		40.21		50.17	
p		<.001		<.001		<.001	

Notes: S.D. = Standard Deviation, df = 5

Cost (F=9.17, p=<.001), journey time (F=3.10, p=.009), and environmental impact (F=6.05, p=<.001), differ significantly between occupations as determinants of long distance travel decision-making. Figure 4.9 shows that environment is less important than cost and journey time, in all occupation categories, and is also least important to those in manual occupations.

Figure 4.9: Cost, travel time and environment determinants, by occupation



H14A and H14B are accepted, as the cost of travel (fare) and travel time were considered more important than environmental impacts in determining intended travel behaviour on long distance trips.

4.8.3 Demographic variations in the importance of the environment

H15 predicts that the importance of the environment as a determinant for travel decision making will differ significantly by age, gender and occupation.

Age and gender differences

A Kruskal-Wallis test for age differences in environmental importance, split by gender indicated that overall there was a significant difference between age groups. However, this was not the case when split by gender (Table E6, Appendix E). As earlier, a parametric two-way ANOVA was used so that the issue of different counts for each age and gender group could be overcome (Table 4.35). Figure 4.11 displays the age group means, split by gender.

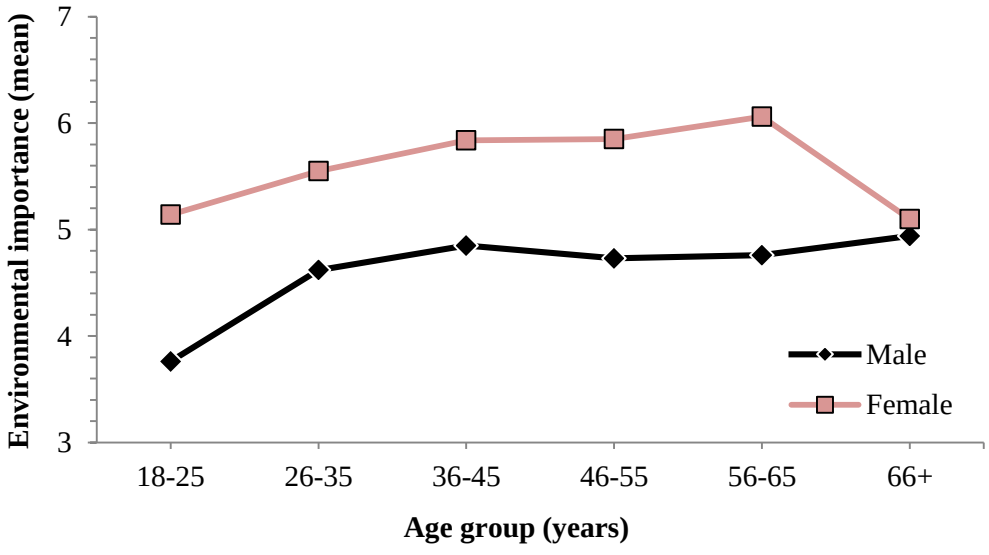
Table 4.35: ANOVA of the importance of the environment in long distance travel decision-making by age and gender, including means.

Age group	Overall		Split by gender			
			Male		Female	
	N	Mean (S.D)	*N*	Mean (S.D.)	*N*	Mean (S.D.)
18 to 25 years	136	4.21 (2.98)	92	3.76 (2.92)	44	5.14 (2.93)
26 to 35 years	339	5.14 (2.87)	147	4.62 (2.92)	192	5.55 (2.76)
36 to 45 years	289	5.30 (2.88)	156	4.85 (2.76)	132	5.84 (2.94)
46 to 55 years	344	5.18 (2.95)	206	4.73 (3.04)	136	5.85 (2.68)
56 to 65 years	351	5.18 (2.96)	237	4.76 (2.91)	112	6.06 (2.86)
66 years and over	133	4.98 (2.81)	100	4.94 (2.89)	31	5.10 (2.95)
Age	*F*	2.35	Gender	*F*	32.88	Interaction	*F*	0.70
	p	.039		*p*	<.001		*p*	*ns*

Notes: df=5, S.D.=Standard Deviation

Figure 4.10 shows the significant gender and age differences in perceived importance of environmental impact as a determinant of long distance travel decision-making. Older people and females consider the issue most important, although an outlier for females in the 66 years and over age category is perhaps due to a low count in that group (*N*=31).

Figure 4.10: Importance of the environment as a determinant of travel decision-making, by age and gender



Occupation differences

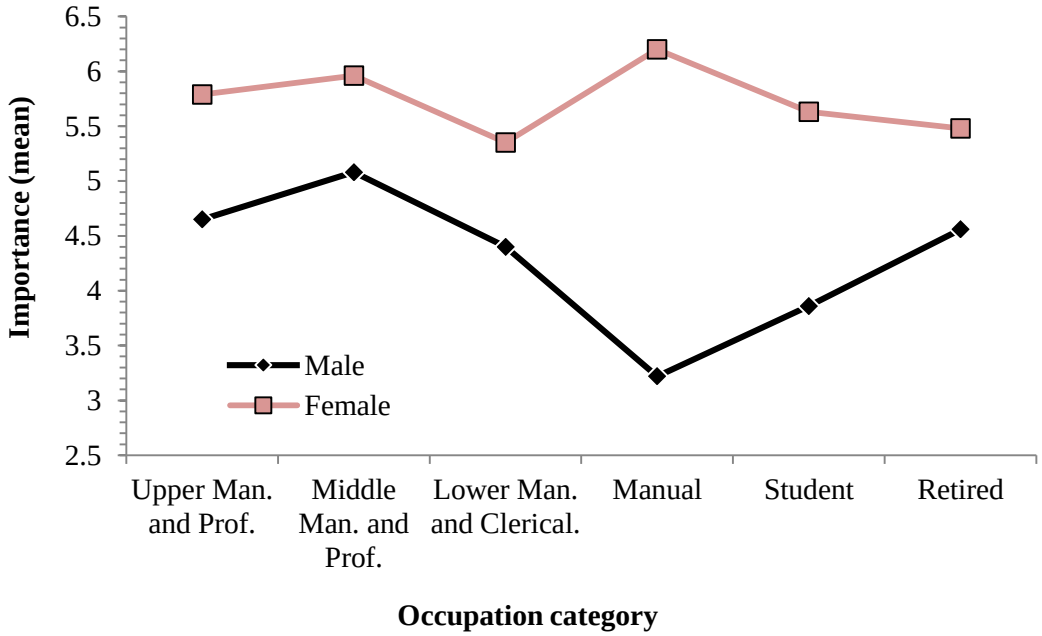
A Kruskal-Wallis test of the importance of the environment as a determinant involved in decision-making for long distance trips found significant differences by occupation (χ^2=29.19, p=<.001), the full statistics for which are in Table E7, Appendix E. To compare the means for each occupation category a one-way parametric ANOVA was used (Table 4.36). Figure 4.11 displays the occupation category means, split by gender.

Table 4.36: ANOVA of the importance of the environment in long distance travel decision-making by occupation and gender, including means.

Occupation category	Overall		Age split by gender			
			Male		Female	
	N	Mean (S.D)	*N*	Mean (S.D.)	*N*	Mean (S.D.)
A	111	5.08 (2.74)	69	4.65 (2.71)	454	5.79 (2.68)
B	788	5.45 (2.86)	454	5.08 (2.89)	328	5.96 (2.75)
C1	212	4.88 (3.00)	105	4.40 (3.02)	107	5.35 (2.91)
C2/D	56	3.75 (2.94)	46	3.22 (2.68)	10	6.20 (2.97)
Student	171	4.76 (3.09)	84	3.86 (2.97)	87	5.63 (2.95)
Retired	204	4.77 (2.88)	155	4.56 (2.95)	46	5.48 (2.54)
Occupation	*F* 3.58		Gender	*F* 38.77	Interaction	*F* 1.46
	p .003			*p* <.001		*p* *ns*

Notes: df=5, S.D.=Standard Deviation, Occupations: A=Upper Managerial and Professional B= Middle Managerial and Professional C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students R= Retired and Part Retired

Figure 4.11: The importance of the environment as a travel determinant, differences between occupation and gender



The results indicate that the importance of environmental impacts is significantly different by both occupation and gender, and females consider the issue to be of greater importance. However, the very low count for females in the C2/D 'Manual' occupations category should be noted, due to the potential for an outlier to affect the mean score.

In Figures 4.10 and 4.11, and Tables 4.35 and 4.36, it can be seen that gender differences are apparent throughout for both age and occupation. Importance of environmental impacts increases with age for both genders, while between occupations there are considerable differences. H15 is therefore confirmed, as significant demographic differences are present in the perceived importance of environmental impacts when making decisions for long distance travel, such as mode choice and route.

4.9 Chapter Summary

In this chapter, the attitudinal data collected through the online questionnaire have been analysed in the key hypothesis areas of demographics, travel behaviour and respondent location (geographic variables). Willingness-to-pay for travel time savings has been explored in these areas also, and the determinants of long distance travel decision making have been investigated. Table 4.37 provides a results summary, organised by hypothesis, indicating where significant effects were detected (p=<.05) shown in green, and were no statistically significant associations were present (shown in red).

Table 4.37 shows that many of the hypotheses could only be partially accepted, as statistically significant differences, or associations were only detected in some cases (e.g. on some attitude factors, or for certain behavioural variables). To summarise these findings briefly, it is noticeable that in terms of attitudes to long-distance travel and HSR, one attitude factor is consistently unaffected by demographic or behavioural factors. F5: Negative perception of HSR, does not vary according to age, gender or occupation. There is no association with previous travel behaviour, except with time-elapsed since the most recent trip by air - which may be effect size.

In the next chapter, these findings will be discussed, calling upon the literature from Chapter Two as appropriate.

Table 4.37: Summary table of research hypotheses results

H1– Attitudes to both long distance travel and HSR will differ by respondents' age, occupation, and gender.							Partially Accepted
H2– Environmental conscience will differ by respondent demographics and their previous travel behaviour.							Partially Accepted
	F1	F2	F3	F4	F5	F6	
Age							
Occupation							
Gender							
H3– Previous travel behaviour is associated with attitudes towards HSR.							Partially Accepted
Time elapsed (Rail)							
Time elapsed (Air)					*p*=.048		
Time elapsed (Car)							
Time elapsed (Coach)							
H4– Attitudes to long distance travel and HSR will be associated with regularity of travel such as commuting.							Partially Accepted
Commuting behaviour							
H5– Attitudes to long distance travel and HSR will be associated with possession of travel discounts.							Partially Accepted
Travel discount							
H6– Attitudes towards HSR will be associated with the time since respondents last had to stay overnight on a journey.							Partially Accepted
Time elapsed (overnight)							
H7: Proximity of living to a station on the proposed HS2 route is directly related to perceived benefits;							Reject Hypothesis
Distance from Birmingham							
Distance from Euston							
H8: Proximity of living to the HS2 route is inversely related to attitudes to high speed rail;							Accept Hypothesis
Contiguous to HS2 route							
H9: Attitudes and perceptions towards HSR will differ by situational factors such as the respondent's region.							Partially Accepted
Differences by region							
H10A: Willingness-to-pay for travel time will be positively associated with attitudes to HSR,							Partially Accepted
H10B: The importance of useful travel time will be unrelated to willingness-to-pay for travel time reductions,							Reject Hypothesis
3 hr trip saving 30 mins							
3 hr trip saving 90 mins							
1½ hr trip saving 45 mins							
1½ hr trip saving 60 mins							
H10C: The association between attitudes and willingness-to-pay for the travel time savings will differ by trip length,							Reject Hypothesis
	3hr trip (30 min)	1½hr trip (45 min)	3hr trip (90 min)	1½ hr trip (60 min)			
WTP by trip length							
H10D: Willingness-to-pay will differ significantly by demographics,							Partially Accepted
WTP by age							
WTP by occupation							
WTP by gender							
H10E: Willingness-to-pay will be associated with previous travel behaviour.							Partially Accepted
Time elapsed (Rail)							
Time elapsed (Air)							
Time elapsed (Car)							
Time elapsed (Coach)							
H11 - Willingness-to-pay for travel time savings will be greater for a faster high speed rail service							Accept Hypothesis
H12– The environmental impact of travel will be perceived as the issue of least importance compared to other determinants of long distance travel, when planning trips.							Accept Hypothesis
H13– Determinants of planned long distance travel behaviour will be associated and will be mode specific.							Accept Hypothesis
H14A– Cost will be considered more important than environmental impacts in determining intended travel behaviour.							Accept Hypothesis
H14B– Travel time will be considered more important than environment when determining intended travel behaviour.							Accept Hypothesis
	Cost of making a journey		Total journey time		Environmental impact		
Differences by age							
Differences by occupation							
Differences by gender							
H15 – Importance of the environment in behavioural intention for travel will differ by age, gender and occupation.							Accept Hypothesis
Differences by age							
Differences by occupation							
Differences by gender							

Chapter 5. Discussion of results

5.1 Introduction

The analysis of the questionnaire responses in the previous chapter indicated the presence of significant differences, associations and moderating effects of demographic, travel behaviour and situation (geographic) variables. These were present for the six attitude factors, willingness-to-pay for travel time savings, and the issues of importance in decision-making for mode choice and routing, on long-distance trips. The following chapter presents a discussion of the major findings made from the analysis of the dataset in Chapter 4.

The results of the questionnaire analysis, and the findings made, are discussed in six themes. Of the six themes, two were comparatively smaller in that they comprised fewer elements than the remaining four and the findings discussed here are fewer. The six themes discussed are;

- A travel cost / pricing theme: The relative importance of cost in decision-making for long-distance travel and the factors influencing willingness-to-pay for travel time savings.

- A demographic theme: Some attitudes to long-distance travel and perceptions of high speed rail were influenced by demographics.

- An environmental theme: The importance of the environment in decision-making for long-distance travel relative to other considerations.

- A travel comfort theme: Importance of comfort for long-distance travel and how this links to willingness-to-pay for travel time savings, travel behaviour and mode choice.

- Perceived negative aspects of high speed rail theme: Negative perceptions of high speed rail are indiscriminate by most variables.

- Importance of making productive use of travel time theme: Discussion of how productive use of travel time influences mode choice, willingness-to-

pay and how important this issue is in light of the accusations that time savings by HS2 are unnecessary.

In the sections that follow, the six theme findings are discussed in depth, and relative to existing literature and previous research.

5.2 Travel costs / pricing theme

5.2.1 *Rationale for theme*

The cost elements of HS2 have become important issues for the public acceptability of the scheme in light of expressed concerns at the recent increase in the budget for HS2. A likely perception is that any additional increases in the HS2 budget will be reflected in fares to use the line once it is open. However, presence of an issue of greater importance than cost was found in the results (reliability), suggesting that while still an important consideration in decision-making for long distance travel, members of the public might be more forgiving of costs increases if HS2 maintains a reliable service. For example by dealing with congestion on existing routes, or improving the reliability of long-distance travel and the perception thereof.

5.2.2 *Cost in mode choice decision-making for long-distance travel*

The results indicated that cost was perceived to be an important issue in determining choices for long distance travel such as mode and routing. This result confirmed the findings of the focus groups, where cost/fare was also identified to be the most important issue in long-distance travel. The finding of the greater importance of cost in relation to other travel choice factors supports previous research highlighting the central importance of cost in decision-making (Anable and Gatersleben, 2005; Stradling *et al.*, 2007; Anable *et al.*, 2009; Thornton *et al.*, 2010). Suggestions have been made that HS2 fares would incorporate a levy to help pay for the costs of constructing the scheme (Hayman, 2010). To ensure that HS2 is well-utilised, these findings support the necessity of considering the pricing of the fares – if these are perceived as being too high, potential users might use alternative modes, or decide not to travel at all (Mokhtarian, 2002).

Cost was secondary to reliability in terms of importance in the questionnaire results, but the opposite was the case in the focus groups, where reliability was the 8th most mentioned issue, compared to cost/fare, which was the most mentioned. The importance of reliability appears less salient compared with cost, as when unprompted (during the focus groups) the issue of reliability was less prominent in decision-making. A possible explanation is that cost is an ever-present issue in long-distance travel, while reliability becomes increasingly salient when transport services are disrupted - a less common occurrence. In relation to HS2, it is possible that the potential costs of HS2 are more defined in media representation compared with the potential impacts on reliability. Previous research by the Department for Transport (2011a) indicated that just over half (52%) of those interviewed regarding the impacts of high speed rail for Britain as a whole, believed that such a scheme would have a negative impact on train ticket costs. However, 21% believed there would be a positive impact on the costs of train tickets. In terms of cost to the government and the whole country, the high speed rail scheme was perceived by 47% of those sampled as likely to have a largely negative impact, with only 26% perceiving a positive effect. Cost impacts on train tickets and cost to government were considered important to the majority of respondents, though less than issues such as the environment and congestion on the roads. The greater importance of reliability compared with cost in the questionnaire distributed for this thesis, therefore appears consistent with the research. However, the importance of the environment does not appear to be consistent (Department for Transport, 2011a).

These findings from the results of the questionnaire distributed for this thesis, support previous research, which indicated that both cost and reliability are important issues when considering options for long-distance travel (Beecroft *et al.*, 2003). Both the value of time and reliability have been described as of crucial importance in making decisions concerning capacity, operations and pricing for transport networks (Fosgerau and Karlström, 2010). The perceived importance of reliability identified by the research for this thesis is consistent with Stradling *et al.* (2007), in which the importance of services being on time (i.e. reliable) was rated by 97% of respondents as being very or quite important, a larger proportion than any other group. Part of the justification for HS2 is the need for new capacity, due to the potential impacts on service reliability as the West Coast Main Line

becomes increasingly full. The finding that reliability is considered more important than cost indicates that members of the public may be more willing-to-pay if the alternative is services with decreasing reliability. It is therefore possible, that if the predicted capacity problems arise, existing services may become increasingly unreliable, in which case the issue of reliability may become increasingly salient.

Those surveyed considered cost and total journey time to be of high importance in decision-making for long-distance travel, although cost is considered to be more important in making decisions about mode choice. That cost is considered more important than travel time in travel decision-making, fits with previous literature questioning the belief that minimising travel time will always be sought (Anable and Gatersleben, 2005; Banister, 2011). As proven by Nijkamp and Baaijens (1999), willingness-to-pay can be multi-directional, and therefore it is possible that some will choose an option for a trip which involves a longer travel time, provided that the cost of that option is less than a faster alternative ('slow-motion behaviour' as per Nijkamp and Baaijens (1999)). The results of this thesis therefore support these suggestions, as cost is considered more important than travel time and, as such, might mean that a decision is made to make a trip with a longer travel time, instead considering the cost of the trip as paramount.

5.2.3 *Willingness-to-pay for travel time savings*

Willingness-to-pay for travel time savings is consistent by age when the available time saving is small, but where larger savings are available, willingness-to-pay is significantly greater for respondents between the ages of 26 and 45 years. This was the case for both a 67% and a 50% time reduction on a one and-a-half hour trip, and for a 50% saving on a three hour trip, but not for a smaller reduction of 17%. A similar finding was made in a study of willingness-to-pay to use express lanes on the American interstate system, where individuals between the ages of 35 and 45 were more likely to pay in order to reduce their travel time by using the system (Brownstone *et al.*, 2003). This finding may be explained by those in the younger and older age groups (more likely to be students or retired persons) having fewer time-constraints, and therefore considering paying to reduce travel time to be less important. These results indicate that travel discounts such as the student railcard and senior railcard should be available for use on HS2 when the

line is open, in order to encourage those groups with less willingness-to-pay for travel time savings, that the high speed rail service is affordable to them.

Willingness-to-pay also differs between the travel time saving offered by HS2, and that offered by VHSR. Regardless of trip length, willingness-to-pay was significantly greater for using the VHSR, compared with using HS2. It is possible that individuals are prepared to pay more to travel by the VHSR, not because of the travel time savings, but due to the novelty of the mode. However, this was not determined from the research conducted. Partialling the effect of the trip times from the choice of mode is extremely difficult, and further investigation of this is needed before any further conclusions can be made.

Another finding of this research in relation to travel costs and fares, was that previous travel behaviour did not account for differences in willingness-to-pay in the vast majority of cases. The amount individuals were willing-to-pay for travel time savings did not differ by possession of a railcard or travel discount. An explanation for this is that respondents might have been factoring the travel discount into the amount that they were prepared to pay. The actual price of the ticket may therefore have been higher than willingness-to-pay indicated, but this is not possible to ascertain. A clear finding here is that willingness-to-pay is not distinct by whether a person has a travel discount, and clearly shows that the travel time and cost trade-off is consistent across this population.

Possession of a railcard or travel discount affects the marginal cost of travel and can thus influence the number of trips that are made (Carbajo, 1988). Those respondents with travel discounts possessed them for rail in the majority, and possession of a discount generally denotes more frequent use of that particular mode. The lack of difference in willingness-to-pay between commuters and non-commuters identified from the questionnaire results, therefore confirms the lack of the travel discount effect. This finding is not consistent with research by Brownstone *et al.* (2003), who found that commuting behaviour was a determinant of whether individuals were willing-to-pay for travel time reductions when driving; Those travelling for commuting purposes were more willing-to-pay to reduce their travel time compared with those travelling for leisure or personal reasons. Furthermore, willingness-to-pay for travel time reductions was not associated with

how recently respondents had made long distance trips by rail, coach or car. However, on all trip time-saving examples, there was a negative association present between willingness-to-pay for travel time reductions, and the time since the respondent had last travelled by air. Therefore, those that had made trips by air more recently, had the greatest willingness-to-pay for travel time savings using VHSR or HSR. This finding is consistent with previous research which indicates the major modal shift potential is from competition with existing air and rail services (De Rus and Inglada, 1997; Vickerman, 1997). Recent users of air transport were willing-to-pay significantly more to use HSR or VHSR compared with those that had travelled by air less recently.

It should be noted that the findings relating to willingness-to-pay, did not account for comfort. The comfort attributes of a mode or trip have been found in previous research to affect the value of the time, and therefore the amount people were willing-to-pay to reduce travel time (Román *et al.*, 2008). As comfort attributes were not applied to the VHSR or HSR, it is not possible to determine whether willingness-to-pay for the travel time reductions involved this issue. A further issue for consideration in what is perceived to be reasonable in terms of willingness-to-pay for travel time savings, is the issue of how the time savings are phrased in respect of the cost. Kahneman (2012) describes 'framing', as an example of bias, in that people react differently to equivalent statements. Kahneman (2012) describes situations where the ultimate outcome is the same, but the framing of the situation can result in preference for one over the other, as loss evokes far stronger emotions than cost. Kahneman (2012) adds that the same outcome can be shown in a different way, for example if an individual receives £50 and gambles it, with the option of losing £30 or keeping £20. Kahneman's study found preference to gamble in the loss option and sure outcome in the keep option. It is therefore possible that phrasing of how much more people are willing-to-pay for travel time savings of a certain amount, might be perceived differently if the willingness-to-pay question was termed with the new travel time, omitting the word 'saving'). For example a three hour trip with a saving of 30 minutes might be perceived differently if referred to as a two and-a-half hour trip.

5.2.4 Willingness-to-pay comparison with HS2 value of time

The willingness-to-pay values ascertained through the questionnaire revealed respondents were accepting of increases in fares to save travel time, albeit at a low level. The values ascertained are shown in Table 5.1, re-calculated to give an hourly value of time comparable with that used in the HS2 business case.

Table 5.1: Willingness-to-pay for travel time savings – questionnaire responses

Available time saving…	Mean WTP	Hourly rate
To save 30 minutes on a 3 hour journey	106.07	£12.14
To save 90 minutes on a 3 hour journey	120.82	£13.88
To save 45 minutes on a 1½ hour journey	56.45	£8.60
To save 60 minutes on a 1½ hour journey	61.31	£11.31

The base cost for the 3 hour journey was £100, while for the 1½ hour journey it was £50. The hourly rate was calculated by subtracting the base cost from the mean willingness-to-pay, and converting the difference to an hourly rate. The resulting hourly rate calculated is similar to that used by HS2 (2013) in the economic case, for long-distance commuting (£12.31) and long-distance leisure travel (£10.72). However, the value is substantially lower than the value used for long-distance business travel (£44.66). The reason why the values of time determined through responses to the journey time scenarios in the questionnaire, are lower, is due to the fact that these did not distinguish between business and leisure travel time. If a distinction were made, it is possible that the values of time would have been closer to those used in the HS2 business case. Clearly values of time for business users will form a considerable part of the financial case for HS2.

5.3 Demographic theme

5.3.1 *Rationale for theme*

Understanding how segments of the population view the potential introduction of a high speed rail line is important as this helps to explain the context of public opinion regarding the HS2 project, and may prove useful in future policy-making.

5.3.2 *Demographic differences in attitudes to high speed rail*

This research identified a distinct association between perceived prestige of high speed rail, and age. This finding was present for both males and females,

indicating that the association was not gender specific. Compared to older respondents, the younger questionnaire respondents in both genders were more agreeable that high speed rail would be a positive and prestigious development, would be beneficial, and a step forward for the future. Furthermore, while the age effect was present for both genders, male respondents exhibited more positive attitudes towards high speed rail overall, compared with female respondents across all age groups. These findings are consistent with those in a study conducted by the Department for Transport (2011a) which found that older people were on average more likely to oppose HS2.

One possible explanation for older respondents perceiving high speed rail to be less prestigious and beneficial compared to the perceptions of younger people, relates to the potential utility of the new transport infrastructure. There is a propensity to change behaviour in reaction to a stimulus (for example the opening of new infrastructure) offering opportunities for changes in trip generation, distribution, frequency, trip re-timing, mode and route choice (Laird *et al.*, 2005). However, such 'Network effects' rely on individuals maximising utility, which has been questioned in the literature (Lehner and Adelman, 1990; Gärling *et al.*, 1998). Indeed Ben-Akiva and Lerman (1985) referred to the presence of individual character and taste differences when weighing-up alternative choices – and as such these individual differences in the decision-making process must be treated explicitly. Individual differences in characteristics include demographics such as gender, age and occupation. The research findings for this thesis indicate the presence of explicit differences in the perceived prestige of high speed rail and thus the perceived benefits and belief that the route would be a step-forward for the future. In terms of possible differences in the perceived utility of high speed rail, it is possible that older respondents consider a new high speed rail line less useful than younger respondents, as they are less likely to change their travel behaviour by using a new high speed rail service. Such a finding would be consistent with the findings of research regarding a railway line under construction in Sweden, in which the younger questionnaire respondents were more open to changing their behaviour compared with older respondents (Nordlund and Westin, 2013).

A further possible explanation for age differences in the perceived prestige and benefits of a new high speed rail route, also relates to the perceived utility of the line by older respondents. In this case, the project timescales for HS2 may have a role in explaining the age variations. At the time of data collection for the research in this thesis, the start of construction was still four years away, while the projected opening date for HS2 to Birmingham was 2026, and to Manchester and Leeds in 2033. The timescales of the project mean that younger respondents might perceive a benefit from HS2 once the scheme is open, as they are more likely to still be working and therefore have time pressures on their long distance trips. Conversely, the low perceived prestige of high speed rail for older respondents might reflect a perception that the long timescales involved in the construction of HS2 mean that they consider the possibility that the line might not open within their lifetime. Given this possibility, they might perceive that the benefits of HS2 will not be experienced by themselves, and thus view the development as irrelevant to them.

Another possible explanation for the age differences in attitudes of high speed rail prestige is that such infrastructure may be perceived as novel. This possibility is especially relevant in Britain, as there are currently no intercity high speed rail networks comparable to those in China, Japan and France. Previous research has suggested that novelty-seeking in younger respondents can have a positive effect on attitudes to high speed rail (e.g. Hsiao and Yang (2010)). The potential to travel at very high speeds on high speed rail might be viewed by some as exciting and also as prestigious. Research by Roth *et al.* (2005) found that novelty varies by age group with novelty greater for younger age groups. Given the findings by Hsiao and Yang (2010) and Roth *et al.* (2005), novelty may explain why younger respondents perceive high speed rail to be a more prestigious development compared to older respondents.

Alongside the age related differences in perceived prestige of high speed rail, attitudes within each age group were found to differ significantly by gender. The finding that males in all age groups believed that high speed rail would be beneficial and prestigious to a greater extent than female respondents is consistent with previous research, including the Department for Transport (2011a) study. As was the case with the age group differences, the novelty of a new high speed rail

system may explain the gender differences in attitudes to such a project. Roth *et al.* (2005) identified novelty scores to be higher for young males, and this would explain why younger and male respondents are more positive about the potential for a high speed rail service

5.3.3 *Situational effect*

The research conducted for this thesis found evidence that perceived prestige of high speed rail differed between regions of Great Britain. This confirmed the results of previous studies which identified favourability towards high speed rail was greater in some regions compared to others (Department for Transport, 2011a). The results indicated that the regions that perceived high speed rail as most prestigious were London, the south east of England, and the north east of England. While the East Midlands, south west of England and West Midlands indicated the least perceived prestige. Previous research also found that those living in the West Midlands were more likely to be opposed to the scheme (Department for Transport, 2011a). There is evidence of limits to the distribution of accessibility benefits from the potential HS2 route (Martínez Sánchez-Mateos and Givoni, 2011). However, whether the region will have a HS2 service does not appear to affect perceived prestige (e.g. Wales is not on the HS2 route, but perceives it more prestigious than the north west of England, but less than Yorkshire and The Humber, both of which are to be served by HS2.

As determined in Chapter Five, there is an association between age and region in perceived prestige of high speed rail, as some regions have imbalances in terms of the age composition of the sample. It is possible to conclude that differences in perceived prestige of high speed rail, may be accounted for by age imbalances in the regions. However, this issue requires further analysis in future research as it is difficult to determine whether regional age imbalances are responsible.

5.4 Environmental theme discussion

5.4.1 *Rationale for theme*

This research found that the environment was considered to be an issue of low importance in decision-making for long distance travel. In light of this finding, it is

questionable whether promoting transport choices on environmental grounds will deliver sustainable travel behaviour. Further intervention may be necessary in light of these findings, or alternatively the promotion of more sustainable travel choices may require highlighting other positive attributes of the service rather than environmental benefits.

5.4.2 *Low perceived importance of the environment*

Throughout this research, the importance of the environment in decision-making for long distance travel, such as in making mode choices, has consistently been an issue of low perceived importance to the participants.

In the focus groups, the environment was an issue of low salience as it was only mentioned by four participants out of 17, on one occasion each. When the environment was raised, it was in relation to whether the environmental impact of high speed rail was better or worse compared with other modes of transport. Thornton *et al.* (2010) indicate the presence of widespread public knowledge about the environmental impacts of transport. However, the findings from the focus group suggest that this is not the case with high speed rail.

Two respondents indicated that they would not pay an additional levy to offset the environmental impacts of their travel. The justification given for this was that they perceived that they had already paid enough money (for a flight) and the fare was already too expensive. In the past, offsetting the carbon emissions of travel has been abandoned by Eurostar on the grounds that the concept was not well understood, and furthermore, that the environmental debate had shifted away from carbon neutrality and offsetting (Otley, 2011). Research by Carbon Clear, cited by the Environmental Audit Committee (2007) indicates that the number of individuals that choose to offset is very small, at only around 1-2% of individual consumers. The Cooperative group add that the personal sector of this market is tiny. The research also comments that if the voluntary offsetting market is going to reach its potential for reducing carbon emissions, then participants need to increase considerably (Environmental Audit Committee, 2007). Low participation in carbon offsetting schemes when a voluntary matter of choice, confirms that some will pass the opportunity to carbon offset while it is not compulsory. Those that choose to carbon offset tend to be those already concerned with environmental

issues, or the affluent according to the Energy Saving Trust (Environmental Audit Committee, 2007). This claim appears to be supported by the finding from the focus group that participants rarely mentioned the environment, and those that mentioned carbon offsetting said that they would not pay. The findings of the focus groups that the environment was an issue rarely mentioned and the unwillingness-to-pay for carbon offsetting appears to be indicative of a low importance given to the issue of the environment.

Responses to the questionnaire were consistent with those from the focus groups, in finding that the environmental impacts of travel are perceived to be of low importance as a determinant of travel behaviour when compared with the other mode choice determinants. The environment was considered to be the least important consideration in decision-making for long distance travel, while cost was the second most important issue. When compared with fare/cost of travel, the environment was secondary, and when compared with travel time, the environment was again the secondary consideration. This finding is consistent with previous research, which has suggested that the environment is not a priority compared to other issues in travel decision making (Thornton *et al.*, 2010; Cafferkey and Caulfield, 2011). The importance of travel time relative to the environment is consistent with other studies that found travel time to be a major influence on mode choice (Mandel *et al.*, 1997; Gonzalez-Savignat, 2004).
The lack of importance placed on environmental considerations when making transport decisions, has been paralleled by both declining concern about climate change and the contribution of transport to climate change (Department for Transport, 2011d). However, previous research has also demonstrated that even where environmental norms are present, they can be overcome by other issues or needs considered more important (Wall *et al.*, 2008). Therefore, environmental concerns in travel decision-making do not appear to be as important or essential as other issues, and can be overridden. Ultimately, while some groups can consider the importance of the environment in travel mode choice similarly, their travel behaviour intentions can differ. Perceived importance of the environment does not necessarily act as a precursor of more sustainable travel behaviour (Anable, 2005).

The low perceived importance of environmental consequences of travel, may be explained by low salience rather than a conscious perception that the environment

is unimportant. In contrast to the finding of this thesis that the environmental impacts of travel are of low importance, other research found that more than three-quarters of adults sampled were concerned about climate change and believed it to be one of the top three most important issues facing Britain (Eleini, 2010). The environment issue was raised from a list of possible answers including climate change. In another study, respondents asked how they felt a high speed rail scheme would impact on them personally, did not mention the environment. However, given predefined options, nearly three-quarters indicated the issue of greatest importance to be the environment (Department for Transport, 2011a). The environment was not raised unprompted in the focus groups, and in the research by Eleini (2010) and Department for Transport (2011a), the importance of environmental issues were provided as an option in a list. This suggests that the environment may be an issue of low salience, and becomes an issue of greater importance when prompted. However, when given a defined list of options in the questionnaire, respondents perceived the environmental impact of a travel choice to be an issue of low importance in decision-making for long distance travel.

To summarise, the lack of mentions in the focus groups and low perceived importance of the environment unless prompted, does raise the possibility that it is an issue of low salience. However, when prompted for the research of this thesis, the environment was still perceived to be an issue of low importance in decision-making for long distance travel. It is possible that the low importance of the environment in the findings of this thesis, is a result of the issue being considered alongside other issues such as cost, travel time etc. The environmental norm may therefore be overcome by other issues in decision-making for long-distance travel, perhaps relating to perceived behavioural control aspects such as cost and time, which are therefore prioritised against perceived environmental impact.

5.4.3 *Demographics and the environment*

A further finding of the research for this thesis is the presence of demographic differences in the perceived importance of the environment. Younger respondents and females consider the environment as a more important determinant of long distance travel decision-making, when compared with males and older respondents. This finding is consistent with similar findings by Arnocky and Stroink (2010),

and Cottrell (2003), who found that environmental concern was negatively correlated with age, and concern for the environment diminished as age increased.

5.4.4 *Preference for unsustainable transport improvements*

The items in attitude factor F2 indicated a preference for unsustainable transport improvements, and thus a low perceived importance of the environment. Agreement with the factor indicated support for expansion of unsustainable transport modes, for example by building and expanding the capacity of roads and airports. The factor also expressed an unwillingness-to-pay to compensate for environmental damage and an acceptance of not being an environmentally friendly traveller. F2 can therefore reflect egoistic viewpoints through demands for infrastructure expansion regardless of the impacts on wider society and the environment.

Preference for unsustainable transport improvements was not distinguishable between genders, or by age. This is not consistent with the differences in the perceived importance of the environment in this thesis, or with the findings of Arnocky and Stroink (2010) and Cottrell (2003). However, there was a significant difference in attitudes to F2, between occupation groups, which identified that manual occupations were most agreeable, while those in upper and middle managerial and professional occupations, and students, were less agreeable. The perceived importance of the environment also differs between occupations, with those in manual occupations considering it to be the less important, compared with those in upper and middle managerial and professional occupations. This indicates a consistency of environmental attitudes between occupations. These findings appear consistent with those by (Scott and Willits (1991) cited in Cottrell (2003)), where higher incomes mean greater inclination to participate in pro-environmental behaviour. However, in other research, the hypothesis that higher income and education levels will have the greatest environmental concern, was not supported for income, but educational level is positively associated with environmental concern (Van Liere and Dunlap, 1980). This would explain the research findings of this thesis, as those in the upper and middle professional occupations, and students, placed greater importance on the environment and were less agreeable to making unsustainable transport improvements, while the reverse was true of those in manual occupations.

A chi-square test for association between the importance of the environment in long-distance travel decision-making, and support for making unsustainable transport improvements, confirmed an association between the attitude scores (χ^2=1610.63, p=<.001). The contingency coefficient (C=.702, p=<.001) also indicates a high degree of association. This determines that respondent's attitudes were consistent regarding desired unsustainable transport developments, and the importance of the environment in travel decision-making. Those perceiving low importance of environmental impacts, were most agreeable to unsustainable transport developments.

5.4.5 *Previous travel behaviour and environmental importance*

Perceived importance of the environment was found to be associated with time elapsed since the most recent long distance trip by rail and car, but not coach or air. Those perceiving a greater importance of environmental impacts in making decisions for long distance travel, were more likely to have made a recent long-distance trip by rail (r_s=-.098, p=<.001). However, those perceiving a low importance of the environment were likely to have made a recent long distance trip by car (r_s=.080, p=.001). These results confirm that those perceiving the environmental impact of choices made for long distance travel, made mode choices consistent with that belief. However, it was surprising that no significant correlation was present between environmental attitudes and time elapsed since the most recent long distance trip by air (r_s=.042, p=*ns*). A possible explanation is that on some long distance trips there are no alternatives to air, so despite considering the environmental impact important, this is outweighed by the desire to travel. These results are also consistent with F2: preference for unsustainable transport improvements. The correlation statistics indicated recent long distance rail travellers were less-favourable to unsustainable transport improvements, while recent long distance car trip-makers were more supportive of unsustainable transport improvements.

5.4.6 *Summary of environment theme*

The research findings of this thesis indicate that the environment is perceived to be an issue of low importance across the sample population. The issue of salience is relevant as previous studies have shown that the issue is considered of low

importance unless prompted or made obvious to respondents. Females and young people perceive the environment to be an issue of greater importance, while those in professional occupations and with higher educational attainment, were more likely to perceive the environmental impacts of travel choices to be important compared with those in manual employment. Perceived importance of the environment is also consistent with preference for unsustainable transport improvements (F2), and also with travel behaviour for car and rail, but not air. Promoting travel choices by environmental credentials therefore appears to be limited, as other considerations override these in travel decision-making. Other means may therefore be necessary to promote choice of sustainable modes to those with low environmental norms, while those perceiving the environment as important, would likely continue to make sustainable travel choices, more so where new alternatives are available.

5.5 Comfort theme discussion

5.5.1 *Rationale for theme*

Comfort emerged as an issue of great importance to respondents, in both the focus groups and the Principal Components Analysis of the questionnaire data. In the focus groups, comfort was an important element of the service quality theme, and as an antecedent of customer satisfaction, service quality can potentially be of great practical importance to both policy-makers and transport providers (Stradling *et al.*, 2007). While it is an abstract concept, it can be described as a journey-based affect based on experience of a journey, as these positive and negative feelings can include comfort and enjoyment (Mann and Abraham, 2006). Understanding the comfort aspects of long-distance travel is important, as these have been proven to impact on mode choice (Beecroft *et al.*, 2003; Johansson *et al.*, 2006; Gao *et al.*, 2012). Previous research has also identified comfort as an issue of high importance in bus service provision (Stradling *et al.*, 2007). Previous improvements to long-distance transport infrastructure have attempted to promote the superior comfort as a means to encourage future users (Lancaster and Taylor, 1988). As with previous experience, the standards of comfort on new infrastructure such as HS2, will be important in ensuring that such services are well patronised, while accounting for any differences in the long-distance travel user market.

5.5.2 *Differences in the perceived importance of comfort*

The importance of comfort when travelling long-distance (F4) comprised items including; being seated, avoiding standing, travelling ambience (both positive and negative), and carrying luggage. When provided with a list of options, comfort was not considered to be of importance when making long-distance travel choices (10^{th} out of 16), with other issues such as cost and travel time, perceived to be of greater importance. However, crowding (an issue strongly associated with comfort (Table 4.32)) was the third most important issue, and outranked travel time. The general concept of comfort is thus not perceived to be of great importance, though when an issue likely to be seriously detrimental to this is presented (crowding) the issue becomes increasingly salient, and important.

A research finding of this thesis was a perceived greater importance of comfort when travelling long-distance for older respondents, and for females in all age groups. This can be explained by the fact that attitudes to the importance of comfort included wanting to have a seat when travelling, and considering not travelling if being required to stand on a long distance trip. This finding is not surprising, as older respondents are more likely to have problems with standing for long periods of time. This would be consistent with findings of previous research that the probability of mobility impairments are likely to increase with age, and with these come a number of potential difficulties for older public transport users. These include difficulties with; standing inside vehicles, carrying items, getting on and off vehicles, and the number of interchanges, all of which can restrict public transport use for older people (Fiedler, 2007). Lower endurance and increased fatigue can also affect older people's use of public transport, as can perceptions of age related constraints of public transport, and fears about whether they can cope (Fiedler, 2007). The finding that females consider comfort to be of greater importance when making long distance trips, compared to males, can be explained by the fact that above the age of 75, females are at an increased likelihood of mobility impairment compared to males (Fiedler, 2007).

A further possible explanation is that F4 contained an item of preference for travelling by car if there was a lot to carry on a long distance trip. Generally, males are physically stronger than females, and as a result, carrying luggage is likely to be perceived to be less of an issue to males. Mohammadian (2005) found that in

attributes of vehicle choice females are more sensitive to space-related attributes (including luggage capacity) and prefer more storage room in their vehicles compared with males. Occupation differences in the perceived importance of comfort were also present, as the retired considered comfort to be of greater importance compared to other occupations, while students considered it of least importance. It is possible that these occupation differences are due to the age of the respondents in each category, or as a result of students prioritising cost due to being mainly on low wages (if at all).

5.5.3 *Comfort and previous travel behaviour findings*

The importance of comfort was positively correlated with time elapsed since the most recent long-distance trip by rail, air and coach, indicating lower perceived importance of comfort for more recent trip-makers by those modes. For time elapsed since the most recent long-distance car trip, a negative correlation indicated that more recent car trip-makers perceived the importance of comfort to be greater. The comfort items relating to having a seat, being able to carry a lot of luggage, and preferring not to stand explain why those who rated comfort as important were more recent long distance travellers by car; which as a mode offers the best means of meeting those aims. Travelling by car without being seated is impossible (thus no chance of being forced to stand) and the availability of personal luggage space without carriage restrictions (other than space) are clear advantages of the car for meeting the comfort requirements. None of the other modes can guarantee meeting these requirements; air and coach guarantee a seat, but can limit luggage allowance, and while rail has fewer luggage limits, being seated is not guaranteed. While previous research found those with a preference for comfort favoured bus over car, this is explained by the comfort variable used including being able to move around, working and resting (Johansson *et al.*, 2006). Other literature has also identified that perceived age related constraints can lead to such individuals choosing to travel by car instead (Fiedler, 2007).

The importance of comfort (F4) was found to differ by commuting behaviour, with non-commuters perceiving comfort to be of greater importance compared with commuters. A possible explanation is that commuters may be more accustomed to rush-hour conditions where standing on crowded transport may be necessary and it is accepted that getting a seat is unlikely. Non-commuters are likely to experience

crowding less than commuters, and may therefore perceive conditions as crowded at a much lower threshold. Costa *et al.* (1988) identified that out of people experiencing uncomfortable conditions, 75.4% were commuters, while only 42.2% were non-commuters. Commuters also suffered more overcrowding (50%) compared to non-commuters (12%). Anable and Gatersleben (2005) found that affective motives and instrumental motives are of similar importance on leisure trips, but on work trips instrumental factors are of greater importance. Comfort is affective and is relatively more important on leisure trips, which is consistent with the finding of the research of this thesis. It should be noted that the reduced travel time between London and Birmingham resulting from HS2, is likely to make increased commuting possible between these cities. Therefore, many of the potential future users of HS2 may be commuters, and as the standards of HS2 might be perceived as comparatively high due to being newer trains, and also due to the provision of new capacity reducing crowding; Willingness-to-pay could therefore increase due to improved perceived quality of service. This thesis research found that those who considered comfort to be more important, were less willing-to-pay for travel time savings (on all trips except the 30 minute saving on a three hour trip). It may be that respondents with a high perceived importance of comfort would rather travel in comfort, seated and enjoying the scenery, than seeking to reduce their travel time. This finding conflicts with suggestions that a trip is a cost yielding negative benefit (Masson and Petiot, 2009), but fits with claims that the travel time itself is useful (Mokhtarian and Saloman, 2001).

It is also important to consider that travelling in comfort is known to affect perceived travel time, being perceived as longer than real time when unpleasant, but shorter when comfortable (Litman, 2008). Issues such as crowding affect comfort, and raise the perceived travel time, making the travel time feel longer. Travel time costs can therefore be higher when travelling on a trip considered to be unpleasant (Litman, 2008). It therefore appears logical that respondents travelling in crowded conditions would be willing-to-pay for more comfortable conditions (Haywood and Koning, 2011). However, this was not found, as willingness-to-pay for travel time reductions did not differ by commuting behaviour. This may mean that respondents would be willing to extend their travel time to travel on less crowded services (Haywood and Koning, 2011). While this is similar to the 'Slow Motion Behaviour' concept (Nijkamp and Baaijens, 1999), it was not tested as part

of this thesis and therefore provides an opportunity for future research. However, it is possible that existing lines may see reduced crowding were HS2 to open, and it is therefore possible that while some long distance travellers may pay for the travel time reductions, others may be willing to extend their journey time to use less crowded services. Therefore, for existing lines to continue to be competitive following HS2, enhancements to comfort may be helpful.

It may be possible to conclude that commuters in the population sample of this thesis are not being exposed to extreme levels of crowding (and discomfort) as they do not perceive comfort to be of greater importance compared with non-commuters, and are not willing-to-pay more to reduce their travel time. However, as mentioned earlier in this discussion chapter, commuters threshold of perceived comfort may be lower, and therefore non-commuters may travel on services they consider crowded, but are not perceived as crowded by commuters.

It is difficult to split perceived importance of comfort, from comfort as a determinant of mode choice. Respondents may desire improvements to comfort levels, but accept crowded conditions as necessary and therefore do not consider comfort as important in their travel decision-making – hence its low rank (10^{th}). Therefore, while improved comfort would be desired, respondents do not necessarily feel that they always want to have a seat, and would choose not to travel if they had to stand.

5.5.4 *Comfort and security*

In previous research comfort and security have been considered as a conjoint issue (Alpizar and Carlsson, 2003). A Chi-square test indicated the presence of a high level of association between perceived F1: Travel security concerns and F4: Importance of comfort (χ^2=29603.25, p=<.001). The contingency coefficient (C=.971, p=<.001) indicated a very high degree of association (exceeding .9). This finding is consistent with previous research, where uncomfortable conditions included crowding, cold or dirtiness, and insecurity (cited in Litman, 2008).

As for the perceived importance of comfort, travel security concerns were greater for older respondents, a finding consistent with previous literature indicating greater sensitivity to crime, in older people (Fiedler, 2007). A possible explanation

is that elderly people are generally less able to counter personal attacks (Lynch and Atkins, 1988; Scott, 2003). As for comfort, travel security concerns differed between genders, with females consistently perceiving the issue to be of greater importance, compared to males.

Explanations for the attitude differences are that females generally have smaller physiques, are more likely to travel with children and are have real fears about attack, affecting their perceptions of travel safety (Root *et al.*, 2000). At night, these perceptions are heightened compared to daytime (Lynch and Atkins, 1988; Root *et al.*, 2000). Males in all age categories considered travel security to be less concerning, perhaps as male travel experience preferences are less risk averse, while females prioritise security (Mieczkowski, 1990, cited in Collins and Tisdell (2002)). Males have also been known to underestimate threats to their personal security and are less fearful about attacks and crime compared to females, despite indications of a comparatively increased likelihood of attacks and victimisation compared to females (Stanko and Hobdell, 1993; Root *et al.*, 2000; Scott, 2003).

In terms of gender differences by age, the thesis research found that females in all the age groups held greater travel security concerns compared to males of the same age group. Travel security concerns of females of 18 to 25 years of age were higher compared to the next few age groups, but rose again for the older age groups. This finding is consistent with the curvilinear relationship between age and fear of crime suggested by Ferraro (1995). This curvilinear relationship can be explained by a higher level of anxiety about sexual assault and personal safety fears among younger women (Lynch and Atkins, 1988; Scott, 2003; Tulloch and Lupton, 2003). However, Tulloch and Lupton (2003) also suggest that younger males often consider themselves physically robust and less vulnerable to assault, perhaps explaining why the travel security by age for males is not curvilinear.

Travel security concerns were less for those in upper and middle professional occupations and students, compared with manual occupations and the retired. While it is difficult to partition the students and retired from the age groups, those in higher income professions have fewer travel security concerns. Across the entire dataset, those in manual occupations were the least recent travellers by all modes, compared with those in managerial and professional occupations. For all modes

except car those that had made long distance trips more recently were less concerned about travel security, while less recent travellers were more concerned. For car, those that had travelled more recently were more concerned about travel security. However, the majority of long-distance car trips were recent and there was no significant difference between occupations. For all other modes the differences in time since the most recent long-distance trip by occupation were significant. As all of these were positive correlations, less recent travellers by these modes (i.e. manual workers) were significantly more concerned about travel security. It is therefore likely that the occupation differences in travel security concerns are linked to previous travel behaviour and mode choice.

Another explanation is that fewer resources (e.g. income) can mean modes are chosen that are considered less safe (Lynch and Atkins, 1988). Those with access to a car are less likely to experience unwanted interactions compared to public transport users. Travel security concerns might therefore be expected to be greater for public transport users. However, the results of this thesis do not support this conclusion, as recent travellers by public transport modes perceived travel security concerns to be less (it should be noted this may be different on short-distance service trains and buses).

The association between travel security and time since the most recent car trip was inverted, meaning recent car users were more concerned about travel security. However, there is a causality issue as to whether those with high travel security concerns chose car due to its perceived comparative safety compared to public transport (control over space, see Mann and Abraham (2006)). Alternatively, more recent car users may perceive public transport as unsafe due to their lack of experience. As for comfort, travel security concerns were perceived as less of an issue for commuters by public transport compared to non-commuters. It is reasonable to conclude that familiarity influences perceived travel security concerns, as more frequent travellers can have more experiences without security concerns to draw upon.

As a caveat, travel security concerns included terrorism and personal safety, as raised during the focus groups. Travel security concerns may be heightened following catastrophes such as large scale public transport accidents or acts of

terrorism. For example, Wagner *et al.* (1999) note that sudden disruptions, such as a catastrophe can influence views held by groups.

5.5.5 *Summary of comfort theme*

Comfort has been recognised as an issue of importance for future policy-makers and transport providers. While comfort can impact on mode choice, this has not been found in this thesis, where the importance of comfort as a determinant in travel decision-making, is low. The importance of comfort is perceived to be of high importance to older respondents, which links to being able to get a seat, and the carriage of luggage. Furthermore, in willingness-to-pay, there appeared to be a preference for comfort. Cost was of greater importance than comfort as a determinant for travel decision-making, indicating a wish to economise when travelling, and instead to improve conditions of service quality, rather than shorten the travel time. However, comfort affects the perception of travel time, and the indication that commuters consider comfort to be of less importance, suggests that for the sample population, travel conditions have not reached a point at which desire for travel time minimisation outweighs cost. As would be expected, travel security is closely related to comfort, and exhibits many similar demographic and travel behaviour patterns.

The findings in this section point towards cost being considered more important than comfort, but that improvements to comfort are preferable to paying more for travel time reductions. An implication of these findings is that the future success of HS2 depends on its ability to provide a service to meet the needs of an ageing population. In light of these findings, attention must be paid to the costs of using HS2 for all, and ensuring high levels of comfort and security for future users. Guaranteeing a seat and luggage space on future long-distance travel services may also improve perceived comfort to older people and females as potential users. Furthermore, as those with low willingness-to-pay for travel time reductions rate the importance of comfort highly, an opportunity exists for existing routes, to provide lower cost services relative to HS2. The freeing up of capacity is also likely to assist with improving comfort by reducing crowding and improving the likelihood of getting a seat. Promoting public transport modes for long-distance travel by their comfort attributes, may also prove beneficial.

5.6 Negative perceptions of high speed rail theme discussion

5.6.1 *Rationale for theme*

Understanding negative attitudes and perceptions of high speed rail is important to determine where these exist and why. It was hoped that negative perceptions to high speed rail would be distinguishable by demographic, travel behaviour and situational factors, as a means to explain where and why such perceptions exist.

5.6.2 *Distinctions in negative perceptions towards high speed rail*

It should be noted that while the negative perceptions of high speed rail were intended to be general, it is likely that HS2 would affect these. From the analysis, it was found that negative perceptions of high speed rail were unrelated to almost all variables. Loss-gain asymmetry theory suggests people are more sensitive to losses than gains (Kahneman and Tversky (1979) cited in Avineri and Waygood (2013)). The findings here do not confirm this, as perceptions of the negative effects of high speed rail are not sensitive to demographics or previous travel behaviour.

This thesis research found no significant differences in negative perceptions of high speed rail by age, gender or occupation. This finding is not consistent with previous research which found that those in higher social grades (A,B,C1) were more likely to perceive a negative impact from high speed rail on Britain (Department for Transport, 2011a). Negative perceptions of high speed rail did not differ by previous travel behaviour except for an association (at the extremity of significance) with time elapsed since the most recent long distance trip by air. More recent air travellers are less negative to high speed rail, which is consistent with the complementarity of both modes for intermodal trips and also for their competition for users in the same market (Blum *et al.*, 1992; De Rus and Inglada, 1997; Vickerman, 1997; Beecroft *et al.*, 2003; Román *et al.*, 2008; Chiambaretto and Decker, 2012). Negative perceptions of high speed rail did not lessen by proximity to a proposed station on HS2, as might be expected where benefits accrue to the access points (Vickerman, 1997). While similarly negative attitudes were not greater in locations more distant from the HS2 stations, such areas might become relatively less accessible (Martínez Sánchez-Mateos and Givoni, 2011).

Negative perceptions of high speed rail were found to be significantly greater for respondents living in postcodes contiguous to the HS2 route. This finding is congruent with Schaap (1996) who found local opposition to a Dutch high speed rail proposal, manifested as extremely negative attitudes to the project. This finding also supports the 'tunnel effect' where locations between stations along the line of the route do not benefit (Vickerman, 1997).

5.6.3 *Localised opposition to HS2*

It is possible, and understandable, that the stronger negative perceptions of high speed rail of those living in affected postcodes along the route of HS2, might suggest egoism due to perceived personal impact. Altruism, that may moderate negative attitudes, does not appear to be present. Therefore, while HS2 may reduce travel time or crowding levels for others, the perceived negative personal impact overrides the greater good. While local opposition to a large scheme is expected, it does raise the issue of salience. To those living along the route of HS2, perceived negative effects are salient. However, for those living further away, the perceived negative effects of HS2 are of low salience. As noted in the literature review (Chapter 2), there has been a considerable amount of media coverage of the positive and negative aspects of developing HS2. It should also be noted that the cost of the HS2 scheme has been revised upwards since the data were collected, and alterations to the route continue in an attempt to mitigate potential negative effects, for example by tunnelling sections of line. The data analysed here do not take these changes into account.

5.7 Importance of useful travel time theme discussion

5.7.1 *Rationale for theme*

Previous literature has suggested that reductions in travel time are not necessarily sought, and instead travel time can be used productively. Questions remain as to whether the travel time reductions save useful or unproductive time (Mokhtarian and Saloman, 2001; Lyons and Jain, 2005; Lyons, 2008; Banister, 2011). Any findings here may have implications for the justification of HS2, in that the focus of claimed benefits should be on attributes other than travel time savings.

5.7.2 *Differences in importance of useful travel time*

The importance of useful travel time factor relates to being able to make use of travel time, and to have the means (technology) to do so. Age differences in the perceived importance of useful travel time were curvilinear, with the importance of useful travel time peaking between 26 and 45 years of age. Familiarity with technology offers an explanation for age differences, with those in the middle age groups more likely to have laptop access when travelling, compared to younger and older respondents (Lyons *et al.*, 2007). When split by gender, the age differences were analogous, though perceived importance of useful travel time was greater for females across all ages. This finding contradicts previous research which found that males are more likely than females to use their travel time in order to work (Lyons *et al.*, 2007).

Declining importance of useful travel time in older age groups may be due to fewer respondents in those groups still working, compared to those in the middle age groups. Those in upper and middle professional and managerial occupations, plus students perceived useful travel time as of greater importance, compared to those in manual occupations and the retired. For students and the retired this may be linked to age. Professionals might be more likely to be required to work while travelling, compared to those in manual occupations. However, a problem with an occupation-based effect is that the useful travel time does not necessarily have to be work-related. This distinction should be made in further work. More recent users of rail, air and coach transport for long-distance trips consider useful time to be of greater importance than less recent trip-makers, while the opposite is true for car users. This finding is expected, as car is the only mode out of the four that does not easily allow work while travelling, thus car users consider useful travel time less important, compared with public transport users.

Commuters perceived useful travel time to be significantly more important than non-commuters. Commuters in crowded conditions may find their travel environment unsuitable for being productive. This conclusion would be consistent with Jain and Lyons (2008), who point out that not all travel takes place in quiet surroundings (e.g. a first class train carriage) and some environments can be restrictive. While crowding has been found to not affect whether work was carried out, being forced to stand reduces the proportion of those working on trains

(Department for Transport, 2009b). Commuters, are more likely to have experienced difficulties with working due to crowding, and are thus supportive of measures to improve travel time utility.

5.7.3 *Useful travel time and willingness-to-pay for travel time savings*

It was expected that those that wanted to make better use of their travel time would not be seeking to pay for travel time reductions. Travel time savings might reduce productive time, so savings made may not necessarily be unproductive time (Lyons, 2008). For a perceived importance of making better use of travel time, paying to reduce it might be at odds with that aim, if the productive time is that which is reduced. However, willingness-to-pay increased as the perceived importance of useful travel time increased. However, it is also possible that those perceiving useful travel time to be important, currently consider their travel time to be mostly underproductive, and therefore are willing-to-pay to reduce this time. It is not possible to conclusively make a judgement on the travel time / useful travel time trade-off with the results of this thesis.

5.8 Behaviour theory discussion of results

Travel behaviour was linked to several theories in the literature review; The results are therefore discussed in light of these. It should be noted that respondents were not psychologically assessed during this research, and therefore while behaviour theory is discussed, links cannot be proven. The results suggest that attitudes and perceptions of long-distance travel and HSR vary by gender, age and occupation, thereby indicating individual differences in how they are perceived. These differences indicate individual tastes and variations in the decision-making process, thereby confirming Random utility theory and Behavioural decision theories provide an accurate theoretical framework for respondent's attitudes. Familiarity, which is an aspect of Behavioural decision theory, does not appear to play a significant part in attitudes to long-distance travel, as there are no statistically significant associations with time elapsed since recent long-distance trips.

It is difficult to determine respondent's world views, as the research did not collect details of respondent's backgrounds, and it is not possible to see the situational influences that might affect world-view formation. There appears to be evidence of

individualistic world views, as those living adjacent to the proposed HS2 line are more negative (F5) and less positive (F3) about the proposal. In this trade-off between self-interest and collective utility, the results suggest that individualistic world views have been adopted by the majority of those living along the proposed route of HS2. This means that respondents along the line of the HS2 are concerned about potential impacts on themselves rather than altruistically accepting negative consequences for the benefit of those likely to make great use of HS2.

Outside influences on world views should also be considered, including significant-others in a person's life, and influences such as the media. As the section in the literature indicated, HSR development is a highly contentious issue, with numerous sources in support of and against such development. While some may critique the views they receive, others may adopt them unquestionably, which can mean that the broadcast media and the views of others can significantly impact on an individuals world views and attitudes. As a result, attitudes and perceptions expressed in this thesis might reflect the prevailing views in the media, and are susceptible to long-term change.

Personality types may also influence respondent's attitudes. Those with extrovert, open-personalities value new experiences and are curious about new ideas, and are likely to be more positive about HS2, possibly perceiving it as novel or exciting. Meanwhile those with introvert, closed-personalities are often seen to be distrustful and defensive about the unknown. As there is no experience of inter-city HSR in Britain, the impacts of HS2 are largely unknown. In combination with negativity in the media about the costs and potential impacts of HS2, this is likely to make such individuals fearful and opposing, and to mistrust those making the pro-HS2 argument.

Moral norms do not appear to play a significant role in attitudes and perceptions of HSR. Those living adjacent to the proposed line are more negative about the proposal, despite it potentially benefitting others. Meanwhile, those living further from the route of HS2 are more positive about the development, despite the potential negative impacts on those living nearby. If moral norms were involved, one would expect that those living further away would feel a strong moral obligation to consider the negative consequences for others. Furthermore, it can be

seen that the environment is an issue of low perceived importance in decision-making for long-distance trips. A perceived social pressure to be environmentally-conscious and to put sustainability above personal gain, does not appear to be present, as both cost and travel time are considered more important in this research.

The results discussed here demonstrate that there are many instances of possible links to travel behaviour and attitudinal theory. Future research on a smaller-scale could concentrate on psychological profiling of respondents, to ascertain the how their personality types and world-views affect their attitudes and perceptions to long-distance travel and HSR.

5.9 Resolutions to contentious HS2 issues?

The main controversies surrounding the development of HS2 are that it will be expensive, environmentally-damaging, economically disadvantageous to peripheral regions (benefitting London) and unnecessary in terms of the travel time savings it will bring.

There does appear to be willingness-to-pay (WTP) to save travel time, particularly on longer trips (3hrs), and especially where a VHSR service is operating. It was clear from the WTP responses, that where HSR only offers small travel time reduction, there is less willingness-to-pay. Therefore, to reach the economic forecast fare-receipts, a faster service delivering greater travel time savings is necessary.

Whether many of the contentious and controversial aspects of the development of HS2 become a reality, will not be known until after construction, opening, and several years of service. This thesis does show that attitudes are generally more positive in younger people compared to older people, and it will be interesting to see whether these views are those of a new generation, or whether the present young people will become increasingly negative with age.

Chapter 6. Conclusions

6.1 Introduction

The conclusion chapter sets out the main findings of this thesis and their implications for policy, research limitations, and the implications of these findings to future research in this field. The results of the statistical analysis performed in the course of this thesis, can be found in Chapter 4. The analysis of attitudes and perceptions to long-distance travel and high speed rail identified demographic, situational and behavioural differences and associations. Willingness-to-pay for travel time savings was also investigated, as were the determinants of travel decision-making for long distance travel. The findings made and their implications, are discussed in this section under their theme headings.

6.2 Research findings and implications

6.2.1 *Conclusions and implications of cost findings*

From a list of defined options, cost was revealed to be the second most important consideration in planning and decision-making for long-distance travel, following reliability of service. However, when unprompted (in the focus groups) reliability was comparatively less important than cost. In these research findings, service reliability is an issue of less salience, while cost is of high salience throughout both stages of the data collection. Cost therefore remains as an ever-present consideration in long-distance travel, while the importance of reliability is not perceived as easily, and becomes increasingly perceivable when prompted, as it is then raised to a more conscious level. This high salience of cost is most likely negative, as satisfaction with fares and travel costs would mean the issue was less of a consideration compared with others. As reliability is considered the primary consideration, cost was also perceived to be more important in making travel choices than trip time, evidence which appears to support the 'Slow Motion Behaviour' theory (Nijkamp and Baaijens, 1999), and may point towards opportunities for patronage of existing services alongside HS2, with relatively lower fares.

Willingness-to-pay for travel time savings peaked for the middle age groups, and was greater for the VHSR than for HS2. While a novelty effect may be present,

this cannot be determined from the data collected, and provides an area for further investigation. Willingness-to-pay did not differ between commuters and non-commuters, surprisingly indicating that the travel time savings were valued similarly by both groups. As HS2 is likely to increase commuting between London and Birmingham due to the reduced travel times, this should be considered in pricing.

In future long-distance transport provision, it is therefore important to note that cost is the most salient issue considered in planning travel behaviour. However, reliability is more important when perceived, and suggests that people may be willing to pay more for projects that will improve service reliability. Framing HS2 and other future transport projects in terms of their impact on reliability and the consequences of a 'do-nothing' approach, may improve perceptions, and help to overcome cost concerns.

6.2.2 *Conclusions and implications of demographic findings*

High speed rail was perceived to be more prestigious by younger and male respondents. There is the possibility that the enthusiasm for high speed rail is a result of the novelty of such technology and engineering, which would be consistent with previous research as novelty tends to be more prevalent in younger people (Roth *et al.*, 2005; Hsiao and Yang, 2010). However, that older people perceive high speed rail as less prestigious, may be a result of fewer perceived benefits for those in higher age groups.

The fewer perceived benefits may be due to older people being less likely to change travel behaviour and to adapt to new infrastructure, and perhaps in terms of perceived utility. The long timescales of the HS2 project mean that while younger people may be future users of the scheme, older people may perceive that they may never use the high speed rail service in their lifetime, and that it will be of little use to them. This would especially be the case where delays in planning and construction occur. It is possible that were HS2 to open sooner, the attitudes towards it from older respondents may be more positive. Indeed, if this research was repeated in the 2020s, this age difference may no longer be present. Whether the timescale to opening a high speed rail route affects attitudes towards it would make an interesting element of a future attitudinal study. Whether shortening the

timescale for delivering major infrastructure projects is feasible, remains to be seen. However, in conclusions made from research regarding HS2, this research indicates that the age profile of respondents should be considered.

6.2.3 *Conclusions and implications of environmental findings*

The environment was an issue of low importance in both in the focus groups and the questionnaire. Previous research has indicated that this may be a result of low salience of the environmental impacts of travel choices, in that when prompted, the issue is perceived to be more important. However, in this research the importance of the environment was perceived to be low in comparison to other factors, even when prompted. Environmental norms can therefore be overcome by other more salient issues, such as cost.

Furthermore, preference for making improvements to unsustainable transport modes was closely associated with environmental concern. Respondent attitudes to the environment were consistent with travel behaviour, as those with low perceived environmental importance chose car, and those with high environmental importance chose rail. Those with established environmental attitudes therefore are consistent in terms of their travel behaviour. The implications of these findings are that promoting travel choices by environmental credentials is likely to be limited by other considerations and determinants, which override environmental norms in decision-making. Promotion of sustainable travel should therefore be made by other attributes, as this might prove more successful in encouraging such travel behaviour.

6.2.4 *Conclusions and implications of comfort findings*

Comfort as a general concept was not perceived to be of great importance, though it is closely associated with crowding, which is of greater importance. The prospect of travelling in crowded conditions therefore appears to be more salient and important than the general concept of travel comfort.

Females and older people perceived comfort as being of greater importance due to perceived challenges, such as luggage carriage, being able to find a seat, and not having to stand. Where comfort was of high importance, previous travel behaviour

reflected this by choosing car for long-distance trips, as this best meets the objectives of this factor.

Commuters considered comfort to be less important compared to non-commuters, which raises the possibility that this is due to a higher perceived threshold of 'crowded' for commuters used to peak-travel conditions. It should be noted however, that where importance of comfort is greater, willingness-to-pay for travel time reductions is lower. Therefore, travel conditions are not perceived to be sufficiently uncomfortable to warrant additional cost by paying to reduce travel time. As a travel choice determinant, cost was of greater importance than comfort. However, when comfort importance was compared with willingness-to-pay for time savings, greater perceived importance of comfort meant willingness-to-pay was lower. Travel comfort can therefore be described as a desire, rather than a determinant of travel behaviour.

Comfort was also closely related to travel security concerns, and as for comfort, travel security concerns were greater for females and older respondents.

The implications for the comfort findings are that future long distance travel provision needs to account for the comfort needs of older people, which will become increasingly important in an ageing society. Measures to improve female comfort should also be sought, such as designing secure environments on long-distance transport services. For HS2, requirements for mandatory seat reservations (as on the French TGV) would also result in lower crowding and being guaranteed not to have to stand while travelling. Such improvements may encourage a greater number of older people to use HS2 once it is open, while also providing for the future needs of an ageing population.

Should HS2 be built, an opportunity exists for existing services to provide a more comfortable service, with reduced crowding as an alternative to the faster trains on HS2. Some people may choose to travel on slower trains as not everyone wishes to travel to their destination as quickly as possible. The results indicate that where these are more comfortable, they may be well utilised by those who consider comfort to be of greater importance than travel time savings.

6.2.5 *Conclusions and implications of negative perceptions (F5) findings*

Negative perceptions of high speed rail were indistinct by all but two of the variables tested. The first was the time elapsed since the most recent long distance trip by air, indicating less negative perceptions of high speed rail for recent air users, indicating potential for modal shift from air. The second was whether the respondent lived in a postcode contiguous to the proposed HS2 route. These findings apply only to the first stage of the route, between Birmingham and London. The stronger negative attitudes in postcodes on the HS2 route compared with those not on the route, indicate that the negative perceptions of high speed rail are of low salience to those in areas non-contiguous to HS2.

It should be noted that HS2 consultation responses came predominantly from postcode areas in proximity to the proposed route (Dialogue by Design, 2011). While it is understandable that the majority of responses would come from those living immediately close to the line, a geographically wider survey with equal representation from all regions might have led to differences in the data obtained. Encouraging responses from more distant locations is therefore paramount, if equal weight is to be given to the views of those living further away.

The lack of distinction in negative perceptions of high speed rail by the variables tested, mean that they cannot be predicted across the population by anything other than whether the respondent lives in a location contiguous to the route of HS2.

6.2.6 *Conclusions and implications of useful travel time (F6) findings*

Commuters perceived useful travel time to be significantly more important than non-commuters. This may link to crowding, as it is difficult to make productive use of travel time where conditions are crowded or it is not possible to get a seat. As commuters on the London to Birmingham corridor might increase as a result of the reduced travel time putting both cities within an hour of each other, it is important to recognise this potentially growing market. As for comfort, mandatory seating would be likely to improve useful travel time by reducing crowding, and therefore this is recommended.

6.3 Limitations of research

In order to minimise interference, and to be a cost-effective means of distribution, an online questionnaire approach was chosen. As such, the questionnaire was disseminated online using internet forums, social media and adopting a cascade approach to attain further responses. Those without computer access were not given an opportunity to participate in the final version of the questionnaire. An alternative means of distribution was through a survey notification in the newsletter of the AA (Automobile Association), providing opportunity to access the online questionnaire. However, distribution in the AA newsletter meant a high incidence of respondents with car access was probable. Many questionnaire respondents may therefore not have used public transport for long-distance travel, for a considerable amount of time. It is also possible that the responses obtained may be more 'pro-car' than would be expected from the general public.

By using an anonymous online approach, controlling responses proved difficult, and ensuring representative sample of the wider UK population was not possible. Compared to the national population, male respondents were over-represented, and the sample was also not representative of the wider UK population in terms of age group and occupation. The sample comprised a larger number of professional respondents compared with those in non-professional occupations, which may have affected the responses, especially due to low counts in the manual occupations category. The mailing lists used to distribute the questionnaire also resulted in many respondents from transport academic and professional backgrounds – i.e. those with an interest.

Responses to the questionnaire were received from locations both internationally, and with a good spread of responses from all regions across Great Britain. However, the population of each region was not controlled, meaning that regions with larger populations did not necessarily have a larger number of respondents. Also, there is an over-representation in the north east of England, which may be accounted for given the additional interest of the location of the university attended by the author.

Separating age from occupation and several of the other variables in the analysis proved difficult. A limit therefore is that significant age effects might also result in

significant occupation effects, given that some of the occupation categories cannot be separated from age. Also, as individuals within specific age groups were not targeted, some regions have a skewed population by age.

Anonymity meant it was not possible to ascertain the accuracy of the responses. This also limits any potential follow-up study as part of a longitudinal research project, as it would prove difficult to identify the same respondents.

It was hoped that the research would test for associations between long-distance commuting, and attitudes to long-distance travel and HSR (Hypothesis 4). However, in the questionnaire, long-distance commuting was termed as 'commuting by inter-city rail'. This oversight meant respondents may not have understood this as intended and may have considered this to mean living in one city and working in another. As there are cities less than 50 miles (80km) apart (Manchester and Liverpool, Southampton and Portsmouth) interpretation may be different than intended, and the accuracy of responses is questionable.

This research is that it is set in a context of a fast-moving and evolving, contemporary transport project. Since commencing this thesis, the planned technology used for the north-south high speed transport system has been confirmed as high speed rail (rather than VHSR). A new route for HS2 has also been confirmed. A final limitation is that since data collection, HS2 has received considerable media attention, elements of the project have changed (most noticeably the cost), and the scheme has proven to be increasingly divisive. As a caveat, the findings of this research should be considered in light of these limitations.

6.4 Conclusions and major recommendations

The implications of the results here will be of interest to policy makers, researchers, and transport service providers dealing with the current proposals for HS2. The contribution to knowledge that thesis provides may wish to be considered by policy-makers in future long-distance travel provision.

6.4.1 Contributions to theory

It was possible to relate some of the findings to the travel behaviour and psychological theories presented in the literature review;

- Low perceived importance of the environment suggests it is viewed as an issue of low salience in transport-decision making, furthermore indicating a degree of introversion and a lack of awareness of the consequences to the environment.
- 'Slow-Motion Behaviour' theory is supported by this research, as travel cost was considered more important than travel time, in the decision-making process for long-distance travel.
- Trade-offs between travel time and cost support the theoretical models abandoning fully-rational decision-making. In such a case willingness-to-pay would be expected to rise proportionally with the travel time savings, as saving time would be maximising utility. However, this was not the case, and willingness-to-pay was focussed at the lower end of the price scale – albeit similar to non-business values in the HS2 economic case.
- Retrievability (first-hand experience), has been found to affect decision-making, but has no visible impact in this research. Where Spearman's Rho calculations between attitudes and time elapsed (rail) were significant, coefficients were low, indicating a possible effect size. Commuting behaviour was also unrelated to perceptions of HSR.
- The research contributes to theory by providing evidence of Cultural Theory facets in attitudes to long-distance travel and perceptions of HSR. Individualism (egoism) is evident, indicating introversion in respondents. This is evident firstly through the low importance of the environment, and, secondly in the proximity effect of HS2 on attitudes to HSR. Those living near the proposed route were significantly more negative (F5) about HSR. This suggests the presence of NIMBYism and individualist goals, overriding willingness-to-accept any negative impacts for others benefit (altruistic and egalitarian behaviour).
- The thesis results also support TPB. Perceived behavioural control (PBC) is an antecedent of behavioural intention, centred upon perceived constraints to performing the intended behaviour. In this thesis, willingness-to-pay for travel time savings is less for lower socio-

economic groups and older people. Furthermore, perceived prestige of HSR (F3) decreases with increasing age, perhaps due perceptions by older people that they may never use such infrastructure, or have the necessary physical condition (due to age) to do so. Low PBC of the ability to behave as intended is therefore present, through not perceiving the necessary means (income) or physical condition (age).

6.4.2 Insights on methods

Methodological insights of this research may be relevant to future work.

- The relative importance of cost and reliability depended on the method used to solicit a response. Unprompted (focus groups), reliability was considerably less important than cost, indicating comparatively low salience of reliability. However, pre-defined options in the questionnaire, revealed reliability to be the most important consideration.
- A 50-mile minimum distance was used to define long-distance travel. However, in one focus group, time was said to be how a trip is perceived as 'long'. Use of a time-based definition may prove useful in future research, though it does not account for congestion or slower modes. Comparative research using a time-based versus distance-based definition of long-distance travel may prove interesting in determining which closer represents how such trips are perceived.
- At the time of data collection HSR is a future concept for most respondents. Tversky's work on retrievability found first-hand knowledge affects decision-making. The method used in this thesis did not distinguish between previous users and non-users of HSR. Future research methods should consider this distinction, as some attitudes are based on experiences, while those with no experience may base their perceptions on novelty.
- The online distribution method effectively collected responses across a wide area and in an efficient and inexpensive way. However, distribution proved difficult without a pre-defined mailing list. Forums and mailing lists used were those likely to have an interest in responding, therefore introducing bias. Postal distribution would overcome this, but would require a printing and distribution company sending thousands of questionnaires to collect the necessary responses. Use of postal

distribution in future research would depend upon finances and the online questionnaires are an inexpensive alternative.

6.4.3 Recommendations to policy

- Consider providing lower cost, more comfortable services on existing lines, to capture demand from those wishing to save money and prioritising comfort.
- Reflect the improved reliability benefits in the debates surrounding new long-distance travel infrastructure.
- Take into account the effect of age and perceived utility on perceptions towards future transport projects, and seek to reduce delays in infrastructure planning and construction where possible.
- Consider promoting sustainable travel behaviour using attributes other than the environment.
- Seek to provide more comfortable and secure surroundings on long distance transport, which will be of increasing importance in an ageing society.
- Assess the feasibility of making seat reservations on long-distance rail services mandatory (at least in some carriages) to improve perceived comfort and allow more productive use of travel time.
- Consider equal regional weighting of consultations so that affected areas with increased salience are not overrepresented.

At the time of writing, the HS2 proposal remains an issue receiving considerable media coverage from both opponents and supporters. Debates have centred upon whether HS2 is worth the expense, the benefits of reducing the travel time, the impact on the local population and environment, the national effects, and the claimed economic case. Whether the line will be constructed remains to be seen. However, as this thesis has identified, there are many issues that may wish to be considered in the provision of long-distance travel services.

List of References

Abrahamse, W., Steg, L., Gifford, R. and Vlek, C. (2009) 'Factors influencing car use for commuting and the intention to reduce it: A question of self-interest or morality?', *Transportation Research Part F*, 12, pp. 317-324.

Aizlewood, K. and Wellings, R. (2011) *High Speed 2: the next government project disaster?* (Paper number 36). London.

Ajzen, I. (1991) 'The theory of planned behavior', *Organizational Behavior and Human Decision Processes*, 50(2), pp. 179-211.

Ajzen, I. (2005) *Attitudes, Personality and Behaviour*. Second edn. Open University Press.

Ajzen, I. and Fishbein, M. (1980) *Understanding Attitudes and Predicting Social Behaviour*. New Jersey, United States of America: Prentice-Hall Inc.

Alpizar, F. and Carlsson, F. (2003) 'Policy implications and analysis of the determinants of travel mode choice: an application of choice experiments to metropolitan Costa Rica', *Environment and Development Economics*, (4), pp. 603-619.

Anable, J. (2005) "Complacent Car Addicts' or 'Aspiring Environmentalists'? Identifying travel behaviour segments using attitude theory', *Transport Policy*, 12(1), pp. 65-78.

Anable, J. and Gatersleben, B. (2005) 'All work and no play? The role of instrumental and affective factors in work and leisure journeys by different travel modes', *Transportation Research Part A*, 39, pp. 163-181.

Anable, J., Lane, B. and Banks, N. (2009) *Act! Innovate! Deliver! Reducing energy demand sustainably: eceee 2009 Summer Study*. La Colle sur Loup, France, 1st-6th June 2009. European Council for an Energy Efficient Economy.

Anable, J., Lane, B. and Kelay, T. (2006) *An evidence base review of public attitudes to climate change and transport behaviour*.

Andrews, T. (2012) 'What is Social Constructionism?', *The Grounded Theory Review*, 11(1).

Arnocky, S. and Stroink, M. (2010) 'Gender differences in Environmentalism: The mediating role of emotional empathy' 19/02/2010 *Current Research in Social Psychology*. 26/07/2011. Available at: http://www.uiowa.edu/~grpproc.

Association of Train Operating Companies (2012) *Cut price fares and rising cost of petrol lead to historic numbers of rail passengers*. Available at: http://www.atoc.org/media-centre/latest-press-releases/cut-price-fares-and-rising-cost-of-petrol-lead-to-historic-numbers-of-rail-passengers-100681 (Accessed: 22/04/2013).

Association of Train Operating Companies, Passenger Focus and Rail Safety and Standards Board (2009) *Station Travel Plans: Research Toolkit*.

Atkins (2010) *High Speed 2 Strategic Alternatives Study: Strategic Outline Case*.

Ausubel, J.H. and Marchetti, C. (2001) 'The Evolution of Transport', *The Industrial Physicist*, April 2001, pp. 20-24.

Avineri, E. and Waygood, E.O.D. (2013) 'Applying valence framing to enhance the effect of information on transport-related carbon dioxide emissions', *Transportation Research Part A: Policy and Practice*, 48(0), pp. 31-38.

Bamberg, S., Ajzen, I. and Schmidt, P. (2003) 'Choice of Travel Mode in the Theory of Planned Behavior: The Roles of Past Behavior, Habit, and Reasoned Action', *Basic and Applied Social Psychology*, 25(3), pp. 175 - 187.

Banister, D. (2011) 'The trilogy of distance, speed and time', *Journal of Transport Geography*, 19(4), pp. 950-959.

Banister, D. and Berechman, Y. (2001) 'Transport investment and the promotion of economic growth', *Journal of Transport Geography*, 9(3), pp. 209-218.

Batley, R., Mackie, P.J. and Wardman, M. (2012) 'Review of the value of time assumptions for business travellers on HS2'. University of Leeds: Institute for Transport Studies.

BBC News (2008a) *High-speed rail back on agenda* (29/10/2008). Available at: http://news.bbc.co.uk/1/hi/uk_politics/7697973.stm (Accessed: 11/07/2013).

BBC News (2008b) *Major new rail lines considered* (21/06/2008). Available at: http://news.bbc.co.uk/1/hi/uk/7467203.stm (Accessed: 11/07/2013).

BBC News (2009a) *High-speed rail link considered* (15/01/2009). Available at: http://news.bbc.co.uk/1/hi/scotland/7830916.stm (Accessed: 12/07/2013).

BBC News (2009b) *New high-speed rail plan unveiled* (26/08/2009). Available at: http://news.bbc.co.uk/1/hi/business/8221540.stm (Accessed: 17/07/2013).

BBC News (2010) *High speed rail: In your back yard* (12/03/2010). Available at: http://news.bbc.co.uk/1/hi/uk/8564154.stm (Accessed: 11/07/2013).

BBC News (2011a) *Critics of high-speed rail are 'well-off nimbys'* (28/06/2011). Available at: http://www.bbc.co.uk/news/uk-politics-13943014 (Accessed: 17/07/2013).

BBC News (2011b) *Government starts high-speed rail consultation* (28/02/2011). Available at: http://www.bbc.co.uk/news/uk-politics-12591464 (Accessed: 16/07/2013).

BBC News (2011c) *Majority in Birmingham survey favour high speed rail* (15/06/2011). Available at: http://www.bbc.co.uk/news/uk-england-stoke-staffordshire-13784202 (Accessed: 16/07/2013).

BBC News (2012a) *HS2: Campaign backs high-speed rail link in media* (06/01/2012). Available at: http://www.bbc.co.uk/news/mobile/uk-16436443 (Accessed: 16/07/2013).

BBC News (2012b) *HS2: High-speed rail link 'being seriously considered'* (07/01/2012). Available at: http://www.bbc.co.uk/news/uk-16453869 (Accessed: 16/07/2013).

BBC News (2012c) *HS2: High-speed rail network gets go-ahead* (10/01/2012). Available at: http://www.bbc.co.uk/news/uk-16478954 (Accessed: 16/07/2013).

BBC News (2013a) *George Osborne 'passionate' about HS2 rail link* (01/09/2013). Available at: http://www.bbc.co.uk/news/uk-politics-23919949 (Accessed: 07/09/2013).

BBC News (2013b) *HS2 challenge rejected by Court of Appeal* (24/07/2013). Available at: http://www.bbc.co.uk/news/uk-23433902 (Accessed: 26/07/2013).

BBC News (2013c) *HS2 costs could mean rail nightmare, says Darling* (23/08/2013). Available at: http://www.bbc.co.uk/news/uk-politics-23808993 (Accessed: 07/09/2013).

BBC News (2013d) *HS2 rail plans: Think tank raises doubts over value*. Available at: http://www.bbc.co.uk/news/uk-22941908 (Accessed: 26/06/2013).

BBC News (2013e) *HS2: High-speed rail route phase two details announced* (28 January 2013). Available at: http://www.bbc.co.uk/news/uk-21221828 (Accessed: 07/07/2014).

BBC News (2013f) *HS2: High-speed rail route phase two details announced* (28/01/2013). Available at: http://www.bbc.co.uk/news/uk-21221828 (Accessed: 16/07/2013).

BBC News (2013g) *HS2: Transport minister says 'upset' is inevitable*. Available at: http://www.bbc.co.uk/news/uk-21213008.

Daily Politics (2013) Directed by BBC Television [Television]. BBC Two: British Broadcasting Corporation. Available at: http://www.bbc.co.uk/news/uk-politics-23048284 (Accessed: 25/06/2013).

Beattie, J. (2013) 'HS2: High Speed rail budget soars by £10BILLION before it's even started', *Mirror* (26/06/2013 edn). [Online] Available at: http://www.mirror.co.uk/news/uk-news/hs2-high-speed-rail-budget-2001374 (Accessed: 16/07/2013).

Beecroft, M., Chatterjee, K. and Lyons, G. (2003) *Transport Visions, Long Distance Travel : The sixth of eight reports from the Transport Visions Network*. London: Landor Publishing.

Ben-Akiva, M. and Bierlaire, M. (1999) 'Discrete choice methods and their applications to short term travel decisions', in *Handbook of Transportation Science*.

Ben-Akiva, M.E. and Lerman, S.R. (1985) *Discrete Choice Analysis: Theory and Application to Predict Travel Demand*. Massachusetts Institute of Technology.

Berger, P.L. and Luckmann, T. (1966) *The Social Construction of Reality*. New York, United States of America: Penguin Books.

Black, R. (2012) *High-speed rail network gets go-ahead* (10/01/2012). Available at: http://www.bbc.co.uk/news/uk-16478954 (Accessed: 16/07/2013).

Blum, U., Gercek, H. and Viegas, J. (1992) 'High-speed railway and the European peripheries: Opportunities and challenges', *Transportation Research Part A: Policy and Practice*, 26(2), pp. 211-221.

Boghossian, P.A. (2001) *What is Social Construction?* Available at: http://as.nyu.edu/docs/IO/1153/socialconstruction.pdf (Accessed: 28/03/2013).

Bonnafous, A. (1987) 'The regional impact of the TGV', *Transportation* 14(2), pp. 127 - 137.

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology*, 3, pp. 77 - 101.

Brog, W., Erl, E., Sammer, G. and Schulze, B. (2003) *10th International Conference on Travel Behaviour Research*. Lucerne, August 2003.

Brownstone, D., Ghosh, A., Golob, T.F., Kazimi, C. and Van Amelsfort, D. (2003) 'Drivers' willingness-to-pay to reduce travel time: evidence from the San Diego I-15 congestion pricing project', *Transportation Research Part A*, 37, pp. 373-387.

Cafferkey, G. and Caulfield, B. (2011) *Proceedings of the ITRN 2011*. University College, Cork, 31/8 to 1/9.

Carbajo, J.C. (1988) 'The Economics of Travel Passes: Non-Uniform Pricing in Transport', *Journal of Economics and Policy*, 22(2), pp. 153-173.

Castle, T. (2010) *UK alters high-speed rail route over resident fears* (20/12/2010). Available at: http://uk.reuters.com/article/2010/12/20/uk-britain-transport-highspeed-idUKTRE6BJ4WP20101220 (Accessed: 16/07/2013).

Cecil, N. (2012) 'Business chiefs and unions join forces to back high-speed rail', *London Evening Standard* (06/01/2012 edn). [Online] Available at: http://www.standard.co.uk/news/business-chiefs-and-unions-join-forces-to-back-highspeed-rail-7304952.html.

Channel Four News (2010) *Ministers may quit over high speed rail route*. Available at: http://www.channel4.com/news/ministers-may-quit-over-high-speed-rail-route (Accessed: 26/06/2013).

Channel Four News (2012) *Business leaders join unions to lobby for high-speed rail*. Available at: http://www.channel4.com/news/business-leaders-join-unions-to-lobby-for-high-speed-rail (Accessed: 06/01/2012).

Channel Four News (2013) *Economic benefits of HS2 rail line lowered*. Available at: http://www.channel4.com/news/hs2-labour-playing-politics-transport (Accessed: 08/07/2014).

Channel Four News,, (2011) Directed by Channel Four Television [Television]. Channel Four: Channel Four Television(Accessed: 28/07/2011).

Chiambaretto, P. and Decker, C. (2012) 'Air–rail intermodal agreements: Balancing the competition and environmental effects', *Journal of Air Transport Management*, 23, pp. 36-40.

Collins, D. and Tisdell, C. (2002) 'Gender and Differences in Travel Life Cycles', *Journal of Travel Research*, 41, pp. 133-143.

Colombotos, J. (1969) 'Personal versus telephone interviews: effect on responses', *Public Health Reports*, 84(9), pp. 773 - 782.

Conner, M. and Armitage, C.J. (1998) 'Extending the Theory of Planned Behavior: A Review and Avenues for Further Research'.

Costa, G., Pickup, L. and Di Martino, V. (1988) 'Commuting - a further stress factor for working people: evidence from the European Community', *International Archives of Occupation and Enironmental Health*, 60, pp. 377-385.

Cottrell, P.S. (2003) 'Influence of Sociodemographics and Environmental Attitudes on General Responsible Environmental Behavior among Recreational Boaters', *Environment and Behaviour*, 35(3), pp. 347-375.

Dargay, J.M. (2010) *The Prospects For Longer Distance Domestic Coach, Rail, Air And Car Travel In Britain*. Institute for Transport Studies.

Dargay, J.M. and Clark, S. (2012) 'The determinants of long distance travel in Great Britain', *Transportation Research Part A: Policy and Practice*, 46(3), pp. 576-587.

Day, G.S. (1972) 'Evaluating Models of Attitude Structure', *Journal of Marketing Research*, 9(3), pp. 279-286.

De Rus, G. (2008) 'The Economic Effects of High Speed Rail Investment', *Round Table (2-3 October 2008) Airline Competition, Systems of Airports and Intermodal Connections*. Joint Transport Research Centre.

De Rus, G. and Inglada, V. (1997) 'Cost-benefit analysis of the high-speed train in Spain', *The Annals of Regional Science*, 31(2), pp. 175 - 188.

Department for Transport (2004) *The Future of Transport : a network for 2030*. London.

Department for Transport (2007) *Delivering a Sustainable Railway*. London.

Department for Transport (2009a) *Britain's Transport Infrastructure High Speed Two*. London.

Department for Transport (2009b) *Productive Use of Rail Travel Time and the Valuation of Travel Time Savings for Rail Business Travellers: Final Report*.

Department for Transport (2009c) *Public experiences of and attitudes towards rail travel: 2006 and 2009*.

Department for Transport (2010a) *National Travel Survey 2010 Technical Report*.

Department for Transport (2010b) *Social Trends 40 - Transport*. UK.

Department for Transport (2010c) *Transport Statistics Great Britain: 2010*.

Department for Transport (2011a) *High Speed Rail Scheme: survey of all adults aged 16+ in Great Britain*. Limited, T.U.

Department for Transport (2011b) *High Speed Rail: Investing in Britain's future - Decisions and Next Steps*.

Department for Transport (2011c) *National Travel Survey: 2010 Statistical Release*.

Department for Transport (2011d) *Public attitudes towards climate change and the impact of transport: 2010*.

Department for Transport (2012) *Reforming our Railways: Putting the Customer First*. London.

Department for Transport (2013a) 'Table NTS0305 - Average distance travelled by mode: Great Britain, 1995/97 to 2012' National Statistics. www.gov.uk. Available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/35599/nts0305.xls.

Department for Transport (2013b) *UK Aviation Forecasts*. London.

Dialogue by Design (2011) *High Speed Rail: Investing in Britain's Future: Consultation*.

Dickinson, J.E. and Dickinson, J.A. (2006) 'Local Transport and Social Representations: Challenging the Assumptions for Sustainable Tourism', *Journal of Sustainable Tourism*, 14(2), pp. 192-208.

Eagly, A.H. and Chaiken, S. (1998) 'Attitude Structure and Function', in Gilbert, D.T., Fiske, S.T. and Lindzey, G. (eds.) *The Handbook of Social Psychology*. Fourth Edition edn. New York: Oxford University Press Inc.

Eddington, R. (2006) *The Eddington Transport Study - The case for action: Sir Rod Eddington's advice to government*. Norwich: HMSO.

Edwards, J. (2006) 'Benefits of an Edinburgh-Newcastle high-speed rail link', *Proceedings of the Institute of Civil Engineers - Engineering Sustainability*, 159(2), pp. 71 - 78.

Eleini, N. (2010) *Public attitudes towards climate change and the impact of transport: 2006, 2007, 2008 and 2009*.

Environmental Audit Committee (2007) *The Voluntary Carbon Offset Market: Sixth Report of Session 2006-07*. London: The Stationary Office Limited.
Directive 96/48/EC Appendix 1.

Express and Star (2011) *New fears raised on HS2 route* (29/11/2011). Available at: http://www.expressandstar.com/news/2011/11/29/new-fears-raised-on-hs2-route/?rs (Accessed: 16/07/2013).

Express and Star (2012a) *HS2 objectors warn of formal challenge* (14/02/2012). Available at: http://www.expressandstar.com/news/2012/02/14/hs2-objectors-warn-of-formal-challenge/ (Accessed: 16/07/2013).

Express and Star (2012b) *Pleas to keep HS2 plan on track for future* (06/01/2012). Available at: http://www.expressandstar.com/news/2012/01/06/pleas-to-keep-hs2-plan-on-track-for-future/ (Accessed: 16/07/2013).

Ferraro, K.F. (1995) *Fear of crime - Interpreting Victimisation Risk*. New York: State University of New York Press.

Fiedler, M. (2007) *Older People and Public Transport: Challenges and Chances of an Ageing Society*.

Finger, M., Bert, N. and Kupfer, D. (2014) 'High-Speed Rail vs. Low-Cost Air: competing or complementary modes?', *European Transport Regulation Observer,*, (2014/01).

Fisher, W.R. (1994) 'Narrative Rationality and the Logic of Scientific Discourse', *Argumentation*, 8, pp. 21-32.

Fitzpatrick, T. (2013) 'Armitt: there is 'a risk that HS2 will not happen'', *Architects Journal*.

Fosgerau, M. and Karlström, A. (2010) 'The value of reliability', *Transportation Research Part B*, 44, pp. 38-49.

Fowkes, A.S., Johnson, I. and Marks, P. (1985) *Long distance business travel and mode choice: The results of two surveys of business travellers*. Institute of Transport Studies.

Fowkes, A.S., Marks, P. and Nash, C.A. (1986) *The Value of Business Travel Time Savings* (Working Paper 214). Institute of Transport Studies.

Frei, A. (2008) 'Survey issues in long-distance travel', *STRC - 8th Swiss Transport Research Conference*. Monte Verita / Ascona, October 15-17th 2008. pp. 1-18.

Gao, Y., Zhang, C.B. and Bruce, P. (2012) 'An analysis of the competitiveness of High Speed Rail in the Beijing - Shanghai market', *World Automation Conference (WAC) 2012*. 24 - 28 June 2012.

Gärling, T., Laitila, T. and Westin, K. (eds.) (1998) *Theoretical Foundations of Travel Choice Modelling*. Kidlington, Oxford: Elsevier Science Ltd.

Gärling, T. and Schuitema, G. (2007) 'Travel Demand Management Targeting Reduced Private Car Use: Effectiveness, Public Acceptability and Political Feasibility', *Journal of Social Issues*, 63(1), pp. 139-153.

Garnett, N. (2009) *Dawning of rail's new golden age* (01/02/2009). Available at: http://news.bbc.co.uk/1/hi/uk/7862831.stm (Accessed: 11/07/2013).

Gigerenzer, G. and Selten, R. (2001) *Bounded Rationality The Adaptive Toolbox*. United States of America: Massachusetts Institute of Technology.

Givoni, M. and Banister, D. (2012) 'Speed: the less important element of the High-Speed Train', *Journal of Transport Geography*, 22, pp. 306 - 307.

Gonzalez-Savignat, M. (2004) 'Competition in Air Transport', *Journal of Transport Economics and Policy*, 38(1), pp. 77-107.

Goodwin, P. (2012) 'Three views on 'Peak Car'', *World Transport, Policy & Practice*, 17.4, pp. 8-17.

Greengauge 21 (2009) *Fast Forward: A High-Speed Rail Strategy for Britain*.

Grunig, J.E. and White, J. (1992) 'The effect of worldviews on public relations theory and practice', *Excellence in public relations and communication management*, pp. 31-64.

Hacking, I. (1999) *The Social Construction of what?* Cambridge, Massachusetts: Harvard University Press.

Hammond, P. (2011) 'HS2: the fast-track fix for bridging the North-South divide', *The Telegraph* (28/07/2011 edn). [Online] Available at: http://www.telegraph.co.uk/news/uknews/road-and-rail-transport/8668412/HS2-the-fast-track-fix-for-bridging-the-North-South-divide.html.

Harré, R. and Parrott, W.G. (1996) *The Emotions: Social, Cultural and Biological Dimensions*. London: SAGE Publications.

Hawkins, N. (2011) *High Speed Fail: Assessing the case for High Speed 2*. England: Ltd., A.R.

Hayman, A. (2010) *High-speed rail levies mooted*. Available at: http://www.regen.net/bulletins/Economic-Development-Bulletin/News/991365/High-speedrailleviesmooted (Accessed: 23/03/2010).

Haywood, L. and Koning, M. (2011) 'Pushy Parisian Elbows: Evidence on Taste for Travel Comfort'. Paris School of Economics, Paris.

Heath, Y. and Gifford, R. (2002) 'Extending the Theory of Planned Behavior: Predicting the Use of Public Transportation'.

Hennessy, P. (2011) '£8.5 billion 'black hole' from HS2 high-speed rail link - report', *The Telegraph* (03/12/2011 edn). [Online] Available at: http://www.telegraph.co.uk/news/uknews/road-and-rail-transport/8933742/8.5-billion-black-hole-from-HS2-high-speed-rail-link-report.html (Accessed: 17/07/2013).

Hennessy, P. (2013) 'HS2 - this time it's personal', *The Telegraph* (03/07/2013 edn). [Online] Available at: http://blogs.telegraph.co.uk/news/patrickhennessy/100224647/hs2-this-time-its-personal/ (Accessed: 16/07/2013).

HS2 (2011) *Demand for Long Distance Travel*. N/A.

HS2 (2012) *Economic Case for HS2: Updated appraisal of transport user benefits and wider economic benefits*. London, . [Online]. Available at: http://www.hs2.org.uk/news-resources/economic-documents.

HS2 (2013) *The Economic Case for HS2*, Department for Transport, London.

HS2 (2014) *Connecting Britain*. Available at: http://hs2.org.uk/about-hs2/facts-figures/connecting-britain (Accessed: 07/07/2014).

Hsiao, C.H. and Yang, C. (2010) 'Predicting the travel intention to take High Speed Rail among college students', *Transportation Research Part F: Traffic Psychology and Behaviour*, 13(4), pp. 277 - 287.

Hsu, C.W., Lee, Y. and Liao, C.-H. (2010) 'Competition between high-speed and conventional rail systems: A game theoretical approach', *Expert Systems with Applications*, 37(4), pp. 3162-3170.

Iandoli, L., Klein, M. and Zollo, G. (2007) 'Can We Exploit Collective Intelligence for Collaborative Deliberation? The Case of the Climate Change Collaboratorium'. MIT Sloan School of Management. Available at: http://ssrn.com/abstract=1084069

Independent Transport Comission (2010) *Long Distance Travel in Britain, Prospects in a time of uncertainty*. Keble College, Oxford.

Institute of Air Transport (1991) *Rail / Air Complementarity in Europe: The Impact of High-speed Train Services*. Paris.

ITV Calendar News (2013) *New attempt to block HS2*. Available at: http://www.itv.com/news/calendar/update/2013-06-26/new-attempt-to-block-hs2/ (Accessed: 26/06/2013).

ITV Central News (2012) *MP urges government to do more* (20/04/2012). Available at: http://www.itv.com/news/central/update/2012-04-20/mp-urges-government-to-do-more/ (Accessed: 16/07/2013).

Jackson, T. (2005) *Motivating Sustainable Consumption*. University of Surrey.

Jain, J. and Lyons, G. (2008) 'The gift of travel time', *Journal of Transport Geography*, 16, pp. 81-89.

Jamieson, S. (2004) 'Likert scales: how to (ab)use them', *Medial Education*, 38, pp. 1212-1218.

Janic, M. (2003) 'High-speed rail and air passenger transport: a comparison of the operational environmental performance', *Proceedings of the Institution of Mechanical Engineers, Part F: Journal of Rail and Rapid Transit* 217(4), pp. 259-269.

Johansson, M.V., Heldt, T. and Johansson, P. (2006) 'The effects of attitudes and personality traits on mode choice', *Transportation Research Part A: Policy and Practice*, 40, pp. 507-525.

Jung, C.G. (1991) 'Psychological types', in Cooper, C.L. and Pervin, L.A. (eds.) *Personality: Critical conflicts in Psychology*. pp. 28-39.

Kahneman, D. (2012) *Thinking, Fast and Slow*. London: Penguin Books.

Khisty, C.J. and Zeitler, U. (2001) 'Is Hypermobility a Challenge for Transport Ethics and Systemicity?', *System Practice and Action Research*, 14(5), pp. 597 - 613.

Kim, H.-J. (2008) 'Common Factor Analysis Versus Principal Component Analysis: Choice for Symptom Cluster Research', *Asian Nursing Research,,*, 2(1), pp. 17-24.

Kite, M. (2012) 'The case for HS2 is completely off the rails ', *The Daily Mail* (06/01/2012 edn). [Online] Available at: http://www.dailymail.co.uk/debate/article-2083051/The-case-HS2-rails.html.

Klein, M. and Iandoli, L. (2008) 'Supporting Collaborative Deliberation Using a Large-Scale Argumentation System: The Mit Collaboratorium'. MIT Sloan Research Paper No. 4691-08.

Knapp, T.R. (1990) 'Treating Ordinal Scales as Interval Scales: An Attempt To Resolve the Controversy', *Nursing Research*, 39(2), pp. 121-123.

Laird, J.J., Nellthorp, J. and Mackie, P.J. (2005) 'Network effects and total economic impact in transport appraisal', *Transport Policy*, 12(6), pp. 537-544.

Lancaster, G.A. and Taylor, C.T. (1988) 'A Study of Diffusion of Innovations in Respect of the High Speed Train', *European Journal of Marketing*, 22(3), pp. 21 - 47.

Landale, J. (2011) *Can nimbys defeat high-speed rail?* (28/02/2011). Available at: http://www.bbc.co.uk/news/uk-politics-12599971 (Accessed: 16/07/2013).

Leftly, M. (2013) 'Network Rail defends HS2 after CBI criticism', *London Evening Standard* (15/07/2013 edn). [Online] Available at: http://www.standard.co.uk/business/business-news/network-rail-defends-hs2-after-cbi-criticism-8708923.html.

Lehner, P.E. and Adelman, L. (1990) 'Behavioural decision theory and it's implication for knowledge engineering', *The knowledge engineering review*, 5(1), pp. 5 - 14.

Lindop, J. (2014) *2013-14 Quarter 3 Statistical Release - Passenger Rail Usage*.

Litman, T. (2008) 'Valuing Transit Service Quality Improvements', *Journal of Public Transportation*, 11(2), pp. 43-63.

Lleras, G.C., Simma, A., Ben-Akiva, M.E., Schafer, A., Axhausen, K.W. and Furutani, T. (2003) 'Fundemental Relationships Specifying Travel Behaviour - An International Travel Survey Comparsion.'. TRB Annual Meeting 2003.

Loo, B.P.Y. (2009) 'How would people respond to a new railway extension? The value of questionnaire surveys', *Habitat International*, 33(1), pp. 1-9.

Lynch, G. and Atkins, S. (1988) 'The influence of personal security fears on women's travel patterns', *Transportation*, 15, pp. 257 -277.

Lyons, G. (2008) 'Briefcase travel - time use and value.', *Transportation Professional*.

Lyons, G. and Jain, J. (2005) 'Travel Time: Gift or burden?', *University Transport Studies Group*. Bristol, January 2005.

Lyons, G., Jain, J. and Holley, D. (2007) 'The use of travel time by rail passengers in Great Britain', *Transportation Research Part A: Policy and Practice*, 41(1), pp. 107-120.

Lyons, J. (2013) 'HS2: Vince Cable says case for £43billon High Speed 2 rail line 'still being made'', *Mirror* (19/07/2013 edn). [Online] Available at: http://www.mirror.co.uk/news/uk-news/hs2-vince-cable-says-case-2067670.

MacEachren, A.M. (1980) 'Travel time as the basis of cognitive distance', *Professional Geographer*, 32(1), pp. 30 - 36.

Mackie, P.J., Wardman, M., Fowkes, A.S., Whelan, G., Nellthorp, J. and Bates, J. (2003) *Values of Travel Time Savings in the UK*. Leeds.

Mallett, W.J. (1999) *Personal travel: The long and short of it*. Washington, D.C. Bureau of Transportation Statistics, U.S. Department of Transportation.

Mandel, B., Gaudry, M. and Rothengatter, W. (1997) 'A disaggregate Box-Cox Logit mode choice model of intercity passenger travel in Germany and its implications for high-speed rail demand forecasts', *The Annals of Regional Science*, 31(2), pp. 99-120.

Mandelson, P. (2013) 'Why I no longer support a new high-speed railway line for Britain', *Financial Times* (02/07/2013 edn). (Accessed: 15/07/2013).

Mann, E. and Abraham, C. (2006) 'The role of affect in UK commuters' travel mode choices: An interpretative phenomenological analysis', *British Journal of Psychology*, 97, pp. 155-176.

Marshall, A. (2010) 'HS2 Unwrapped', *Railnews Focus*(3), 08/10/2010, pp. 4-14.

Martínez Sánchez-Mateos, H.S. and Givoni, M. (2011) 'The accessibility impact of a new High-Speed Rail line in the UK – a preliminary analysis of winners and losers', *Journal of Transport Geography*, (0).

Masson, S. and Petiot, R. (2009) 'Can the high speed rail reinforce tourism attractiveness? The case of the high speed rail between Perpignan (France) and Barcelona (Spain)', *Technovation*, 29(9), pp. 611-617.

McCrae, R.R. and John, O.P. (1992) 'An introduction to the five-factor model and its applications', *Journal of personality*, 60(2), pp. 175-215.

McDermott, J. (2013) 'The irrational case for High Speed 2', *The Financial Times* (24/07/2013 edn). [Online] Available at: http://www.ft.com/cms/s/0/19afcbe8-e4cd-11e2-a74d-00144feabdc0.html#axzz2aBUP8VxH.

Meader, N., Uzzell, D. and Gatersleben, B. (2006) 'Cultural theory and quality of life (Théorie culturelle et qualité de vie)', *Revue européenne de psychologie appliquée*, 56, pp. 61-69.

Mehrabian, A. (1981) *Silent Messages: Implicit Communications of Emotions and Attitudes*. Belmont, CA, United States of America: Wadsworth.

Melbourne, L. (2013) *National Travel Survey: 2012 Statistical Release*.

Metz, D. (2004) 'Travel Time - Variable or Constant?', *Journal of Transport Economics and Policy*, 38, pp. 333-344.

Metz, D. (2007) 'The Myth of Travel Time Saving', *Transport Reviews*, 28(3), pp. 321-336.

Millward, D. (2012a) 'Business leaders back high speed rail', *Daily Telegraph* (06/01/2012 edn). [Online] Available at: http://www.telegraph.co.uk/news/uknews/road-and-rail-transport/8994914/Business-leaders-back-high-speed-rail.html (Accessed: 17/07/2013).

Millward, D. (2012b) 'Councils launch bid to block high speed rail', *The Telegraph* (02/04/2012 edn). [Online] Available at: http://www.telegraph.co.uk/news/9181888/Councils-launch-bid-to-block-high-speed-rail.html (Accessed: 17/07/2013).

Millward, D. (2013) 'Is Labour's enthusiasm for HS2 on the wane?', *Telegraph* (15/07/2013 edn). [Online] Available at: http://www.telegraph.co.uk/news/politics/labour/10180094/Is-Labours-enthusiasm-for-HS2-on-the-wane.html

Mohammadian, A.K. (2005) *Research on Women's Issues in Transportation*. Chicago, Illinois, 18/11/2004 to 20/11/2004.

Mokhtarian, P.L. (2002) 'Telecommunications and Travel: The Case for Complementarity', *Journal of Industrial Ecology*, 6(2), pp. 43-57.

Mokhtarian, P.L. and Saloman, I. (2001) 'How derived is the the demand for travel? Some conceptual and measurement considerations', *Transportation Research Part A: Policy and Practice*, 35, pp. 695-719.

Montello, D.R. (1991) 'The Measurement of Cognitive Distance: Methods and Construct Validity', *Journal of Environmental Psychology*, 11, pp. 101-122.

Murphy, J. (2013) '"Think big" on HS2, Cameron says', *i on Saturday* (07/09/2013 edn), p. 9.

Nash, C. (ND) *High Speed Rail Investment; an overview of the literature*.

National Readership Survey (2010) *Lifestyle Data: Social Grade - Definitions and Discriminatory Power*. Available at: http://www.nrs.co.uk/lifestyle-data/ (Accessed: 30/04/2013).

National Travel Survey (2013) 'Long distance trips within Great Britain by main mode and length: 2008/12' July 2013 Department for Transport statistics. 2008 to 2012. Online: National Travel Survey. Available at: https://www.gov.uk/government/statistical-data-sets/nts03-modal-comparisons#table-nts0317 (Accessed: 22/06/14).

Network Rail (2009a) *Meeting the capacity challenge: The case for new lines*.

Network Rail (2009b) *Network Route Utilisation Strategy: Scenarios & Long Distance Forecasts*.

Network Rail (2011) *West Coast Main Line Route Utilisation Strategy* London.

Network Rail (2013) *Long Term Planning Process: Long Distance Market Study*. London.

Network Rail (ND) 'New Lines Programme: Strategic Business Case'.

Niemeyer, S. and Dryzek, J.S. (2007) 'The Ends of Deliberation: Meta-consensus and Inter-subjective Rationality as Ideal Outcomes', *Swiss Political Science Review*, 13(497-526).

Nijkamp, P. and Baaijens, S. (1999) 'Time Pioneers and Travel Behavior: An Investigation into the Viability of 'Slow Motion'', *Growth and Change*, 30(2), pp. 237 - 263.

Nordlund, A. and Westin, K. (2013) 'Influence of values, beliefs, and age on intention to travel by a new railway line under construction in northern Sweden', *Transportation Research Part A: Policy and Practice*, 48(0), pp. 86-95.

Odel, M. and Pickard, J. (2012) 'High Speed Rail link must be built, economists insist', *The Financial Times* (5/1/12 edn), 5/1/12.

Office for National Statistics (2012).

Office for National Statistics (2013) *Age Structure of United Kingdom 1971-2085*. Available at: http://www.neighbourhood.statistics.gov.uk/HTMLDocs/dvc1/UKPyramid.html (Accessed: 29/04/2013).

Office of Rail Regulation (2014) 'Passenger journeys by sector' LENNON Database and train operating companies. NRT Data Portal,,. Available at: http://dataportal.orr.gov.uk/displayreport/report/details/978eccd3-abbc-402e-9965-af2200234414 (Accessed: 22/06/2014).

Oppenheim, A.N. (2001) *Questionnaire Design, Interviewing and Attitude Measurement*. new edition edn. London and New York: Pinter Publishers.

Ostrom, T.M. (1969) 'The relationship between the affective, behavioural and cognitive components of attitude', *Journal of Experimental Social Psychology*, 5(1), pp. 12-30.

Otley, T. (2011) *Eurostar ceases carbon offsetting*. Available at: http://www.businesstraveller.com/news/eurostar-ceases-carbon-offsetting (Accessed: 23/04/2013).

Pearson, A. (2010) 'North East may miss out on high-speed train', *The Journal* (01/03/2010 edn). [Online] Available at: http://www.thejournal.co.uk/news/north-east-news/north-east-miss-out-high-speed-4461424 (Accessed: 16/07/2013).

Pett, M.A., Lackey, N.R. and Sullivan, J.J. (2003) *Making Sense of Factor Analysis*. SAGE.

Pfaffenbichler, P., Emberger, G. and Shepherd, S. (2012) 'Estimating future long-distance passenger travel demand up to 2050 utilising the system dynamics based model LUNA (simulating the demand for long-distance travel using a non-od-matrix based approach)'. Association for European Transport and Contributors 2012.

Railnews (2012) *Rail travel sets new record*. Available at: http://www.railnews.co.uk/news/2012/03/12-rail-travel-sets-new-record.html (Accessed: 13/03/2012).

Railway Technology (ND) *West Coast Main Line, United Kingdom*. Available at: http://www.railway-technology.com/projects/virgin/ (Accessed: 10/02/2012).

Rickard, J.M. (1988) 'Factors Influencing Long-Distance Rail Passenger Trip Rates in Great Britain', *Journal of Transport Economics and Policy*, 22(2), pp. 209-233.

Rickman, D. (2012) *High Speed Rail: Something Business Leaders, Unions And Economists Can Agree On* (06/01/2012). Available at: http://www.huffingtonpost.co.uk/2012/01/06/high-speed-rail-government-justine-greening_n_1188613.html (Accessed: 24/07/2013).

Rofique, J., Humphrey, A., Pickering, K. and Tipping, S. (2011) *National Travel Survey 2010 Technical Report*.

Román, C., Espino, R. and Martín, J.C. (2008) 'Analyzing Competition between the High Speed Train and Alternative Modes. The Case of the Madrid-Zaragoza-Barcelona Corridor', *Journal of Choice Modelling*, 3(1), pp. 84 - 108.

Root, A., Schintler, L. and Button, K. (2000) 'Women, travel and the idea of 'sustainable transport'', *Transport Reviews*, 20(3), pp. 369-383.

Rosenberg, M.J., Hovland, C.L., McGuire, W.J. and Abelson, R.P. (1960) *Attitude organization and change: An analysis of constency among attitude components*. United States of America: Yale University Press.

Roth, M., Schumacher, J. and Brähler, E. (2005) 'Sensation seeking in the community: Sex, age and sociodemographic comparisons on a representative German population sample', *Personality and Individual Differences*, 39, pp. 1261-1271.

Rowson, J. (2008) 'West Coast Main Line upgrade works complete', *New Civil Engineer*, (9/12/08) [Online]. Available at: http://www.nce.co.uk/west-coast-main-line-upgrade-works-complete/1945197.article (Accessed: 10/2/12).

Russell, D.W. (2002) 'In Search of Underlying Dimensions: The Use (and Abuse) of Factor Analysis', *Personality and Social Psychology Bulletin*, 28(12), pp. 1629-1646.

Schaap, D. (1996) 'Local attitudes towards an international project: A study of residents' attitudes towards a future high speed rail line in general and towards annoyance in particular', *Journal of Sound and Vibration*, 193(1), pp. 411 - 415.

Schippl, J., Leisner, I., Kaspersen, P. and Madsen, A.K. (2008) *The Future of European long-distance transport - Scenario Report*. Bruxelles / Brussels.

Schofield, K. (2010) 'London to Manchester in 75 mins on Y-Speed Rail', *The Sun* (12/03/2010 edn). [Online] Available at: http://www.thesun.co.uk/sol/homepage/news/2889445/London-to-Manchester-in-75mins-on-Y-Speed-Rail.html (Accessed: 16/07/2013).

Schwartz, S.H. (1977) 'Normative Influences on Altruism', in Berkowitz, L. (ed.) *Advances in Experimental Social Psychology*. London: Academic Press Inc. Ltd., pp. 221-275.

Scott, H. (2003) 'Stranger Danger: Explaining Women's Fear of Crime', *Western Criminology Review*, 4(3), pp. 203-214.

Sessa, C. and Enei, R. (2009) *EU transport demand: Trends and drivers*.

Sharp, D. (1987) *Personality Types: Jung's Model of Typology*. Toronto, Canada: Inner City Books.

Shaw, J., Walton, W. and Farrington, J. (2003) 'Assessing the potential for a 'railway renaissance' in Great Britain', *Geoforum*, 34(2), pp. 141-156.

Shlens, J. (2005) 'A Tutorial on Principal Component Analysis'. Institute for Nonlinear Science, University of California, San Diego. Available at: http://www.brainmapping.org/NITP/PNA/Readings/pca.pdf (Accessed: 25 / 02 / 13).

Short. Jr, J.F. (1984) 'The Social Fabric at Risk: Toward the Social Transformation of Risk Analysis', *American Sociological Review*, 49(6), pp. 711-725.

Siegel, S. and Castellan Jr, N.J. (1988) *Nonparametric statistics for the behavioral sciences*. Second Edition edn. United States of America: McGraw-Hill.

Sky News (2012) *Full Steam Ahead For HS2 Despite Criticism* (11/01/2012). Available at: http://news.sky.com/story/916369/full-steam-ahead-for-hs2-despite-criticism (Accessed: 16/07/2013).

Slovic, P. (2000) *The Perception of Risk* London: Earthscan Publications.

Stanko, E.A. and Hobdell, K. (1993) 'Assault on Men: Masculinity and Male Victimization', *British Journal of Criminology*, 33(3), pp. 400-415.

Steer Davies Gleave (2004) *High Speed Rail: International comparisons*. London.
StopHS2 (2014) *New Man, New Spin: Sir David Higgins at the IOD*. Available at: http://www.51m.co.uk/new-man-new-spin-sir-david-higgins-at-the-iod/ (Accessed: 22/06/2014).

Storper, M. and Venables, J. (2004) 'Buzz: face-to-face contact and the urban economy', *Journal of Economic Geography*, 4, pp. 351-370.

Stradling, S.G., Anable, J. and Carreno, M. (2007) 'Performance, importance and user disgruntlement: A six-step method for measuring satisfaction with travel modes', *Transportation Research Part A*, 41, pp. 98-106.

Taylor, E., Humphrey, A., Pickering, K. and Tipping, S. (2013) *National Travel Survey 2012: Technical Report*. London.

The Economist (2013) 'The Northern Line', *The Economist*, 06/07/2013, p. 31.

The Northern Way (2009) *Transforming Our Economy and Our Connectivity: High Speed Rail for the North*.

Thornton, A., Bunt, K., Dalziel, D. and Simon, A. (2010) *Climate Change and Transport Choices: Segmentation Study*.

Thorpe, N., Hills, P. and Jaensirisak, S. (2000) 'Public attitudes to TDM measures: a comparative study', *Transport Policy*, 7(4), pp. 243-257.

Tighe, C. (2014) 'Long commutes reveal London's dominance of UK', *Financial Times* (16/01/14 edn).

Topham, G. (2012) 'High speed rail routes bring benefits too, insists head of HS2', *The Guardian*edn), 02/09/2012. [Online] Available at: http://www.guardian.co.uk/uk/2012/sep/02/hs2-high-speed-rail-routes-benefits (Accessed: 17/07/2013).

Tsai, Y.C. (2010) 'Applying the theory of planned behavior to explore the independent travellers' behavior', *African Journal of Business Management*, 4(2), pp. 221-234.

Tulloch, J. and Lupton, D. (2003) *Risk and Everyday Life*. London: SAGE publications

Tversky, A. and Kahneman, D. (2000) 'Judgment under Uncertainty: Heuristics and Biases', in Connolly, T., Arkes, H.R. and Hammond, K.R. (eds.) *Judgment and Decision Making: An Interdisciplinary Reader*. Cambridge University Press, pp. 35-52.

Urry, J. (2007) *Mobilities*. Cambridge: Polity Press.

Van den Berg, H., Manstead, A.S.R., Van der Pligt, J. and Wigboldus, D.H.J. (2006) 'The impact of affective and cognitive focus on attitude formation', *Journal of Experimental Social Psychology*, 42, pp. 373-379.

Van Goeverden, C.D. (2009) 'Explaining Factors for Train Use in European Long-Distance Travel', *Tourism and Hospitality Planning & Development*, 6(1), pp. 21-37.

Van Liere, K.D. and Dunlap, R.E. (1980) 'The Social Bases of Environmental Concern: A Review of Hypotheses, Explanations and Empirical Evidence'. Public Opinion Quarterly: Elsevier North Holland.

Vickerman, R. (1997) 'High-speed rail in Europe: experience and issues for future development', *The Annals of Regional Science*, 31(1), pp. 21-38.

Vickerman, R., Spiekermann, K. and Wegener, M. (1999) 'Accessibility and Economic Development in Europe', *Regional Studies*, 33(1), pp. 1 - 15.

Vickerman, R. and Ulied, A. (2009) 'Indirect and and wider economic impacts of high speed rail', in de Rus, G. (ed.) *Economic Analysis of High Speed Rail in Europe*. Fundacion BBVA.

Vidal, C. (2012) 'Metaphilosophical criteria for Worldview comparison', *Metaphilosophy*, 43(3), pp. 306-347.

Virgin Trains (2010) *West Coast mainline capacity will be exhausted long before High Speed 2 is built says Virgin Trains*. Available at: http://mediaroom.virgintrains.co.uk/2010/02/west-coast-mainline-capacity-will-be.html (Accessed: 14/02/2012).

Volkery, C. (2012) 'High-Speed Controversy: Massive Rail Project Has Britain Divided', *Spiegel*edn), 12/01/2012.

Wagner, W., Duveen, G., Farr, R., Jovchelovitch, S., Lorenzi-Cioldi, F., Markovà, I. and Rose, D. (1999) 'Theory and method of social representations', *Asian Journal of Social Psychology*, (2), pp. 95 - 125.

Wall, R., Devine-Wright, P. and Mill, G.A. (2008) 'Interactions Between Perceived Behavioural Control and Personal-Normative Motivation: Qualitative and Quantitative Evidence From a Study of Commuting-Mode Choice', *Journal of Mixed Methods Research*, 2(1), pp. 63-86.

Wardman, M. (1998) 'The Value of Travel Time', *Journal of Economics and Policy*, 32(3), pp. 285-316.

Warner, J. (2013) 'If it looks, walks and talks like a white elephant, then it must be High Speed 2', *The Telegraph* (03/07/2013 edn). [Online] Available at: http://www.telegraph.co.uk/finance/comment/jeremy-warner/10158554/If-it-looks-walks-and-talks-like-a-white-elephant-then-it-must-be-High-Speed-2.html (Accessed: 16/07/2013).

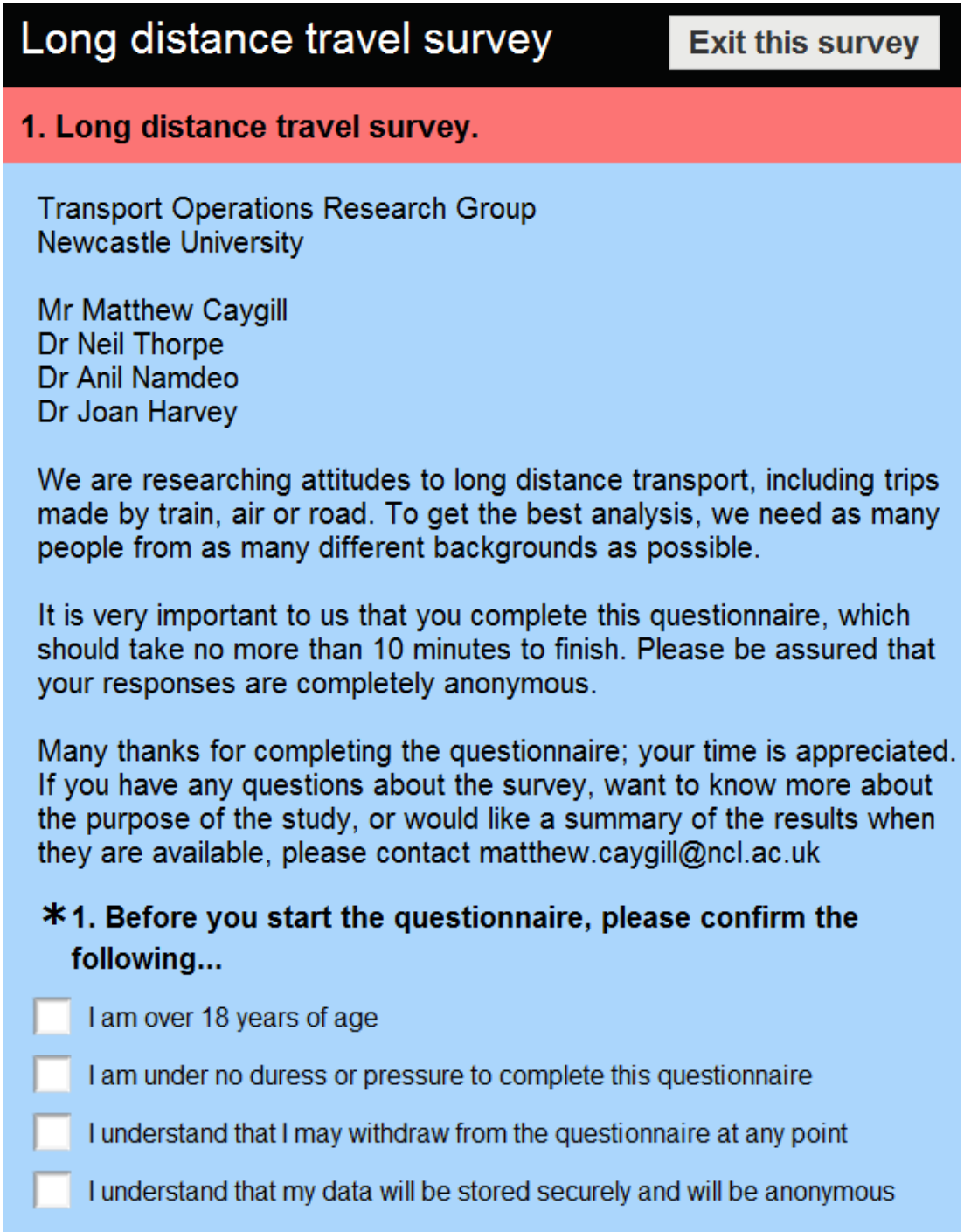
Wildavsky, A. (1979) 'No Risk Is the Highest Risk of All', *American Scientist*, 67(1), pp. 32-37.
Willis, J. (2013) 'HS2 "could damage North-East economy", expert claims', *The Northern Echo* (09/07/2013 edn).

Woodman, P. (2012) 'Group plans court action over HS2', *The Independent* (03/04/2012 edn). [Online] Available at: http://www.independent.co.uk/news/uk/home-news/group-plans-court-action-over-hs2-7614726.html (Accessed: 17/07/2013).

Wright, O. (2013) 'The British first complain about big infrastructure projects, then come to revere them. HS2 will be no different.', *The Independent* (03/09/2013 edn), p. 13.

Appendix A: Long distance travel survey

Screenshots for long distance travel survey, posted online using SurveyMonkey (www.surveymonkey.net).



2. We would like you to think about long distance travel (trips of over 50 miles / 80 kilometres in one direction).
Please click the circle indicating your level of agreement with the following statements.
Please consider your attitudes towards all types of transport, even if you do not use them.

	Strongly Agree	Agree	Slightly Agree	Not Sure	Slightly Disagree	Disagree	Strongly Disagree
1) I think current travel times by rail are acceptable	○	○	○	○	○	○	○
2) Planes and airports can allow productive use of travel time	○	○	○	○	○	○	○
3) If I had to set off very early I would be anxious about oversleeping	○	○	○	○	○	○	○
4) I think current travel times by domestic air are acceptable	○	○	○	○	○	○	○
5) Changing trains can be complicated	○	○	○	○	○	○	○
6) There should be more domestic flights in the future	○	○	○	○	○	○	○
7) I am in favour of a visible security presence on trains	○	○	○	○	○	○	○
8) Travelling in standard class on the train can be generally unpleasant	○	○	○	○	○	○	○
9) Wi-Fi access would be important to me when travelling	○	○	○	○	○	○	○
10) Being able to do something while travelling is important to me	○	○	○	○	○	○	○
11) Fear of terrorism would be a concern if travelling by rail	○	○	○	○	○	○	○
12) Capacity on existing roads should be increased by adding extra lanes	○	○	○	○	○	○	○
13) Comfort is more important than travel time	○	○	○	○	○	○	○
14) I would prefer a mode of transport that gave me flexibility about when I could leave	○	○	○	○	○	○	○
15) I am prepared to pay extra to compensate for any environmental costs of my travel	○	○	○	○	○	○	○
16) I enjoy looking at the view while I am travelling	○	○	○	○	○	○	○
17) I find travelling alone boring	○	○	○	○	○	○	○
18) If I knew that I would have to stand on a long trip, it would discourage me from using rail	○	○	○	○	○	○	○
19) I consider myself to be an environmentally friendly traveller	○	○	○	○	○	○	○
20) I would always want to have a reserved seat if travelling	○	○	○	○	○	○	○
21) If I was on a train, I would like to be able to see my luggage	○	○	○	○	○	○	○
22) The road network should be expanded by building new roads	○	○	○	○	○	○	○
23) I always want to reach my destination as quickly as possible	○	○	○	○	○	○	○

24) I would fear the potential for terrorism if travelling by air	○	○	○	○	○	○	○
25) If I was travelling long distance to a city centre, I would prefer to use the train	○	○	○	○	○	○	○
26) I would always want to get to my destination as comfortably as possible	○	○	○	○	○	○	○
27) Travelling by train would allow productive use of my time	○	○	○	○	○	○	○
28) If I had a lot to carry, I would generally choose to travel by car	○	○	○	○	○	○	○
29) I would worry about missing my transport connection if I could not travel directly	○	○	○	○	○	○	○
30) I think that theft of checked-in hold luggage on airlines is a problem	○	○	○	○	○	○	○
31) I would worry about my personal safety if travelling by train	○	○	○	○	○	○	○
32) In the future, train services should be more frequent	○	○	○	○	○	○	○
33) Security procedures would make me feel more comfortable if travelling on public transport	○	○	○	○	○	○	○
34) Other people sitting nearby would disrupt or distract me if I was travelling on public transport	○	○	○	○	○	○	○
35) Personal safety would be a worry on flights	○	○	○	○	○	○	○
36) On a plane I would be concerned that my luggage might not arrive at my destination	○	○	○	○	○	○	○

3. High Speed Rail (HSR) is proposed as a means of long distance travel in many countries.
Please select one circle indicating your level of agreement with the following statements.

	Strongly Agree	Agree	Slightly Agree	Not Sure	Slightly Disagree	Disagree	Strongly Disagree
37) I would be discouraged from using high speed rail if it had weight and liquids luggage restrictions	○	○	○	○	○	○	○
38) Travelling by high speed rail would be more expensive compared to existing rail services	○	○	○	○	○	○	○
39) Britain should be investing and building high speed rail in the UK	○	○	○	○	○	○	○
40) High speed trains would use more energy than the trains we have now	○	○	○	○	○	○	○
41) I think that high speed rail is a step forward for the future	○	○	○	○	○	○	○
42) In general, I do not know much about high speed rail	○	○	○	○	○	○	○
43) High speed rail would make return journeys easier to do in a single day	○	○	○	○	○	○	○
44) I would feel proud if Britain had a new high speed rail network	○	○	○	○	○	○	○
45) High speed trains would generate more pollution that the trains we have now	○	○	○	○	○	○	○
46) High speed trains would be noisier than the ones we have now	○	○	○	○	○	○	○

4. Apart from commuting, how long ago is it since you last travelled long distance (a trip of over 50 miles / 80 kilometres in one direction) by the following types of transport? (Please select the approximate month and year from the drop down menus)

	Month	Year
Air	January	2012
Rail	January	2012
Coach	January	2012
Car	January	2012

5. Approximately when was the last time that you had to stay overnight because you were unable to complete the return journey there and back in a single day?

	Month	Year
Please select the approximate month and year	January	2012

6. Please select the number that best describes the importance to you of each issue if choosing how to travel long distance (a trip of over 50 miles / 80 kilometres in one direction).

	No importance 0	1	2	3	4	5	6	7	8	9	Very important 10
Fare / cost of making journey	○	○	○	○	○	○	○	○	○	○	○
Flexibility of departure / arrival time	○	○	○	○	○	○	○	○	○	○	○
Who pays the fare	○	○	○	○	○	○	○	○	○	○	○
Ease of getting to station / airport	○	○	○	○	○	○	○	○	○	○	○
Waiting time	○	○	○	○	○	○	○	○	○	○	○
Number of interchanges	○	○	○	○	○	○	○	○	○	○	○
Time of departure	○	○	○	○	○	○	○	○	○	○	○
How much luggage I have	○	○	○	○	○	○	○	○	○	○	○
Comfort	○	○	○	○	○	○	○	○	○	○	○
Service reliability	○	○	○	○	○	○	○	○	○	○	○
Amount of crowding	○	○	○	○	○	○	○	○	○	○	○
Day of travel	○	○	○	○	○	○	○	○	○	○	○
Ability to work on board	○	○	○	○	○	○	○	○	○	○	○
Total journey time	○	○	○	○	○	○	○	○	○	○	○
Environmental impact	○	○	○	○	○	○	○	○	○	○	○
Frequency of service	○	○	○	○	○	○	○	○	○	○	○

7. Do you have any of the following railcards or travel discounts? (select those that you have or type an answer if your discount or travelcard is one other than those listed)

- ☐ 16-25 (Young person's) Railcard
- ☐ Senior Railcard
- ☐ Family & Friends Railcard
- ☐ Disabled person's Railcard
- ☐ Network Railcard (South East)
- ☐ Forces Railcard
- ☐ GroupSave discount
- ☐ New Deal Photocard
- ☐ Season Ticket
- ☐ Other discount
- ☐ None

Other (please specify)

Please imagine you need to make a long distance trip by rail and have the option of using faster trains.

If you are not from the UK, please convert the costs in the next few questions from pounds sterling (£) into your local currency.

8. Please imagine an inter-city rail trip that currently takes 3 hours and costs £100
Please select how much you personally would be prepared to pay for the following journey times

	£100 (current)	£110	£120	£130	£140	£150	£160	£170	£180	£190	£200 or more
2 hours 30 minutes (saving 30 mins)	○	○	○	○	○	○	○	○	○	○	○
1 hour 30 minutes (saving 1 hr 30 mins)	○	○	○	○	○	○	○	○	○	○	○

9. Please imagine another inter-city rail trip that currently takes 1 hour and 30 minutes and costs £50.
Please select how much you personally would be prepared to pay for the following journey times.

	£50 (current)	£55	£60	£65	£70	£75	£80	£85	£90	£95	£100 or more
45 minutes (saving 45 mins)	○	○	○	○	○	○	○	○	○	○	○
30 minutes (saving 1 hr)	○	○	○	○	○	○	○	○	○	○	○

10. Do you commute by inter-city train on a daily basis?

- ○ Yes (Please answer question 11)
- ○ No (Go to question 12)

11. If you answered yes to the last question, which stations do you travel between?

From:

To:

12. Do you commute by domestic air (internal flights) on a weekly basis?

- ○ Yes (Please answer question 13)
- ○ No (Please continue to question 14 on the next page)

13. If you answered yes to the last question, which airports do you travel between?

From:

To:

14. Please indicate your age group;

- ○ 18 to 25 years
- ○ 26 to 35 years
- ○ 36 to 45 years
- ○ 46 to 55 years
- ○ 56 to 65 years
- ○ 66 to 75 years
- ○ 76 years or above

15. Are you?

- ○ Male
- ○ Female

16. What is your occupation? (please type in the box provided)

17. If you live in the UK, please type the first part of your main postcode (e.g. G1, NE1 or SE10)

18. If you do not live in the UK, please enter the name of the country you live in...

19. Do you have any further comments about your experiences and views of long distance travel or the introduction of high speed trains in Britain?

Thank you for taking the time to complete this questionnaire

If you require any further information or a copy of a results summary report, please email matthew.caygill@ncl.ac.uk

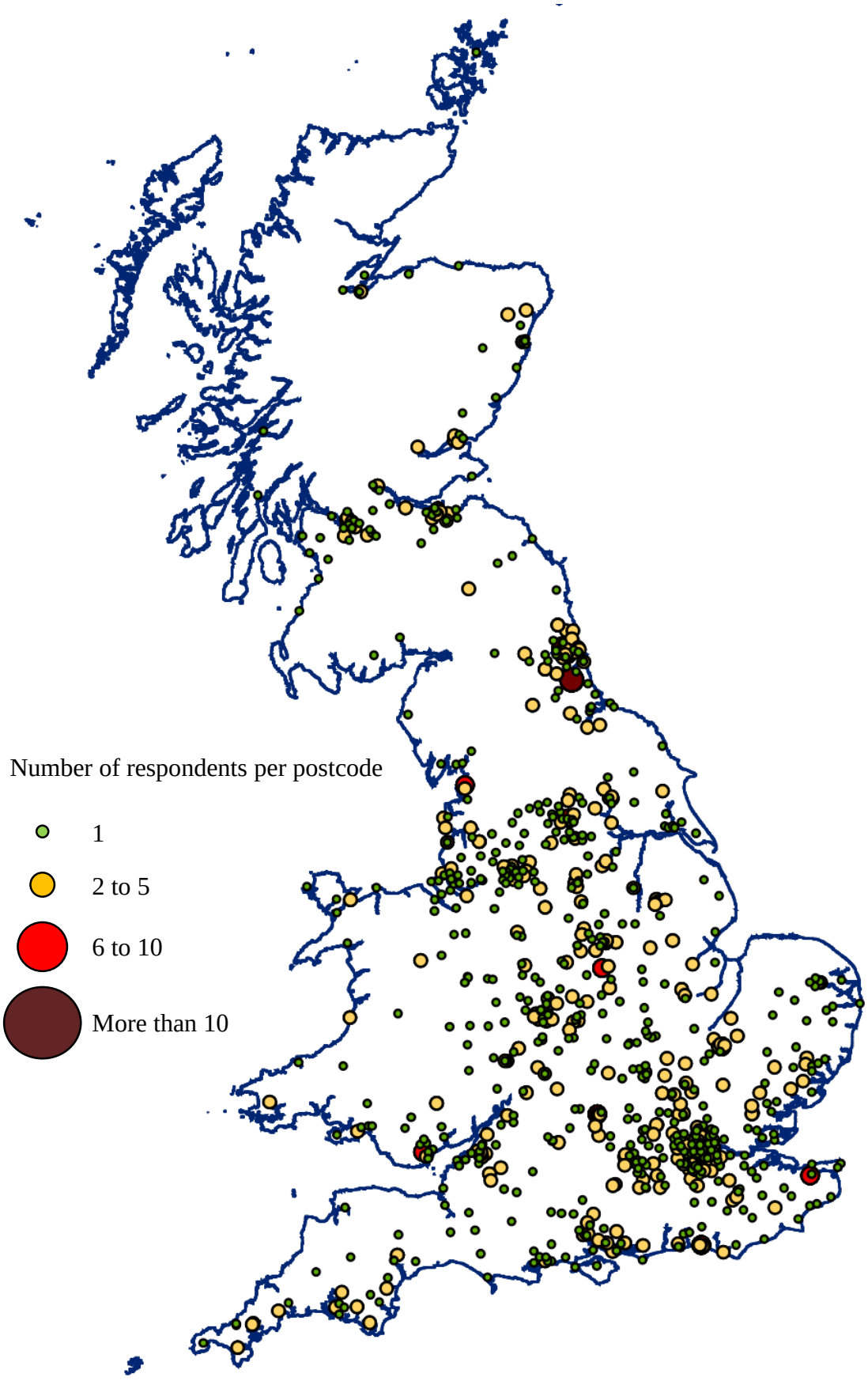
Appendix B: Descriptive statistics

Figure B1: Descriptive statistics for attitudinal statements, arranged in factor order

Factor items	Mean	*s.d.*
1 Current travel times by rail are acceptable	5.06	1.51
2 Planes and airports allow productive travel time	4.09	1.73
3 Anxious about oversleeping if setting off very early	4.65	1.91
4 Domestic air travel times are acceptable	4.99	1.32
5 Changing trains can be complicated	4.47	1.65
6 Should be more domestic flights in the future	3.23	1.81
7 Favour security presence on trains	4.41	1.72
8 Train standard class can be generally unpleasant	3.95	1.71
9 Wi-Fi is important when travelling	4.91	1.82
10 It is important to do something while travelling	5.77	1.36
11 Fear of terrorism if travelling by rail	2.22	1.33
12 Should add extra lanes to existing roads	3.33	1.93
13 Comfort is more important than journey time	4.32	1.37
14 I prefer transport with flexibility about when to leave	5.53	1.11
15 Willing to pay to compensate environmental costs	4.07	1.63
16 I enjoy looking at the view when I am travelling	5.88	1.05
17 I find travelling alone boring	2.75	1.60
18 Discouraged from using rail if I knew I would stand	5.94	1.47
19 I consider myself an environmentally friendly traveller	4.70	1.41
20 If travelling I always want a reserved seat	4.49	1.71
21 If on a train I like to be able to see my luggage	5.42	1.33
22 New roads should be built	3.19	1.89
23 I always want to reach destination as quickly as possible	4.80	1.52
24 I fear potential for terrorism if travelling by air	3.18	1.70
25 Travelling long distance to a city centre, I prefer the train	5.69	1.37
26 Always want to reach my destination comfortable as possible	5.47	1.10
27 Train travel would allow productive use of my time	5.56	1.19
28 Would choose car if lots to carry	5.30	1.63
29 Worry about missing connections on air and rail if changing	4.61	1.55
30 Think hold luggage theft problem on airlines	3.15	1.48
31 Worry about my personal safety if travelling by train	2.45	1.41
32 Should be more frequent train services in future	5.41	1.20
33 Public transport more comfortable with security	3.66	1.68
34 If travelling by rail, others would disrupt or distract me	3.71	1.61
35 I would worry about personal safety on flights	2.83	1.51
36 Concerned my plane luggage may not arrive at destination	4.13	1.57
37 Luggage restrictions would discourage high speed rail use	4.76	1.77
38 High speed rail would be more expensive than current rail	5.48	1.19
39 Britain should be investing in high speed rail	5.34	1.56
40 High speed trains use more energy than current trains	4.42	1.27
41 I think high speed rail is a step forward for the future	5.46	1.38
42 I do not know much about high speed rail	4.06	1.81
43 Day return trips would be easier by high speed rail	5.71	1.11
44 Would be proud of a new British high speed rail network	4.74	1.67
45 Pollution from high speed trains greater than current trains	3.78	1.25
46 High speed trains would be noisier than current trains	3.61	1.25

Notes: N=1799, s.d.=Standard Deviation, var=Variance, skew=Skewness statistic

Figure B2: Number of respondents by postcode



Source of map: Ordnance Survey Boundary Line™ Data
Postcode data from: Ordnance Survey Code-Point Open (February 2013)

Appendix C: Principal Components Analysis

Figure C1: Scree Plot of dataset as part of Factor Analysis

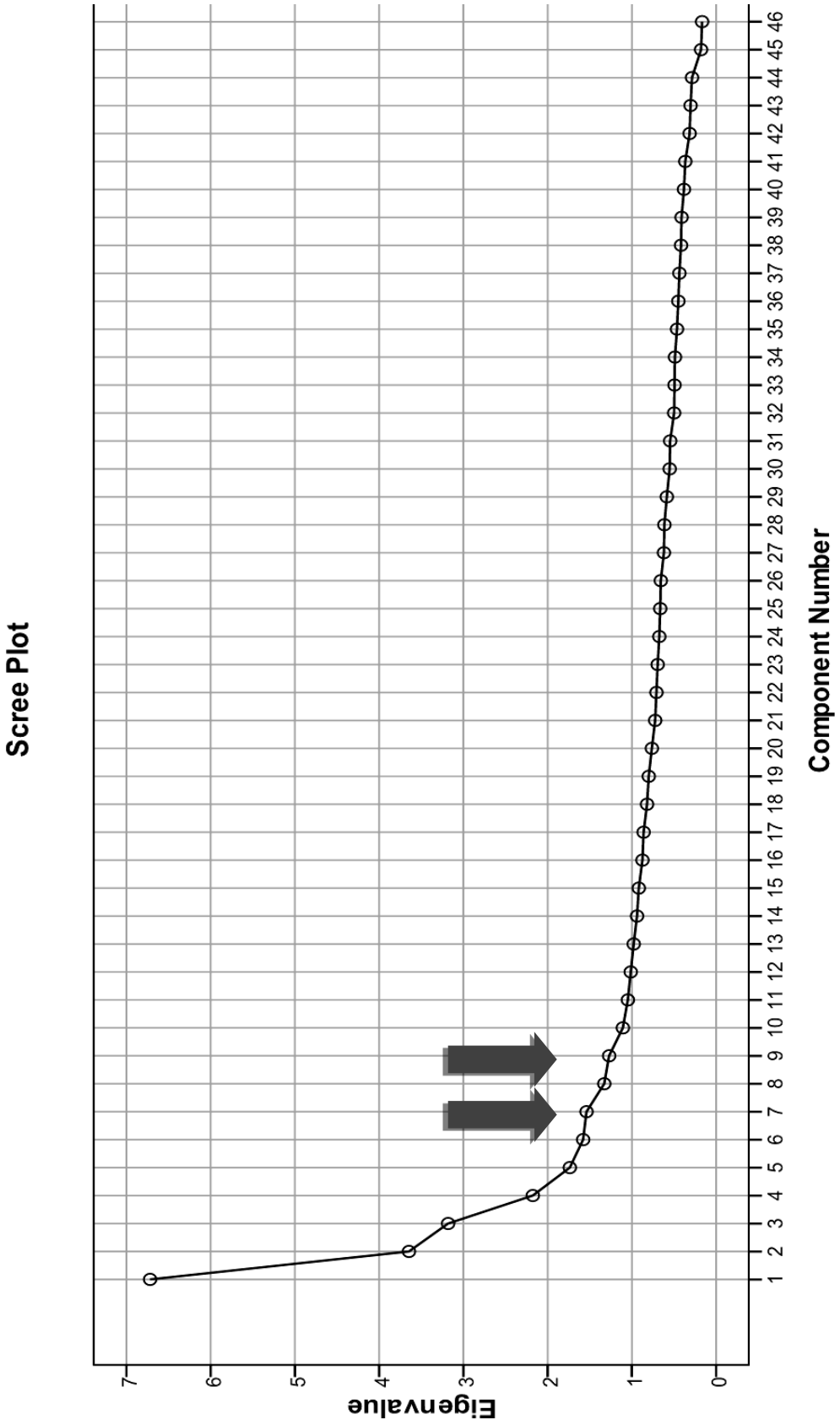


Figure C2: Principal Components Analysis with a nine factor solution

Variable	F1	F2	F3	F4	F5	F6	F7	F8	F9
1 Current travel times by rail are acceptable	-.245	-.017	-.150	-.106	.045	-.160	-.035	.571	.117
2 Planes and airports allow productive travel time	.334	.054	.046	-.022	.024	.114	.124	.531	-.264
3 Anxious about oversleeping if setting off very early	-.125	.097	.019	-.022	.055	.573	.064	.067	.092
4 Domestic air travel times are acceptable	.127	-.109	.056	.004	.077	.323	-.031	.604	-.072
5 Changing trains can be complicated	.199	.204	.007	.149	.021	.595	.028	.040	-.084
6 Should be more domestic flights in the future	.661	.197	.013	.162	-.044	.171	.093	.207	-.131
7 Favour security presence on trains	.290	.500	.032	.325	-.063	-.037	-.028	.213	-.053
8 Train standard class can be generally unpleasant	.291	.236	-.030	.483	.057	.109	.046	-.237	-.076
9 Wi-Fi is important when travelling	.029	-.021	.115	.051	.003	.074	.742	-.067	-.044
10 It is important to do something while travelling	-.139	-.040	.038	.046	.040	.053	.782	.017	-.027
11 Fear of terrorism if travelling by rail	.242	.682	.030	.067	.062	.085	.126	-.008	-.180
12 Should add extra lanes to existing roads	.733	.225	.075	.190	.025	-.139	-.030	.124	.083
13 Comfort is more important than journey time	-.150	.107	-.024	.649	.115	-.140	-.179	.070	-.070
14 I prefer transport with flexibility about when to leave	.078	-.004	.088	.318	.051	.220	.022	-.039	.186
15 Willing to pay to compensate environmental costs	-.502	.059	.081	.053	.095	.087	.061	.060	-.430
16 I enjoy looking at the view when I am travelling	-.358	.013	.109	.275	-.036	.092	-.191	.210	.164
17 I find travelling alone boring	.349	.310	.083	.042	.082	.163	.073	-.108	-.108
18 Discouraged from using rail if I knew I would stand	.154	-.056	.011	.513	.048	.150	.036	-.140	-.050
19 I consider myself an environmentally friendly traveller	-.571	.161	.104	.064	.050	-.123	.005	.125	-.139
20 If travelling I always want a reserved seat	.123	.196	-.048	.456	-.134	.215	.208	.064	-.025
21 If on a train I like to be able to see my luggage	.125	.279	.003	.234	-.100	.153	.035	.196	.306
22 New roads should be built	.742	.213	.102	.199	.007	-.117	-.024	.137	.103
23 I always want to reach destination as quickly as possible	.406	.149	.188	-.002	-.102	.168	.409	.040	.216
24 I fear potential for terrorism if travelling by air	-.095	.780	.003	-.029	.014	.053	.000	-.009	-.012
25 Travelling long distance to a city centre, I prefer the train	-.622	-.010	.130	.056	.014	-.064	.144	.009	.194
26 Always want to reach my destination comfortable as possible	-.060	.149	.098	.659	-.057	-.033	.139	.053	.158
27 Train travel would allow productive use of my time	-.530	-.073	.108	.051	.025	-.152	.481	.206	.062
28 Would choose car if lots to carry	.492	.101	-.008	.316	-.061	.215	-.063	.095	.043
29 Worry about missing connections on air and rail if changing	.157	.323	.043	.246	.031	.591	.052	.030	.109
30 Think hold luggage theft problem on airlines	-.005	.606	-.007	.043	.045	.088	-.107	-.043	.122
31 Worry about my personal safety if travelling by train	.283	.653	-.001	.210	.059	.106	.001	-.023	-.092
32 Should be more frequent train services in future	-.208	.027	.297	.190	.031	.136	.190	-.191	.043
33 Public transport more comfortable with security	.243	.644	.031	.251	-.043	.010	.012	.197	-.152
34 If travelling by rail, others would disrupt or distract me	.226	.297	.030	.302	.099	.158	.047	-.099	.093
35 I would worry about personal safety on flights	-.053	.799	-.012	-.009	.017	.056	-.001	-.092	-.004
36 Concerned my plane luggage may not arrive at destination	-.103	.530	-.004	.012	-.028	.261	-.067	-.060	.299
37 Luggage restrictions would discourage high speed rail use	.000	-.032	-.063	.049	.161	.102	.045	-.138	.555
38 High speed rail would be more expensive than current rail	.082	-.029	-.077	.150	.328	.039	-.045	.216	.400
39 Britain should be investing in high speed rail	.027	-.024	.849	.006	-.135	-.020	.053	-.107	-.095
40 High speed trains use more energy than current trains	-.081	.020	.008	-.025	.783	-.009	.006	.073	.209
41 I think high speed rail is a step forward for the future	.012	-.030	.876	.028	-.146	.015	.071	-.044	-.061
42 I do not know much about high speed rail	.229	.075	-.172	.130	.030	.353	.069	.001	-.409
43 Day return trips would be easier by high speed rail	-.073	.005	.712	.008	-.073	.053	.092	.104	.061
44 Would be proud of a new British high speed rail network	.000	.090	.809	.031	-.095	-.037	.001	.025	.004
45 Pollution from high speed trains greater than current trains	-.045	.058	-.194	.034	.834	.070	-.011	.020	-.008
46 High speed trains would be noisier than current trains	.006	.058	-.281	.031	.736	.053	.043	-.035	-.041

Figure C3: Principal Components Analysis with a seven factor solution

Variable	F1	F2	F3	F4	F5	F6	F7
1 Current travel times by rail are acceptable	-.076	-.315	-.089	-.069	.142	-.222	.440
2 Planes and airports allow productive travel time	.070	.231	.026	-.027	-.044	.152	.642
3 Anxious about oversleeping if setting off very early	.151	-.098	-.003	.106	.145	.281	.058
4 Domestic air travel times are acceptable	-.077	.062	.038	.081	.118	.065	.632
5 Changing trains can be complicated	.284	.207	-.051	.234	.022	.309	.139
6 Should be more domestic flights in the future	.225	.602	.000	.178	-.082	.170	.348
7 Favour security presence on trains	.489	.225	.036	.313	-.087	-.073	.253
8 Train standard class can be generally unpleasant	.272	.292	-.076	.439	-.023	.145	-.137
9 Wi-Fi is important when travelling	-.047	-.028	.147	.040	-.023	.683	-.019
10 It is important to do something while travelling	-.080	-.207	.080	.036	.027	.686	.029
11 Fear of terrorism if travelling by rail	.700	.194	.004	.031	-.037	.177	.098
12 Should add extra lanes to existing roads	.214	.686	.104	.186	.039	-.100	.192
13 Comfort is more important than journey time	.109	-.181	-.070	.563	.040	-.212	.062
14 I prefer transport with flexibility about when to leave	.015	.095	.087	.378	.130	.091	-.061
15 Willing to pay to compensate environmental costs	.097	-.535	-.013	-.047	-.095	.166	.135
16 I enjoy looking at the view when I am travelling	.006	-.355	.114	.332	.062	-.203	.091
17 I find travelling alone boring	.349	.340	.049	.031	.015	.188	.007
18 Discouraged from using rail if I knew I would stand	-.019	.159	-.037	.487	-.002	.140	-.071
19 I consider myself an environmentally friendly traveller	.143	-.604	.082	.002	-.016	-.061	.071
20 If travelling I always want a reserved seat	.201	.087	-.052	.484	-.128	.251	.099
21 If on a train I like to be able to see my luggage	.253	.108	.064	.348	.066	-.014	.107
22 New roads should be built	.202	.696	.133	.206	.035	-.092	.200
23 I always want to reach destination as quickly as possible	.128	.377	.257	.095	.015	.374	.046
24 I fear potential for terrorism if travelling by air	.773	-.116	.008	-.021	.000	-.002	-.018
25 Travelling long distance to a city centre, I prefer the train	-.054	-.617	.168	.080	.100	.027	-.147
26 Always want to reach my destination comfortable as possible	.118	-.096	.120	.661	-.006	.044	-.008
27 Train travel would allow productive use of my time	-.142	-.596	.163	.037	.060	.277	.094
28 Would choose car if lots to carry	.131	.479	-.016	.367	-.028	.030	.161
29 Worry about missing connections on air and rail if changing	.382	.171	.018	.369	.111	.281	.063
30 Think hold luggage theft problem on airlines	.607	.001	.003	.082	.087	-.090	-.076
31 Worry about my personal safety if travelling by train	.675	.251	-.027	.193	-.005	.065	.061
32 Should be more frequent train services in future	.040	-.192	.280	.194	.031	.241	-.199
33 Public transport more comfortable with security	.644	.171	.019	.224	-.111	.001	.267
34 If travelling by rail, others would disrupt or distract me	.317	.226	.020	.322	.113	.112	-.068
35 I would worry about personal safety on flights	.797	-.064	-.011	-.005	-.003	.009	-.091
36 Concerned my plane luggage may not arrive at destination	.529	-.068	.033	.132	.118	-.023	-.156
37 Luggage restrictions would discourage high speed rail use	-.058	.056	.014	.172	.387	-.006	-.292
38 High speed rail would be more expensive than current rail	-.046	.076	-.029	.227	.488	-.111	.104
39 Britain should be investing in high speed rail	-.004	.027	.818	-.018	-.184	.086	-.055
40 High speed trains use more energy than current trains	.040	-.088	-.012	-.054	.793	.010	.036
41 I think high speed rail is a step forward for the future	-.014	.006	.853	.022	-.170	.100	-.006
42 I do not know much about high speed rail	.153	.207	-.267	.090	-.136	.314	.194
43 Day return trips would be easier by high speed rail	.005	-.090	.716	.042	-.031	.083	.083
44 Would be proud of a new British high speed rail network	.095	-.012	.799	.031	-.095	-.010	.030
45 Pollution from high speed trains greater than current trains	.110	-.056	-.264	-.043	.741	.087	.068
46 High speed trains would be noisier than current trains	.103	-.005	-.342	-.049	.633	.131	.027

Figure C4: Final Principal Components Analysis (full six factor solution).

Factor items	F1	F2	F3	F4	F5	F6
F1 Travel Security Concerns						
35 I would worry about personal safety on flights	**.797**	-.064	-.011	-.005	-.003	.009
24 I fear potential for terrorism if travelling by air	**.773**	-.116	.008	-.021	.000	-.002
11 Fear of terrorism if travelling by rail	**.700**	.194	.004	.031	-.037	.177
31 Worry about my personal safety if travelling by train	**.675**	.251	-.027	.193	-.005	.065
33 Public transport more comfortable with security	**.644**	.171	.019	.224	-.111	.001
30 Think hold luggage theft problem on airlines	**.607**	.001	.003	.082	.087	-.090
36 Concerned my plane luggage may not arrive at destination	**.529**	-.068	.033	.132	.118	-.023
7 Favour security presence on trains	**.489**	.225	.036	.313	-.087	-.073
F2 Unsustainable Transport Improvements						
22 New roads should be built	.202	**.696**	.133	.206	.035	-.092
12 Should add extra lanes to existing roads	.214	**.686**	.104	.186	.039	-.100
25 Travelling long distance to a city centre, I prefer the train	-.054	**-.617**	.168	.080	.100	.027
19 I consider myself an environmentally friendly traveller	.143	**-.604**	.082	.002	-.016	-.061
6 Should be more domestic flights in the future	.225	**.602**	.000	.178	-.082	.170
27 Train travel would allow productive use of my time	-.142	**-.596**	.163	.037	.060	.277
15 Willing to pay to compensate environmental costs	.097	**-.535**	-.013	-.047	-.095	.166
23 I always want to reach destination as quickly as possible	.128	**.377**	.257	.095	.015	.374
F3 High speed rail Prestige / Favourability						
41 I think high speed rail is a step forward for the future	-.014	.006	**.853**	.022	-.170	.100
39 Britain should be investing in high speed rail	-.004	.027	**.818**	-.018	-.184	.086
44 Would be proud of a new British high speed rail network	.095	-.012	**.799**	.031	-.095	-.010
43 Day return trips would be easier by high speed rail	.005	-.090	**.716**	.042	-.031	.083
F4 Importance of Comfort						
26 Always want to reach my destination comfortably as possible	.118	-.096	.120	**.661**	-.006	.044
13 Comfort is more important than journey time	.109	-.181	-.070	**.563**	.040	-.212
18 Discouraged from using rail if I knew I would stand	-.019	.159	-.037	**.487**	-.002	.140
20 If travelling I always want a reserved seat	.201	.087	-.052	**.484**	-.128	.251
8 Train standard class can be generally unpleasant	.272	.292	-.076	**.439**	-.023	.145
29 Worry about missing connections on air and rail if changing	**.382**	.171	.018	**.369**	.111	.281
28 Would choose car if lots to carry	.131	**.479**	-.016	**.367**	-.028	.030
16 I enjoy looking at the view when I am travelling	.006	**-.355**	.114	.332	.062	-.203
36 If travelling by rail, others would disrupt or distract me	.317			.322		
F5 Perceived Negative Impact of high speed rail						
40 High speed trains use more energy than current trains	.040	-.088	-.012	-.054	**.793**	.010
45 Pollution from high speed trains greater than current trains	.110	-.056	-.264	-.043	**.741**	.087
46 High speed trains would be noisier than current trains	.103	-.005	-.342	-.049	**.633**	.131
38 High speed rail would be more expensive than current rail	-.046	.076	-.029	.227	**.488**	-.111
F6 Importance of Useful Travel Time						
10 It is important to do something while travelling	-.080	-.207	.080	.036	.027	**.686**
9 Wi-Fi is important when travelling	-.047	-.028	.147	.040	-.023	**.683**
Alpha Coefficients	.832	.789	.852	.668	.700	.611
Eigenvalues	1.791	1.350	1.029	.718	.613	.499
Variance	71.097	67.120	23.127	48.739	12.917	7.455
Standard Deviation	8.432	8.193	4.809	6.981	3.594	2.730
Factor Mean	26.022	26.529	21.248	43.671	17.295	10.680
Standardised Factor Mean	3.253	3.316	5.312	4.852	4.324	5.340

Notes: Factor seven removed due to unacceptably low Cronbach's alpha score (.449)
Loadings exceeding .35 are in bold to denote highest factor loadings.

Appendix D: Results

Figure D1: Normality plot showing combined attitude means for Factor one

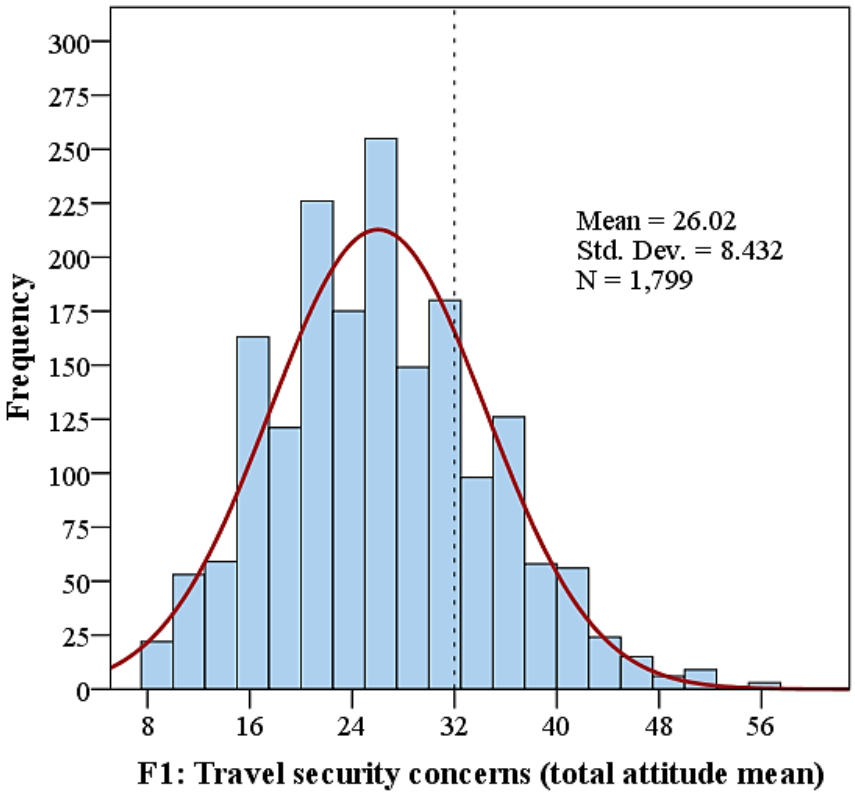


Figure D2: Normality plot showing combined attitude means for Factor two

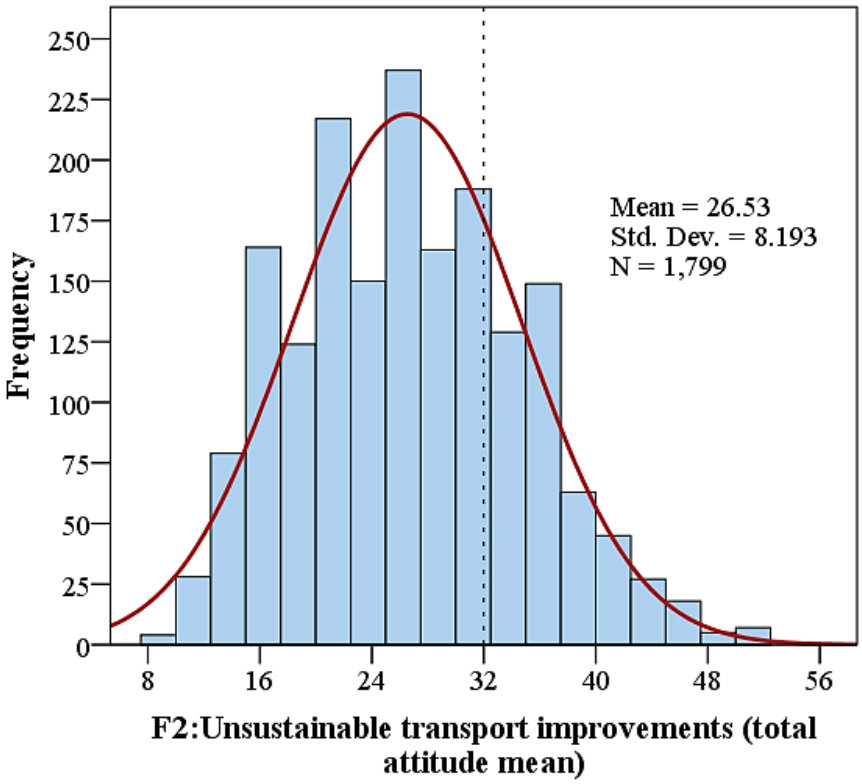


Figure D3: Normality plot showing combined attitude means for Factor three

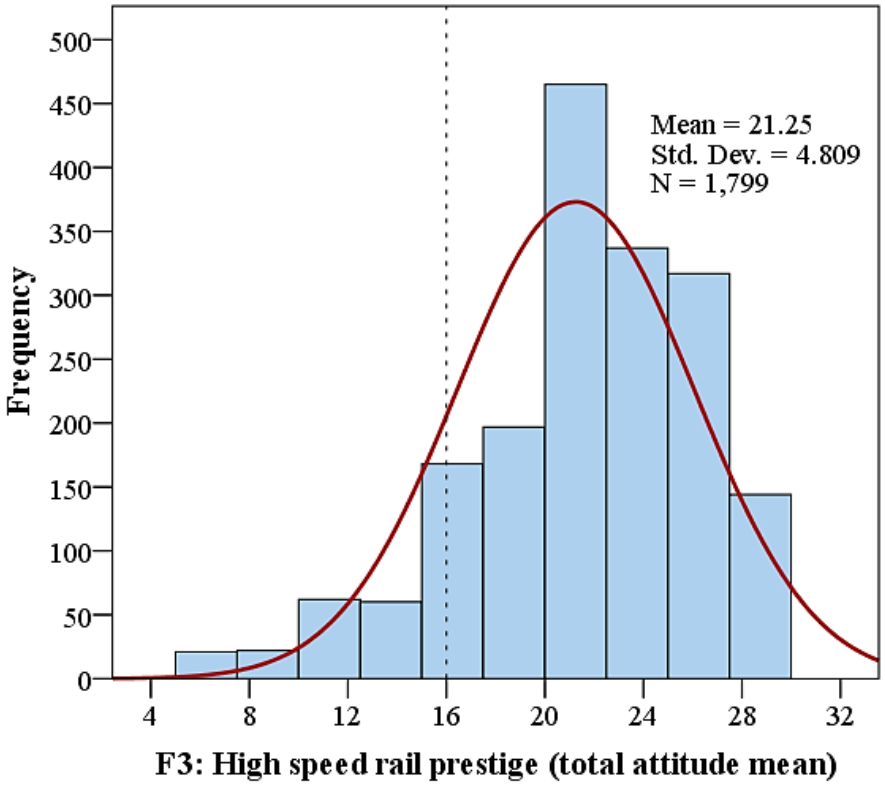


Figure D4: Normality plot showing combined attitude means for Factor four

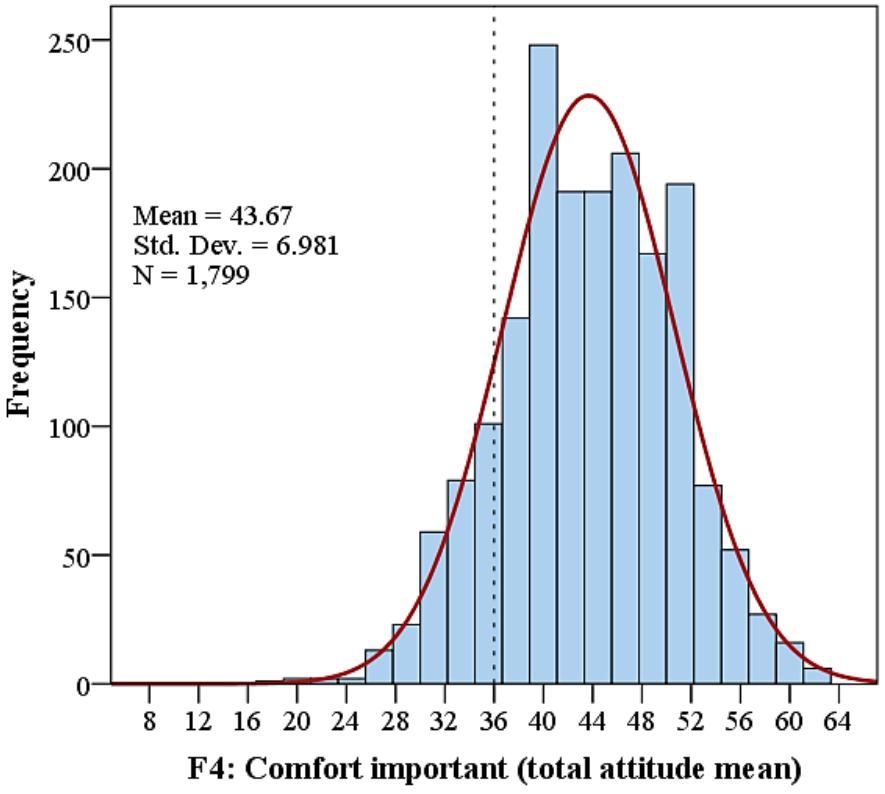


Figure D5: Normality plot showing combined attitude means for Factor five

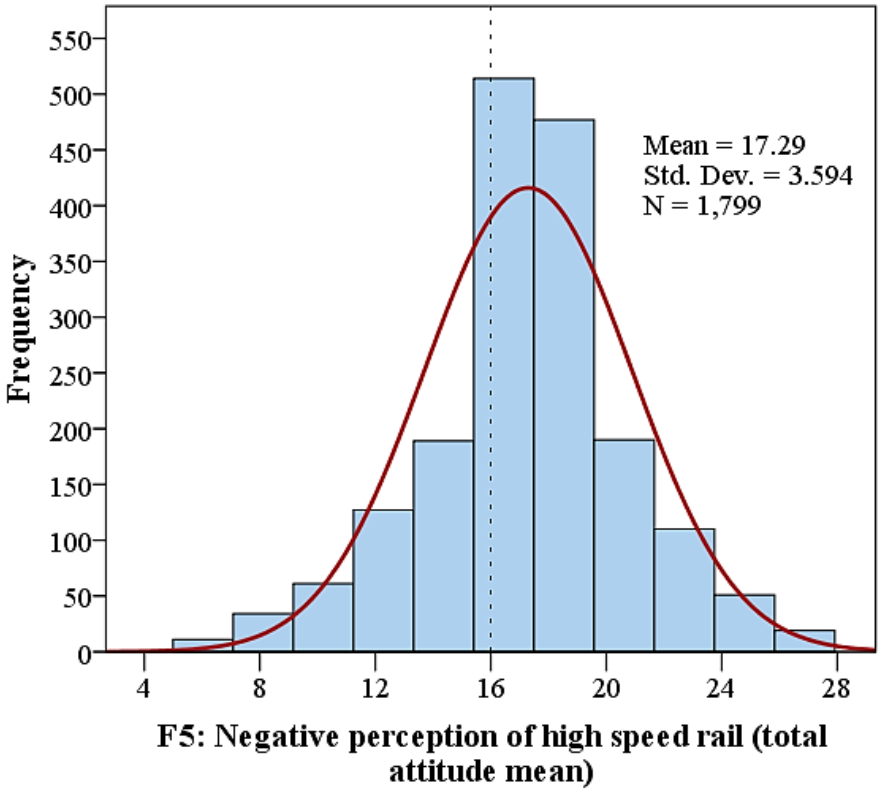


Figure D6: Normality plot showing combined attitude means for Factor six

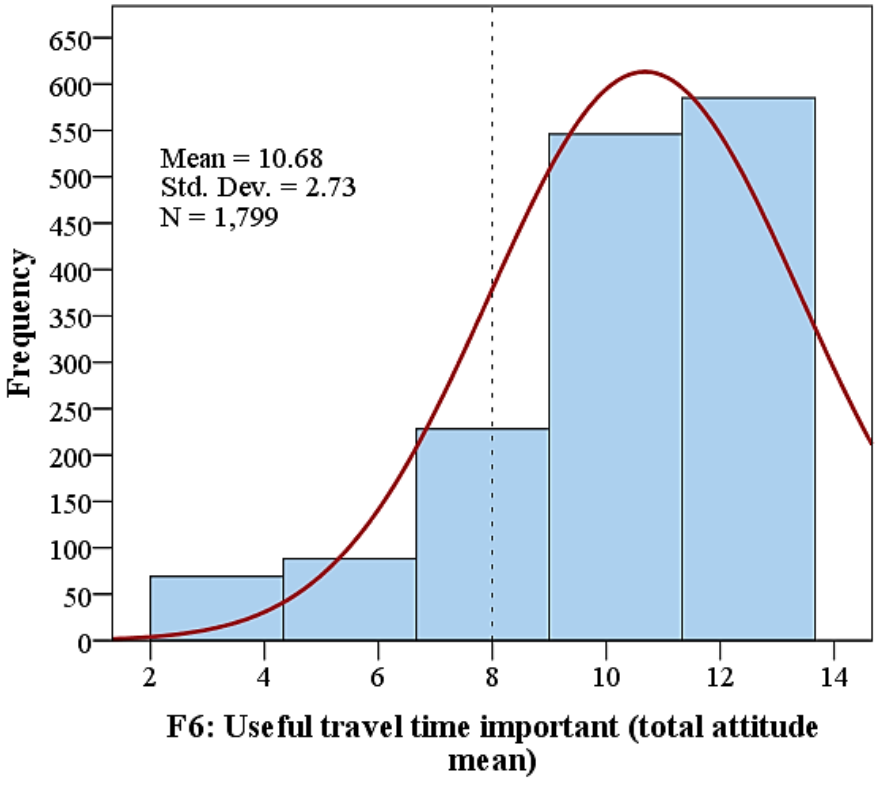


Table D1: Pair-wise comparisons between age groups and attitudes (Mann-Whitney Z-scores and probabilities)

Age category	18 - 25 years		26 - 35 years		36 - 45 years		46 - 55 years		56 - 65 years	
F1: Travel Security										
26 to 35 years	-0.96									
36 to 45 years	-0.19		-1.33							
46 to 55 years	-1.52		-2.94	**	-1.53					
56 to 65 years	-3.53	***	-5.58	***	-4.02	***	-2.53	*		
66 years and over	-3.82	***	-5.20	***	-4.13	***	-2.97	**	-1.10	
F3: HSR Prestige										
26 to 35 years	-0.59									
36 to 45 years	-1.90		-1.80							
46 to 55 years	-2.61	**	-2.75	**	-0.85					
56 to 65 years	-2.48	*	-2.61	**	-0.79		-0.06			
66 years and over	-3.03	**	-3.11	**	-1.77		-1.14		-1.17	
F4: Comfort										
26 to 35 years	-0.06									
36 to 45 years	-0.15		-0.22							
46 to 55 years	-1.81		-2.54	*	-2.81	**				
56 to 65 years	-3.49	***	-4.71	***	-4.84	***	-2.39	*		
66 years and over	-3.22	**	-4.04	***	-4.25	***	-2.12	*	-0.25	
F6: Useful travel										
26 to 35 years	-2.71									
36 to 45 years	-1.95		-0.75							
46 to 55 years	-0.12		-3.41	**	-2.42	*				
56 to 65 years	-2.42	*	-6.50	***	-5.42	***	-3.32	**		
66 years and over	-5.95	***	-9.30	***	-8.42	***	-7.12	***	-4.53	***

*Notes: df=5 , *** p=<.001, ** p=<.01, * p=<.05*

Figure D7: Positive Perceptions of HSR (F3) attitude mean by age and gender

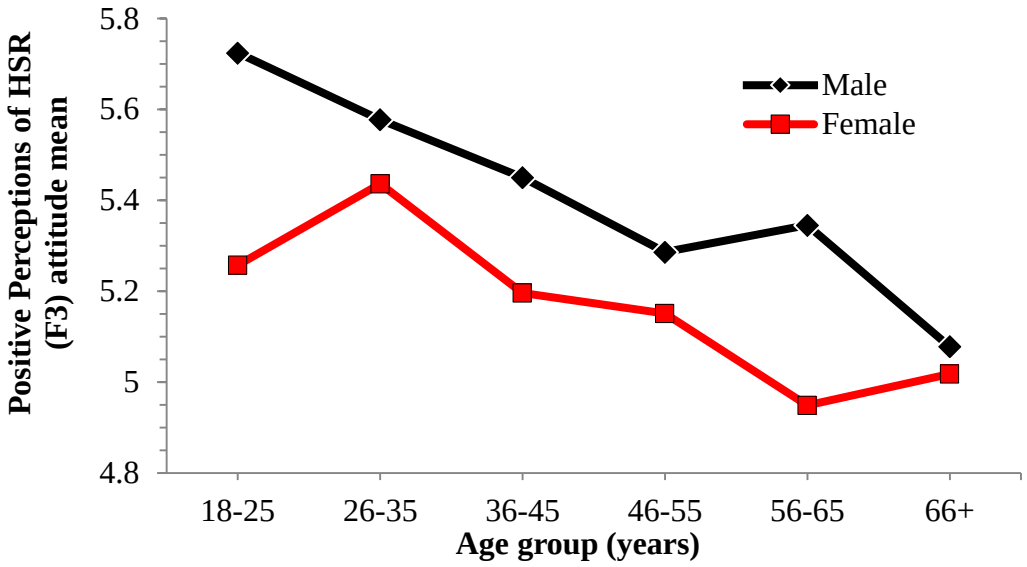


Table D2: Pair-wise comparisons between occupation categories and attitudes (Mann-Whitney Z-scores and probabilities)

Age category	A		B		C1		C2/D		Student	
F1: Travel Security										
B	-0.87									
C1	-2.60	**	-5.25	***						
C2/D	-2.27	*	-3.39	**	-0.77					
Student	-1.27		-0.79		-4.62	***	-3.42	**		
Retired	-2.85	**	-5.58	***	-0.46		-0.60		-4.84	***
F2: Unsustainable										
B	-2.58	*								
C1	-1.16		-5.01	***						
C2/D	-3.11	**	-5.13	***	-2.45	*				
Student	-0.56		-2.31	*	-1.97	*	-3.70	***		
Retired	-1.83		-5.75	***	-0.83		-1.92		-2.75	**
F4: Comfort										
B	-1.79									
C1	-0.40		-1.72							
C2/D	-0.51		-1.97	*	-0.64					
Student	-2.53	*	-1.34		-2.31	*	-2.34	*		
Retired	-2.39	*	-5.99	***	-3.10	**	-1.22		-5.68	***
F6: Useful travel										
B	-2.55	*								
C1	-4.36	***	-3.26	**						
C2/D	-4.85	***	-3.82	***	-1.79					
Student	-1.68		-0.52		-2.80	**	-3.63	***		
Retired	-8.88	***	-10.47	***	-6.15	***	-2.44	*	-8.06	***

*Notes: N= 1557, df=5 , *** p=<.001, ** p=<.01, * p=<.05*
Notes: A=Upper Managerial and Professional B= Middle Managerial and Professional
C1= Junior Managerial and Professional C2/D= Manual S= Full and Part-time students
R= Retired and Part Retired

Table D3: Multiple Regression between attitudes, time elapsed values for coach, and age

Attitude	R^2	*F*	*p*	Age		Time elapsed (coach)	
				t	*p*	*t*	*p*
F1: Travel Security	.023	13.65	<.001	4.49	<.001	0.73	*ns*
F4: Comfort	.015	9.45	<.001	3.71	<.001	1.20	*ns*
F6: Useful travel	.061	36.34	<.001	-6.91	<.001	-2.99	.003

Notes: N=1521

Figure D8: Comfort important (F4) attitude mean by age and gender

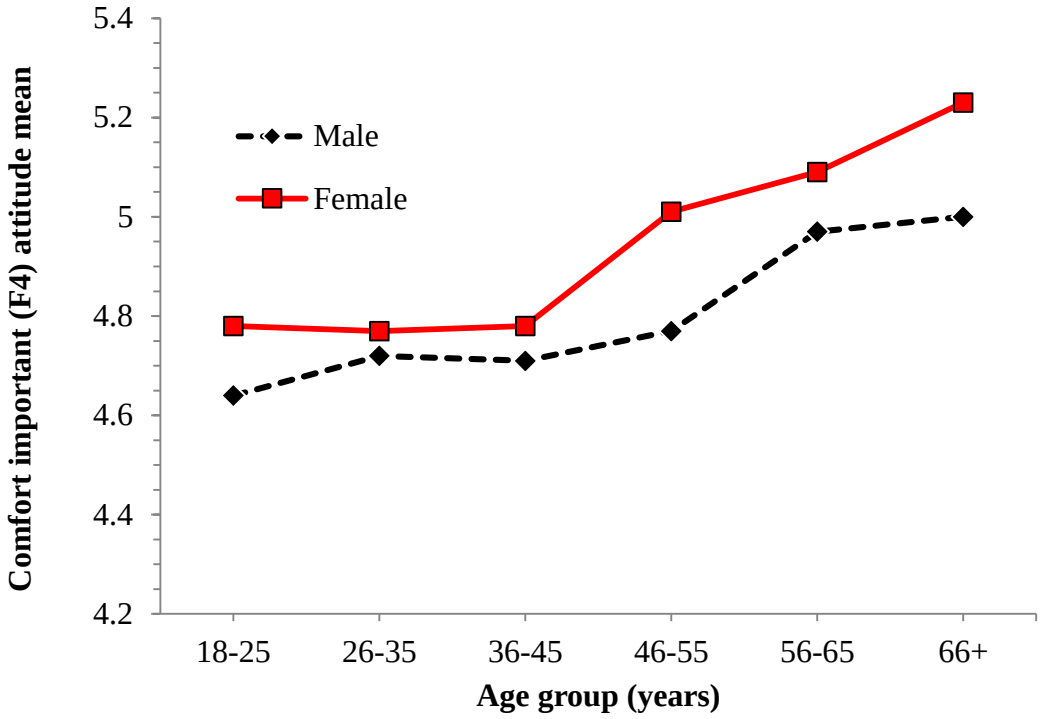


Figure D9: Useful travel time important (F6) attitude mean by age and gender

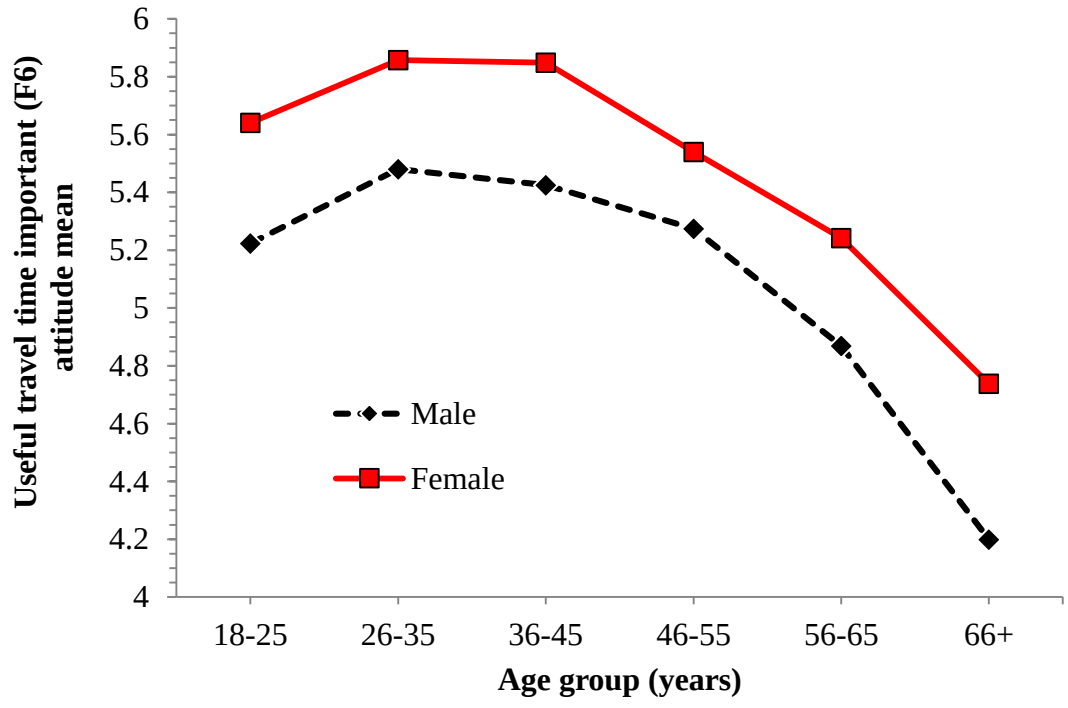


Table D4: Mann-Whitney *U* tests of gender differences in Negative attitudes to high speed rail (F5), between regions.

Region of Great Britain	Mann-Whitney *U* test		Attitude mean ranks			
	Z	*p*	*N*	Male	*N*	Females
East Midlands	-0.50	*ns*	65	52.81	42	55.85
East of England	-0.93	*ns*	73	59.55	50	65.57
Greater London	-1.40	*ns*	83	90.87	87	80.38
North East of England	-1.06	*ns*	80	73.62	60	66.34
North West of England	-0.36	*ns*	68	59.45	48	57.16
Scotland	-0.39	*ns*	83	63.08	44	65.73
South East of England	-0.73	*ns*	141	108.68	71	102.16
South West of England	0.00	*ns*	66	57.00	47	57.00
Wales	-0.39	*ns*	29	24.34	20	25.95
West Midlands	-1.47	*ns*	58	49.61	34	41.19
Yorkshire and the Humber	-0.04	*ns*	79	55.92	32	56.19

Notes: df=10

Table D5: Kruskal-Wallis test for differences in willingness-to-pay for travel time savings, split by age

Age group	Travel time reduction offered by mode							
	Savings by High speed rail				Savings by VHSR			
	30 minutes saved on 3 hours		45 minutes saved on 1½ hours		90 minutes saved on 3 hours		60 minutes saved on 1½ hours	
	N	Mean rank	*N*	Mean rank	*N*	Mean rank	*N*	Mean rank
18 to 25 years	136	782.92	136	762.31	137	774.58	136	774.58
26 to 35 years	340	788.66	340	843.15	337	830.36	339	849.30
36 to 45 years	279	797.81	280	831.27	282	835.50	278	836.35
46 to 55 years	330	770.00	329	760.98	330	764.40	328	743.91
56 to 65 years	334	735.82	339	717.55	333	713.36	332	695.13
66 years and over	125	765.32	127	683.95	124	643.85	123	649.35
Chi square (χ^2)	4.73		25.45		28.86		38.13	
p	*ns*		<.001		<.001		<.001	

Notes: df=5, ns=not significant

Table D6: Kruskal-Wallis one-way analysis of variance between environmental importance and age group, summary table of statistics

Age group	Overall		Age split by gender			
			Male		Female	
	N	Mean ranks	*N*	Mean ranks	*N*	Mean ranks
18 to 25 years	136	660.22	92	385.98	44	286.56
26 to 35 years	339	801.42	147	463.16	192	311.92
36 to 45 years	289	831.53	156	486.61	132	335.59
46 to 55 years	344	812.19	206	476.04	136	332.66
56 to 65 years	351	809.79	237	478.16	112	347.93
66 years and over	133	771.53	100	494.96	31	278.11
χ^2	14.92		10.81		7.17	
p	.011		*ns*		*ns*	

Figure D10: Time elapsed (in months) since most recent long distance rail trip, number of respondents

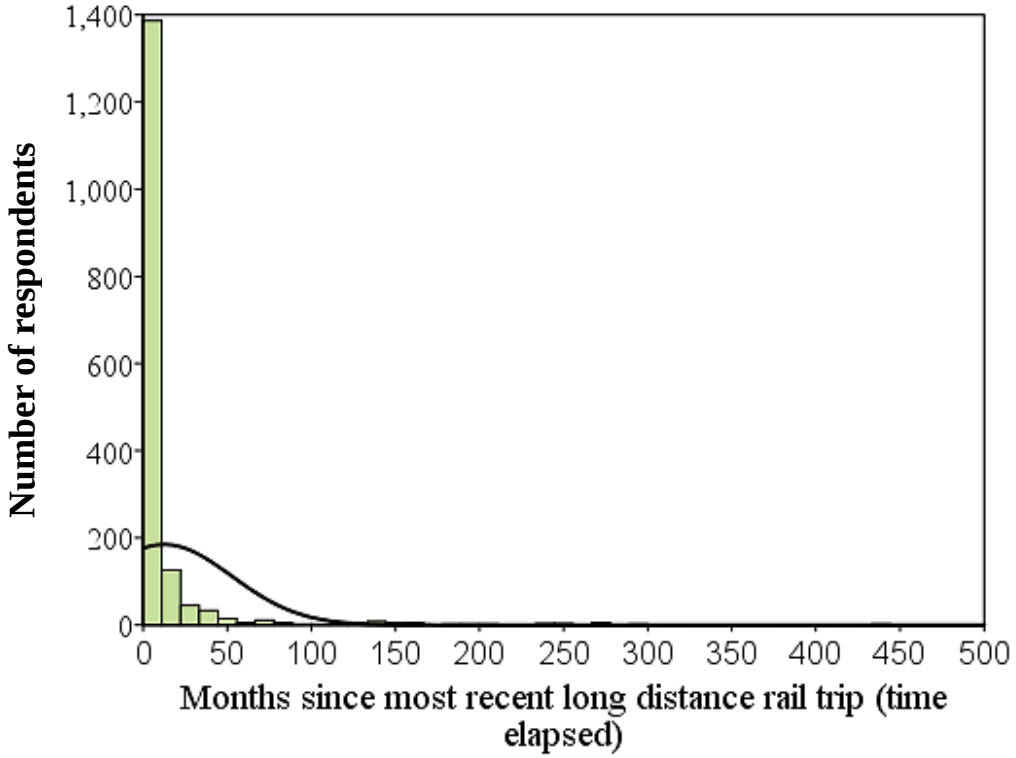


Figure D11: Time elapsed (in months) since most recent long distance air trip, number of respondents

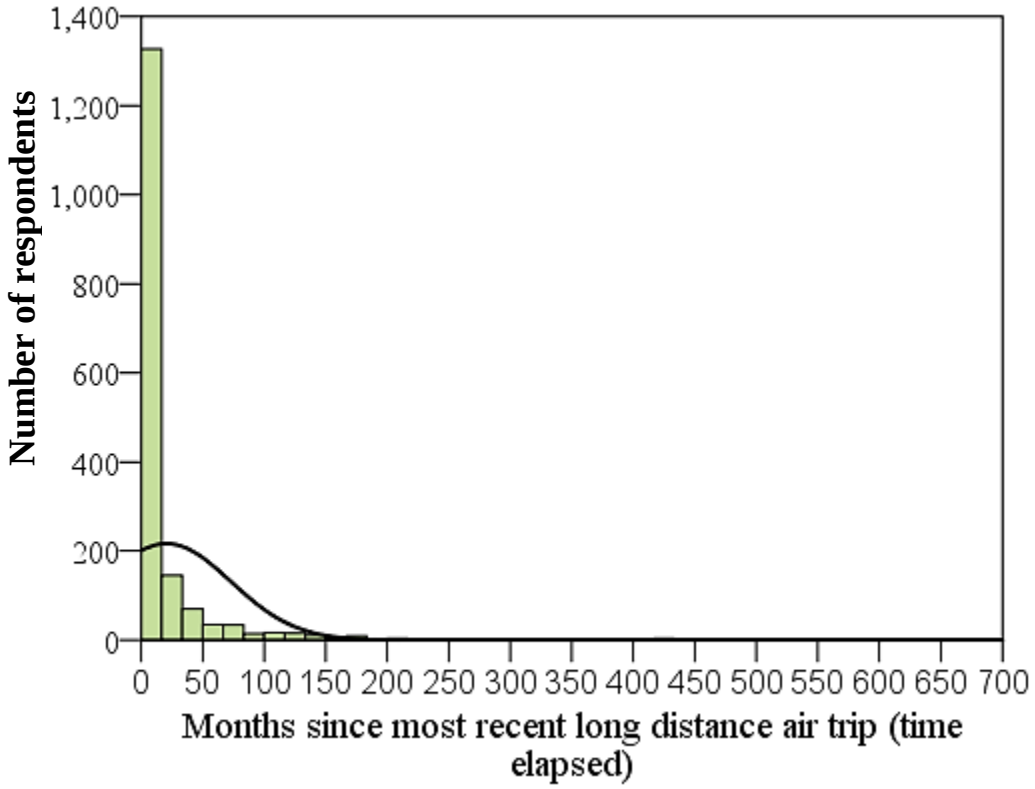


Figure D12: Time elapsed (in months) since most recent long distance car trip, number of respondents

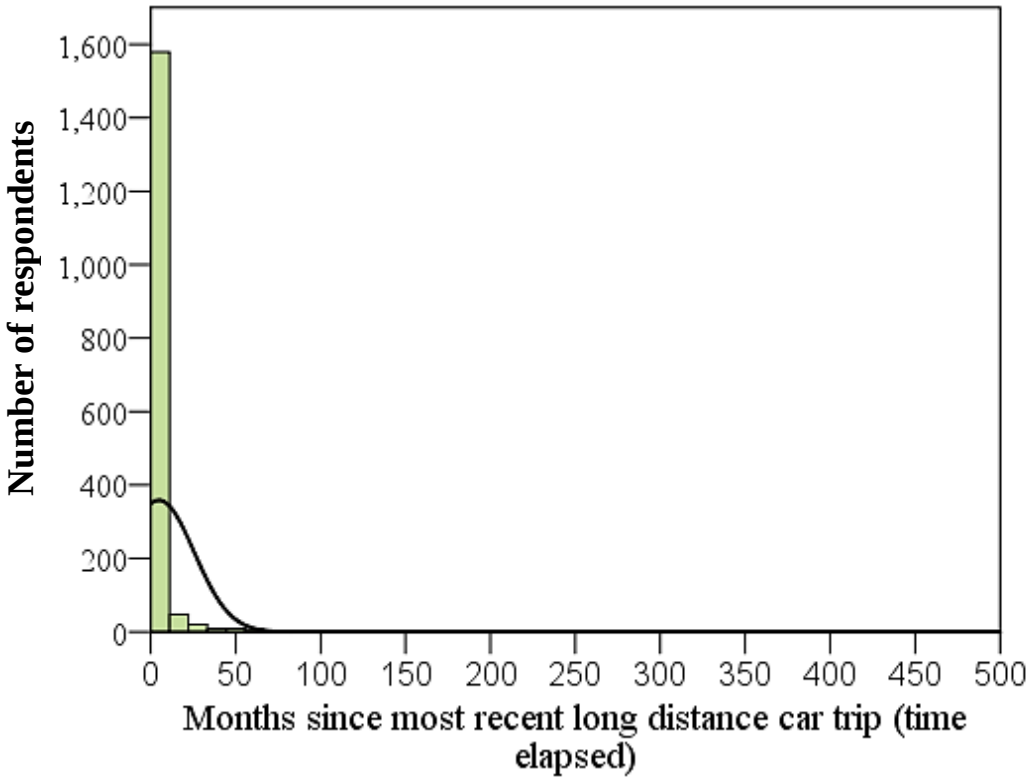


Figure D13: Time elapsed (in months) since most recent long distance coach trip, number of respondents

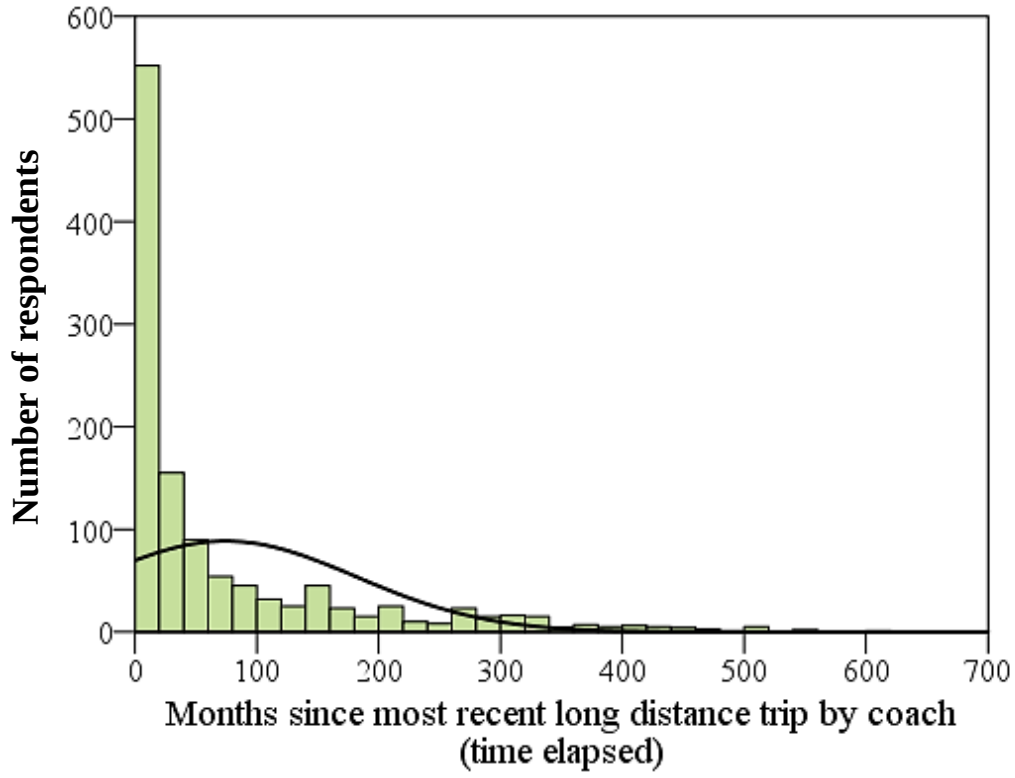


Figure D14: Time elapsed (in months) since respondent last stayed overnight due to being unable to complete a return trip in a day. Number of respondents / month

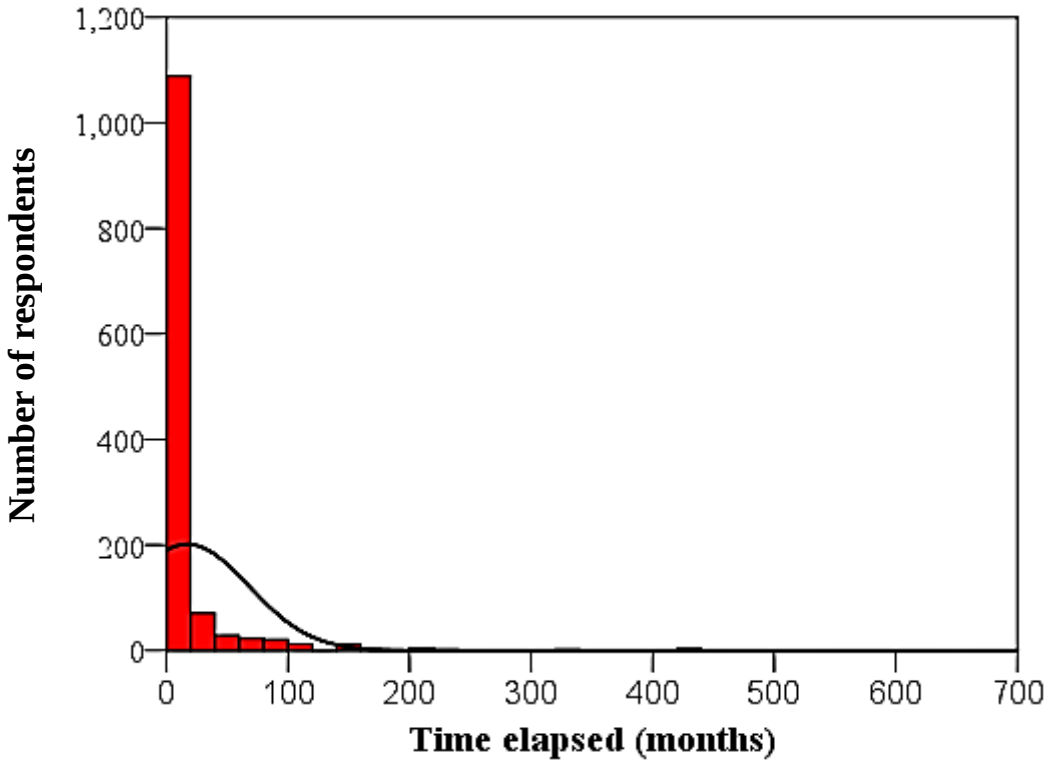


Table D7: Kruskal-Wallis of occupation differences in the importance of the environment as a determinant in travel decision making

Occupation category		*N*	Mean rank
A: Upper Managerial and Professional		111	764.12
B: Middle Managerial and Professional		788	822.62
C1: Lower Managerial and Clerical		212	735.69
C2/D: Manual occupations		56	571.12
Student		171	718.35
Retired		204	714.82
χ^2 =	29.19		
p=	<.001		

Notes: df=5