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Better Informed, Better Behaved?
Public attitudes to climate change and transport: empirical findings from England

Dr Greg Marsden*
Dr Helen Harwatt
Mary Kimble
Dr Ann Jopson

Institute for Transport Studies
University of Leeds
Leeds
LS2 9JT
United Kingdom
Tel: +44 (0)113 343 5325
Fax: +44 (0)113 343 5334

* Corresponding Author: G.R.Marsden@its.leeds.ac.uk
H.Harwatt@its.leeds.ac.uk
M.G.Kimble@its.leeds.ac.uk
A.F.Jopson@its.leeds.ac.uk

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ABSTRACT

This paper describes a 2 year research study funded by the UK Department for Transport looking at the understanding and attitudes of the general public to climate change, the links made between travel behaviour and climate change and the opportunities to influence attitudes and behaviour through better information about climate change.

To unpick the notoriously difficult attitude-behaviour gap, the research applied an innovative mixed-methods approach. Participants took part in five deliberative group discussion meetings, completed four one-week travel diaries and completed two psychographic questionnaires. A further sub-sample of participants also took part in follow-up telephone interviews. 141 participants were recruited to form five groups around England. The groups were selected to capture distinct lifestage, socio-economic, geographic and carbon consumption profiles.

Awareness and acceptance of climate change amongst participants was very high. Just over half of the sample felt that their emissions made a difference but, despite this, almost three quarters of participants were motivated to consider some form of behaviour change. Over the course of the project intentions to reduce car use increased. Overall there was a significant reduction in the number of trips made by participants, although there was no reduction in carbon. Attitudinal, rather than traditional socio-demographic measures, seem key to understanding who is likely to respond to climate change related behaviour messages and how. It is also necessary to consider how climate change related motivations tie in with other factors such as health and financial benefits.

1.   INTRODUCTION

Globally, transport is responsible for 24% of greenhouse gas emissions (*1*). In the US in 2003 emissions from transport were estimated to be 1.8bn tonnes, around 30% of total global transport greenhouse gas emissions (*2*). In developed countries, transport is one of the few sectors which, over the past two decades has continued to see growth in greenhouse gas emissions. In the UK transport emissions have increased by 12% since 1990 and now, at 134 million tonnes of CO_2 account for around a quarter of domestic greenhouse gas emissions (*3*). With the current set of policy measures in the UK, the Government forecasts that transport emissions will level out by 2020, and then possibly begin to fall despite continuing or rising demand. Recent research disputes whether levelling out by 2020 is sufficient and challenges the transport sector to make deep cuts in its emissions (*4, 5*).

The Stern review of the economics of climate change (2006) has moved the international debate on climate change further (*6*). Its three-legged policy framework presents the main approaches to tackling emissions from transport (see also *7, 8*):

- carbon pricing through tax, trading or regulation;
- technology development; and
- behavioural change.

Several studies have identified the difficulty of achieving significant cuts in CO_2 emissions from a combination of pricing and vehicle technology improvements alone (*9, 10, 11*). Tight et al. conclude that "significant behavioural change will be needed to complement gains made through technological improvement…" (*5*, p243).

If behaviour change is to be a major plank of the strategy then it will be necessary to gain a much deeper understanding of the detail of who contributes to the problem, how much and how they will respond to different policy instruments (*12*). Anable et al. demonstrate, through an evidence base review commissioned by the UK Department for Transport (DfT), that very little is understood about the relationship between what people know about climate change, how this influences their underlying belief systems and, in turn how this interacts with their travel behaviour (*13*).

The evidence review resulted in the DfT commissioning a study into public attitudes to climate change with three main objectives:

1. to explore public understanding of, and engagement with, climate change;
2. to identify and explore the barriers and incentives to behavioural change, which could result in reduced impact of personal travel behaviour on climate change, and;
3. to explore the role of information (especially scientific information) in improving public awareness, understanding and attitudes towards travel behaviour and climate change and its potential for influencing behavioural change.

This paper describes the research methods (Section 2), key results (Section 3) and draws conclusions about the impacts of information, attitudes and changing behaviour as a response to climate change emission reduction pressures (Section 4). A full project report is also available (14).

2.   METHODS

The study was conducted using a novel combination of mixed methods bringing together a deliberative and participatory approach with behavioural and psychographic data. Full details of the methodology are provided elsewhere (*14, 15*) and this section therefore focuses on the key elements of the method and the research process.

2.1 Deliberative Study

There is a wealth of information on public attitudes to climate change collected through conventional quantitative surveys (e.g. *16*, *17*). There is however significant concern that climate change is such a complex phenomenon that it is difficult to ask the right questions or indeed interpret the answers which are returned (*18*, *19*).

In order to produce a richer evidence base of how the public understands and engages with climate change the project was developed around a deliberative methodology. The deliberative element was conducted in groups of 25-30 participants. Five different groups were established (Section 2.4), each meeting five times over the course of the study (Section 2.5). The participants were provided with scientific information and access to experts, and allowed time to reflect and deliberate on the information. Participants were therefore able to explore their understanding of climate change, how transport contributes to it, whether they felt a need or desire to take action in the light of this understanding, and if so, what action they and others might take and why.

2.2 Psychographic Data

The evidence base review on climate change and travel behaviour identified the complexity of joining together climate change attitudes and subsequent reported intentions and actual behaviour (*13*). The review concludes the hypothesis that because people are better informed they will act in accordance with this knowledge is "untenable" (*13*, p61), and that more complex socio-psychological models, which try to unpick the relationships between attitudes, intentions and behaviours at both an individual and collective level are required.

This project therefore developed a psychographic questionnaire, which asked a series of questions designed to explore individual's knowledge, beliefs, attitudes, personal and subjective norms (an individual's perceptions of social pressure from significant others), perceived control over change, and intentions to change behaviour, as well as capturing more general socio-demographic information about participants. The questionnaire was administered at the beginning and again at the end of the project, and therefore provides a baseline picture, as well as a measure of change. This data also allows for the joining up of data sets gathered at geographically distinct locations as the variables (e.g. on perceived control over change) reflect individual assessments. The data was used during the deliberative process to help cluster sub-groups for discussions (for example based around intentions to change). The data was also combined with travel diary data (Section 2.3) in an application of the Theory of Planned Behaviour to establish which aspects of beliefs about climate change and behaviour modifications explain intentions to change, and actual behaviour change for frequent car drivers (those who drive a car at least once a week).

2.3. Travel Diary Data

Participants completed four one week travel diaries starting prior to the first deliberative meeting and completing the last prior to the final meeting. The travel diary data had two main purposes. First, it was used to connect intentions to behaviour (through the psychographic modelling), and to assess the net impacts on travel patterns and carbon consumption of taking part in the project. Details of the carbon calculator methodology applied can be found in Pridmore et al. (*20*). Secondly, summary reports of individual's travel diaries were given back to the participants as part of the deliberative process and this formed the basis of some discussions.

2.4 Sample

The project ran five deliberative groups, each representing a different combination of carbon consumption and socio-demographic variables. Each group was drawn from one geographic area and met locally; those from the five different groups never met each other. A pen portrait of each of the five groups is provided in Table 1 along with their carbon consumption levels at the start of the study.

In total 141 participants were recruited of which 119 (84%) completed the 11 month period of the project. Of the 119 completing participants 111 completed both entry and exit psychographic questionnaires and the first and final travel diaries. Those with low income and very low carbon levels were excluded from consideration at the recruitment stage as they have limited scope to reduce their carbon emissions. Those who live in very rural areas were also excluded given the limited sample size and lack of transport alternatives. The findings from the project cannot therefore be taken to be representative of the UK population but do provide important methodological and deeper behavioral insights than are currently available. An analysis of the attrition of participants shows that those participants that did not complete largely left after the first round of meetings and this was predominantly from the group "Younger People" where 13 out of 28 did not complete. This seemed largely to be due to apathy about the project as well as difficulties in keeping track of the participants through residential relocations and mobile phone number changes. Care should therefore be taken in interpreting the results relating to under 29 year olds.

2.5 Research Timetable

The five groups each followed an identical pattern of activities over a period of around 11 months. A sub-sample of 25 participants was recruited for telephone interviews around 4 months after the final meeting. The key tasks are outlined below:

1. Week 0: Complete One Week Travel Diary 1
2. Week 1: Attend Meeting 1, project introduction, complete entry psychographic questionnaire
3. Week 3: Attend Meeting 2, expert presentations and discussions
4. Week 4: Attend Meeting 3, discussion of expert findings and implications, travel diary feedback
5. Week 5: Complete One Week Travel Diary 2
6. Week 21: Complete One Week Travel Diary 3
7. Week 22: Attend Meeting 4, update, travel diary feedback, changes and action plans
8. Week 41: Complete One Week Travel Diary 4
9. Week 42: Attend Meeting 5, discuss changes, complete exit psychographic questionnaire, implications
10. Week 58: Selected Follow-up Telephone Interviews.

TABLE 1 Pen Portraits of Groups

Group Name	Location	Number of Participants		Description	Carbon in Initial Travel Diary (kg/person/week)		
		Start	Finish		Private	Public	Total
Educated Professionals	Reading – (41miles west of London)	29	28	Comprised individuals aged 45 and over with above average incomes and professional or managerial occupations (social grades AB), although some were retired. While some participants lived in Reading, others lived in more rural locations. Many had children who were adults, some of whom no longer lived with them.	9.5	2.2	11.7
Middle Class Families	Leicester – East Midlands (90 miles north of London)	29	26	Includes a mixture of suburban and rural dwellers. Aged 30-44, this group was relatively affluent being mainly employed in clerical and managerial occupations (social grades ABC1). Many had school-aged children living at home.	10.8	0.5	11.3
Younger People	Leeds – North of England (198 miles north of London)	28	15	This group was aged 20-29 and included a spread of occupations and therefore income levels and social grades. A few had young children, some lived alone or with partners and others with their parents. Many had started work but some were still in full-time education. Most participants lived in the outer suburbs of the city.	2.9	1.0	3.9
Less Affluent Older Families	Plymouth – South West of England (244 miles from London)	27	26	This group was based in Plymouth and was drawn from the surrounding communities. They were aged 45-64 and some were retired. Their occupations were administrative, clerical and skilled manual (C1C2).	8.3	0.4	8.7
Less Affluent Younger Families	Liverpool – North West of England (176 miles NW of London)	27	24	Based in the Liverpool conurbation, this group's occupations were clerical, administrative and skilled/semi-skilled manual (social grades C1C2D). They were aged 30-44 and tended to have younger children living with them.	3.7	0.8	4.5

3.   RESULTS

This paper reports on a selection of the most important qualitative and quantitative findings from the plethora of information obtained. The findings presented here are divided into three parts. The first looks at understanding how climate change is viewed and attitudes to climate change related behavioural adjustments. The second presents the key findings from the reported behaviour change. Conclusions that pull these strands together are then drawn.

3.1 Awareness of and attitudes to climate change

This Section reports on data obtained through the entry and exit psychographic questionnaires, drawing out the interpretation of the answers through the deliberative events and interviews. Summary statistics from key questions in the psychographic questionnaire are provided in Table 2.

3.1.1. Awareness

Awareness of climate change is very high with all respondents initially reporting they have heard of it, and 123 of 131 respondents having 'read about, watched or listened to a TV or radio programme about, thought about or discussed climate change'. Participation in the project seemed to make participants more aware of the subject and more likely to subsequently engage with a climate change related article or documentary.

3.1.2 Acceptance

The initial questionnaires suggest that acceptance of climate change was virtually universal. At the outset of the study only four participants did not believe that climate change is happening. Many people reported feeling that they had observed climate change with changing seasons such as milder winters. There is however, much greater scepticism about the role of human activity in causing or accelerating climate change. 80 out of 111 respondents felt, to some degree, that human activity caused climate change and this increased to 93 by the end of the study. Few sceptics were convinced by the evidence presented but overall the strength of belief increased significantly ($t = 2.12$, $p<0.05$).

Even though 93 people felt that human activity contributes to climate change, far fewer (56) believed that their individual actions will make a difference, and this only increased marginally over the course of the project (from 53). This may act as a constraint on climate change motivating behaviour change. Several participants questioned the role that they play relative to industry and government, and also questioned what difference action by the UK would make compared to larger polluters such as China, India and the US.

3.1.3 Understanding of climate change

Despite high levels of awareness and belief in climate change initially the participants were generally confused as to what causes it. Other environmental problems such as the hole in the ozone layer get mixed up with climate change, and even though most people had heard of greenhouse gases few knew what they were.

TABLE 2 Key descriptive statistics from Psychographic Questionnaire

	Entry		Exit	
	n	**Average**[1]	**n**	**Average**
Happening	109	2.1	110	1.9
Made worse by my personal contribution	109	3.8	110	3.5
A threat to my quality of life	109	3.6	110	3.4
Caused by human behaviour	109	2.7	110	2.4
A threat to my children's and grandchildren's quality of life	109	2.2	109	2.1
A serious problem	109	2.3	110	1.9
Having severe impacts on the UK climate	110	2.9	110	2.7
Having severe impacts on the world climate	110	2.4	109	2.1
An important issue	110	2.0	110	1.8
Made worse by emissions from cars	109	2.6	110	2.2
Made worse by emissions from buses	109	3.1	109	2.9
Made worse by emissions from goods vehicles	109	2.4	109	2.4
Made worse by emissions from trains	110	3.6	110	3.6
Made worse by emissions from industry	110	2.1	110	1.9
Made worse by emissions from running homes	109	3.2	110	2.7
Made worse by emissions from aircraft	110	2.4	110	1.9
Made worse by farming	110	4.6	110	4.0
My children think I should reduce my car use to help reduce climate change	91[2]	5.7	91	5.2
My partner…	91	5.6	91	4.8
My parents…	91	6.2	91	6.0
My boss…	91	6.7	91	6.3
My colleagues…	91	6.4	91	6.0
My friends…	91	6.1	91	5.3
Other members of the public at this event…	90	4.9	91	3.9
To protect the environment, it is my responsibility to take action to reduce my car use	90	3.0	90	2.5
To protect our quality of life…	90	3.1	90	2.6
To protect the environment, I am morally obliged to take action to reduce my car use	90	3.4	90	2.7
To protect our quality of life…	90	3.4	90	2.7
To what extent do you see yourself as able to reduce car use over the next 11 months	91	4.1	91	3.6
To what extent would it be easy for you to …	91	4.5	91	4.1
To what extent do you feel confident that you could …	91	4.5	91	3.8
To what extent do you feel in control of reducing …	91	4.1	91	3.7

[1] 1 = agreement, 7 = disagreement (e.g. happening = 1, not happening = 7; good = 1, bad = 7)
[2] Questions related to reducing car use were posed differently to infrequent drivers and these results are therefore excluded from this analysis

Participants believed that emissions from industry were the biggest exacerbating factor, followed by aviation (Table 2). Some misconceptions about the relative importance of different sources of emissions did exist. For example, emissions from homes are low on the list and those from goods vehicles high (whereas goods vehicles contribute only around one quarter as much CO_2 as residential usage (*3*, *21*)). Some of the misconceptions appear to be driven by visible pollution being equated to 'bad for the environment'. The importance attached to different contributors to climate change is likely to be important to individuals in framing their personal response to behaviour change initiatives.

3.1.4 Impacts: Seriousness, importance and distribution
The questionnaire asked participants to rank how serious a problem they felt climate change to be. Initially only 8 of 109 respondents tended to disagree that climate change is a serious problem. Women reported slightly (but not statistically) stronger beliefs that climate change is a serious problem, and that it is having severe impacts on the UK climate, than men.

Table 2 shows the overall views about the importance of climate change. People saw the impacts as being worse for future generations and for areas other than the UK initially (both significant ($t = 10.04$, $p<0.05$; $t = 5.61$, $p<0.05$)) and at the end of the study ($t = 10.25$, $p<0.05$; $t = 6.40$, $p<0.05$)).

Although warmer summers (as experienced in the UK) were often quoted as a benefit some participants could also identify some negative impacts from climate change such as flash floods, and insects and diseases that currently the UK does not have. Participants from the wealthiest socio-economic groups were more likely to take a broader perspective on the importance of impacts outside the UK.

3.1.5 Feelings of personal responsibility to act
Amongst frequent drivers (91 of the 111 completers) women reported stronger feelings than men of personal responsibility to reduce car use to improve the environment and their quality of life throughout the study (referred to as personal norms from here on). Both males and females reported significantly higher levels of personal responsibility to take action at the end of the study (Males ($t = 3.83$, $p<0.05$), Females($t = 2.30$, $p<0.05$)) but a gap remained. Initially 59 (out of 91) participants expressed some form of personal responsibility which rose to 71.

3.1.6 Social Pressure
Participants generally did not report a feeling that significant others (e.g. friends, family) thought that they should reduce car use to tackle climate change and struggled to influence others:

> *"so how that has rubbed off on my friends I don't really know…they sort of go oh yeah and they listen, but I don't think they're really putting it into practice in their own private life…"*
>> Less Affluent Younger Families, female (follow-up telephone interview)

3.2 Travel Behaviour Change
This section details the reported ease of changing travel behaviour to reduce carbon emissions, the intentions participants had at the start of the project to do so, what they said they would change and then how this unfolded. It draws on the psychographic questionnaire, the travel diaries and the discourse from the events.

3.2.1 Willingness, Intention and Ease of Changing
At the start of the project just over a half of the frequent drivers were willing to reduce car use and this increased significantly (test of proportions, $p<0.05$) over the course of the project to almost three-quarters (Table 3). A similar number also intended to reduce car use at least once per week. A series of related questions were asked to determine the extent to which that willingness might be moderated by ease, confidence in taking action and degree of control over changes (in psychology the terms relate to the concept of Perceived Behavioural Control). Female frequent drivers were more likely than male frequent drivers to see reductions as practical and they saw themselves as more willing and able to reduce their car use; and generally perceived themselves as having greater control over their travel modes. Neither age nor socioeconomic group appear to explain attitudinal differences in willingness or ability to change car usage and the event discussions support this finding.

TABLE 3 Variation in intention to reduce car use once a week by gender

Question	Frequent Car Users			Male			Female		
	N	Initial	Final	N	Initial	Final	N	Initial	Final
Willing to reduce car use	88	47	65	45	22	30	43	25	35
Intended to at least once per week	88	50	60	45	19	26	43	31	34

N: All frequent drivers answering questions, 87

3.2.3 Action Plans
By the end of the first three meetings participants had received feedback from their initial travel diaries and had heard presentations, amongst others, on how the transportation system might be improved and what individual actions they might take to cut car use. It was clear from the discussions however, that participants found it quite difficult to understand the impact of individual actions in amongst the whole range of activities they do. For example, some wanted to know whether internet-based supermarket shopping really was a saving and how much difference pumping up tires makes to a vehicle's efficiency. Importantly, they were motivated by the financial as well as environmental impact. A list of actions with associated impacts was therefore prepared and during Meeting 4 participants indicated what they were already doing, and what they would be prepared to try. Then in Meeting 5 they indicated what they had done, and discussed what worked, what did not, what they did not attempt and why.

The behaviours that participants were most likely to say they actually tried were:
1. walk or cycle for journeys of up to two miles (64 out of 108);
3. cut down the number of shopping trips (59/108);
4. trip chain in order to reduce unnecessary journeys (53/108);
5. drive with smooth acceleration (53/108); and
6. check that tyres are pumped up (50/108).

Participants were least likely to try giving up a car (2/108), offsetting emissions from flights (6/108) and working from home sometimes (9/108).

3.2.4 Travel Diary Data

This section presents results from the 111 participants completing the initial and final travel diaries. Overall there was no significant net change in carbon usage from the first to the final travel diary. Within this 62 participants cut their carbon usage (referred to as 'carbon reducers') whilst 49 either made no change or increased their carbon usage ('carbon non-reducers'). Table 4 shows the carbon change by mode per group over the course of the project. In general, carbon from car, van and motorcycle use dominates total carbon consumption across all groups but particularly the more affluent and less urban groups (educated professionals, middle class families and less affluent older families). Whilst local context is clearly important in the extent to which modal change was felt possible, this varied substantially for individuals even within a location so a combined whole sample analysis using the measure of perceived behavioural control over making changes provides a more robust understanding of this.

Overall there was a statistically significant and consistent reduction in the number of trips made by participants across the study period consistent with the types of actions they reported trying (Paired samples t-test (t = 3.61, p<0.05)). Carbon reducers and carbon non-reducers took around 30 trips per week at the start of the project. By the end the carbon reducers had made a significant cut in trip levels to 23 per person whilst carbon non-reducers were still making approximately 30 trips per person.

Over the period of study there was a more varied pattern of changes in distance travelled and there was no statistically significant change in overall distance travelled. This is consistent with the dialogue from the meetings which, aside from shopping more locally, focussed more on reducing the number of separate trips and "unnecessary journeys". The data on trips and distance is shown in Table 5 for the four travel diaries.

As a group, the carbon reducers decreased the number of trips they made for all purposes, which suggests a conscious decision to travel less. The biggest reductions were for trips classed as 'other' (e.g. collecting/dropping off relatives) and shopping. Carbon non-reducers as a group also cut the number of trips they made for all purposes except business and commute. The average number of shopping trips reduced from 5.1 in the entry travel diary to 1.9 in the final diary. Distances travelled for shopping and visiting reduced by over 50% between the start and end of the study. The average length of shopping trips also decreased from 5 kilometres in the initial travel diary to 3.9 kilometres in the final diary which reflects the intentions of participants to shop more locally.

TABLE 4 Carbon change by mode per lifestage

		Car, Van, Motorcycle	Bus, Train, Taxi, other	Total
Educated Professionals	Diary 1 (N = 23)	10.6	2.0	12.6
	Diary 2 (N = 20)	11.9	1.7	13.6
	Diary 3 (N = 23)	10.6	1.7	12.3
	Diary 4 (N = 23)	8.4	2.2	10.6
	% change: 1 and 4	-21.8	+10.0	-15.9
Less Affluent Families (Older)	Diary 1 (N = 26)	8.7	0.3	9.0
	Diary 2 (N = 26)	6.8	0.4	7.2
	Diary 3 (N = 26)	6.2	0.3	6.5
	Diary 4 (N = 26)	6.3	0.5	6.8
	% change: 1 and 4	-27.6	+66.7	-24.4
Middle Class Families	Diary 1 (N = 26)	10.8	0.5	11.3
	Diary 2 (N = 25)	15.6	0.1	15.7
	Diary 3 (N = 26)	13.1	0.3	13.3
	Diary 4 (N = 26)	11.4	1.1	12.5
	% change: 1 and 4	+5.6	+120.0	+10.6
Younger People	Diary 1 (N = 14)	2.8	0.7	3.6
	Diary 2 (N = 9)	5.8	0.6	6.3
	Diary 3 (N = 12)	6.5	0.9	7.4
	Diary 4 (N = 14)	6.1	1.5	7.6
	% change: 1 and 4	+117.9	+114.3	+111.1
Less Affluent Families (Younger)	Diary 1 (N = 22)	4.0	0.8	4.8
	Diary 2 (N = 21)	4.0	0.9	4.9
	Diary 3 (N = 22)	4.3	1.9	6.2
	Diary 4 (N = 22)	3.1	0.6	3.7
	% change: 1 and 4	-22.5	-25.0	-22.9
Caron kilograms per person: all groups	Diary 1 (N = 111)	7.9	0.9	8.8
	Diary 2 (N = 101)	9.3	0.7	10.0
	Diary 3 (N = 109)	8.4	1.0	9.4
	Diary 4 (N = 111)	7.4	1.1	8.5
	% change: 1 and 4	-6.3	+22.2	-3.4

TABLE 5 Trips, Distance Travelled and Average Distance/Trip

	Travel diary 1	Travel diary 2	Travel diary 3	Travel diary 4	% Change from 1 to 4
Trips	30.1	28.7	27.6	26.0	-13.6
Kilometres	286.1	300.4	295.7	273.1	-4.5
Kilometres/trip	9.5	10.5	10.7	10.5	+10.5

Overall, the main reason for changes in the number of trips and the distance travelled appears to be variations in car-based travel rather than a systematic mode shift to other forms of travel. Bus use declined slightly overall, and whilst the use of rail increased, this tended to be for long-distance commute and leisure trips for a few individuals. It therefore appears that participants' ability to reduce "unnecessary journeys", to combine journeys, and to conduct at least some activities more locally is at the heart of the travel behaviour change observed.

3.2.5 Discourse and Summary
Most people, even those not intending to reduce car use, reported driving more smoothly, pumping up tires and/or emptying the boot. Whilst this was not validated through a quantitative measurement, participants discussed the actions at a level of detail (including working out how much money they saved) that suggests many did perform the behaviour. Although this research work concluded before the recent price spike in oil, it can be expected that these behaviours will be more attractive when fuel prices are high.

Importantly, in terms of placing trust in the travel diary results, the discourse on other behaviours was very consistent with the travel diary results. Participants were surprised by how many "unnecessary" trips they made, and many felt motivated to tackle this. Trip chaining and conducting multiple activities in one location were frequently cited.

> *"Trip chaining can actually benefit your lifestyle - planning things can give you more time."*
>
> Educated Professionals, male (event 3)

Participants were also motivated to shop more locally, try internet shopping and to conduct less frequent visits to bigger more distant supermarkets. This came out strongly through the results. By contrast, the proposed shift to walking and cycling was less clear. As this was not a controlled experiment we cannot be certain whether the additional walking and cycling observed in diaries 2 and 3 is simply seasonal (longer nights and better weather conditions), or as a result of conscious choices. The truth is most likely somewhere between the two. Indeed, follow up interviews identified respondents that had taken up cycling and walking shortly after the study and continued with it. The behaviours adopted by people typically involved only a small disruption to their lifestyle and exhibited other benefits such as time and cost savings or were healthier. This moves our understanding forward as previous research has suggested that climate change may be too far removed to influence behaviour (*22*). In general, socio-demographics do not explain the differences in travel behaviours and carbon changes between groups, which accords with the expectations of Anable et al. (*13*).

3.3 Attitudes and Behaviour

The previous section showed that socio-demographic variables were unable to explain changes in carbon use over the study period. A comparison of differences in the various attitudinal measures captured through the psychographic questionnaires between carbon reducers and carbon non-reducers shows that carbon reducers had significantly greater feelings of personal responsibility for taking action than carbon non-reducers both initially and at the end of the study (Personal Norms Entry (t = -2.13, p<0.05); Personal Norms Exit(t = -1.94, p=0.06)). Only frequent drivers were considered in this analysis due to differences in the wording of questions to infrequent drivers.

Further investigations were also undertaken to understand the strength of the relationships between participants' actual travel behaviour, their stated intentions regarding car use, and their climate change beliefs. This study applied the Theory of Planned Behaviour (TPB see *23*). to study these interactions, although several other potential behavioural modelling frameworks exist (*13*). The theory states that behaviour is the combined result of intentions and perceived behavioural control. Perceived behavioural control is the perceived ease or difficulty of carrying out a behaviour successfully; it is assumed to reflect past experience as well as anticipated practical impediments and obstacles (*13*). In this instance, as most respondents reported reductions in trips, and as trip reduction featured strongly in the discussions as a possible action (compared with distance reduction), the TPB modelling seeks to explain intentions and behaviour regarding car trips at the start and end of the study.

The Theory of Planned Behaviour also sets out the basis for the formation of intentions, stating that they are formed from the combined effects of attitudes towards behaviour, subjective norms, and further influence from perceived behavioural control. Attitudes towards a particular behaviour are a set of learned (positive/negative) beliefs about a behaviour, its context and its outcomes, that result in a tendency to respond in a particular way, to a particular situation. This project has been specifically concerned with attitudes towards car use in the context of climate change. The Theory of Planned Behaviour modelling is discussed fully in King et al., (*14*), key results are presented below.

3.3.1 Intentions and behaviour at the start of the study

A model was generated to see the extent to which initial attitudes towards behaviours, subjective norms, perceived behavioural control and personal norms could explain the initial intention to reduce car use. This model explained 53% of intentions, with perceived behavioural control and personal norms being significant to the explanation (PBC (t 5.35, sig < 0.05) and personal norms (t 4.05, sig < 0.05)). Of these two factors, perceived behavioural control made the greatest contribution. This level of explanation suggests that certain climate change beliefs are important in the formation of intentions, but they do not provide a full explanation.

The second model tested the extent to which intentions to change and perceived behavioural control could explain the number of car and van driver and passenger trips. This model explained only 7% of behaviour. This model suggests that beliefs about climate change are not important when it comes to actual behaviour; indeed the model indicates that there is little or no linear relationship between trips and intentions or perceived behavioural control.

3.3.2 Intentions and behaviour at the end of the study

An identical modelling approach was undertaken using the data from the final questionnaire at the end of the study and the fourth travel diary. This is interesting as the participants have

all taken part in a long awareness raising exercise relating to climate change and have discussed actions to help tackle the problem.

The findings are in agreement with those from the initial model. However, the modelling suggests that the intervention has strengthened the relationship between intentions, and perceived behavioural control and personal norms. This model was able to explain 70% of intentions (PBC (t 6.495, sig < 0.05) and personal norms (t 4.945, sig < 0.05)), but again it was not possible for the second model to really provide an explanation of behaviour. Given this, it is concluded quite confidently that beliefs about climate change do not relate to the number of trips made, and the consequences of this are discussed below.

These findings can be contrasted to those of Taniguchi et al. (2003) who found that a travel behaviour feedback in Sapporo (Japan) lead to a CO_2 emission reduction of 16% (24). However, in that study around one-third of the initial participants did not reply to the follow up survey and concerns must exist over potential response bias amongst the sample that did respond.

4. DISCUSSION AND CONCLUSIONS

Awareness and acceptance of climate change as a phenomenon is extremely high but only half of our participants believed that their personal contribution makes a difference. There is, perhaps unsurprisingly, little social pressure to tackle climate change through changing travel behaviour. There exists some confusion over what causes climate change and how important transport is to the problem. Without some form of education and awareness raising it should not therefore be assumed that the public would know what best to do to tackle the problem even if they were motivated to do so. Although people think climate change is a serious problem the impacts are deemed to be most serious for future generations and outside of the UK. As information about climate change and the actions that people can take is clearly linked to the formation of intentions there is scope and a rationale to improve public understanding of the problem.

Despite the very mixed picture within the sample on the importance and nature of climate change, over three quarters of participants felt some personal responsibility to act to reduce car use to tackle the problem and, over the course of the project, intentions to reduce car use increased. The research has shown that where such intentions exist, they are formed primarily on the basis of perceived behavioural control and personal norms. The greater an individual's acceptance of the problem, awareness of their personal contribution and responsibility to act, the more likely they will be to form intentions to reduce car use. Whilst we conclude above that there is scope to improve understanding of the problem these findings seem to indicate that a detailed understanding of the problem is important but not critical to bringing about behaviour change. Other recent research suggests that acceptance of the problem is indeed important to the acceptability of measures to encourage people to change behaviour (25).

Overall there was a significant reduction in the number of trips made by participants, although there was no significant reduction in carbon use. Those participants who reduced their carbon consumption had stronger reported feelings of personal responsibility towards the environment and this is consistent with their underlying stated intentions. Nevertheless, the lack of explanation of the number of car trips made by participants through the behavioural modelling confirms that the gap between intentions and behaviour is complex. However much people believe they need to change their travel behaviour for the sake of climate change, and actively want to do so, providing information about climate change, and general information on individual contributions alone has limits to the types of behaviour which can be encouraged. Other, more general motivations such as time, cost and availability

remain critically important in individual's decision-making. There is a set of actions however which appeal to many of the participants which can reduce time and cost and/or offer other lifestyle benefits such as feeling healthier at least for some types of journeys. Participants talked of the dual benefits of such savings alongside environmental gains in relation to transport and other forms of pro-environmental action (such as energy saving behaviour in the home) which offers support to the inclusion of climate change mitigation as part of a behaviour change strategy. Knowing what can be done and what the personal and broader environmental benefits are was found to be important.

It is clear that attitudinal rather than traditional socio-demographic measures are key to understanding who is likely to respond and to what types of messages, and who will not. This study used a purposively selected non-representative sample of the population and involved a series of intensive and supported activities. It would be unwise therefore to extrapolate the findings too much further. Without such an in-depth approach however many of the behavioural understandings would have remained hidden and the study has established the need for a more sophisticated market segmentation based approach to understanding the target groups and key messages required to motivate travel behaviour change. This will be an important part of the package of policies needed to reduce our climate change emissions.

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