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Public attitudes to and perceptions of high speed rail in the UK

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ABSTRACT

With the planned expansion of high speed rail (HSR) in the UK, demand for longer-distance travel is expected to increase significantly over the coming decades. This paper presents a study into attitudes and perceptions of long distance travel in the UK, particularly in relation to HSR. A questionnaire was developed to investigate attitudes to travelling long distances and to HSR, importance of journey characteristics and current travel behaviours. A factor analysis of 46 attitude items yielded six factors: travel security, improvement to road and air, prestige of HSR, comfort, negative aspects of HSR and the usefulness of travel time. Analyses showed significant demographic and travel characteristic differences across the factors. There was also evidence of a more negative impact and lower prestige for people living closer to proposed HSR routes. Willingness to pay for travel time saved was related to a number of journey characteristics but the utility of time was also important. The findings are considered in light of theories of attitude change, attitudes to travel and sustainability and the implications for the future development of HSR policy, particularly in terms of balancing increased fares with utility of travel time.

1. Background

The total number of journeys by rail in Great Britain has more than doubled between 1994/95 and 2009/10 leading to capacity concerns on key sections of the network (Department for Transport, 2011a). Also, forecasts suggest that the average person will make 61% more long distance rail trips by 2043 compared with today (High Speed Two, 2011). However these predicted demands must be considered in terms of what rail travel might look like in decades to come, what other travel modes may compete with rail and whether new forms of rail travel are attractive to potential passengers. There are also potential development options being considered for reducing travel times by rail, as has happened in other countries such as the high speed magnetic levitation train (Maglev) using Transrapid technology already in service in Shanghai, China.

There have been two proposals for reducing travel times by rail in the UK. One is the Ultraspeed project, which proposed a Maglev (UK Ultraspeed, 2006). The second, and current choice of the UK Government, is HS2, an HSR line initially between London and Birmingham, and later to Manchester and Leeds. Following much debate in Government about the costs and benefits, and media attention covering issues such as being good for business outside of London, convenience of and work time savings from reduced travel time, the HS2 Bill eventually passed the Commons on 28 April 2014. HS2 will differ from existing rail services primarily in terms of travel time and potentially in terms of image and has been predicted to impact substantially on travel behaviour in terms of decision-making about long distance travel (Department for Transport, 2011a, 2011b). Given the recent media debates and apparent reduced emphasis by the UK Government on the 'value' to business of travel time saved, this matter warrants further attention. Indeed, the Independent Transport Commission (2010) identified a need for further research for greater understanding of why travellers make certain choices for long distance journeys.

Therefore the main aim of this paper is to ascertain how people perceive HSR and whether they are prepared to pay more to use it. Thus, the study investigates as its objectives the following: attitudes towards long distance travel and HSR in particular, including personal safety and security; the perceived status and/or negative perceptions of HSR; the importance of comfort, convenience and sustainability and the need for transport improvements; and the willingness to pay (WTP) for travel time reductions. All of these are considered in terms of demographic differences, travel behaviour and geographic variables. An evaluation of these issues can make a major contribution in understanding whether potential passengers would use HSR relative to existing services and how much pricing strategies for HSR relate to its likely use.

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2. Attitudes, travel behaviour and situational influences

2.1. The role of attitudes in travel behaviour

HSR will increase travel speeds on intercity transport corridors and, due to the relatively high speeds and infrequency of stations, users of the line will almost entirely be making long distance trips (a single long distance trip is defined as >50 mile, 80.5 km by the Department of Transport (Rofique et al., 2011)). Attitudes are of considerable importance in decisions about travel behaviour. For example, they are a determinant of behavioural intention in the Theory of Planned Behaviour (TPB). The components of the theory include the attitude towards the behaviour, subjective norms and perceived behavioural control (Ajzen, 1991). Attitudes reflect beliefs about the intended behaviour, and are evaluative. It is therefore important to recognise the extent to which these attitudes will determine the likely users of any new HSR route in Britain, as well as what experiential parts of travelling are important.

Four major groupings of attitudes in relation to long distance travel and HSR were identified by Caygill (2012). These are security, cost, quality of service and convenience. Environment was particularly notable here by how little it was mentioned unless prompted. This is consistent with Cafferkey and Caulfield (2011) who found a lack of consideration for the environment when making decisions about long distance travel by 22.5% of respondents whereas only 7.9% considered it to be a major concern. There is also the issue that egoistic values appear to be linked to negative environmental behaviours (Collins and Chambers, 2005; Yusuf et al., 2014). There is evidence of gender differences in relation to the environment, including in relation to travel. For example, Arnocky and Stroink (2010) found that women expressed greater altruistic concern and willingness to cooperate for the sake of the ecosystem, while men were more resource competitive and Hess et al. (2013) found women to have stronger pro-environmental attitudes in relation to transport. The implications of this are that women may be more likely than men to choose rail travel, including HSR, for environmental reasons.

In terms of attitudes to security and safety, Lynch and Atkins (1988) suggest that the elderly are generally less able to counter physical attacks, and that young women have high levels of anxiety about sexual assault and apprehension when travelling by train (15% felt unsafe during daylight, while 25% felt unsafe during darkness). The elderly are making more use of travel cards and are thus travelling more frequently, which may have implications for attitudes to safety and security (Coronini-Cronberg et al., 2012).

Dargay and Clark (2012) found demographic differences in travel behaviour decisions about long distance travel in Great Britain. Income was found to be a major determinant in making decisions about long distance travel, while other factors included gender, age, employment status and household composition. This tallies with Hess et al. (2013) who found that women, older respondents and those who are better educated have stronger pro-environmental attitudes in relation to transport and rail travel in particular. Studies cited in Ajzen (1991) in relation to the TPB have shown that behaviour is influenced strongly by confidence in the ability to perform it (perceived behavioural control), for example by being able to afford it. Low income groups would therefore be expected to have lower perceived behavioural control, which may be reflected in their attitudes to long distance travel and HSR. Similarly, greater wealth is associated with higher levels of mobility (Lleras et al., 2002); thus the perceptions of new transport infrastructure such as HSR may be more likely to be favoured by those in higher income professions. Understanding what affects attitudes to long distance travel and HSR in terms of demographics is therefore important and it is hypothesised here that attitudes will differ by age, gender and occupation (Hypothesis H1).

As the determinants of planned behaviour include attitudes partly based on cognitive evaluation, empirical knowledge of long distance travel based on experience is likely to be greater for those who have travelled more recently or more frequently and may therefore relate to attitudes to travel security and the importance of comfort. Further, Lyons et al. (2007) indicate that commuters are more likely to consider their time use wasted than compared with business or leisure travellers and thus it is reasonable to predict that they will differ in attitude and perceived utility of HSR. Therefore it is hypothesised that previous travel behaviour will relate to attitudes to HSR (H2) and that attitudes to long distance travel and HSR will differ by regularity of travel, e.g. commuting (H3).

Users making many trips will generally choose a discounted travel pass, while those that make few trips generally choose an ordinary ticket (Carbajo, 1988). Once a travel pass is purchased, it influences the marginal cost of travel and thus the number of trips made depends on that choice (ibid.). Thus, the fourth hypothesis (H4) is that possession of a travel discount will be related to attitudes to long distance travel and a more positive perception of HSR. H4 links to both demographics and previous travel behaviour as determinants of planned behaviour as a result of effects on attitudes and perceived behavioural control. Demographics also link to possession of certain travel discounts through exclusivity, for example, in the UK a young person's railcard is for students and those aged 16–25 years and the senior railcard is only available to those over 60 years of age.

2.2. Situational influences on the determinants of travel behaviour

Dargay and Clark (2012) found geographic and regional differences in long distance travel behaviour. For example Londoners travel long distances the least, while those in the South West of the UK travel the most. This may be partially explained by differences in transport provision, for instance Londoners being the least likely to travel by car. It is also likely that the introduction of HSR will have implications for regional variations in long distance travel. Dargay and Clark also found that long distance travel increases as the population of the municipality of residence decreases and conclude that those in rural areas travel longer distances. However, this was only the case for car travel, as this has no impact on travel by other modes such as rail.

Martínez Sánchez-Mateos and Givoni (2012) suggest the presence of a 'tunnel' effect for HSR, whereby those living in between stations perceive little or no benefit in terms of accessibility. Significant accessibility benefits in terms of journey time reductions were limited to a small number of cities, with intermediate locations relatively less accessible. Therefore H5 predicts distance to an HS2 station is negatively associated with benefits from HSR. It is also reasonable to conclude from the above research that some communities will see a dis-benefit from HS2. Most communities along the route of HS2 are unlikely to see accessibility benefits due to the infrequency of stations, but are more likely to be impacted upon by the line when operating (such as by noise). A considerable opposition has emerged in affected areas, with some pressure from campaigners opposed to HS2 (Channel 4 News, 2012), and previous experience suggests that local opposition due to perceived negative impacts is possible (Schaap, 1996). Subjective norms from the TPB (Ajzen, 1991) may act here in that respondents living close to the proposed HS2 line may feel social pressures to adhere to local convention (which is most likely to be opposition). Thus it is hypothesised that negative attitudes about HSR will be greater for those living along the proposed route of HS2 (H6).

Travel time is usually considered to be a cost, not in financial terms but in that a person 'spends' time while travelling. WTP is based upon the individual's value of time saved, which is how much they are willing to spend in monetary terms in order to minimise the time they spend travelling. Essentially, travel time is monetised. Mackie et al. (2001) suggest six major influences on individual valuation of travel time savings, these being the following: the time at which the journey is made, the journey characteristics (e.g. congested), journey purpose, journey length, mode and the size of the time saving. H7.1 predicts that WTP for travel time savings will be positively associated with attitudes towards HSR, including novelty or prestige. Lyons et al. (2007) suggest that travel time can have a utility and is not necessarily wasted. Rather than wanting to reduce travel time, making better use of it may be valued more highly, or it may also mean that people are prepared to pay more to increase what they value. Yusuf et al. (2014) found self-interest to be a primary motivator for WTP through a balancing of benefit to cost relative to individual income and frequency of use. Therefore the hypothesis must be two-tailed to reflect either that respondents who place greater importance on the usefulness of travel time will be less willing to pay for travel time savings, or that they are more willing to pay in order to minimise it (H7.2). Further, it might be that savings are valued differently depending on the length of the journey, even without the travel time reductions (Mackie et al., 2001) and therefore it is hypothesised that WTP for travel time savings will differ depending on journey duration and day-of-travel, (over-) crowding and other journey characteristics including time elapsed since last travelled (H7.3).

3. Methodology and data collection

A questionnaire was developed to gather attitudinal, travel behaviour and demographic information from long distance travellers in the UK. Measures of attitudes to long distance travel and perceptions of HSR were obtained through 46 seven-point Likert-type statements derived from a thematic analysis of focus groups addressing long distance travel (Caygill, 2012). These items covered comfort, security, personal safety, convenience, luggage, changing connections and activities while travelling. In order to test those factors affecting WTP proposed by Mackie et al. (2001), a further set of 16 items were constructed using a 0–10 point rating scale from 'no importance' to 'very important' in choosing how to travel long distance, defined as >50 mile (>80 km). These are as follows: the fare, the total journey time, the environmental effects, amount of luggage, number of interchanges, who is paying the fare (as a proxy for the journey's main purpose), the flexibility of departure or arrival times, waiting time, departure time, service reliability, amount of crowding, the day of travel, whether the passenger can work during travel, getting to the station, comfort, and service frequency. Time elapsed since the most recent long distance trip by rail, air and car, railcard ownership and commuting behaviours was also measured by year and month. The demographic measures included gender, age group, occupation and the first half of a respondent's postcode.

WTP questions gave two example trip times of 3 h and 90 min respectively: the former because it was perhaps the longest trip feasible for a day return and the latter because it is the current travelling time from London to Birmingham. Two hypothetical travel time reduction options were provided for each trip, one based on HS2 and another based on the UK Government's non-preferred option of Ultraspeed, although these were not defined as such in the questionnaire but simply given as journey times with savings. These savings were 30 and 90 min on the 3 h journey and 45 and 60 min on the 90 min journey respectively to reflect the savings proposed for two unnamed actual journeys based on London–Newcastle and London–Birmingham. The associated WTP choices were in £10 units from £100 to £200+ for the 3 h journey, and in £5 units from £50 to £100+ for the 90 min journey, starting in accordance with current typical 2nd class ticket prices. These could then be treated as interval data so long as an amount was nominated for the £200+ and £100+ upper limits, both set high enough to limit the number of respondents likely to choose them. In the event, no respondent actually did choose either in this survey.

The questionnaire was disseminated on-line in 2012 to maximise geographic distribution. The questionnaire was distributed using on-line message boards, mailing lists and social media. The distribution was aimed to obtain as wide a range of demographic sectors of the adult public as possible. 1,799 responses were obtained from a variety of age groups, occupations and locations. These comprised 956 male and 653 female respondents, spread by age group as follows: 18–25=137, 26–35=346, 36–45=296, 46–55=346, 56–65=353 and 66+=135.

4. Data reduction

A principal components analysis was performed on the 46 attitude items and the scree plot indicated seven factors be rotated. Cronbach's alphas were computed to confirm factor reliability and this resulted in the seventh factor being discarded. The ordered factor loadings from the varimax rotation and alphas are presented in Table 1, which includes all item loadings $>.3$.

Mean scores were standardised to be comparable to the seven point scale for all factors. The number of months since the most recent long distance rail trip is referred to here as 'time elapsed'. 1680 respondents provided this in month and year format. However, since the date of questionnaire completion was accurate to a day, a mid-point value for the last month of travel was used to calculate time elapsed. For occupation, in order to create groups of sufficient size to allow two-way ANOVAs, groups were combined into Professionals (comprising A and B: $N=1050$), Intermediate (comprising C1, C2 and D: $N=97$), Students ($N=168$) and Retired persons ($N=197$).

Postcode data were processed. The proposed termini of the government's planned HS2 scheme are Curzon Street in Birmingham and Euston in London and the point-to-point distance between London and Birmingham is approximately 100 mile. Therefore, as a halfway point, postcodes within 50 mile of an HS2 station were converted to interval distances (in mile). In addition, by identifying postcodes through which the HS2 route passes, respondents were classified according to whether or not they were in close proximity to the proposed route.

5. Results

5.1. Demographic differences in attitudes to long distance travel and HSR

H1 concerns demographic differences in attitudes for six age groups, gender and four occupational groups. In Table 2 it can be seen that there are significant age and gender differences for four of the six attitude factors, the exceptions being F2 Road/Air Improvements and F5 Negative perception of HSR. In order to understand these differences, the means are provided in Table 3.

In Tables 2 and 3 it can be seen that factors 1, 3, 4 and 6 have yielded significant age, gender and occupational differences with no major interaction effects. For F1Travel Security Concerns, women are scoring higher than men for all ages, and there is a

Table 1
Ordered six factor solution including alphas, eigenvalues and standardised factor means.

Factors and items	F1	F2	F3	F4	F5	F6
F1: Travel Security Concerns						
I would worry about personal safety on flights	.797					
I fear potential terrorism in travelling by air	.773					
Fear of terrorism is travelling by rail	.700					
Personal safety worries if travelling by train	.675					
Public transport more comfortable with security	.644					
Think hold luggage theft a problem on airlines	.607					
Concern plane luggage won't arrive at destination	.529					
Favour security presence on trains	.489					
I find travelling alone boring	.349	.340				
F2: Road/Air Improvements						
New roads should be built		.696				
Add extra lanes to existing roads		.686				
Prefer train if travelling long distance to a city centre		−.617				
Consider myself an environmentally friendly traveller		−.604				
Should be more domestic flights in the future		.602				
Train travel would allow more productive use of my time		−.596				
Willing to pay to compensate environmental costs		−.535				
Want to reach destination as quickly as possible		.377				
F3: High Speed Rail Prestige/Favourability						
I think high speed rail is a step forward for the future			.853			
Britain should be investing in high speed rail			.818			
Would be proud of a British high speed rail network			.799			
Day return trips would be easier by high speed rail			.716			
F4: Importance of Comfort						
Always want to reach my destination comfortably				.661		
Comfort is more important than journey time				.563		
Discouraged from using rail if I knew I would stand				.487		
If travelling I always want a reserved seat				.484		
Standard class on trains can be generally unpleasant				.439		
Worry about missing air/rail connections if changing	.382			.369		
Would choose car if lots to carry		.479		.367		
I enjoy looking at the view when I am travelling		−.355		.332		
If travelling by rail, others would disrupt or distract me	.317			.322		
F5: Negative perception of HSR						
High speed trains use more energy than existing trains					.793	
More pollution from high speed trains than existing					.741	
High speed trains noisier than existing trains					.633	
High speed rail more expensive than existing trains					.488	
F6:Useful Travel Time Important						
It is important to do something when travelling						.686
Wi-fi is important when travelling						.683
Alpha values	.852	.789	.852	.668	.700	.611
Eigenvalues	1.79	1.35	1.03	.72	.61	.50
Factor Mean	28.77	26.53	21.25	43.67	17.29	10.68
Standardised Factor mean	3.20	3.32	5.31	4.85	4.32	5.34

Table 2
Two-way ANOVAs of F1–F6 for age × gender and age × occupation: F values and significances.

Independent variables	Attitude factors					
	F1	F2	F3	F4	F5	F6
Age	10.76***	1.74	4.79***	14.38***	1.08	18.69***
Gender	28.89***	.03	11.67***	4.91*	2.01	26.80***
Age × gender	1.10	.98	.83	.49	1.05	.22
Occupation	17.14***	7.56***	2.88*	21.71***	1.35	34.43***
Gender	9.79**	.09	8.25**	7.74**	.00	23.05***
Occupation × gender	1.95	2.30	.65	2.67*	2.59	.46

Notes: Age $N=1606$, Occupation $N=1503$. Significances: $^{*}p<.05$, $^{**}p<.01$, $^{***}p<.001$.

general increase with age. Occupation effects are more mixed since they vary with gender but it can be said that the professional group score lowest and the retired group highest. For F3, the strongest effect was for gender, with women perceiving less than men the importance of prestige, for all age and occupational groups. For F4, differences are most pronounced for age and occupation such that there are clear increases with increasing age and, in terms of occupation, the retired value comfort the most and students value it the least. F6 yielded the largest F values, which show a significant increasing concern for usefulness of time with age, women rating it higher for all age and occupational groups, and students and professional groups valuing the use of their time the most. Thus H1 is supported for F1, F3, F4 and F6.

5.2. Attitudes to long distance travel and HSR with recency of rail travel (H2 and H3)

H2 proposed that previous travel behaviour is related to attitudes and perceptions of long distance travel and HSR. Significant correlations were found between time elapsed since travelling by rail and all attitude factors except F5 Negative perception of HSR, with correlations as follows: F1 Travel Security Concern ($r_s=.235$, $p=<.001$), F2 Road/Air improvements ($r_s=.288$, $p=<.001$), F4 Comfort Importance ($r_s=.233$, $p=<.001$) and lower but still significant was F3 Perceived Prestige of HSR ($r_s=-.098$, $p=<.001$). These indicate that

Table 3
Means for attitude factors by age, occupation and gender.

Age in yrs	F1		F2		F3		F4		F5		F6	
	M	F	M	F	M	F	M	F	M	F	M	F
18–25	3.10	3.65	3.14	3.29	5.72	5.26	4.64	4.68	4.40	4.09	5.22	5.64
26–35	3.10	3.29	3.09	3.07	5.58	5.44	4.72	4.74	4.39	4.31	5.48	5.86
36–45	3.22	3.38	3.19	3.05	5.45	5.20	4.74	4.84	4.26	4.29	5.43	5.85
46–55	3.31	3.53	3.27	3.13	5.29	5.15	4.86	5.06	4.41	4.26	5.27	5.54
56–65	3.46	3.82	3.21	3.17	5.35	4.95	5.10	5.21	4.23	4.29	4.87	5.24
66+	3.62	4.03	3.24	3.46	5.08	5.02	5.15	5.34	4.45	4.45	4.20	4.74
Occupation												
Prof.	3.23	3.43	3.11	3.05	5.42	5.21	4.85	4.88	4.35	4.27	5.37	5.74
Interm.	3.61	3.84	3.09	3.28	5.80	5.25	4.80	5.28	4.16	4.29	4.85	5.47
Student	3.59	3.23	3.28	3.01	5.56	5.41	4.61	4.60	4.36	4.08	5.24	5.80
Retired	3.59	4.13	3.36	3.58	5.24	5.07	5.24	5.48	4.29	4.52	4.19	4.60

Notes: M=Male, F=Female, Prof.=Managerial and Professional, Interm=Intermediate.

Table 4
T-tests of attitude factors by commuting/non-commuting.

Attitude	*t*	*P*	Factor mean (s.d.)	
			Commuter	Non-commuter
F1: Travel Security Concerns	2.67	.008	3.14 (.86)	3.41 (1.01)
F2: Road/Air improvements	2.95	.003	2.91 (.91)	3.18 (.93)
F4: Comfort Important	4.81	<.001	4.52 (.90)	4.93 (.87)
F6: Useful Travel Time	−2.60	.009	5.65 (1.27)	5.29 (1.37)
N			108	1546

Table 5
T-tests of attitude factors by travel discounts or not.

Attitude	*t*	*P*	Factor mean (s.d.)	
			No discount	Discounted
F1: Travel Security Concerns	5.59	<.001	3.50 (1.05)	3.24 (.94)
F2: Road/air improvements	10.47	<.001	3.36 (.93)	2.89 (.89)
F3: HSR Prestige / Favourability	−3.22	.001	5.24 (1.19)	5.43 (1.22)
F4: Comfort Important	7.70	<.001	5.03 (.84)	4.71 (.90)
N			1125	674

the more recent the long distance journey, the greater the positive prestige of HSR. Finally, F6 Useful Travel Time ($r_s = -.077$, $p = .002$) is low but significant and indicates a diminishing importance of useful travel time as time elapsed increases. Interestingly, if these findings are similarly prepared for time elapsed since travelling by air, the correlation with F6 is much higher (the only one to be higher) than for rail at $r_s = -.225$ $p < .001$, implying that people may choose air travel as it may save time. The conclusion here is that H2 is supported for all the attitude factors except F5.

H3 proposed that attitudes to long distance travel and HSR will differ by regularity of travel. Long distance commuters comprised those commuting over 50 mile (per trip) either weekly by air or daily by rail (the likelihood of a daily air commute considered very low). A comparison of these commuters, aggregated and compared to non-commuters, yielded no statistically significant differences for F3 and F5, but significant differences for the other four factors (Table 4).

Table 4 suggests that non-commuters are more concerned than commuters about travel security, are more favourable to transport improvements regardless of sustainability and think that comfort is more important. They also seem to recognise more importance of useful travel time. Neither of the HSR-related factors, F3 and F5, showed any commuter/non-commuter differences. Therefore, H3 was supported for the four non-HSR factors.

5.3. Impacts of travel discounts on attitudes to long distance travel and HSR (H4)

H4 proposed that possession of a travel discount would be associated with differences in attitudes to long distance travel and a more positive perception of HSR. This was tested using independent *T*-tests, yielding significant differences for F1, F2, F3 and F4 (Table 5).

In Table 5, it can be seen that those with travel cards were less concerned about security or comfort, saw HSR as more prestigious and were much less interested in improvements to road or air and also more interested that travel should be sustainable (the opposite pole of F2). Perceived prestige of HSR (F3) is greater for those respondents with a travel discount compared to those without. Thus H4 was supported for factors 1, 2, 3, and 4.

Table 6
Mean factor scores and Spearman correlations for F2 and F6 by distance from an HS2 station.

	Distance (mile) from London Euston HS2						r_s	*P* [2-*tailed*]
	<5	5–10	10–20	20–30	30–40	40–50		
F2 Improve	2.73	3.11	3.16	3.24	3.22	3.13	.12	.002
F6 Useful time	5.83	5.45	4.88	5.14	5.29	4.99	−.17	.001
N	68	66	53	67	52	69		

Table 7
T-tests comparing attitude factors by proximity to planned HS2 route.

	Factor means		*T*	*P* [1-*tailed*]
	Contiguous	Non-contiguous		
F3: Perceived HSR Prestige	4.70 (1.89)	5.32 (1.18)	1.86	.037
F5: Negative perception of HSR	4.83 (1.20)	4.31 (.89)	−2.42	<.001
N	32	1767		

Note. Standard deviations in brackets.

5.4. Spatial differences in attitudes to HSR (H5 and H6)

H5 proposed that respondents living closer to the proposed HS2 stations would be more positive towards HSR and that there would be differences in attitudes relative to distance from the HS2

stations. Spearman's correlations were computed for attitude factors and distance from London Euston and also from Birmingham Curzon Street. These analyses yielded only two significant correlations out of 12 tested, being for F2 and F6, both from London Euston, shown in Table 6. Thus H5 has, at best, only limited support.

H6 proposed that attitudes about HSR will be more negative for those living by the proposed route of HS2. *T*-tests of the two attitude factors relating to HSR, F3 and F5, by proximity to HS2 were both significant, indicating that the negative impact was higher, and the prestige lower, for those whose postcode was contiguous with the line (Table 7). Thus H6 can be supported, although it might be that a larger sample of those living contiguously might make the picture here even clearer.

5.5. Willingness-to-pay for travel time savings (H7.1, 7.2, 7.3)

H7.1–H7.3 relate to WTP for travel time savings, measured here in £5 or £10 intervals upwards from current fares for four journeys. The hypotheses predicted that WTP for travel time savings would be positively associated with attitudes to HSR (H7.1), negatively related to importance of useful travel time (H7.2) and these relationships would be related to trip length and day-of-travel, crowding and other journey characteristics (H7.3).

In order to test H7.1, F2 (since it relates to alternatives to HSR by road and air), plus F3 and F5 as attitudes to HSR, along with F6 and the three times elapsed to test H7.2 were correlated (Spearman's since WTPs were skewed) with the WTP amounts for the four travel time reductions (Table 8). It can be seen that only F3 comfort and F6 useful time are correlated with WTP for all four journeys' savings. These provide some support for H7.1 To test H7.2, F6 correlations were compared to see if they were significantly different such that longer journeys with greater time savings would demonstrate a stronger relationship, and $r=.111$ is significantly different to both $r=.171$ and $r=.191$ [$z=.170$ $p=.0446$ and $z=2.28$ $p=.0113$, both $N=1565$, one-tailed]. F6 has the highest mean of all the factors and therefore the greatest agreement of the importance of time and these findings suggest that it is important enough that people are prepared to pay money to save it.

Whilst there are significant correlations of F2 with the shorter journey, these are low but do support the notion that there is less willingness to pay for a shorter train journey if roads and air improvements are made. F5 relates to the perceived negative impact of HSR and is not correlated at all with WTP for any time saving. Whilst the correlations are all indeed negative, this can hardly be considered any more than a trend in relation to H7.1.

H7.3 proposed that WTP would be related to a number of journey factors. To test this, the importance ratings, factor scores, age and gender (as a dummy variable) along with time elapsed since air travel, which was the only one of the time elapsed measures significantly related to WTP in Table 8, were all entered as independent variables into four regressions onto the four WTP variables. The significant coefficients and adjusted R^2s are given in Table 9 where it can be seen that the least time saving of 30 out of 180 min has fewest predictors and that F2 is the only attitude factor predictive for all four WTPs. The importance of the cost/fare and total journey time are likewise predictors for all four journeys, as is time elapsed since travelling by air. In addition, F1 security, F5 negative perception of HSR, F6 usefulness of time, age, gender, and the importance of ease of getting to the departure/arrival venue, comfort and service frequency have at least two of the four journeys where they are predictors of WTP. There are clear implications about how higher prices for HSR might be marketed here, especially in considering those items that were consistently not significant in the regressions, being the flexibility of departure or arrival times, who is paying for the fare, waiting time, departure time, amount of luggage, service reliability, amount of crowding, the day of travel, whether the passenger can work during travel and the environmental impact.

In terms of WTP, Table 8 also shows that the correlations with prestige and time saved are in fact largely similar, albeit in both cases higher for the greater time savings. A *z* test using the Fisher *r*-to-*z* transformation to compare the two correlations of .179 and .220 on the 3 h journey, representing the greatest journey time difference for F3 prestige proved insignificant, but for F6 useful time the lowest correlation of .111 was significantly less than .171 ($z=1.71$ $p=.0436$ 1-tailed). Thus greater time savings are not related to greater prestige but are related to greater WTP, giving mixed support for H7.3.

5.6. Summary of the hypothesis testing

- H1 concerns demographic differences in attitudes by age, gender and occupational groups; it is supported for F1, F3, F4 and F6 but not for F2 and F5.
- H2 proposed that previous travel behaviour is related to attitudes and perceptions of long distance travel and HSR and is supported for all the attitude factors except F5.
- H3 proposed that attitudes to long distance travel and HSR will differ for commuters and is supported for the four non-HSR factors, i.e. F1, F2, F4 and F6.
- H4 proposed that possession of a travel discount will show differences in attitudes to long distance travel and a more positive perception of HSR and was supported for F1, F2, F3 and F4.
- H5 proposed that distance to HS2 stations is negatively related to benefits from HSR; this is not supported.

Table 8
Correlations between attitude factors and time elapsed and WTP for different trip time savings; mean WTPs standardised to £100.

	Trip of 3 h saving		Trip of 1 h 30 min saving	
	30 min	90 min	45 min	60 min
F2: Improve road/air	−.047	−.045	−.110***	−.096***
F3: Prestige of HSR	.179***	.220***	.189***	.222***
F5: Negative HSR	−.026	−.037	−.035	−.049
F6: Useful time	.111***	.171***	.139***	.191***
Time since rail	−.047	−.067*	−.044	−.048
Time since car	−.033	−.053	−.033	−.047
Time since air	−.078**	−.122***	−.088**	−.104***
Mean (s.d.) £ WTP	£106.07 (8.3)	£120.82 (17.5)	£112.92 (13.14)	£122.58 (19.33)
N	1568	1567	1574	1560

* $p<.05$.
** $p<.01$.
*** $p<.001$.

Table 9
Significant predictors for four regressions of WTP on attitudes, gender, age, and importance ratings: *T* values, probabilities, adjusted R^2 and F ratios.

	180 min save 90 journey 150 min		180 min save 30 journey 90 min		90 min save 45 journey 45 min		90 min save 60 journey 30 min	
	T	*p*	*T*	*p*	*T*	*p*	*T*	*p*
F1: security	–	–	−2.33	.0200	–	–	–	–
F2 improve rds	–	–	–	–	−1.81	.0702	–	–
F3 prestige HSR	5.69	< .0001	8.11	< .0001	6.70	< .0001	7.20	< .0001
F4 comfort	–	–	–	–	−1.62	.1048		
F5 negative HSR	–	–	2.50	.0126	2.34	.0194	1.80	.0721
F6 time saving	–	–	2.93	.0035	3.24	.0012	3.81	.0001
Gender	–	–	–	–	−2.61	.0093	−3.26	.0012
Age gp	–	–	−3.17	.0016	−2.69	.0072	−3.55	.0004
Fare	−5.28	< .0001	−5.57	< .0001	−4.53	< .0001	−4.90	< .0001
Ease get to statn/port	−1.75	.0803	−2.32	.0205	–	–	−1.67	.0959
N interchanges	–	–	3.03	.0025	3.31	.0010	3.45	.0006
Comfort	–	–	–	–	−2.44	.0147	−1.75	.0809
Service reliability	−2.57	.0102	–	–	–	–	–	–
Can wk on board	–	–	–	–	–	–	–	–
Total journey time	2.35	.0188	2.49	.0131	2.57	.0103	3.52	.0004
Service frequency	–	–	−2.07	.0388	–	–	−2.30	.0215
Time since Air	−2.13	.0336	−2.36	.0182	−1.92	.0547	−1.84	.0666
Adjusted R^2	.066		.125		.093		.122	
F ratio (signif)	5.199 (< .0001)		9.406 (< .0001)		7.049 (< .0001)		9.141(< .0001)	

Notes: N= 1481; no values for *T* or *p* denotes insignificance.

- H6 proposed that proximity to the HSR route is associated with negative attitudes to HSR; this is supported, although less so than might have been expected.
- H7.1 to H7.3 predicted that WTP for travel time savings would be positively associated with attitudes to HSR, negatively related to importance of useful travel time and related to a number of journey characteristics. H7.1 has some support, H7.2 is supported in the direction of more WTP for saved travel time and H7.3 has considerable support for some characteristics.

6. Discussion and policy analysis

The themes in the discussion that emerge from the findings are as follows: travel security, road and air improvements versus sustainability issues, impact of HSR in terms of both positive (prestige) and negative factors, comfort and convenience, and finally the perceived usefulness of travel time and WTP.

6.1. Travel security

In this study, security and safety, relating to luggage and personal safety including terrorism, was the largest factor in terms of variance. The findings that women and older respondents rate this factor as more important are consistent with those of Lynch and Atkins (1988). Findings here suggest that the professional occupational group (and some elderly with travel cards) perceive themselves as having lower travel security concerns, possibly as a consequence of being more likely to travel in first class. Students have the lowest travel security concerns of all groups here, which is also consistent with Lynch and Atkins (1988).

The finding that travel security concerns increases with time elapsed since the last long distance journey could be related to the level of familiarity, which also explains why commuters indicate lower travel security concerns. In the latter case, increased numbers (of commuters) and larger numbers of safe journeys might lead to a decreased risk perception and increased trust in rail travel (Slovic, 2000). Nevertheless, it can be proposed that communication about HSR will need to emphasise trust and security in order to encourage those who are considering HSR and rail travel generally. However doing this effectively needs to consider many principles of risk-related communication.

6.2. Investments in road and air travel versus sustainability

In this study, F2 contained items relating to improving road and air travel, which might be considered unsustainable, as well as those relating to the more sustainable nature of rail travel, not specifically HSR. A normative ethical position of self-interest is clearly present in the non-sustainable aspects of this factor, although the low mean score indicates that when people are prompted about the environment they place importance on it in relation to attitudes to rail, air and road developments. From this, there is the issue of whether prompting respondents can be considered leading, although this is an inherent problem in any survey design (Caygill, 2012). There is also evidence elsewhere that the environment does *not* play a large part in travel mode choice or even driving behaviours (Cafferkey and Caulfield, 2011; Harvey et al., 2013, 2014; Yusuf et al., 2014). Explanations for this are several, including egoistic values, the inconvenience of behaving environmentally in terms of time lost, discomfort, deferred responsibility, and not relating own behaviour to sustainability (e.g. Collins and Chambers, 2005; Harvey et al., 2013). F2 here did not yield different findings by age or gender. This is surprising since the more accepted view is that women demonstrate stronger pro-health and environmental attitudes than men (e.g. Arnocky and Stroink, 2010).

The findings here show that recency of travel by long distance rail was associated with positive views on sustainable transport developments, which might be considered as a self-serving response (Hewstone, 1989). Weekly air commuters were most favourable, and rail commuters least favourable, to unsustainable transport. Whilst preference for unsustainable travel did not appear to vary by distance from an HS2 station, the mean for F2 of those living within 5 mile of London Euston was significantly lower. This is understandable since driving in London can be very problematic. Scheiner and Holz-Rau (2007) offer an explanation in that inhabitants of dense, compact cities with mixed land-use make short trips and use public transport or non-motorised modes.

From a policy perspective, findings here and elsewhere do not convince that persuading the use of HSR can be done on environmental grounds and other aspects of attitudes and perception would work better.

6.3. Attitudes towards HSR: prestige versus a negative impact

Travelling at very high speeds on HSR might be construed as exciting and prestigious, which might explain why younger and male respondents in this study perceive it this way. However, despite higher speeds of HSR, this perception is not remotely strong enough to be considered as exciting/sensation-seeking and thus it may be difficult to appeal to such attitudes other than very early in the operation of HSR (Zuckerman, 1994). Beyond the speed stimulus and status issues of prestige, there may also be a novelty value initially for HSR, as identified by Roth et al. (2005). Hsiao and Yang (2010) suggest that novelty-seeking has a positive effect on attitudes to HSR. Their sample comprised mainly students, as are many younger respondents here, so the findings are consistent but may present a problem in generalisation and indeed there is the issue of how long such a novelty value would last. Further, since both commuters and non-commuters perceived high prestige from HSR it is not possible to predict this attitude by commuting behaviour, although HSR could render destinations such as Birmingham more of a possibility for commuting to London than it is already. In this study, distance from home to an HS2 station was unrelated to the perceived prestige of HS2, in contrast with the findings of the Department for Transport (2011b). However higher scores on F5 negative perception of HSR and lower scores on F3 prestige of HSR were found for postcodes closer to the proposed route, indicating a NIMBY (Not In My Back Yard) effect of self-interest and local opposition, consistent with (but obviously much more recent than) the findings of Schaap (1996). It is interesting to note that the scores for perceived prestige and negative impact were nearly identical for those living close to the route, but the prestige score exceeded significantly that of the negative impact for those not living proximally, thus providing an idea of the impact/importance of the contiguity NIMBY effect.

In terms of marketing policy for HSR, it can be proposed that prestige may have some motivational value, but probably only for a limited time period. We are not convinced from evidence here in terms of the magnitude of the correlations that the NIMBY effect would be long-lasting once HSR was in operation.

6.4. Comfort

Affect in the form of comfort and convenience associated with travel has been increasingly investigated and it is recognised now that affect is part of mode choice and of the activities related to consideration of alternatives, such as information-seeking (e.g. Algers et al., 1975; Farag and Lyons, 2010). Women and older respondents in this study consider comfort while travelling as more important than do younger and male respondents, which may reflect a general age pattern or one where mobility issues play an increasing part for older travellers, or that changing attitudes may result in changed behaviours over time (e.g. Anable, 2005).

The longer the time since the last long distance travel by rail, the more important was comfort. This may relate to perceptions of uncomfortable and crowded trains, the latter often emphasised by the media in the UK since the rail franchises, and their promises to increase rolling stock to reduce overcrowding, as well as HS2, have been covered quite extensively. Comfort is of greater importance for non-commuters than commuters, possibly due to differing expectations, but also possibly because commuting behaviour is habituated, an issue that is an important moderator in the relationship between attitude and behaviour in mode choice (Klöckner and Matthies, 2004; Lanken et al., 2006). In addition, habit strength may also be viewed as related to inertia and resistance to change, and thus needs to be considered, along with comfort, time, cost and personal utility, in terms of the implications for travellers to change to HSR from their cars or alternative trains (Klöckner and Matthies, 2004; Lanken et al., 2006; Van Exel and Rietveld, 2009; Verplanken et al., 1998).

In terms of policy, comfort is an issue for many people, but may not necessarily be a deciding factor if travellers assume in any case that taking HSR would be a comfortable experience. However, it may be that guaranteeing a seat whatever class of travel may be a stronger selling point.

6.5. Use of time when travelling and willingness to pay

The importance of usable time when travelling declined with age for both sexes and women rated this as more important than did men. However F6 contained only two items, one of which related to the importance of WiFi and it is likely that younger and/or professional respondents will be most likely to use such technology, as Lyons et al. (2007) suggest. However a problem in the UK media recently has concerned the slow speeds and poor connections for WiFi on trains, not due for improvement until approximately 2018, so any publicity for higher-priced HSR travel will need to address this as an important issue if it has not been resolved by train operators by then (BBC Business News, 2014).

WTP for travel time savings were greater for those with the most positive attitudes towards HSR, but it is clear here that people would rather save the time and are prepared to pay for it, at least for the greater time savings. The amount of WTP for the 30 min saving on a 3 h journey was, whilst being significantly higher than the base fare, nevertheless low, being only 6% of it. Indeed the highest WTP was under 23% for a journey time reduced from 90 minutes to 30 min, so it looks like WTP is not huge even then. These findings are highly relevant to any pricing policy for HSR. The findings also suggest that prestige will be relevant for a while, although it is likely to decrease over time, the only question being for how long a prestige effect is worth charging higher fares. These findings perhaps imply that perceived prestige, as well as total journey time and the cost may all be predicting WTP directly.

In this study, the relationship between WTP and usefulness of time became stronger as the time saved increased, although the relationship was at best only $r_s = .191$, which does not really account for much shared variance. Further, commuters, those who travelled most recently and those living further from the two proposed HSR stations all rate the importance of time higher than their 'opposites'. Thus, whilst there are questions about what constitutes wasted or useful time while travelling, e.g. sleeping, working, relaxing (Lyons and Urry, 2005), we can reasonably assume that greater time spent or frequency of travelling should be associated with a wish to make some use of that time. However, the proposal of Lyons et al. (2007) that travel time may have a utility presents a reason why the correlations here were not higher than they are, although the findings here also support the proposition that people will pay up to a point to minimise travel time. It is clear from this study that there was certainly a WTP for reduced journey times and we can propose that this may be more important than the perceived use of travel time. The big policy question from this is how much can be charged for the reduction of travel time before the passenger would decide not to pay for it and instead prefer the utility of the time. Charging more than our WTP data may mean that the utility of the time is valued more highly than the time saved and the passenger will not pay, especially if more interchanges are involved.

To the suggestion of Mackie et al. (2001) that the major influences on individual valuation of travel time saving are time of the journey, journey characteristics, purpose and length, the mode and the size of the time saving, the findings here allow us to add comfort and the utility of time while travelling, journey characteristics ease/convenience and number of interchanges, service reliability, frequency and security, which may variously act to mitigate the other six effects. In the specific case of HSR, prestige and novelty can also be added as influences in the short term. Stronger associations with WTP were for the greatest time savings. However whilst this needs further investigation, it may be that how the data are presented, in reduced total trip

times or as time saved or as percentage time saved, may have a bearing on how these are interpreted, an issue found elsewhere in domains such as risk research (e.g. Slovic, 2000).

7. Conclusions

The findings here suggest that WTP for time saved may have a limit and beyond that the utility of the time may be preferred. The number of interchanges that HSR may present could be a strong factor in the choice of paying the extra or not, as to a lesser extent could comfort and other convenience factors.

WTP for travel time reductions was also related to prestige and comfort. However there are several other, possibly more important, factors affecting such a choice, not only journey-related information and journey type, but also habituation, the latter being increasingly recognised as important. To persuade people to change modes, or to change within one mode type to save time but at a cost, will require HS2 to capture demand from elsewhere or create new demand. These two alternatives may involve different choice variables and thus require different strategies to attract, so for example encouraging first time users of any rail travel may involve emphasising perceptions of comfort, convenience, useful time, centre-to-centre, security and environment-friendliness through direct personal knowledge, whereas persuading changes to HSR from other rail services may need to focus more on the number of interchanges and time saving as part of journey-related information.

This paper has also shown clear evidence of demographic effects on attitudes to long distance travel and perceptions of HSR and that travel behaviour such as commuting and owning a railcard is significantly associated with attitudes. However, the NIMBY effect, whilst it existed, was not particularly strong, nor were the advantages of living near to a HSR station. It may be that people living neither near an HSR station nor near the track reflect attitudes of disinterest rather than negative ones.

Finally, because the issue has been so controversial in terms media coverage, it is important to collect further data on what to prioritise in terms of persuading customers and businesses about HSR. In this case, these should include WTP, time saved, comfort, convenience factors including dealing with interchanges. However the timing of collection of such data is important to avoid being related to media coverage rather than to attitudes.

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