Exploring public attitudes to personal carbon dioxide emission information

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Executive summary

BMRB was commissioned by the Department for Transport to conduct research to improve our understanding of how the public engages with environmental terminology and personal carbon emissions information. This research was also carried out to inform good practice recommendations for the design and presentation of carbon calculators aimed at raising awareness of personal contribution to climate change and encouraging behaviour change.

The research involved interviews with âstakeholdersâ (professionals with experience of communicating environmental information), and individuals with experience of using carbon calculators, as well as group discussions with people who had never made use of carbon calculators.

Attitudes and understanding of environmental issues

- Recent growth in public awareness about climate change has not equated to greater understanding of the issues involved, nor how these issues relate to personal behaviour.
- Terminology used to describe broad environmental phenomena, such as âclimate changeâ and âglobal warmingâ, are broadly recognised though poorly understood, which adds to public confusion and encourages cynicism.
- Respondents were less aware of emissions-related terminology, yet once explained these terms were felt to have more personal connotations than broader environmental terminology
- Awareness of how carbon emissions are quantified and measured was limited, and once explained, felt to be meaningless unless contextualised.

Views on carbon calculators

- Stakeholders emphasised common sense and targeting specific populations when designing carbon calculators.
- Usersâ motivations for exploring carbon calculators centred around the idea of âdoing somethingâ in relation to climate change.
- Key features of a successful carbon calculator, as identified through practical sessions with non-users, include: illustrative and fun graphics; sparse and simple text; bright, consistent colour scheme; clear layout; everyday language; simple yet personalised information requirements; meaningful and understandable results; personal and realistic follow-on action; available but discrete calculation information; succinct process.
- Accuracy and reliability of calculations was not a primary concern, with respondents equating these to the level of detail required as part of the calculation process. Standardised calculations were viewed as the best method for increasing user confidence.

Attitudes towards personal carbon emissions information

- Practical sessions with carbon calculators increased levels of understanding about emissions amongst non-users, yet had limited impact on users who felt they were already informed on such issues.
- An impact on attitudes in relation to carbon emissions among non-users was also noted, although this was negated in some cases by perceptions of insignificance of personal contributions in comparison to larger emitters, such as national and international actors.

- Non-users remained largely resistant to carbon reduction suggestions requiring lifestyle changes, particularly in relation to travel behaviour, with respondents citing limited alternatives, time and costs as more crucial factors than environmental concerns. However, less regular travel for leisure was seen as a potential area of change among some respondents.
- In spite of these limitations, carbon calculators were recognised by respondents as playing a role in the development of more environmentally conscious travel, through raising awareness and understanding, and making excessive carbon emissions less socially acceptable.

Introduction

Previous research suggests that the public are aware of climate change as an issue but lack a detailed understanding of the science involved and how these environmental issues relate to personal behaviour, particularly travel behaviour. [1] Linked to this, the Department for Transport (DfT) has added a carbon calculator to the Transport Direct web portal, with the aim of engaging people more directly in the issue of carbon emissions in relation to travel. The calculator will allow people to estimate the level of carbon dioxide produced and emitted by alternative travel modes for the journeys they specify. It is hoped that provision of this information may influence the travel decisions they make. [2]

DfT commissioned BMRB Social Research, together with academics at the University of the West of England, Bristol (UWE) to conduct research into these areas with two main objectives:

1) To improve our understanding of how the public engages with the terminology often used by experts and the media in relation to climate change.

2) To explore public attitudes and understanding of information relating to personal carbon emissions and the potential impact of carbon calculators on behavioural change.

Background

There is evidence that public awareness about climate change has reached a substantial level. Yet in contrast to this, understanding of the underlying science is limited. More importantly, people are largely unable to link these general environmental terms to their own personal behaviour and carbon emissions. [3] However, there is a substantial proportion of people who claim to want to live a more environmentally friendly lifestyle but simply lack the knowledge of how to do so. [4]

There is a growing recognition amongst the public that both air traffic and road transport are impacting negatively on the environment. [5] In particular, vans, lorries and cars are seen as having the greatest potential negative impact on climate change and there is a clear link that the public view climate change synonymously with air pollution generated from road traffic. [6]

Despite recognition that many transport modes have negative environmental effects and that people claim to want to live greener lifestyles, people are quite reluctant to change travel behaviour in line with this. [7] People are more willing to change lifestyle at home than they are to alter travel patterns, including recycling more, insulating their house and installing low energy light bulbs. [8]

As such a strong attitude-behaviour gap is found with regards to environmental concern and travel behaviour. It could be that the exact link between travel behaviour and environmental damage is required at a personal level. Personal messages, especially interactive messages, have greater impact on attitude and behaviour change. [9] One way of potentially engaging people more directly in the issue of carbon emissions is through the provision and use of carbon calculators.

Carbon calculators are tools that allow people to assess how their personal behaviour does, or could, impact on the environment. They work by way of a questionnaire approach with people inputting information in response to specific questions. At the end of the process an estimate of carbon dioxide emissions (or carbon equivalence) is produced. There are a variety of such tools and the information used to make calculations includes gas and electricity bills, transport usage and so on. As such, carbon calculators have the quality of being personalised and interactive and therefore may have significant potential for changing attitudes and behaviour.

In response to this, the Department has developed a carbon calculator for inclusion within the Transport Direct web portal - the Department for Transport's online national multi-modal door-to-door journey planning service - providing customers with additional information on the carbon dioxide (CO2) produced and emitted by each planned journey.

There is a great deal of complexity that lies behind the assumption that usage of a carbon calculator might play a significant role in determining transport choice. The first of these is the extent to which practicable transport alternatives for journeys are available to individuals; the second is that where they are available, whether factors such as cost, time, comfort and other convenience factors such as luggage, will over-ride environmental concerns in the decision making.

If it can be assumed that the results of a carbon calculation may act as a factor, however influential, in peopleâs journey planning, the next important focus needs to be how the calculated information is presented. Some of the factors that need to be considered include the level of detail people are willing to submit during the calculation process, the language that is used, the layout of information, and how the results are presented in order to convey meaning to people. In addition, consideration needs to be given to the level of information that is provided about the calculation, for example whether the emissions calculators work on distance alone, or would incorporate factors to account for congestion, gradients, driving styles, loading of the vehicle and other factors which directly affect vehicle fuel consumption and therefore carbon emissions.

These issues and more were explored during qualitative research with stakeholders including members of the general public. This report summarises the findings of the research, exploring public attitudes towards environmental terminology specifically related to the measurement and provision of personal CO2 emissions information and how these relate to personal behaviour, particularly travel behaviour, and the use of carbon calculators in this role.

Methodology

The approach adopted for this project consisted of three stages of research, each with a distinct group of respondents.

Stage 1 - Stakeholder meetings

Stage one involved separate meetings with eight key âstakeholdersâ, each of whom had either direct experience of setting up and managing an on-line carbon calculator, or other experience of communicating environmental information. The meetings explored the views of these stakeholders in relation to good practice for communicating environmental information and the lessons learnt from existing carbon calculators, with regard to their usage and perceptions of attitudes towards them.

Stage 2 - User interviews

Stage two involved 20 depth interviews with people who had previously used carbon calculators, looking at their motivation to use the tool, and their thoughts about accessibility and usability, understanding of terminology, information needs, improvements and suggestions, as well as their expectations and responses to the final carbon âscoreâ. Respondents were identified by email through an on-line carbon offset provider, who contacted a proportion of their customers in relation to the research.

Stage 3 - Reconvened non-user group discussions

Stage three formed the main body of the research, incorporating 15 reconvened (meeting twice in total) focus groups around England, Scotland and Wales [10] , made up of between 8-10 people who had never used a carbon calculator. The first session (Wave 1) explored peopleâs spontaneous views and understanding of environmental issues, with particular focus on terminology and quantifying carbon emissions. The second session (Wave 2) involved a practical hands-on exploration of existing carbon calculators, with respondents sharing their reactions to different aspects, for example, content, layout and terminology. Participants were recruited using free-find methods and, in order to reflect a broad spread of the general public, quotas were incorporated, including age, gender, ethnicity, social class, urban / suburban classification, and family status. Most importantly, groups were segmented using a simplified version of the Anable segmentation [11] , which classifies people according to their attitude towards car usage and the environment.

The original Anable classification identified seven different segments (with respective population percentage in brackets) - Car Complacents (21%); Die Hard Drivers (20%); Aspiring Environmentalists (16%); Malcontented Motorists (18%); Car Aspirers (9%); Car Sceptics (9%); Reluctant Riders (7%). [12]

For this study, we combined some of these segments to produce three broad categories (once again with respective population percentages in brackets) - Car Complacents / Die-hard Drivers (41%); Malcontented Motorists / Car Aspirers / Reluctant Riders (34%); and Aspiring Environmentalists / Car Sceptics (25%) - with 5 groups of each. Where differences in views arose between these groups these are stated throughout the report, otherwise it should be assumed that differences were not observed.

Verbatim quotations are used throughout this report to illustrate points made; such quotations are referenced according to the quota characteristics.

A detailed breakdown of the demographic make-up of the group discussions, as well as a description of the methods adopted for recruitment and analysis, can be found in appendices1.1, 1.3 and 1.4. [13]

[1]See Chapter 1 in Anable et al, An evidence base review of public attitudes to climate change and transport behaviour, DfT 2006

[2] In this way, the Transport Direct carbon calculator differs from other calculators that exist to more explicitly increase understanding of personal CO2 emissions and how they can be reduced through behavioural change e.g. the Government's Act on CO2 calculator (http://actonco2.direct.gov.uk/index.html) or to calculate personal CO2 emissions for offsetting purposes.

[3]Ibid. for further details

[4]Hounsham, S, Painting the Town Green, Green-Engage Communications, 2006 shows that on a survey of 645 people, 38% said they didnât know how to be more environmentally friendly. In addition, 81% agreed they ;want more advice on what to do from experts.;

[5] See Chapter 2 in Anable et al, 2006.

[6] ONS/DfT, 2006

[7]Gatersleben, B., & Vlek, C. (1998). Household consumption, quality-of-life and environmental impacts: a psychological perspective and empirical study. In: K.J. Noorman & A.J.M. Schoot Uiterkamp (Eds.), Green households? Domestic consumers, environment and sustainability (pp. 141-183). London: Earthscan

[8] See Chapter 2, section 2.11 in Anable et al., 2006.

[9] See Ebring L, Goldenbery EN and Miller A, 1980 ;Front-Page News and Real-World Cues: A New Look at Agenda-Setting by the Media;, American Journal of Political Science, 24, 16-49 for seminal work in this area.

[10] 15 focus groups were carried out in England, Scotland and Wales, of which four groups took place in London, two in Northern England, two in Southern England, two in the Midlands, two in Scotland, and three in Wales.

[11] See Anable et al, 2006

[12] See Anable, 2006 NB this work refers to percentage of Scottish population

[13]It is important to note that the methods employed in this research were qualitative in nature. This approach was adopted to allow for individualsâ views and experiences to be explored in detail. Qualitative methods neither seek, nor allow, data to be given on the numbers of people holding a particular view nor having a particular set of experiences. The aim of qualitative research is to define and describe the range of emergent issues and explore linkages, rather than to measure their extent.

Attitudes and understanding of environmental issues

Each stage of the research involved exploring public understanding and attitudes towards a range of environmental issues. Stakeholders (stage 1) drew on their experience of engaging with the general public in these areas, whilst users and non-users of carbon calculators (stage 2 and stage 3 wave 1) discussed

their take on issues including the associated terminology and quantification methods. [14] This section aims to pull together the findings from each stage to establish the range of responses.

Environmental awareness and terminology

Stakeholders suggested that a recent surge in public environmental awareness has occurred, largely as a result of increased scientific agreement about the reality of climate change and the media finally embracing the issue after what stakeholders considered a long period of muted response.

"Awareness has been growing following on from the BBC Climate Chaos series, the Stern report, and the Oxford University aviation report. Thereâs been a media feeding frenzy and âAn Inconvenient Truthâ and the Live Earth events will only feed into that." [Stakeholder]

Despite this increased awareness, stakeholders claimed that the environment remained a fringe issue for the majority of the population, and that raised awareness of the general issues did not necessarily equate to greater understanding of how climate change relates to personal behaviour. More crucially, this would not necessarily result in substantial behaviour change at an individual level.

This perception was explored in subsequent stages of the research conducted with the general public. Both users and non-users were asked about their understanding of a number of environmental issues, focusing on both broad environmental terms such as âglobal warmingâ and âclimate changeâ, and more emissions-related terminology, including âcarbon emissionsâ, âcarbon footprintâ, âcarbon neutralityâ and âcarbon offsettingâ. Each of these terminology sets are considered in turn below.

Broad environmental terminology

Respondents from both stages demonstrated awareness of the more general terms, such as âglobal warmingâ and âclimate changeâ. Differences emerged between the groups in relation to their acceptance of the associated phenomena as reality, with users appearing more convinced of the validity of climate change and more ready to accept a link between such issues and human behaviour. Users also demonstrated greater scientific understanding behind the issues than non-users, and this was highlighted in their critique of the terms. âGlobal warmingâ was felt to be a slightly old-fashioned term, and misleading given their understanding that some areas may cool as a result of global warming. In contrast, âclimate changeâ was felt to be the current most appropriate term embraced by the media, though largely reflecting similar issues to global warming. This term was also considered unhelpful given usersâ assessment of the general publicâs inability to distinguish between climate and weather. [15]

Overall, users described the broad environmental terms as interlinked, reflecting overarching environmental concerns and conveying an important message. However, the perceived inadequacies of the terms caused users to believe they would be confusing and unhelpful for the wider public, causing concern rather than greater understanding. There were few recommendations for improved terminology, though more general terms such as âenvironmental damageâ were felt to clearly convey a message without implying potentially contentious scientific phenomena.

"Iâm not happy how the terminology is being applied to this. I mean you can call it environmental damage, I think that would be more useful. Cars cause environmental damage, but I wouldnât say that cars cause global warming or cause hurricanes. I donât think that is useful, because first itâs not true. So

far, we donât have the evidence to say thatâs true, and second, people will react to that information in a way that is not going to be very positive sometimes." [User interview, Southern England]

Users expressed concern that whatever terminology is adopted, how the terms are circulated and explained is central, with the aim of encouraging wider public engagement with current debates.

Non-users demonstrated similar understanding of the broad terms, albeit with a greater degree of confusion about the underlying science; some initial responses to the term climate change included âapocalyptic temperature changeâ, âArmageddonâ and âbetter weatherâ. However, there was greater cynicism amongst this group, particularly within segmentation A (die-hard drivers), around the causes and effects of environmental change, with a range of explanations including solar flares and natural climate cycles. Perhaps surprisingly, individuals in segmentation C (aspiring environmentalists) also described a similar degree of cynicism. Several respondents suggested that the use of the terms âclimate changeâ and âglobal warmingâ were deliberate scaremongering tactics by European governments used to justify perceived political agendas, such as restricting the development of other countries or increasing tax domestically.

"I still think theyâre banging on about [emissions] because they want to keep countries like China down and stop them progressing like we have, because theyâre 200 years behind us and they donât want them to catch up." [Non-user group participant, Southern England]

While users felt able to link these broad environmental terms with their own personal behaviour, they were less than optimistic about the general publicâs ability to do the same.

"I mean the issue is most people think well, you know, how does it affect me, and they’re not particularly interested in the issues, well not enough to actually realise that what theyâre doing does have an effect." [User interview, Northern England]

Indeed, non-users also discussed their feelings of powerlessness, with the terms provoking both fear and apathy.

"You hear about the hole in the ozone layer, you hear about the hole in the earthâs crust, you hear about all the icebergs melting and you think âhow much more depressing can it getâ so I tend to switch off and think âwell when it happens to me, I canât do anything about it anyway." [Non-user group respondent, Northern England]

The abstract nature of the terms, relating to both impact and timescale, along with the range of sometimes contradictory messages within the media, caused some respondents to avoid thinking about climate change and global warming.

Respondent 1: *"I think [the terminology] should be more important or made more aware of really so that people will stop and think twice and do something about it." [Non-user group respondent, Midlands]*

Respondent 2: *"I agree. I recognise all the terms but I donât know very much about any of them. I feel all the words weâve said theyâre all banded about but I bet if you actually ask people they donât really know what they mean and the effects of them enough. I donât think the message has come across enough." [Non-user group respondent, Midlands]*

Emissions-related terminology

In contrast to their more developed understanding of the broad environmental terms, users were less confident about their understanding of emissions-related terminology. Generally, they expressed a rudimentary understanding of emissions, in terms of perceptions of worst perpetrators, such as 4x4 cars and planes, emitting ânoxious gasesâ [16] . Respondentsâ ability to refer to greater scientific knowledge was limited. Similarly, non-users expressed greater confusion in relation to emissions, quoting examples of power stations and car exhausts as visual representations. When prompted, respondents from both groups were also able to link household energy usage with emissions.

There was confusion around the various descriptions of emissions, such as âCO2â, âcarbonâ, âcarbon dioxideâ, and âcarbon equivalentâ. For those with a greater understanding of the issues, the most widely used term, âcarbon emissionsâ, was felt to be misleading given the difference between carbon and carbon dioxide. Instead, references to âcarbon dioxide emissionsâ or âcarbon equivalentâ were favoured for providing greater accuracy. However, respondents recognised that in order to engage the wider public in debates around the issue, descriptive accuracy was less important than appreciating how our behaviour effects the environment. These views were replicated amongst both users and non-users, with participants generally preferring consistency over descriptive accuracy.

âCarbon footprintâ provoked initial confusion amongst non-users, some of whom took a literal understanding of the term.

"What is it, like black stuff?" [Non-user group respondent, London]

Following an explanation of the term, by researchers and/or resulting from group discussions, the term âcarbon footprintâ was generally felt by both users and non-users to convey an idea of personal emissions. The idea of a personal carbon footprint was linked to energy consumption and equated to an individualâs impact on the earth. For many, this was a positive term that was tangible on an individual basis and lent itself well to visual representation.

"When youâve got a footprint in the sand, you can see it. My interpretation of a carbon footprint would be the damage youâve already done. I think itâs about visualising what youâve done." [Non-user group respondent, Wales]

Despite their experience of off-setting, many users were unsure about the terms âcarbon neutralityâ and âcarbon off-settingâ. They were understood again in fairly simplistic terms, for example the perception of environmentally conscious rock stars planting trees to off-set their tours. Off-setting as a way of achieving carbon neutrality for specific situations, was seen as a way of assuaging guilt, or counteracting âunavoidableâ impacts of behaviour. It was recognised as a way of âgetting away with emissionsâ and not a long term solution.

Among non-users, awareness of the terms âcarbon neutralityâ and âcarbon off-settingâ was less common and there was a corresponding lack of understanding, although some non-user groups embarked on discussions about tree planting and energy efficiency, demonstrating at least rudimentary understanding of the issues involved in off-setting carbon emissions. Discussions of this kind included a range of views, both positive and negative, towards off-setting as a response to emissions.

Overall, users found this range of emissions-related terminology confusing and questioned the ability of the wider public to absorb and engage with these terms. They identified the need to simplify complex issues in order to engage the wider public without toning down the hard hitting scientific meaning behind the terms or ending up with a range of terms that leave people feeling as though they are âdrowning in terminologyâ.

"I'm never sure there's always such a need â¦ for so much [terminology] in the public arena. People have too much to think about." [User interview, London]

In general, these views were replicated amongst non-users. It was felt that these terms were often âbandied aboutâ, but rarely explained. For some, a lack of explanation was irrelevant given their views negating any personal responsibility for environmental issues. Others expressed an interest in hearing explanations but remained cautious about being âblinded by scienceâ. A third group emerged among the non-users who were resistant to hearing more as they felt pressurised into feeling guilty about the environment. For this group, the contradictory and constantly changing messages presented in the media were likened to food health scares - worrying, but having a diminishing impact due to perceived overuse.

"We are hearing it all the time, you get beyond the stage of thinking âI should be interested in thisâ to the point where you think âoh God not againâ. I wonât lose sleep over it, but I naturally want to know what is happening, but not twenty four hours a day." [Non-user group respondent, Northern England]

Figure 1: Summary of attitudes to environmental terminology

	Positive aspects:	**Negative aspects:**
âGlobal warmingâ	Familiar	Old fashioned Misleading Abstract
âClimate changeâ	Familiar Current	Misleading Abstract
âCarbon emissionsâ	Able to visualise	Unfamiliar Misleading
âCarbon footprintâ	Conveys personal impact once understood	Unfamiliar
âCarbon neutralityâ	Thought provoking	Confusing Technical
âCarbon offsettingâ	Thought provoking	Confusing Technical

In response to these views, non-users were asked how they related these terms to personal behaviour. [17] Overall, cutting emissions was seen as involving a degree of sacrifice in relation to current lifestyles. The perceived degree of sacrifice required emerged as intrinsic to participantsâ acceptance or rejection of personal responsibility and any subsequent behaviour change. For some participants, extreme interpretations of behavioural changes sought by government initiatives demonstrated the potential for confusion and resistance in this area.

"I think [politicians] would be happy if we did away with cars, did away with holidays and just sat in the dark in the house with absolutely nothing. [Non-user group respondent." Northern England]

Whilst some respondents were willing to make small changes to their lifestyle, potential emissions reductions from such actions were perceived as relatively insignificant, particularly if larger emitters are not held to account. This feeling of unfair environmental burden-sharing led to claims of households being penalised for something that should be the responsibility of industry, or the state, or the world as a whole.

"There is no point in penalising us if nobody else is going to adhere to it." [Non-user group respondent, Wales]

In spite of these views, subsequent discussions with non-users highlighted that even the most cynical respondents, particularly within segmentation A (die-hard drivers) were happy to engage in other environmentally friendly behaviour - recycling, buying organic food, turning off unnecessary lights - although these were not often considered to be explicitly environmentally friendly, but rather a cost saving exercise, health benefit or fitting in with socially acceptable behaviour. The indirect environmental effect was seen as âdoing our bitâ. The concept of changing travel behaviour was viewed differently to that involving change in behaviour in the household, thus highlighting the uniqueness and salience of travel as a behaviour that is particularly resistant to change. [18]

"Itâs like being a hypocrite isnât it. You are doing all these things around the home but you think nothing of jumping in your car." [Non-user group respondent, Southern England]

Personal carbon emissions quantification and measurement

Users and non-users were asked about their awareness and understanding of how carbon emissions are measured and quantified. Most users felt they either knew or could guess how carbon emissions are quantified, in grams, kilograms and tonnes. In contrast, non-users were less confident, describing confusion around measuring gases in terms of weights and volumes.

Irrespective of the level of awareness of quantities of carbon emissions, both users and non-users had a limited grasp on how these quantities could be understood. The idea of visualising a quantity of gas was difficult for people to comprehend.

"The units mean absolutely nothing, like you canât imagine a tonne of carbon, or how much space that would fill, or what damage that will do. It is completely abstract really." [Non-user group respondent, London]

Whilst participants questioned the relevance of an abstract measurement, some users felt that as long as standard units were used consistently, understanding would evolve over time, as had occurred with other âinvisibleâ measurements such as megabytes and calories. However, a section of respondents in both groups claimed that abstract measurements only become meaningful when applied relative to something else, for example, continuing the calories metaphor, in relation to a recommended daily intake.

Participants were asked to suggest more meaningful ways of expressing quantities of carbon emissions. Both groups came up with a similar range of options:

- *Judgement* - provide measurement in relation to an assessment of acceptable and unacceptable levels, such as illustrated by a traffic light system, or high/low fat food labelling;
- *Impact* - indicate the related level of environmental damage caused by the emissions, or conversely, the positive difference made by changing behaviour;
- *Target allowance* - indicate proportion of targeted personal emissions allowance used up by the measurement, along the same lines as calorie counting and alcohol unit limits;
- *Social comparison* - indicate how this measurement compares to other groups of people, whether locally, nationally or globally;
- *Energy equivalence* - provide measurement in relation to equivalent energy consumption of an identifiable household appliance, such as how many boiled kettles that equates to;
- *Volume visualisation* - provide measurement in visual terms showing the volume of emissions in terms of an identifiable alternative, such as how many hot air balloons that equates to;

Respondents were unable to recall good examples of carbon emissions presentation, however, the concept of relating an abstract measurement to understandable real life examples was seen as crucial. One respondent commented on the success of recent government television adverts, such as one describing the effects of leaving the tap running when brushing your teeth being equivalent to wasting a lake of water.

"You can understand it because you can relate to itâ¦ so yes if I run this, wow itâs the equivalent to putting so much water out or whatever, or half a lake or something. You can get a sense of the dimension I think." [User interview, London]

The preferred method of carbon emissions presentation for both groups was through mainstream television or through school education to get the message to children before they settled into consumer habits. [19] Respondents stressed the importance of not being talked down to or patronised, but that presentations should be as simple and clear as possible.

Issues relating to accuracy and reliability of carbon emissions measurement and calculation did not emerge without prompting. However, both groups acknowledged the complexity of measuring emissions. For some, the perceived complexity was such that they were willing to trust a rough estimate from an official source, whilst others preferred to be able to calculate their own emissions and felt that unless accuracy could be achieved there was no point attempting the calculation. Despite this, accuracy emerged as less important to participants than other factors, such as understanding the issues and associated terminology.

Summary

There has been a recent growth in public awareness about climate change, but this has not necessarily led to greater understanding of the science behind climate change or peopleâs ability to relate such issues to individual behaviour.

Common terminology, such as âclimate changeâ and âglobal warmingâ, were recognised and felt to convey a broad message about environmental problems, yet a lack of understanding combined with often contradictory media coverage provoked confusion and cynicism.

Emissions-related terminology was less well recognised and was felt to be confusing. However, once explained, people were able to relate such terms to their personal behaviour. Extreme perceptions of personal behaviour change sought by government initiatives highlighted the potential for confusion in this area.

People were generally unaware of how carbon emissions are quantified and measured. Abstract quantities were felt to be meaningless, unless related to something more tangible, such as social norms, target emissions or environmental impact.

[14] For simplicity, from this point forward stage two participants will be referred to as âusersâ and stage three participants as ânon-usersâ, in relation to their use of carbon calculators prior to participating in the research (see section 2 re methodology).

[15]The difference between weather and climate is a measure of time. Weather is what conditions of the atmosphere are over a short period of time, and climate is how the atmosphere ;behaves; over relatively long periods of time. NASA definition - http://www.nasa.gov/mission_pages/noaa-n/climate/climate_weather.html

[16] NB Participants were not aware that CO2 is not defined as a ânoxious gasâ

[17] See section 6 for information about how participants were able to link their personal behaviour to emissions and climate change.

[18] See section 7.3 concerning the uniqueness of travel behaviour change.

[19] These views were given before carbon calculators were raised in discussions as a potential presentation tool.

Views on carbon calculators

All stages of the research included an exploration of peopleâs views on carbon calculators. In the stakeholder meetings, interviewees were asked about their experience of developing and managing on-line carbon calculators (where relevant). In-depth interviews with users focused on their experience of carbon calculators, both in terms of what motivated them to use one and their assessment of the tools they had used. Finally, the reconvened discussion groups with non-users explored participantsâ views of carbon calculators, initially based on theoretical discussions, and then following a practical session in which participants experimented with various on-line sites, were asked their views about the process of using a calculator and their assessment of the various features of a calculator. This section will summarise the

findings from each of these stages of research. Reactions to carbon calculators will be considered in the following section.

Calculator development and management

Five of the eight stakeholders were either running or in the process of setting up an on-line carbon calculator. Of the remaining three stakeholders, two were environmental communication organisations who had supported the development of carbon calculators in other organisations. All of these stakeholders were asked about their experience of developing and managing on-line carbon calculators. [20]

Motivations for establishing a calculator ranged from consumer education and market leadership to altruism. Two commercial organisations, anticipating growing environmental awareness among their consumer populations, developed carbon calculators as a way of improving brand image and staying ahead of their respective industries by taking a lead on the issue. In contrast, a small carbon offset provider embarked on calculator development after watching a documentary about emissions and realising a gap in the market for comprehensive personal carbon emissions calculation.

Perhaps indicative of the early stages of carbon calculation, only one of the organisations with an on-line carbon calculator embarked on research prior to development. The majority of the research conducted by this organisation was aimed at identifying and characterising target groups, which emerged as a key issue for all the stakeholders. The remaining four based their work on assumptions, common sense and previous experience of communicating environmental messages and website development.

All stakeholders were aware of their user populations, whether these were acquired by deliberate targeting or were indirectly realised. One organisation targeted their calculator at mainstream usage, deliberately ignoring both extremes of ânot interestedâ and âalready fully awareâ, based on the assumption that these groups were unlikely to engage with their tool. The carbon offset providers acknowledged that their customer base were the âalready convertedâ in environmental terms, being recruited through either environmental concern or indirectly through business clients. Without independent large-scale advertising these off-setting organisations were dependent on rising levels of awareness among the population and word of mouth.

"Weâre aware that we only catch the lowest hanging fruit, but things are changing." [Stakeholder]

In contrast, the research conducted by one of the commercial organisations identified specific segments of the population who were assumed to be the most receptive to carbon calculators. Initially two potential segments were identified - referred to in short hand as âthe eco-friendlyâ and âthe uninformedâ - which together formed 50% of this organisationâs customer base. Further research highlighted that the former group would be more resistant to campaigns, believing themselves to be already aware and more opposed to commercial approaches in this area. TGI [21] research into the âuninformedâ group produced a range of characteristics (typified as a female Daily Mail reader), which enabled the organisation to design their calculator with this more receptive group in mind.

Overall, interviews with all eight stakeholders highlighted the need for targeted environmental campaigns, whether aimed at the already environmentally aware or harder to reach groups. If the goal of the campaign is to achieve widespread change, either in awareness or behaviour, stakeholders felt that previous experience has demonstrated that a narrowly focused approach tends to reach only a small group of already environmentally aware individuals. To reach the wider population, campaigns need to appeal to

the values and motivations of different groups.

One stakeholder referred to the work of 1950s psychologists that identified why certain people react in different ways. [22] A simplistic breakdown of this research identified three main groups - pioneers, prospectors and settlers - all with different values and motivations. Based on this assumption, any campaign aimed at achieving change would need at least three different strategies to appeal to each segment. An example of different strategies might involve associating reducing emissions with different emotional triggers - being desired, i.e. making environmental behaviour a socially desirable status (prospectors); feeling belonging, i.e. making environmental behaviour a social norm (settlers); saving the planet, i.e. making environmental behaviour a worthy goal (pioneers) - each of which would need to be built into the design and marketing of any campaign.

Motivation of users

Interviews with users explored peopleâs motivation for completing an on-line calculation. Before drawing conclusions from these findings, however, it should be noted that the characteristics of âusersâ in this study need to be acknowledged as potentially unique to a small proportion of the population. According to a Halifax survey, only 10% of the population would consider making a financial donation to offset their travel carbon emissions. [23] The respondents in this group are yet more unique given that they were sourced through an off-setting provider organisation. Off-setting involves a different process to simply measuring emissions, as it provides a calculation in both emissions and monetary terms, in some ways offering a âsolutionâ to the problem and providing a specific purpose for visiting the site. The findings from this group therefore highlight a very unique section of the population.

Broadly, participantsâ motivations fell into two areas - those who felt unable or unwilling to alter their emissions behaviour and therefore used the off-setting calculator to alleviate environmental guilt; and a second group driven primarily by environmental concerns, using the calculators to assess their behaviour with the aim of reducing emissions where possible and offsetting where not possible. In terms of travel behaviour, these groups can be considered âguilt offsettersâ and âemissions reducersâ respectively.

A more detailed breakdown of respondentsâ motivations for using a carbon calculator included for curiosity or fun, to signal to the market that people are willing to pay for environmental damage, and the concept of âdoing somethingâ to combat environmental problems.

Features of carbon calculators

This section draws on the experiences of both users and non-users of carbon calculators, assessing specific features and components of carbon calculators. The features are broken down into broadly front-end and back-end sections of a carbon calculator. The front-end features include the initial presentation of the website, as well as calculation input requirements, whilst back-end features include calculation results and follow-on actions and advice.

Users were asked to draw on their previous experience of carbon calculators, whilst non-users were taken through a practical session involving two on-line calculators (see appendix 1.2 for materials used in focus groups). Discussions were also prompted using a range of screen shots of existing calculators.

The range of calculators used within this research highlights some of the differences between existing tools. The two examples that were used for the practical session were the Department for Transportâs âTransport Directâ site - primarily a journey planner with the option to calculate emissions for specific journeys; and the governmentâs current âAct on CO2â site - an end use calculator designed to capture a wide range of personal emissions related information and provide an action plan to encourage environmental behaviour change. [24] In addition, the screen shots used during group discussions included sites whose main purpose is public engagement and raising awareness of carbon emissions, such as the âAct on CO2â calculator, as well as sites aimed at facilitating or enabling the purchase of an offsetting product, such as that used by respondents in stage two (users).

Front-end features

Graphics

Graphics featured on most of the carbon calculators explored in this study, including cartoon images as well as detailed illustrations of complex issues (see figure 2). Respondentsâ assessments of different graphics varied, from feeling patronised by childish images to appreciating the use of amusing images to indicate a more relaxed approach.

Figure 2: Transport Direct [25]

Respondents were also mixed in their assessment of cartoons as opposed to photos, with some preferring the informal nature of cartoons and animations, such as those employed in the âAct on CO2â and âTransport Directâ sites, whilst others preferred the clarity of photos, focusing the mind on specific information requirements, such as examples of small, medium or large cars (see figure 3).

Overall, respondents preferred simple graphics, reaching a balance between engaging and distracting attention, providing useful illustrations without cluttering the page, and indicating fun without losing the thrust of a serious issue.

Text

Figure 4: WWF [26]

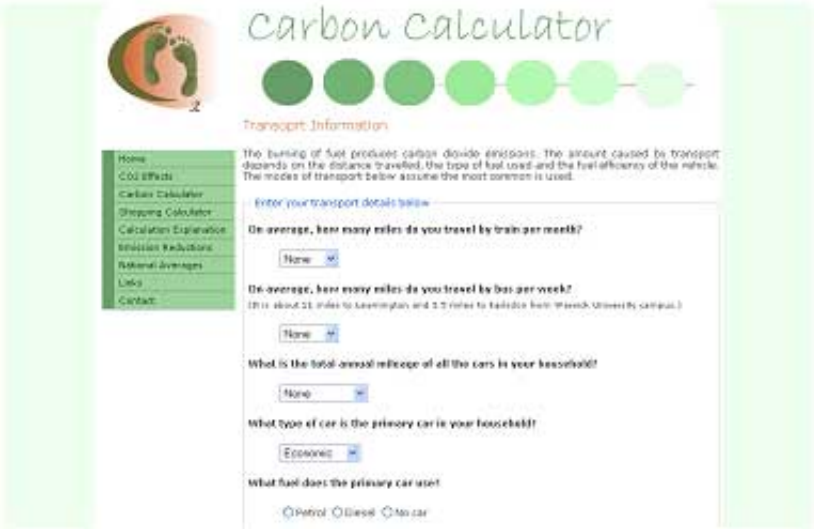
Simple fonts in large sizes were generally preferred. Elaborate fonts caused problems for some, particularly older participants who experienced difficulties making out smaller text in paler colours or confused by non-standard fonts. The need for calculators to perform in line with the norms and expectations people have of other websites is vital.

"There were a couple of bits [of text] which looked like they were greyed out. âCos if you use computers all the time, things that are grey you canât click on, but when you went over it, you could click on it, and you thought, oh, cos it was quite dull wasnât it." [Non-user group respondent, Southern England]

Despite this preference for simplicity and clarity, respondents also expressed a desire for sites to stand out from typical work-related screens, avoiding basic text in black and white. The overall impression of the site should be professional yet eye-catching. In particular, respondents highlighted the âAct on CO2â site as encapsulating this clear but fun approach.

Colours

Figure 5: Warwick University [27]



The most important aspect for participants in relation to colours emerged as being a consistent colour scheme, clearly identifying the site as distinct from other sites and flowing through all relevant sections. Separate colours for different sections of a single page caused confusion and led to participants ignoring less central areas on the page.

Layout

Figure 6: Climate Care [28]

Screens that were divided into sections or requiring the user to scroll down or across caused confusion, with participants tending to skip perceived peripheral sections. A ânatural flowâ through the calculation was considered ideal, with the user being taken through the process without having to search for the next step.

"You have got so much going on it absolutely puts me offâ¦ The other one is straightforward you know, your eye level is actually going straight down, and when you have got things going on either side it just puts me off. "[Non-user group respondent, Northern England]

Language

Participants preferred sites using simple âpunchyâ English rather than jargon or technical language. In reference to calculation questions, respondents were more likely to read and therefore answer a question that was phrased in terms of behavioural rather than technical language. For example, participants in one group queried a siteâs blunt phrasing of âAnnual car mileageâ above an input box.

Respondent 1: *"Number one is terrible. It is just like youâre applying for a loan. It uses really formal language like âannual car #No 1 mileageâ, you know."*

Respondent 2: *"Yeah, why not just use plain Englishâ¦ like âhow many miles do you drive each year?'"*

[Non-user group respondents, Southern England]

Measurements and abbreviations were also criticised, with participants uncomfortable with the use of perceived jargon, such as kw (kilowatts), MPG (miles per gallon) and ârenewablesâ (renewable energy sources).

"To me it's like thereâs a load of really intelligent men that have put these together and theyâve wiped out your average normal person. They think everybody has got super brains and will understand it automatically and we donât. "[Non-user group respondent, Northern England]

Users, who were generally more comfortable with the language associated with these areas, were aware that wider public engagement depended on a balance being found between âdumbing downâ and âgoing above peopleâs headsâ.

Input information

As mentioned above, participants preferred questions phrased in behavioural terms rather than ârâ or technical terms. Questions that were surprising or thought provoking were welcomed, as they helped people to envisage more positive behaviour and activities.

"It was questions like how often you use a washing machine and how many light bulbs you have got and that was getting the thought process going, because I didnât realise that there are a couple of lights you really donât need to use. "[Non-user group respondent, Northern England]

In contrast, unrealistic questions, such as annual bus or train miles, were off-putting and participants felt they would not bother to attempt such questions. Yet the idea of simple questions being sufficient was also queried, with the use of averages or too basic questioning going against an accurate personal calculation.

"Itâs just an average and itâs not your particular average so itâs not your carbon footprint. So the answerâs not correct." [Non-user group respondent, Scotland]

While participants were unlikely to attempt calculators that required âhomeworkâ or preparation before completion, they were also keen to have an accurate and personalised calculation. Participants highlighted calculators that were able to ask detailed and personalised information without causing confusion. One method was to offer two versions of the calculator - a simplified version based on behavioural questions, and a more detailed version requiring some knowledge from bills or other documents, as offered by the âAct on CO2â site. This was felt to accommodate different requirements and was particularly appealing to users, believing that the majority would not be prepared to complete a detailed calculation.

"There is a point beyond which extra complexity defeats the principal purposeâ¦ Increasing layers of complexity should be something you buy into as opposed to something you have to wade through." [User interview, Scotland]

Yet participants felt that even a simplified version should contain enough detail to provide a personalised calculation. From the examples explored with non-users participants identified existing methods of combining simple questions with detailed information. In particular, the use of tick boxes and drop down menus were felt to be easier to deal with than text boxes. For example, the option of selecting the make and model of a car from drop down menus, rather than typing in specific details about a carâs MPG. Additionally, the âdonât knowâ option was valued by participants, who felt they would be more likely to give up on a site if they were not confident about the options on offer.

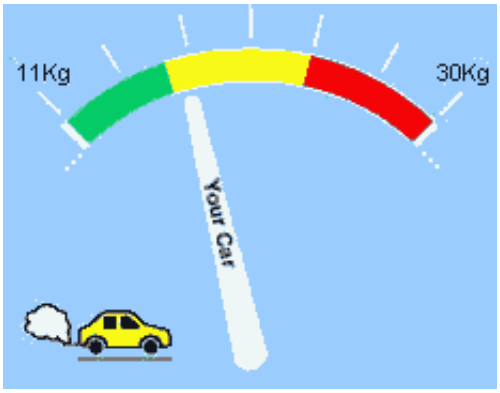
Back-end features

Feedback

As considered in section three, abstract measurements of carbon emissions lack meaning for many. The need to contextualise measurements in understandable terms was once more raised by participants. From the range of existing on-line tools, participants considered a number of different possibilities for presenting calculation results. Several of the options mentioned in section three were once again discussed by participants as offering more meaningful feedback.

(i) Judgement: Presenting results in terms of a good/bad judgement was felt to be simple and effective, with participants highlighting good examples, such as Transport Directâs gauge indicating varying levels of emissions on a colour scale ranging from green (=good) to red (=bad) (see figure 7).

"They should do that for your end result, like if you have got a good score, like your score comes up in green with a picture of an oak tree or something, or a rain forest."[Non-user group respondent, London]



Yet the simplicity of this approach was criticised by some participants who questioned the morality of implying that some emissions could be considered âgoodâ. In addition, the âjudgementâ was perceived by some to be arbitrary and more demanding users expressed a desire for clear justifications behind the assessment.

(ii) Impact: Several participants commented on the hard-hitting nature of presenting results in terms of resource consumption. For example, one site presented results in terms of the number of planet earths that would be required to sustain the population at the user's personalised emissions rate. For many this was a shocking finding, underlining the environmental message behind the calculation.

"I thought that was quite simple for somebody like me to understandâ¦ Itâs the strongest message of all of them isnât it?" [Non-user group respondent, Wales]

However, this broad theoretical approach was confusing for some participants, who preferred a more realistic presentation that they could relate to their personal experience, for example, equating units of carbon emissions to their equivalent household energy use, such as 100 kg carbon emissions = leaving the car running for 47 hours non-stop. [29]

(iii) Target allowance: Another approach that participants reacted positively towards featured results in comparison to either a national average and/or a target for emissions (see figures 8 and 9). In both cases participants were either shocked or pacified to discover their relative position. Where results were relatively low, participants questioned the motivation for increasing their environmentally-friendly behaviour. In contrast, if results appeared to be relatively high, some participants reacted negatively, assuming any attempt to achieve the target would require too large a shift in lifestyle.

Figure 8: Act on CO2 [30]

Figure 9: Act on CO2 [31]

Finally, participants stressed the need for a range of actions that are easily achievable. Tips for behaviour change should always be practical and realistic.

"Some [suggestions] arenât practical. Switch to a smaller carâ¦ I canât just go out and buy a smaller car. It's like, I'm stuck with the car Iâve got until it blows up and then I have to go and find some money to buy another banger, but I do think [carbon calculators] are a good idea." [User interview, London]

Calculation information

How do you estimate my car's CO2 emissions?

[32]

Interviews with stakeholders revealed that information screens are visited less frequently than expected, and much less frequently than other pages associated with the calculator.

"You donât really want to know about the mathsâ¦ Itâs simplicity I think that people want. They donât want another element to their life that is more complicated and just adds a layer of complexity." [User interview, London]

In spite of this preferred ignorance, when participants were prompted further they expressed strong views about what should and should not be included in the calculation. Views were split as to whether calculations should include indirect emissions. In the case of travel calculations, some participants were adamant that emissions resulting from maintaining the road network or road lighting should not be included as they were powerless to affect change in those areas. Others maintained that it was important to acknowledge some individual responsibility for these communal services, but that the results should be provided separately so that the original calculation was still a personal result. However, exploring one calculator that included indirect emissions separately had negative effects on some participants, who noted that the relatively high proportion of indirect emissions, about which they felt powerless to change, made them feel there was little point in trying to change their behaviour.

"The things you can’t control, the effect they have is huge and the effect of the things you can control is tiny and I think sod it, it’s not worth it. The little bit I can do isn’t going to make anywhere near as much difference as the stuff I can’t." [Non-user group participant, Southern England]

Overall it emerged that participants would prefer to assume that the calculation is accurate and have the option to explore what is or is not included in the calculation, although this is unlikely to be used by most participants. Where this further information is provided it should be explained in simple terms, avoiding complicated formulae that people will skip if they cannot understand.

Time taken

Before using a carbon calculator, non-user participants were asked to estimate how long they would be willing to spend working out their personal carbon emissions. Whilst some said it was something they would not be interested in doing, particularly respondents from segmentation A (die-hard drivers) others compared the activity to an on-line survey on which they might consider spending 5-10 minutes at work.

Having explored some of the existing calculators in a practical session, participants from all segmentations were more discerning about what they would and would not be willing to spend time on. Generally, participants were more willing to spend time on sites that were considered to be fun. Sites that looked busy and complicated at first glance provoked impatience, whilst sites that were simple and attractive produced greater enthusiasm.

"If it isn’t fun to use or it’s not interesting to use you get part-way into it and, oh I’m not interested in this, and you just quit the site and go on and do something else, but [if itâs fun] it makes you want to stick at it." [Non-user group participant, Midlands]

The flow of the calculation process was central to users persevering with a site. Participants from both users and non-users preferred a natural flow of a site, without having to scroll down or across pages. Participants also felt they were more likely to persevere if they knew how far along the process they had gone, although several failed to notice the process bars on some existing calculators.

Accuracy and reliability

As with participantsâ interest in calculation information, participants generally expressed a preference for assuming accuracy of the sites.

"I’m most unlikely to check the mathsâ¦ I mean you could blow your mind trying to work it out. I think you have to take a fairly robust approach. You could blow your mind trying to work out have you got the cheapest train ticket. At the end of the day you think Â£15 that sounds about right. Itâs the same kind of thing." [User interview, London]

The complexity of emissions calculations was acknowledged by participants, who assumed a link between the level of input required and the accuracy of the calculation. In particular, sites that made extensive use of averages or simplified information - such as average annual mileage, size of car broken down into small, medium and average - were considered to be less accurate than sites asking for specific personalised information. In contrast, (and as considered above in the section on âcalculation informationâ) participants were unlikely to dwell upon the actual calculation method and implicit assumptions involved in the calculation, unless specifically prompted.

When asked about the reliability of a site, users were more concerned with the reliability of the projects associated with off-setting their emissions. When prompted about the reliability of calculation results, both users and non-users noted the variety of results from different calculators. Despite acknowledging the differences between input information and the complexity involved in calculating emissions, both groups stressed the importance of consistency in calculation methods. Both sets of participants suggested that standardised data and methodology, preferably visibly identified as governmental information, would increase the perceived reliability of sites.

Summary

Stakeholders had largely embarked on carbon calculator development with limited research. One factor considered important to calculator development was identifying target populations and designing calculators (often based on common sense) with that population in mind.

Users’ motivation for visiting a carbon calculator centred around âdoing somethingâ in relation to climate change, involving either researching carbon reduction methods and/or off-setting emissions.

Practical sessions with on-line carbon calculators enabled previous non-users to identify key features of a successful site, including:

Illustrative and fun graphics

Sparse and simple text

Bright, consistent colour scheme

Clear layout

Everyday language

Simple yet personalised information requirements

Meaningful and understandable results

Personal and realistic follow-on action

Available but discrete calculation information

Succinct process

Accuracy and reliability of results was not a main concern, although people tended to equate the level of input detail required for the calculation with both accuracy and reliability. Standardised calculation methodology, perhaps identified by a government kite mark, was felt to be the best method for improving user confidence.

[20] The final stakeholder was an environmental consultant with no direct experience of carbon calculators. The interview in this case focused on communicating environmental information, and findings have been included elsewhere in this report.

[21] TGI provides media and marketing data to understand market segmentations and consumer motivations.

[22] Riesman D, Denney R, Glazer N, The lonely crowd: A study of the changing American character. New Haven. CT: Yale University Press, 1950

[23] Cited in Woodward W, ;MPs investigate carbon offset projects; The Guardian, 11th January 2007.

[24] It should be noted that the version of the âAct on CO2â calculator used in this research was still under development and has since been updated.

[25] DfTâs âTransport Directâ site -www.transportdirect.info

[26] WWFâs âFootprint calculatorâ -http://footprint.wwf.org.uk

[27] Warwick University Carbon Footprint Project Group http://www.carboncalculator.co.uk/

[28] Climate Care http://www.climatecare.org/

[29] Figures from Lastminute.comâs Carbonwise initiative:
http://www.lastminute.com/site/travel/climatewise

[30] âAct on CO2â site - http://actonCO2.direct.gov.uk/index.html

[31] âAct on CO2â site - http://actonCO2.direct.gov.uk/index.html

[32] DfTâs âTransport Directâ site -www.transportdirect.info

Attitudes towards personal carbon emissions information

After considering some of the specific features of carbon calculators in communicating personal carbon emissions information, participants were asked to consider the role such information might play in affecting their understanding, attitude and behaviour with regard to carbon emissions generally. This section explores participantsâ reactions to using carbon calculators and how people might be encouraged to engage with these tools. Finally, this section considers how personalised carbon emissions information relates specifically to travel behaviour, drawing on respondents assessments of the role such information might play in relation to other key factors involved in their travel decision-making.

Reaction to using a carbon calculator

Interviews with users and non-users explored reactions to completing a personal carbon emissions calculation in terms of the impact on their understanding, attitude and behaviour in relation to their personal contribution towards climate change.

Impact on understanding

Prior to using a carbon calculator, non-users from all segmentations [33] were pessimistic about the potential for carbon calculators to have an impact on their understanding of personal carbon emissions. This was partly a result of their limited understanding of the role of a carbon calculator, with early assumptions including a household device measuring carbon dioxide in the air, but also partly an assumption that calculators are ânot for usâ. Several participants expressed the thought that only people who âfaff aboutâ on the internet would be interested in carbon calculators. Generally, carbon calculators were not felt to be aimed at ordinary people, or as one respondent put it, they are for âpeople who donât watch Coronation Streetâ.

After experimenting with a range of calculators as part of this research, non-users from all segmentations were able to draw on their better understanding of carbon calculators and were therefore better able to judge their potential impact. Despite claiming that some of the calculation findings were âobviousâ, such as that small cars emit less than larger cars, participants also mentioned being surprised and even shocked by some calculation findings, such as comparisons with national averages or target emissions. As a result, this previously inexperienced group felt they were made more aware and had a greater understanding of the issues involved in carbon emissions. These findings did not vary significantly between the different segmentations.

In contrast, research with users highlighted a greater level of understanding prior to engaging with a carbon calculator. In this case, users were either confident of their understanding and consequently were not interested in exploring the results other than to offset, or were surprised by the level of emissions in spite of their assumed understanding and therefore made more aware of the scale of their personal emissions.

Impact on attitude

When asked their views on calculating personal carbon emissions prior to experimenting with existing tools, non-users were again negative about the role of carbon calculators in affecting their attitude towards carbon emissions. Participants across all segmentations were resistant to exploring emissions for a number of reasons, including the belief that the results would be depressing and would make them feel guilty about behaviour they felt was difficult to change. Respondents also stated assumptions that the issues involved were âboringâ and âobviousâ, and any calculation would not stimulate interest in this area.

Those respondents that did express an interest in calculating their emissions invoked a contrasting argument, that it would be interesting to locate their emissions in terms of others, along the lines of a magazine survey. However, this was expressed in terms of one-off novelty rather than stimulus for attitude change. If emissions results were linked to either money savings or practical tips and presented in a meaningful way, this was felt to improve the impact of using a carbon calculator. Again, there was no significant difference between the segmentations.

After going through the process of using a carbon calculator, non-users had a slightly more positive outlook. Once again, surprising or shocking results led some participants to review their attitude and to seek ways to improve their results. However, this effect was undermined for some respondents who maintained that financial concerns exceed and to some extent negate environmental responsibility - this view was particularly prevalent among segment A (die-hard drivers).

As with the perceived impact on understanding, discussions with users revealed that experience of using a carbon calculator had a limited impact on their attitudes. Once again, this group expressed themselves as âalready convertedâ and believed that only those not aware of the environmental impact of personal behaviour, or the âmiddle of the spectrum of the populationâ would be affected by this process.

Impact on behaviour

Prior to experimenting with a carbon calculator, but with an understanding of their purpose, non-users were also asked how they thought their behaviour might be affected by calculating their personal carbon emissions. Again, they were largely negative about potential impact, with explanations including a resistance to implied lifestyle changes, or a perceived lack of alternatives preventing any potential for behaviour change. In addition, participants expressed the view that environmental concerns were a government or commercial responsibility, rather than a personal responsibility.

Among non-users, participants who believed that calculating their carbon emissions might result in at least limited behaviour change explained that if their results were presented as being outside acceptable levels, and simple and practical advice for change was provided requiring limited lifestyle change, then they would be more likely to aim to improve their emissions behaviour.

The same question was put to non-users after their practical session with existing calculators, and the views expressed previously re-emerged. Whilst participants appeared more willing to consider adopting small behaviour changes, such as fitting energy-saving light bulbs and taking appliances off standby, in relation to larger behaviour change the impact of having used the calculators was felt to be limited. This was particularly pertinent in relation to travel behaviour, where participants were resistant to lowering emissions by substituting car use with public transport. Factors such as cost, speed, availability and âconvenienceâ were cited as overriding concerns that would limit action to reduce their carbon emissions.

This view was expressed across all segmentations, although there appeared to be a difference between urban and suburban/rural respondents, with the latter justifying their reticence by perceived limitations to travel alternatives in their area.

Similar views were expressed during interviews with users, some of whom cited carbon offsetting as a way of circumventing the need for undesirable or difficult behaviour change. In addition, as with impact on understanding and attitude, users felt that carbon calculators would have a limited impact on their behaviour given their engagement with the issues prior to ever having used a carbon calculator.

"I wouldnât probably say [Iâve changed my behaviour] as a result of using the tool itself, but certainly as a result of global warming and my response to that, and these tools have been a part of it definitely." [User interview, London]

In spite of these limitations, users implied that carbon calculators were useful reminders to limit emissions where possible and to âfeel it in the pocketâ where not possible.

Engagement with carbon calculators

Both users and non-users were asked what they thought might encourage people to use carbon calculators. Before experimenting with existing calculators, non-users were not convinced that they would want to spend time on a carbon calculator.

"Most people live such complicated lives that we are not going to start working out our carbon calculations everyday. Any mother with two children does not have time to deal with that." [Non-user group participant, London]

Indeed, cynicism around the purpose of carbon calculators and environmental campaigns in general, lead some participants to question the purpose of calculating carbon emissions.

"Donât you think the Politicians are flogging a dead horse with this carbon emissions thing? I think that they are. I think they are flogging a dead horse. They are trying to raise it for the next general election and I think there are many more important issues that people in this country have got to consider rather than carbon emissions." [Non-user group participant, Northern England]

However, the process of using a carbon calculator lifted some of that cynicism, and when the question was put to them again, similar views to those of previous users were expressed. Both sets of participants were not optimistic about the general public engaging with calculators purely for environmental reasons. Instead, participants felt that incentives, such as money and fuel savings, health benefits, or supermarket vouchers linked to completion might attract people to calculate their emissions. In addition, improved site credibility through standardisation or government approval of calculations, combined with quality design would further improve how calculators are perceived.

One factor that both sets of participants highlighted as crucial to encouraging calculator usage was raising awareness of their existence.

"Otherwise you wouldnât even think there were things out there like that. So you have to be made aware of the problem and the resolutions and anything else in betweenâ¦ We can’t do that if we donât know about it. It’s about awareness." [Non-user group participant, Southern England]

One approach for raising awareness, cited repeatedly by non-user participants, was to add information about carbon calculators to better known campaigns, such as the governmentâs television campaign featuring adverts with suggested behavioural changes, such as switching off lights and recycling.

"Itâs quite good, cos they are always like subliminal reminders arenât theyâ¦ because eventually it gets through whether you are conscious of it or not." [Non-user group participant, Southern England]

When asked what factors they would consider in choosing which calculator to use, again participants stressed the importance of good design, reiterating many of the discussions about graphics, layout and language considered above. Participants also felt they would prefer a site that had been recommended to them or that followed on from another activity, such as a journey planner or electricity bill reading. An obvious agenda for the site, such as asking for donations or campaigning was seen as off-putting, with participants preferring more neutral informative site. [34] For both sets of respondents, the presence of sites on key search engines was also felt to play a role in calculator selection.

Role of calculating carbon emissions in terms of travel behaviour

All participants were asked to list and prioritise the factors considered when making travel decisions - for non-users this occurred prior to experimenting with carbon calculators. The key factors that emerged for both sets of respondents were time and cost, with comfort, convenience (in terms of independence, reliability and flexibility), health (including safety), and lack of alternative transport options featuring as secondary concerns. In both sets of participants, environmental concerns such as pollution and emissions were raised, but acknowledged as less of a priority than other considerations.

Differences between journey purpose and destination were explored, revealing that short, more regular journeys, such as travel to work, were more dependent on time and cost than less regular journeys for leisure, where participants appeared to be more willing to sacrifice time and cost for comfort and convenience, and in some cases for environmental concerns. The idea of work-related travel being a necessity and therefore more inflexible to emissions-driven behaviour change than leisure travel also emerged among non-users. Non-users expressed a higher level of guilt about travel behaviour after calculating their emissions, but were uncompromising about necessary travel.

"In my social travel [emissions information might have an impact] but â¦ if youâve got be somewhere at a time and have deadlines, you really look at the efficient and fast way of getting there." [Non-user group participant, London]

Journey destination also emerged as an important factor in transport decision-making, with journeys into large urban areas more likely to involve public transport, whilst journeys to more rural areas more likely to involve car use.

"It depends where I’m going. If I’m going into town I use public transport. If I’m going out of town Iâll drive or get a train because the further you get out of London the harder it is to get anywhere by bus. Iâll usually drive my car. It tends to be driving is the cheapest and easiest option." [User interview, London]

This dichotomy between rural and urban locations played an important role in separating participantsâ views, with respondents living in either rural or urban locations displaying more similarity in their travel behaviour within these groups than within their segmentation according to environmental and car preferences. In general, participants from rural locations expressed less concern about environmental

issues than those from urban locations. Possible explanations for this behaviour lie in the perceived lack of alternative transport options available to people, in line with less visibility of the air pollution and less immediate short-term impact compared to urban areas.

In the reconvened groups, and therefore after having considered some of the issues relating to carbon emissions, non-users maintained that time and cost were still key factors for travel decision-making, but were able to consider situations where carbon emissions might achieve a higher influence on travel behaviour. Primarily, where cost and time factors for a specific journey are similar across different modes of transport, participants felt they were now more likely to consider emissions as a factor. However such a situation was perceived as unlikely given their perceptions about transport options and associated costs.

"90% of people can’t change the way they live. Theyâre governed by how their lives work, their children to take to school, their work routine, so they can’t change." [Non-user group participant, London]

In spite of this negative assessment of the perceived influence of carbon emissions information on travel planning, a number of alternative reactions were noted that implied a more positive outcome. As a result of exploring their personal carbon emissions, participants in the non-user groups felt that they were better able to engage in discussions about carbon emissions, both with friends and family and to more broadly engage with media debates. In addition, participants expressed heightened awareness of broader initiatives, such as government environmental campaigns at national and international levels. This all adds to a greater level of awareness, which some participants recognised as the first step on a slow progress of environmental evolution.

"I do think that people will slowly re-educate themselves. For example in the last 6 months to a year, people, ordinary people have started to think well it’s not enough to just switch off the, you know the phone charger, we actually have to take the plug outâ¦ Slowly I think enough of us will do it and then weâll move on to the next bit that weâve got to learn. So it’s keeping us educated the whole time." [Non-user group participant, London]

In the meantime, participants were more willing to consider small changes, particularly energy saving actions at home, and consider carrying more people in their car when possible, or avoiding unnecessary car journeys. All of which, should be considered in contrast to the general lack of enthusiasm displayed prior to using a carbon calculator.

"I think all of this has made us change our opinions. Since [previous group discussion], the more the government are putting it in our face the more we’re stopping and thinking about it and without that direction most of us wouldn’t give it a second thought." [Non-user group participant, Southern England]

Summary

Despite initial pessimism about the impact of completing a carbon calculator on peopleâs understanding of emissions, following the practical session, non-users expressed an increased appreciation of carbon emissions information. This was in contrast with the user group, who felt their prior understanding had motivated them to use a calculator in the first place.

Again, following an initially negative assessment of the impact of carbon calculators on attitudes about carbon emissions, non-users expressed an interest in emissions reduction, albeit tempered by perceived insignificance of personal emissions reduction compared with those emissions outside their immediate control such as general industrial emissions or those related strongly to national policies. The attitude of users was again unchanged.

Despite these changes in understanding and attitude, non-users were still resistant to carbon reduction suggestions requiring lifestyle changes, often perceived as impossible.

People were pessimistic about the wider public engaging with carbon calculators for purely environmental reasons, suggesting incentives and awareness raising would be required. Good design was also important for engaging people, with the suggestion that a fun site would be more likely to attract people and be circulated through word of mouth.

Travel behaviour was particularly resistant to change, with people citing limited alternatives and time and cost as being more important than environmental concerns. This was particularly relevant to necessary regular journeys, such as travel to work. Less regular leisure travel was seen as being more open to the possibility of environmentally conscious travel.

Participants recognised that carbon calculators may play a crucial role in the slow evolution of more environmentally conscious travel, through raising awareness and understanding and making excessive carbon emissions less socially acceptable.

[33]As noted earlier, participants were segmented according to their attitude towards car usage and the environment, into three broad categories - Car Complacents / Die-hard Drivers; Malcontented Motorists / Car Aspirers / Reluctant Riders; and Aspiring Environmentalists / Car Sceptics.

[34] NB This point was not explored in relation to off-setting.

Conclusions

In this section the findings are considered in three main areas: an assessment of public attitudes to environmental issues and understanding of personal CO2 emissions information; the role of carbon calculators in relation to peopleâs attitudes and behaviour; and the specific position of travel behaviour in this context.

Public attitudes and understanding of environmental issues and personal emissions information

Participants had a general awareness of current environmental terminology relating to carbon emissions and climate change, albeit at an elementary level. Deeper understanding of the terminology appeared lacking and confusion emerged between different terms used to discuss environmental damage. Amongst previous users of carbon calculators there was a high level of knowledge about the factors contributing towards environmental problems and an appreciation of the importance of urgent action. Despite a widespread desire to engage in pro-environmental behaviour, there was a lack of knowledge about what could be done, especially from non-users.

These findings appear to correspond with previous research outlined by Anable et al. (2006) [35] . In the Anable et al review of research examining public understanding towards climate change, it was concluded that most people have a very high awareness of the problem and know what the major causes are. However, the public has less knowledge about urgency and importance, much less acknowledgement of their own contribution and very little understanding of the science and complexity behind the issue (see figure 1).

While there may be no particular need for the public to engage at the deepest level of understanding, clearly there is a need for the public to better understand their individual contribution to climate change. This is especially true for those participants that expressed a desire to contribute more personally to climate change reduction.

The ambiguities in the terminology are problematic. Research highlights that ambiguities can lead to conflicting understanding, which leads to a lack of trust in the argument and an overall lack of engagement by the audience. [36] Thus, ambiguity reduces the likelihood that people will make an informed decision to change behaviour. There is also the concern that if presentation of a deeper level of knowledge is not managed properly, then the public will get unfiltered snippets of information on the topic which can lead to misinterpretation and misunderstanding, again leading to a lack of trust and understanding in the environmental argument and an overall lack of engagement.

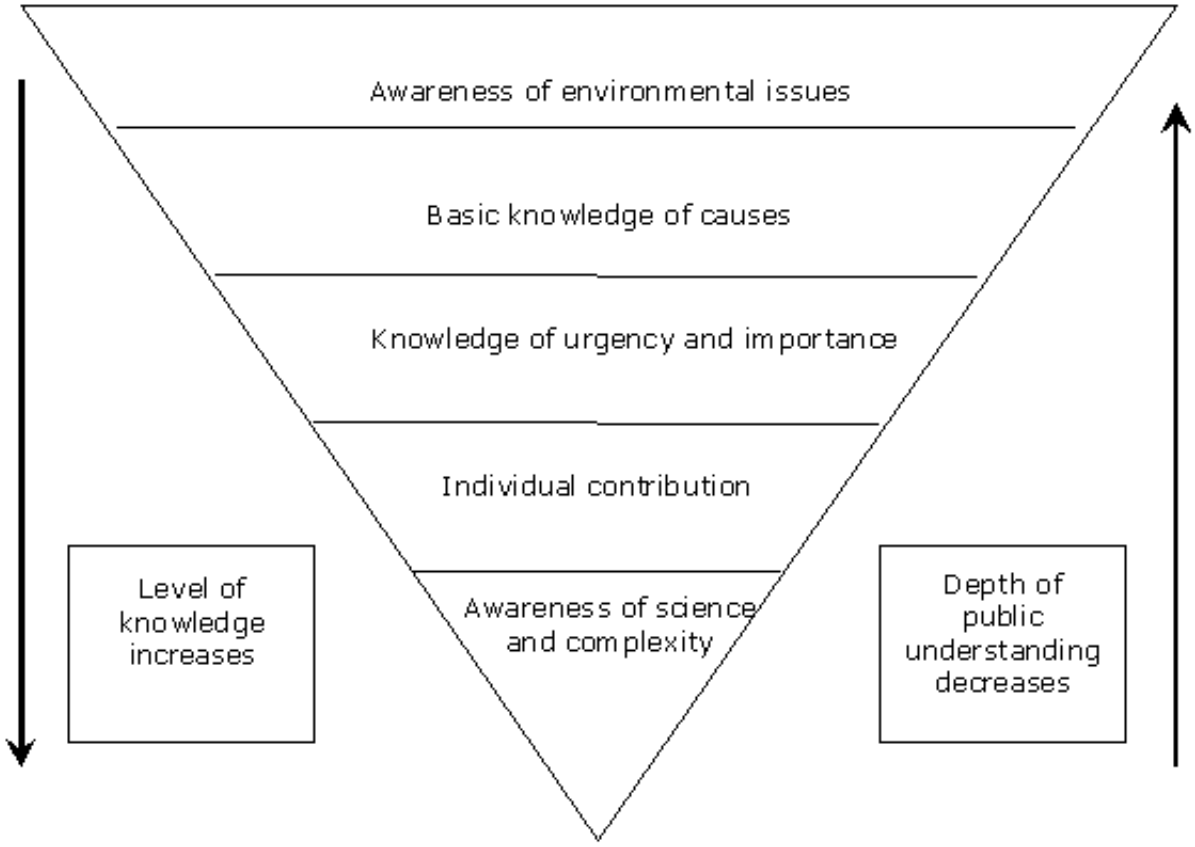


Figure 1: Public understanding of environmental problems and issues (after Anable et al., 2006).

Effects of carbon calculators on attitudes and behaviour

Of those participants who had not previously used carbon calculators, participants who expressed more positive views towards using calculators also expressed greater understanding (subsequent to use) of pro-environmental behaviours. Clearly, carbon calculators play a useful role in promoting environmental awareness from an individual and personalised situation. However, the research also shows that usersâ attitudes remain the same and, perhaps more crucially, some non-users are unlikely to be inclined to use a carbon calculator in the first place.

In relation to actual behaviour change, again non-users indicated that they were more likely to make behavioural changes as a result of using a carbon calculator. Users felt they already were making enough changes and could not make any further ones, so were less likely to alter their behaviour. Again, this perhaps shows the limitation in the depth of knowledge that calculators allow for.

There is no doubt that social comparison plays a key role in shaping attitudes and behaviour with regards to the environment. Identifying oneself as being aware and concerned for the environment seems to be a dominant attitude amongst many people. Therefore, presentation of results that encourages social comparison, either with targets, national averages or in a ;league table; format with other carbon calculator users, enhances the desire to act pro-environmentally (thus potentially reducing the gap between attitude and behaviour). It must also be remembered, for some groups at least, it could act in reverse, so that to be least environmentally aware would be dominant and people would strive to achieve this (there was certainly a stronger resistance to environmental messages amongst the die-hard driver segment). As such, it shows how changes in environmental awareness are still crucial to the success of people acting upon the results of carbon calculators.

The uniqueness of travel behaviour change

With regards to helping the environment at a personal level, most participants felt able to make changes around the home, but were less willing to make changes to their own travel behaviour, especially with regard to moving from private motor vehicles to other modes of travel. These findings reinforce those reported previously (e.g. Anable et al, 2006), which suggest that participantsâ perceptions of travel behaviour is perhaps unique and requires a different approach. A number of reasons can be suggested:

Change in travel behaviour is perceived as substantial and difficult compared to some other lifestyle changes: Sometimes carbon calculator sites reinforce such an idea by presenting strategies which require a perceived large change such as buying a smaller car or giving up a certain journey altogether. This is compared to suggestions for small-scale changes put forward for household emissions like boiling the kettle with less water (rather than to give up tea altogether or drink cold tea!). [37] In addition, household changes are likely to intuitively save the individual money - not leaving appliances on stand-by (a small scale inconvenience which helps the environment and saves money), changing to energy saving light bulbs (a small extra outlay of money that helps the environment AND saves money in the longer term by increasing length of life of bulb and a reduction in amount of electricity used). Increasing self-interest alone helps pro-environmental behaviour (see Figure 2). Transport changes from car to bus or public transport could often (but not always) incur extra costs for those who already own a car. Per passenger mile, costs of bus and train journeys can be less than for private motor vehicles when all annual running costs are taken into account [38] . However, most people already own or have access to a car and as such using public transport both incurs an additional cost and is often considerably more expensive than the simple fuel cost for using a car on the same journey. In addition, walking and using a bike for journeys incurs extra effort compared to changes in the household.

Figure 2: Pro-environmental behaviour is more likely to occur when it is coupled with self-interest! (Brian G Segal, 2004 see http://www.ebnflo.com/)

Car travel is viewed as essential and necessary: Travel by car is often seen as essential. No perceived alternatives are considered as plausible. In many cases, alternatives are available but are not sought.

Car travel has emerged as dominant resulting from social engineering: The dominance of the car in society has not just arisen out of necessity but has been crafted through careful social engineering by car manufacturers making vehicles appealing, wanted and desired. As such the use of the private motor vehicle is associated with feeling of status, wealth, wellbeing and normality [39] . In fact for some, the freedom a car achieves is viewed as a basic human right. [40] Any attempt, however subtle, at breaking the status and freedom aspects of driving a motor vehicle, is likely to be resisted. Although people often identify with wanting to be seen as having concern for the environment, they also like to identify with the positive social signals displayed by owning and driving a vehicle. This conflicting situation results in contradictory statements found in research in this manner or indeed in some cases leads to cognitive dissonance, where a discrediting of the source or a shift of blame occurs to allow guilt-free driving to continue.

Habitual behaviour limits peopleâs propensity to evaluate travel behaviour: Another barrier to behavioural change from the car to other forms of travel is habit. People get into the routine of using the car for certain journeys and never even consider other modes [41] . The longer this continues the more difficult it becomes to break a habit, as the behaviour becomes more autonomous and less conscious and car drivers will not be seeking to compare the impacts of their mode of travel. Carbon calculators do have the ability to make individuals reflect on their travel behaviour and raise in consciousness the habitual behaviour and re-consider alternative transport but first they have to be made aware of the issue. As such, information on comparative journeys should be made on website tools that âdie-hard driversâ use so that comparative information on impacts of journeys, such as that provided by the Transport Direct site, are automatically made available to them without having to first break their habit in order to seek the information.

Disincentives for switching to alternative transport: There are currently little or no comparable penalties or inconveniences in using a car. The shift in recycling in households in the UK has occurred not through willingness to help the environment alone, but by door-step provision and, at least in some areas, councils refusing to collect overfull ordinary household rubbish bins, meaning extra places for rubbish must be found. Demand management strategies, such as increasing car park prices, reducing car park availability and introducing road pricing are areas which may make the car less convenient in comparison to

alternative more sustainable modes of transport.

It is likely that significant work would need to be done to counter each of the cultural issues outlined above before carbon calculators are able to become a significant influence on decisions on transport mode by themselves. [42]

Summary

Findings from this study correspond to previous research into public engagement and understanding of environmental issues. Confusion arising from participantsâ limited understanding of environmental issues (i.e. beyond simple awareness of the terminology) provoked feelings of cynicism and disinterest, particularly among non-users.

Carbon calculators can play a useful role in closing the gap between public understanding of broad environmental issues and how this relates to personal actions.

However, this research also highlights the limitations of these tools, particularly among previous users and a subgroup of non-users who failed to be engaged by them. Meanwhile another section of non-users emerged as more receptive to personalised carbon emissions information. This group, although interestingly not clearly divided by segmentation, appeared to be more distinguishable from the other group by their previous lack of engagement with environmental issues. Yet even within this group, any subsequent behaviour change was limited by perceptions of the practicalities of changing behaviour and the relative insignificance of individual action in comparison to national, international and commercial emissions.

Travel behaviour appeared to be particularly resistant to the influence of environmental information, where a range of other factors override environmental concerns. Yet, discussions with participants indicated several areas where environmental factors may be more pertinent and acknowledged that carbon calculators can play a key role in underpinning a slow evolution towards more environmentally-conscious behaviour. However, the equating of environmental damage solely with carbon emissions may fail to convey the full impacts of transport choice, particularly for key problems such as the âschool runâ where non-climate impacts such as noise, congestion, road safety and local air quality may (when properly explained) be a significantly greater driver for behaviour change than climate change.

[35] See figure 1.1 in Anable et al, 2005

[36] See Einhorn, H J and Hogarth, R M Decision Making Under Ambiguity. The Journal of Business, Vol. 59, No. 4, Part 2: The Behavioral Foundations of Economic Theory (Oct., 1986), pp. S225-S250 for a review of the problems of ambiguity in behavioural decision making

[37] Although there were smaller changes suggested in relation to travel behaviour, such as smarter driving techniques and planning to avoid congestion, these were largely overlooked by respondents, focusing instead on larger scale suggestions, perhaps indicating their desire for a justification to maintain their current behaviour.

[38] Rail is 17p/passenger mile; bus is 22p/passenger mile and car is 24p/passenger mile (6p/mile of which is fuel) - source: Focus on Personal Travel, DfT, 2005 - available from http://www.dft.gov.uk/pgr/statistics/datatablespublications/personal/focuspt/2005/ (last accessed

22/6/2007)

[39] For examples see Musselwhite, C. B. A. and Haddad, H. (2007). Prolonging the Safe Driving of Older People through Technology. Interim report. February 2007. Bristol: Centre for Transport & Society, University of the West of England. And Ellaway, A., Macintyre, S., Hiscock, R. and Kearns, A. (2003). In the driving seat: psychosocial benefits from private motor vehicle transport compared to public transport. Transportation Research Part F. 6, 217-231.

[40] See Sweeting, A., Stone, V., Owen, R., Musselwhite, C. and Lyons, G. (2006). Public Acceptability of Road Pricing. Interim Report. Public report for Department for Transport, December 2006. Unpublished at present.

[41] See Bamberg, S., Rolle, D. and Weber, C. (2003). Does habitual car use not lead to more resistance to

change of travel mode? Transportation, 30(1), 97-108

[42] DfT have commissioned further research exploring barriers and incentives to travel behaviour change, in order to better understand the attitude-behaviour gap

Carbon calculator good practice recommendations

Pulling together findings from each stage of the research highlights a number of key good practice recommendations in relation to carbon calculator development, design and accountability. Each of these areas is considered separately.

Recommendations for carbon calculator development

There are some recommendations for research and underpinning work for the future development of carbon calculators to maximise their potential impact.

Recommendation 1: Ensuring carbon calculators provide for a gap in knowledge and meet public needs regarding personal contribution to environmental damage.

This research has highlighted the need for personalised information about environmentally damaging behaviour. Carbon calculators are a way of providing for this need. While there is a significant amount of information already distributed about how to be more environmentally aware, carbon calculators have the ability to provide tailored, personalised, real-time information through a dynamic and interactive manner. The increased personalisation of such messages clearly helps people to understand their own personal and individual contribution to environmental damage. The dynamic and interactive nature of the carbon calculator also provides a greater depth of engagement and understanding. Hence there is a clear opportunity for carbon calculators to inform pro-environmental attitudes and behaviour.

Recommendation 2: Carbon calculators need to be part of a wider strategy aimed at promoting environmentally friendly behaviour, taking into account cultural norms and social identity.

Cultural norms and an understanding of cultural and individual identity are required for results to be turned into action. As such, carbon calculators may only be a small but significant part of a wider public engagement about the environmental consequences of individual behaviour in order to facilitate a cultural shift and change. Concerns at reducing carbon and other GHG emissions should be aligned with policies to reduce other atmospheric pollutants and any co-benefits described in order to add strength to the overall emissions reduction message.

Recommendation 3: Standardisation about terminology needs to occur - The government should start a national debate which should result in a glossary of terms being developed

To underpin the development of carbon calculators, it is suggested that the government take a lead in generating a glossary of environmental terms. An approach could include using structured interviews and focus groups with experts, stakeholders and members of the public, perhaps using discourse analysis to arrive at a coherent set of definitions.

Recommendation 4: Further research looking at the use and effects of carbon calculators over time is required

Further research is suggested to explore how attitudes towards calculator results and information evolve over time. Identifying the key points in an educational journey would help to clarify at what points in using calculators further information should be suggested, so people can achieve a deeper level of understanding should they wish. Obviously, the effects of carbon calculators on attitudes and on potential behaviour change vary with amount and depth of use and engagement with the calculators over time. As such, more research is required to ascertain the desired frequency and optimum time intervals people show between using calculators in order to achieve maximum effect.

Recommendations for carbon calculator design

Recommendation 5: Carbon calculators should take into account user needs and perspectives with regards to good website design.

Pulling together findings from each stage of the research highlights a number of good practice recommendations in relation to carbon calculator design:

Illustrative and fun graphics - Graphics should serve two purposes, illustrating complex ideas and improving the attractiveness of the site. Where illustrating certain points, such as examples of car type and size, a more detailed image or photo should be used. In contrast, where graphics are used to engage peopleâs attentions, a humorous and more light-hearted approach should be adopted.

Sparse and simple text - Sites should be uncluttered with clear links and large, simple text in an attractive font.

Bright, consistent colour scheme - Make use of bright colours, particularly greens and blues which are most clearly associated with the environment, and ensure a consistent colour scheme that identifies and flows throughout the site.

Clear layout - Maintain a simple layout, avoiding dividing the page into different areas or requiring users to scroll down or across the page. If necessary opt for more pages rather than overloading individual pages. Consider the use of a variety of different ;skins; for each website to appeal to a variety of different segments of the population.

Everyday language - Avoid using jargon or abbreviations in explanations, and ask questions in a simple behavioural rather than technical manner.

Simple yet personalised information requirements - Avoid questions that require research, instead opting for behavioural questions that are simpler to answer. Avoid using averages, people prefer to input specific information associated with a more personalised calculation. .

Succinct process - Aim for an engaging process that flows simply and naturally through the calculation, clearly identifying where along the process the user is, and keeping overall timing to a minimum.

Recommendation 6: Glossary of terms should be available throughout carbon calculator websites.

There is also the need for terminology to be standardised. Glossary of terms should be included along with the carbon calculators. On the website, it is suggested that a small ;?; is placed next to terminology used, so that a new box can open with an explanation of the term should the user require it.

Recommendation 7: Use of positive pro-environmental language needed through carbon calculators.

Carbon calculators should be designed taking into account identity and impression management with regards to the environment, ensuring that pro-environmental behaviour is seen as socially desirable.

Recommendation 8: Using carbon calculators to overcome habitual travel behaviour.

Encouraging people to focus on their habitual car driving behaviour helps them to raise consciousness of this behaviour. Careful consideration needs to be given to the design of questions around travel behaviour so that people are required to focus on the details not just broader aspects of the journey (for example, getting people to think about details of the journey such as types of road driven on, amount of time spent waiting in traffic, rather than just number of miles driven).

Recommendation 9: Carbon calculators should suggest personalised links to further information to increase the depth of public understanding

Whilst further information on the calculations themselves can be provided on the calculator website itself, there is a clear need for further depth of information for those who require it. Online carbon calculators are ideally placed for simple links to more in-depth sites where further knowledge and education on the issues can be found. Given the interactive and personalised nature of the calculators there is no reason why direction to suggested sites could not be prioritised based on information given by the user themselves, for example, someone who drives a high number of miles could be directed to sites examining the science of pollution from road vehicles, whereas someone who spends most of their time at home would be directed, in the first instance at least, to sites about issues and science involved in reducing the environmental impact of the home. The depth of information then becomes something that can be chosen to be studied further and can be tailored to the lifestyle and characteristics of the person. Carbon calculators move away from giving simple feedback on lifestyle choices to engaging the user in deepening

knowledge and education about the science according to their lifestyle (should they wish to).

Recommendation 10: Results should allow for gradual or stepped changes in environmentally friendly behaviour

Further suggestion of links to websites or other references at relatively greater depth would help people achieve a further step in making changes. For example, an individual who has already reduced their driving behaviour with help from the calculator could then be directed to a car-free website with stories and documentaries about living a car-free lifestyle. Gradual or stepped changes in behaviour can be achieved in this manner. Further understanding is required as to the extent of change a carbon calculator can achieve on its own before further education and knowledge is needed for behavioural change to occur.

Recommendation 11: Carbon calculator results should be presented as part of social interaction in everyday life

It is suggested that the use of social interaction in achieving and maintaining environmentally friendly behaviours is considered. Carbon calculators should be incorporated into social networking sites. For example, results from carbon calculators could be downloaded and added to personal websites. Consideration could be given to adding calculators to personal websites such as MySpace where people complete online tests and questionnaires to say something about themselves. In addition, calculators could link to online blogs, chats and discussion rooms to allow further social interaction regarding the results.

Recommendations for carbon calculator accuracy and reliability

For calculations to lead to behavioural change, people need to have trust in their calculations.

Recommendation 12: Consistency in calculations is required to enhance trust

There needs to be consistency in the data used in all different carbon calculators.

Recommendation 13: Official endorsement of calculations is required to enhance trust.

The data used in the carbon calculators could benefit from an official endorsement from an independent body, for example the government or a ;green; organisation.

Appendices

Sample details

Focus group respondents in stage three were recruited using free-find methodology (description in Appendix 1.3) based on the following primary quotas:

	Age					
Segmentation+	18-24	25-29	30-39	40-RA	RA plus	Total
Die-hard drivers / car complacent	1 group	1 group	1 group	1 group	1 group	5
Malcontented motorists / car aspirers / reluctant riders	1 group	1 group	1 group	1 group	1 group	5
Aspiring environmentalists / car sceptics	1 group	1 group	1 group	1 group	1 group	5
Total	3	3	3	3	3	15

+ based on simplified Anable segmentation, asking respondents a number of questions to establish their attitude towards car usage and the environment

In addition to these quotas, a range of secondary quotas were used to ensure a spread of respondent characteristics, including gender, social class, urban / suburban classification, ethnicity, family status, and geographic region.

Fieldwork materials

Principal aims of the research:

The project has two key aims:

- To increase knowledge of the publicâs attitudes towards, and understanding of, information relating to personal carbon emissions and
- To explore the potential impact of carbon calculators on behavioural change

Stage one of this study specifically aims to:

- Explore why they have made carbon calculators available (or why not)
- Feedback they have had
- Views on simplicity/complexity of carbon calculators
- Explore views on usage and perception of public attitudes towards existing carbon calculators
- Explore views on public understanding of carbon emissions and relevant terminology more generally
- Views on what would influence attitudinal and behavioural change
- Explore how me might recruit users to the study

Introduction

Short intro to research: To explore public attitudes towards carbon calculators and carbon emissions in general - this stage is a scoping exercise

Commissioned by Department for Transport

BMRB independent research agency

Purpose of meeting (see above)

Recording interviews

Explain recordings are only available to the research team

Confidential - their views will be used, but not identifiable

Length of the discussion - approx. 1 hour

Carbon calculators - for those with

[Research note: only discuss with organisations that DO have an on-line carbon calculator]

Development:

- Decision/motivation/rationale behind establishing calculator [probe re environmental concerns, business concerns and relative priorities of motivations stated]
- Process of developing (i.e. contracting provider, internal development)
- What alternatives were considered /ruled out? Why?
- What research / public involvement was included in development?
- What issues/problems were faced? How were they overcome?
- Were any restrictions placed on them? Did they originally want to include anything that they couldn't? Why?

Target groups:

- Who are they targeting? Probe why
- Who do they think would be interested/want to use a calculator? Probe Why they think that and why they think these groups are interested
- What was predicted/envisaged level of interest?
- What attempts to measure use are they engaged in? Why/why aren't they?

Best practice: (probe fully as to why decisions/approaches taken)

- Format - i.e. usability, design
- Content - what viewed as necessary/ruled out
- Style - i.e. language, terminology
- Contextual information for measurement - presentation, level of context (complexity/simplicity)

- Follow-on information - off-setting, reducing emissions etc

Awareness of alternative carbon calculators:

- Transport Direct and recent developments (addition of car travel calculator)
- Views, thoughts on the TD website and others
- What examples do they think are particular effective/good/useful/user friendly/bad? Why?

Calculator management:

- Impact evaluation / assessment of behaviour change
- What are their success criteria? How assessed?
- What level of usage do they expect/want?
- How are they measuring usage? What are results?
- Do they collect feedback from users? What does it show?
- What do they know about their users/non-users?

Lessons learned

- Is redevelopment planned? Why?
- When/how would this be reviewed?
- What would they do differently/recommend to others developing carbon calculators?

Carbon calculators - for those without

[Researcher note: only discuss with organisations that DO NOT have an on-line carbon calculator]

Awareness re calculators

Role (environmental / marketing)

Effectiveness

Level of usage

Awareness of available carbon calculators:

- Transport Direct and recent developments (addition of car travel calculator)
- Have they used TD and/or other carbon calculators? Why/why not?

Views, thoughts on the TD website and/or others used

- What examples of carbon calculators/presentation of carbon emission information do they think are particular effective/good/useful/user friendly/bad? Why?
- Why not developed carbon calculator?
- What do they see as the main issues/barriers?

Public understanding

Assessment of public understanding about:

- carbon emissions and environmental issues generally
- carbon calculators and off-setting
- relevant terminology - âcarbon allowanceâ, âcarbon footprintâ, units of measurement for carbon emissions
- presentation of such information to the public e.g. content/concepts/format
- issues to be addressed? Why? How?

Best practice for communicating environmental information (keep focussed on carbon emissions information)

Tactics - information, shock, shame, social comparisons

What are key messages? Why?

What are public information requirements?

How important is communicating carbon emission information?

How effective can this information be on behaviour and/or attitude change?

What barriers exist to changing peopleâs attitudes and behaviour through the provision of carbon emission information?

Other

How to access âuserâ participants

[for those with a calculator] do they have such information? Are they willing to share it/use it to help us sample for Stage 2? If not why not? Can barriers be overcome e.g. them contacting them on our behalf?

For âfree-findâ recruiting where would be the best place to go? What are the âgreenestâ areas?

[If use calculator] Have you analysed where people live?

Suggestions for other relevant stakeholders

Other thoughts?

Thank and close

Principal aims of the research:

The project has two key aims:

- To increase knowledge of the publicâs attitudes towards, and understanding of, information relating to personal carbon emissions and
- To explore the potential impact of carbon calculators on behavioural change

Stage two of this study specifically aims to:

- Explore individual understanding of relevant terminology
- Investigate engagement with calculators and how this can be increased
- Explore motivation for using calculators and interest in climate change / energy consumption
- To gather views on what information would influence attitudinal and behavioural change;
- To provide feedback on how information can best be presented; and
- To make recommendations on good practice in terms of the design and presentation of CO2 emission information.

Introduction [2 mins]

Short intro to research: To explore public attitudes towards carbon calculators and carbon emissions in general

Commissioned by Department for Transport

BMRB independent research agency

Purpose of meeting (see box above)

Also talking to non-users

Recording interviews

Explain recordings are only available to the research team

Confidential - their views will be used, but not identifiable

Length of the discussion - approx. 1 hour

Personal lifestyle and travel behaviour [3 mins]

Describe typical travel patterns - to work, shopping, holidays

Do they own a car

How often do they use public transport? What do they think of public transport in their area?

How often do they fly? Are they likely to increase/decrease this in future?

What is their ideal travel behaviour - whatâs stopping them achieving that?

Factors that influence journey planning decisions [5 mins]

What kinds of things influence their journey planning decisions

[NB If respond âconvenienceâ push for more detail]

Prompt re cost, time, comfort, luggage, health, infrastructure issues (parking fees, congestion), wider issues (environmental concerns)

Which factors are the most important, why

Understanding of âclimate changeâ and related terminology as concepts [10 mins]

[Note to researcher - Aim to start off with broad environmental concepts moving towards more carbon calculator relevant terms. In all cases, guide discussion towards how things relate to travel behaviour]

Understanding of terminology and concepts

Climate change / Global warming / Greenhouse gases / Energy efficiency [group together if necessary given time constraints]

- Carbon emissions
- Carbon neutrality
- Carbon footprint
- Carbon offsetting

Views - how useful are such terms? How important are such terms? Why?

Aware of how personal travel behaviour contributes to carbon emissions

Do they understand link between fuel consumption/efficiency and carbon emissions? What do they understand?

Are they aware of a link between air travel and carbon emissions? What do they understand?

How do they view emissions as differing between modes of transport (esp. relevant to public transport)?

Aware of how carbon emissions contribute to climate change

How serious do you think climate change is in relation to other problems associated with road transport, such as air pollution or road safety?

Exploration of carbon/CO2 quantification and measurement [10 mins]

[Note to researcher - Aim to start with unprompted exploration of known types of carbon/CO2 emission measurement]

What terminology are they aware of when considering/calculating the measurement of their personal emissions?

[Note to researcher - if none known/suggested, then prompt and explore the above for each of the following using supplied example cards: grams, kilograms and tonnes of each of i) carbon, ii) carbon equivalent, iii) CO2, iv) carbon dioxide, v) carbon dioxide equivalent, and vi) CO2(e)]

Inclusion of example car CO2 emission information

For each:

- What is their understanding of them?
- What does this mean to them?
- How useful do they find them? Why?
- How important do they find them? Why?
- How easy are they to visualise? Does this matter to them? Why/Why not?
- What methods of presentation have they come across that has helped them to visualise the amounts involved? What was good/bad about them? Why?

Views and understanding of carbon calculators [15 mins]

[Note to researcher - if they are willing, this could be done in front of their home computer. Offer Â£5 if dial-up connection TO SORT WHEN HAVE SAMPLE]

Awareness and familiarity - where did they initially hear about carbon calculators? In general / specific calculators?

Understanding of their purpose and usage

Motivation - what initially prompted them to use a calculator?

Alternatives - What carbon calculators/counters have they visited/used? Which ones have they used most regularly? Why? What do they use it for most commonly? What do they like about it? What have they disliked about others?

[Note to researcher - explore good/bad examples of following aspects. Use computer if possible and relate to known calculators and TD website (www.transportdirect.info). Otherwise use screen shots of TD website as prompts]

Usability

Features they like / dislike

Ease of use

Language used

Time taken to complete and time taken for calculation

Type of information required (too much / too little / inappropriate etc)

Feedback

Do they understand the type of feedback provided? What are their views on units of measurement presented to demonstrate emissions?

How do they make sense of the information provided?

Do they contextualise the information with other emissions (i.e. compared to other people, travel vs household emissions, individual as percentage of overall local / national / global emissions)

Layout - what works best for them and why

Reliability and accuracy of information presented - what enhances perceived accuracy?

Improvements that could be made

What issues would need to be addressed in presentation of public transport specific emissions?

What would influence understanding?

What would influence perceived reliability?

Exploring reactions to personal carbon emissions results [15 mins]

Did the use of carbon calculators affect their understanding of personal carbon emissions/their contribution to climate change? Why? If not, what would and why?

Did use of carbon calculators change/influence in any way their attitudes towards their personal carbon emissions? Why/how? If not, what would and why?

Have they changed their behaviour resulting from use of calculators? If so, why? And, in what ways? (i.e. reduce amount of travel, change route / mode of transport)

How does emission information compare to other factors that influence their travel choices? Why? How can the use and presentation of carbon emission information be used to overcome these other factors?

What might encourage individuals to change their travel behaviour

What might encourage people to use carbon calculators

Thank and close

Principal aims of the research:

The project has two key aims:

- To increase knowledge of the publicâs attitudes towards, and understanding of, information relating to personal carbon emissions and
- To explore the potential impact of carbon calculators on behavioural change

Stage three (wave 1) of this study specifically aims to:

- Explore individual understanding of relevant terminology
- To gather views on what information would influence attitudinal and behavioural change;
- To provide feedback on how information can best be presented; and
- To make recommendations on good practice in terms of the design and presentation of CO2 emission information.

Introduction [2 mins]

Short intro to research: To explore public attitudes towards carbon calculators and carbon emissions in general

Commissioned by Department for Transport

BMRB independent research agency

Purpose of meeting (see box above)

Recording interviews

Explain recordings are only available to the research team

Confidential - their views will be used, but not identifiable

Length of the discussion - approx. 1 hour and a half

Personal lifestyle and travel behaviour [5 mins]

[Note to researcher - Use as introduction, ask group members to go round, identify themselves, including household information, occupation and in 1 or 2 sentences describe what forms of transport they use and why.]

Factors that influence journey planning decisions [10 mins]

Brainstorm what kinds of things influence their journey planning decisions for two different journeys - i) regular journeys, e.g. to work and ii) less frequent long distance journeys, e.g. visiting relatives, holidays

[Note on large pad. Hold off prompting unless people are reticent, ask people to expand on âconvenienceâ]

Personal issues, such as cost, time, comfort, luggage, health

Infrastructure issues, such as parking fees, congestion

Societal/wider issues, such as environmental issues

Ask people to prioritise the most important factors

[Keep notepad - Come back to this after discussion re environmental concepts]

Understanding of âclimate changeâ and related terminology as concepts [15 mins]

[Note to researcher - Aim to start off with broad environmental concepts moving towards more carbon calculator relevant terms]

Spontaneous impressions - word association exercise

Climate change / Global warming / Greenhouse gases / Energy efficiency [group together if necessary]

- Carbon emissions
- Carbon footprint
- Carbon neutrality
- Carbon offsetting

Understanding of each

Views - how useful are such terms? How important are such terms? Probe why?

Aware of how personal behaviour contributes to carbon emissions

Do they understanding link between fuel consumption/efficiency and CO2/carbon emissions? What do they understand?

Are they aware of a link between air travel and carbon emissions? What do they understand?

How do they view emissions as differing between modes of transport (esp. relevant to public transport)?

Aware of how carbon emissions contribute to climate change?

Has anyone ever attempted to measure their carbon footprint? What were their motivations for doing so? How did they react to it? Why?

Exploration of carbon/CO2 quantification and measurement [10 mins]

[Note to researcher - Aim to start with unprompted exploration of known types of carbon/CO2 emission measurement]

What terminology are they aware of in relation to the measurement of personal emissions?

[Note to researcher - if none known/suggested, then prompt and explore the above for each of the following: grams, kilograms and tonnes of each of i) carbon, ii) carbon equivalent, iii) CO2, iv) carbon dioxide, v) carbon dioxide equivalent, and vi) CO2(e)].

Inclusion of example car CO2 emission information

For each:

- What is their understanding of them?
- What does this mean to them? How meaningful is such terminology?
- How useful do they find them? Why?
- How important do they find them? Why?
- How easy are they to visualise? Does this matter to them? Why/Why not?
- Have they come across any methods of presentation that have helped them to visualise the amounts involved? What was good/bad about them? Why?

Information needs (for example, questions they have) [10 mins]

[Note to researcher - useful for understanding gaps in knowledge. Get groups to discuss briefly. Donât get drawn into long deliberations.]

Any confusion over concepts / issues involved?

What areas would they like more information on?

How would they like that information provided - prompt re related to practical tips, broader context, use of illustrations, calculations etc

What are views/thoughts on importance of accuracy and reliability of any provided emissions information?

How accurate is existing information?

How easy do they feel it would be to provide accurate information?

If it were possible to guarantee accuracy, would this matter/ make a difference to them? What would this be and why?

Views and understanding of carbon calculators [20 mins]

[Note to researcher - if there is no knowledge at all, may need to prompt with brief description from researcher briefing notes]

Awareness - if heard of but never used, why not?

Understanding of their purpose and usage

Expectation of purpose and usage (if necessary)

Who do they think are the type of people to use calculators?

- Knowledge about them
- How to access them
- What kind of feedback do they give?

Sources of information - newspaper articles, news stories etc

Views, including any concerns - focus on what theyâre for

How useful would such tools be? Why? What use would be made?

[Note to researcher - may be useful to refer back to journey examples given by participants earlier.]

Potential future use:

Perceived barriers to using such tools? Why?

Willingness to use? Why? How could this be encouraged? What would encourage them to use them? In what situations/circumstances?

What would impact/effect of use a) of carbon calculator and b) provision of personal carbon emission information be?

- On understanding of climate change, personal contribution and personal carbon emissions
- On attitudes towards each
- On travel planning behaviour and transport choices

Do views (and would potential use) differ when considering regular ’everyday’ journeys or more infrequent/unusual journeys where more planning required/conducted? How? Why?

Do views (and would potential use) differ when considering journeys utilising alternative transport modes? How? Why?

Personal carbon emissions and travel behaviour [15 mins]

[Use list of prioritised factors involved in decision making about travel]

Awareness of how travel behaviour impacts on the environment

What might encourage individuals to change their travel behaviour, would personal carbon emission information? Why/why not?

What might encourage people to use carbon calculators

Would the use of carbon calculators/provision of personal carbon emission information affect their understanding of personal carbon emissions/their contribution to climate change? Why? If not, what would and why?

Would the use of carbon calculators change/influence in any way their attitudes towards their personal carbon emissions? Why/how? If not, what would and why?

Next group [3 mins]

[Note to researcher - Remind people about next group details]

Time / date

Place

What sort of things weâll be doing

Trying out some possible carbon calculators and seeing what you think of them

Thank and close

Principal aims of the research:

The project has two key aims:

- To increase knowledge of the publicâs attitudes towards, and understanding of, information relating to personal carbon emissions and
- To explore the potential impact of carbon calculators on behavioural change

Stage three (wave 2) of this study specifically aims to:

- To explore views of alternative carbon calculators
- To provide feedback on how information can best be presented; and
- To make recommendations on good practice in terms of the design and presentation of CO2 emission information.

Introduction [5 mins]

Short intro to research: To explore public attitudes towards carbon calculators and carbon emissions information in general

Commissioned by Department for Transport

BMRB independent research agency

Purpose of meeting (see box above)

Recording interviews

Explain recordings are only available to the research team

Confidential - their views will be used, but not identifiable

Length of the discussion - approx. 1.5 hours

Recap from previous group [10 mins]

Awareness and familiarity of carbon calculators - since previous group

Alternatives - What carbon calculators/counters have they visited/used (if any)? Why did they use them? What did they think of them? What did they like/dislike? Any preferences between sites/features visited since last time? Why?

Discussions - have they had any chats with family/friends about any of these issues since the last group? What kinds of debates were generated?

Trying carbon calculators [20 mins - 10 mins on each site]

[Note to researcher: this is a âthink out loudâ exercise with the group completing 2 carbon calculators online in pairs

- Give each pair a âworksheetâ - each sheet shows a screengrab of one of the carbon calculators we are asking them to visit, together with instructions and headers for them to make notes on (based on section 5).
- For each website ask them to âhave a goâ using a typical/ actual journey/home calculation - the idea is for them to get an idea of how these sites work and also to explore these 2 calculators in more depth.
- Ask the pairs to make notes on each of the carbon calculators to bring back to the whole group for discussion.]

Exploring reactions to personal carbon emissions results [10 mins]

What did they think of the results / feedback from the sites?

Did the process have any impact on:

- their understanding of personal carbon emissions?
- their attitude towards personal carbon emissions?
- thinking about their behaviour (travel and/or household)?

If yes - how? In what way?

If not - why not? What information would work better and why?

Views of carbon calculators [40 mins]

[Group discussion based on their exercise notes plus pack of alternative screen shots]

Ask people to look at the 5 front end screens first, and then the 5 back end screens (for the back end screens there are also 2 prompt sheets for the Defra and Transport Direct sites that show extra stages of the process - people will have seen these from section 3, but useful for prompting):

Front end screens (where you input information etc)

Focussing on specific aspects of the front end: e.g. inputting transport information component, description of task

The overall look of the carbon calculators

Probe on:

- Graphics (types / amount)
- Text (amount of text / size / font)
- Content (level)
- Colour schemes
- Other features
- Layout

What works best for them and why

Images

Clarity

Usability

Features they like / dislike

Language used (clarity / explanations)

Type of information required and ease of access to it (too much / too little / inappropriate etc)

Time taken to complete and time taken for calculation

Overall ease of use, why?

Improvements that could be made

Back end screens (results, context, action etc)

Focusing on specific aspects of the back end: e.g. method for presenting emissions, actions that could be considered (if presented).

Feedback

- Do they understand the type of feedback provided? What are their views on units of measurement presented to demonstrate emissions?
- How do they make sense of the information provided?
- Views about how results should be presented in order to make more sense to individuals (i.e. contextualised - compared to other people, travel vs household emissions, individual as percentage of overall local / national / global emissions

Reliability and accuracy of information presented - what enhances perceived accuracy?

Improvements that could be made

Suggestions for improving information on personal carbon emissions [10 mins]

What factors would affect their decision about which calculators they might use? [speed, clarity etc - hold off prompting unless thereâs no response]

What might encourage people to use carbon calculators?

How does emission information compare to other factors that influence their travel choices? Why? How can the use and presentation of carbon emission information be used to overcome these other factors?

What might encourage individuals to change their travel behaviour?

Thank and close

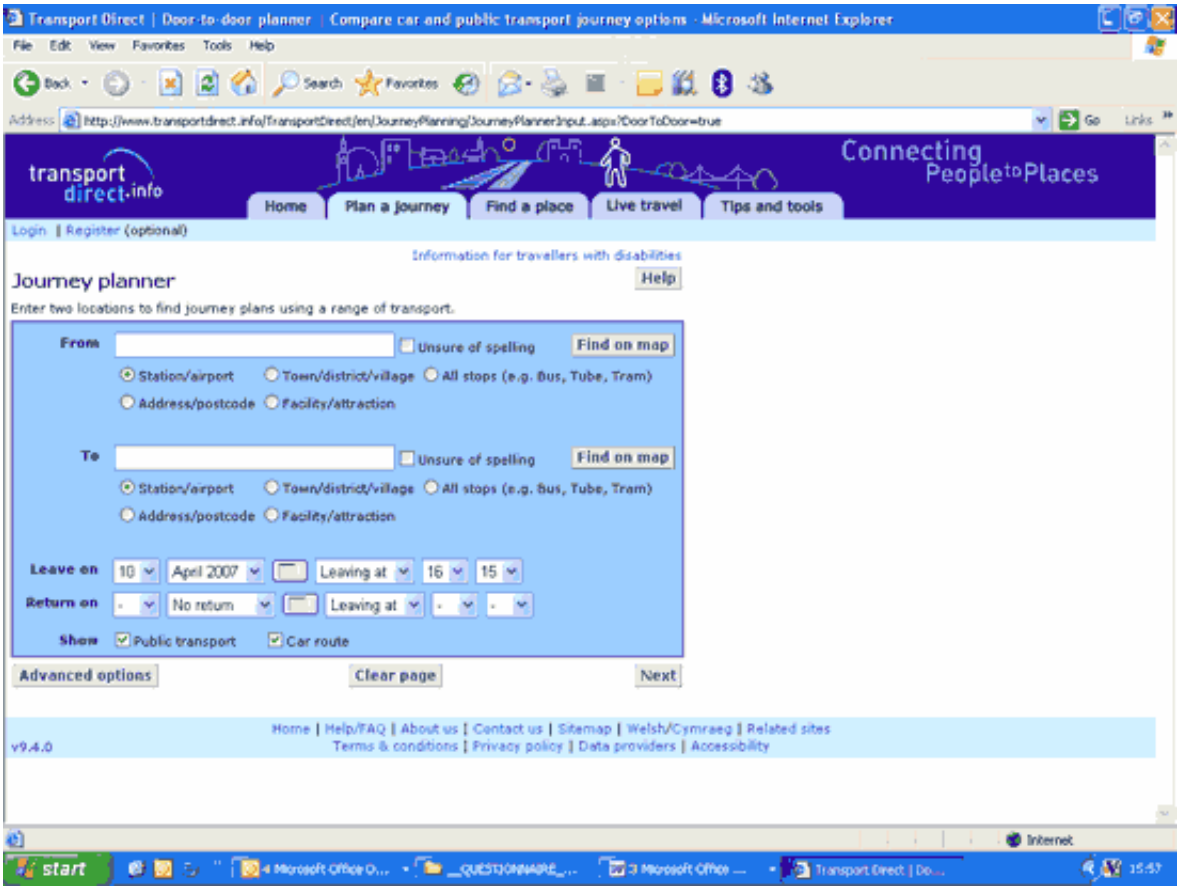
45105982 CC W2 worksheet

May 2007

FINAL

âTRANSPORT DIRECTâ - type in www.transportdirect.info

The screen should look like this:



Put in a typical car journey you might make (e.g. from home to work, or visiting relatives)

Select the car route option and click ’Go’

Select âDetailsâ

Click on ’Find out how to save fuel and cut your CO2’ next to the petrol pump icon - 

Enter your car details (if you donât have a car, pick a car you have travelled in) click ’Next’

Have a look at the results screen

Click on - âCompare your car emissions with public transport emissionsâ and click ’Next’

Have a look at the results screen and explore the available options

Note down your thoughts about the site:

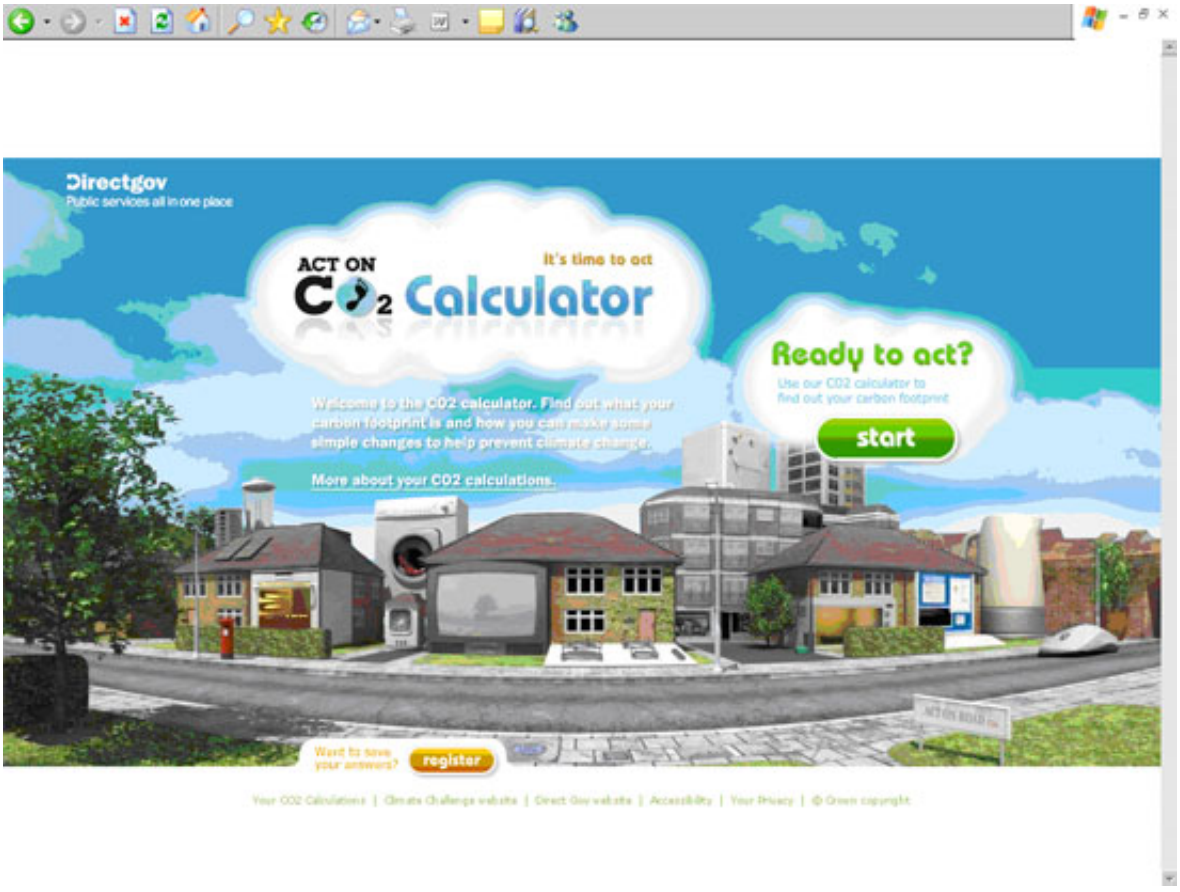
What features do you like?

What features donât you like?

2. âDEFRAâ - type in http://CO2.coi.staging.4ddigital.co.uk/

- This website is not live yet, so you will need to enter the following details:
- Username: CO2calculator
- Password: 3xhaust!

The screen should look like this:



Click on âStartâ and following the on screen instructions to calculate your home, appliance and travel emissions

Explore your results

Note down your thoughts about the site:

What features do you like?

What features donât you like?

Recruitment process

The recruitment was managed by our internal field team who used eight recruiters, one to select from the respondent samples for the depth interviews (stage two), and one recruiter using âfree findâ methods [43] for each of the areas involved in the study - North London, South London, Southern England, Midlands, Northern England, Scotland and Wales. The field managers were fully briefed on the project and provided with detailed recruitment instructions and a screening questionnaire in order for recruiters to assess respondentsâ eligibility to participate in the research. Respondents were recruited using email recruitment for the depth interviews and âfree findâ for the group discussions. All recruiters are members of the IQCS (Interviewers Quality Control Scheme).

In depth interviews and group discussions were carried out by four experienced qualitative researchers who have extensive experience and have been trained in the techniques of non-directive interviewing.

Analytical methodology

Material collected through qualitative methods is invariably unstructured and unwieldy. Much of it is text based, consisting of verbatim transcriptions of interviews and discussions. Moreover, the internal content of the material is usually in detailed and micro-form (for example, accounts of experiences, inarticulate explanations, etc.). The primary aim of any analytical method is to provide a means of exploring coherence and structure within a cumbersome data set whilst retaining a hold on the original accounts and observations from which it is derived.

Qualitative analysis is essentially about detection and exploration of the data, making senseâ of the data by looking for coherence and structure within the data. Matrix Mapping works from verbatim transcripts and involves a systematic process of sifting, summarising and sorting the material according to key issues and themes. The process begins with a familiarisation stage and would include a researcherâs review of the audio tapes and/or transcripts. Based on the coverage of the topic guide, the researchersâ experiences of conducting the fieldwork and their preliminary review of the data, a thematic framework is constructed. The analysis then proceeds by summarising and synthesising the data according to this

thematic framework using a range of techniques such as cognitive mapping and data matrices. When all the data have been sifted according to the core themes the analyst begins to map the data and identify features within the data: defining concepts, mapping the range and nature of phenomenon, creating typologies, finding associations, and providing explanations.

The mapping process is similar for both individual interviews and group discussions. The analyst reviews the summarised data; compares and contrasts the perceptions, accounts, or experiences; searches for patterns or connections within the data and seeks explanations internally within the data set. Piecing together the overall picture is not simply aggregating patterns, but it involves a process of weighing up the salience and dynamics of issues, and searching for structures within the data that have explanatory power, rather than simply seeking a multiplicity of evidence.

Assessment of strengths and weaknesses of adopted approach

Overall, the methodological approach adopted for this research was felt to be appropriate.

The mix of depth interviews and focus groups provided a range of responses to the stimulus materials and worked well, allowing for the different levels of experience of each of the target groups to be accommodated.

Stage 2 was potentially limited by the recruitment being solely through a carbon offsetting provider. This was unavoidable given the timescale; however for future research, adopting a recruitment approach from a wider sampling frame might be beneficial, for example, by enabling a mix of experience of different carbon calculators to be explored. However, the sample of carbon calculator users in this research had visited other carbon calculator sites, not simply offsetting sites. It should also be noted that as carbon calculators are relatively new the people who are currently using them are likely to hold a particular set of environmental views.

[43] With the free-find method a recruiter approaches individuals either in the street or by door-knocking. Having introduced themselves and confirming their identity as a BMRB recruiter, the individual is then given a brief overview of the research, the client, and asked whether they would be interested in participating. Where interest is shown, the recruiter then asks a series of questions to determine their eligibility and ensure that the designated quotas are accurately filled. Individuals agreeing to participate in the study would be given a confirmatory letter, which would further describe the nature of the study, the voluntary nature of their participation, the appointment date and time for the group discussion and the confidentiality of their answers. Individuals are re-reminded at least once before the day of the group discussion.