Climate change mitigation at the individual level

Examining climate change beliefs and energy saving behaviours with the aim to encourage the reduction of end-user energy consumption

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Κωνσταντίνος Καβάφης «Ιθάκη»

Σα βγεις στον πηγαιμό για την Ιθάκη,
να εύχεσαι νά'ναι μακρύς ο δρόμος,
γεμάτος περιπέτειες, γεμάτος γνώσεις.
Τους Λαιστρυγόνας και τους Κύκλωπας,
τον θυμωμένο Ποσειδώνα μη φοβάσαι,
τέτοια στον δρόμο σου ποτέ σου δεν θα βρεις,
αν μέν' η σκέψις σου υψηλή, αν εκλεκτή
συγκίνησις το πνεύμα και το σώμα σου αγγίζει.
Τους Λαιστρυγόνας και τους Κύκλωπας,
τον άγριο Ποσειδώνα δεν θα συναντήσεις,
αν δεν τους κουβανείς μες στην ψυχή σου,
αν η ψυχή σου δεν τους στήνει εμπρός σου.

Να εύχεσαι νάναι μακρύς ο δρόμος.
Πολλά τα καλοκαιρινά πρωιά να είναι
που με τι ευχαρίστησι, με τι χαρά
θα μπαίνεις σε λιμένας πρωτοειδωμένους·
να σταματήσεις σ' εμπορεία Φοινικικά,
και τες καλές πραγμάτειες ν' αποκτήσεις,
σεντέφια και κοράλλια, κεχριμπάρια κ' έβενους,
και ηδονικά μυρωδικά κάθε λογής,
όσο μπορείς πιο άφθονα ηδονικά μυρωδικά·
σε πόλεις Αιγυπτιακές πολλές να πας,
να μάθεις και να μάθεις απ' τους σπουδασμένους.

Πάντα στον νου σου νάχεις την Ιθάκη.
Το φθάσιμον εκεί είν' ο προορισμός σου.
Αλλά μη βιάζεις το ταξείδι διόλου.
Καλλίτερα χρόνια πολλά να διαρκέσει·
και γέρος πια ν' αράξεις στο νησί,
πλούσιος με όσα κέρδισες στον δρόμο,
μη προσδοκώντας πλούτη να σε δώσει η Ιθάκη.

Η Ιθάκη σ' έδωσε τ' ωραίο ταξίδι.
Χωρίς αυτήν δεν θάβγαινες στον δρόμο.
Άλλα δεν έχει να σε δώσει πια.

Κι αν πτωχική την βρεις, η Ιθάκη δεν σε γέλασε.
Έτσι σοφός που έγινες, με τόση πείρα,
ήδη θα το κατάλαβες η Ιθάκες τι σημαίνουν.

Konstantinos Kavafis 'Ithaka'

As you set out for Ithaka,
hope the voyage is a long one,
full of adventure, full of discovery.
Laistrygonians and Cyclops,
angry Poseidon—don't be afraid of them:
you'll never find things like that on your way
as long as you keep your thoughts raised high,
as long as a rare excitement
stirs your spirit and your body.
Laistrygonians and Cyclops,
wild Poseidon—you won't encounter them
unless you bring them along inside your soul,
unless your soul sets them up in front of you.

Hope the voyage is a long one.
May there be many a summer morning when,
with what pleasure, what joy,
you come into harbours seen for the first time;
may you stop at Phoenician trading stations
to buy fine things,
mother of pearl and coral, amber and ebony,
sensual perfume of every kind—
as many sensual perfumes as you can;
and may you visit many Egyptian cities
to gather stores of knowledge from their scholars.

Keep Ithaka always in your mind.
Arriving there is what you are destined for.
But do not hurry the journey at all.
Better if it lasts for years,
so you are old by the time you reach the island,
wealthy with all you have gained on the way,
not expecting Ithaka to make you rich.

Ithaka gave you the marvelous journey.
Without her you would not have set out.
She has nothing left to give you now.

And if you find her poor, Ithaka won't have fooled you.
Wise as you will have become, so full of experience,
you will have understood by then what these Ithakas mean.

To my dad,
who passed away just before I submitted,
confident I had almost reached my Ithaka.

&

To my mum,
who always encouraged me to reach for the stars.

Abstract

Unsustainable levels of energy consumption, resulting in carbon emissions, are leading to one of the world's greatest environmental problems: climate change. The only short-term strategy for reducing these emissions is a reduction in end-user energy demand. Households have a major part to play in this reduction as they are responsible for 29% of total UK emissions (excluding direct transport related emissions and indirect emissions).

The research reported in this thesis contributes to understanding what makes people adopt or not adopt climate change mitigation behaviours. The study employed an on-line questionnaire answered by a nationally representative quota sample of just over five hundred participants of Great Britain (England, Scotland, Northern Ireland and Wales) aged 18 years and older. It thus contributes a major dataset for secondary analysis.

The findings of this research contribute through an analysis of three different aspects of climate change beliefs and behaviours. Firstly, the examination of climate change beliefs reveals that justifications differ depending on belief. More specifically, those who believe that climate change is happening base their belief on changing weather, while those who don't believe climate change is happening were found to base their belief on the natural process involved. A third category of those unsure whether climate change was happening was also identified. These respondents were found to point to both humans and other causes for climate change. Additionally, perceptions of believers about climate change (impact of lifestyle and action for climate change, ability of humans to overcome climate change, problem extent of climate change, and levels of confidence in scientists' confidence both regarding climate predictions and regarding the link between emissions and climate change) were found to differ to those held by deniers.

Secondly, the data demonstrate that there is little association between belief in climate change and the adoption of climate change mitigation behaviours. Although the majority of the public state that they believe climate change is happening and that they take action out of concern for climate change, neither of these two factors was found to be related to the adoption of the 21 energy saving behaviours examined (Gardner and Stern, 2008). Furthermore, the findings indicate that self-efficacy (which is concerned with people's beliefs about their capabilities to perform a specific behaviour) is associated with behaviour adoption. However, despite money being found to be the key motivator for behaviour adoption, the behaviours carried out do not correspond to the ones that are the most effective for saving money, nor those perceived to be the most effective. This could be due to misunderstandings of the effectiveness of behaviours. Thirdly, interventions aimed to encourage households to reduce their energy consumption are examined through a literature review. This is followed by an examination of the potential audiences that could benefit the most from targeted interventions. Sociodemographic variables are able to partially identify the groups of people that may respond most positively to targeted interventions (incorporating antecedent and consequence strategies); those who want to do more for the environment, those who save the least amount of energy, and those who make the biggest error regarding the potential financial savings.

This research suggests that interventions should focus on supporting individuals in developing self-efficacy in relation to mitigation behaviours, providing information on the possible savings when adopting different behaviours and on addressing the barriers to behaviour adoption.

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Author's Declaration

'I declare that, except where explicit reference is made to the contribution of others, that this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.'

Signature:

Printed name: Alexia Koletsou

Glossary

Belief - In the philosophy literature, a belief is defined as 'a dispositional state of mind which endures for a greater or lesser length of time, and that may or may not manifest itself (either in consciousness or in behaviour) during that time' (Smith, 2001, p.285). According to Koballa (1988), people can have beliefs about virtually anything (e.g. people and issues). He went on to point out that beliefs associate attributes or characteristics with an object. For example, the belief 'climate change is happening' links the object 'climate change' with the attribute 'happening'. Additionally, beliefs may be held by people at varying levels of strength. Indeed, Fishbein and Ajzen (1975) pointed out that beliefs associate objects to attributes at a probability level between 0 and 100 percent. For example, one person may be absolutely certain that climate change is happening, whereas someone else may tend to believe it is happening.

Attitude – In the applied psychology literature, an attitude is defined as 'a learned predisposition to respond in a consistently favourable or unfavourable manner toward an attitude object' (Fishbein and Ajzen, 1975, p.6). Fishbein and Ajzen (1975) pointed out that beliefs and attitudes are different, by pointing out that 'whereas attitude refers to a person's favourable or unfavourable evaluation of the object, beliefs represent the information he has about the object. Specifically, a belief links an object to some attribute' (p. 12). Thus, as Koballa (1988) noted, 'a person's beliefs about an object determine how the person feels towards the object (that is, the person's attitude)' (p.121). For example, people's attitudes to energy saving behaviours can be influenced by their beliefs about climate change (Maio and Haddock, 2010).

Perception – In the psychology literature, a perception can be defined as 'the process through which people take raw sensations from the environment and give them meaning, using knowledge, experience, and understanding of the world' (Bernstein, 2013, p.85). According to Smith (2001), perceptions are not beliefs, as they are the acquiring of belief. Indeed, Smith (2001) pointed out that perceptions involve either the acquiring of beliefs or their reinforcement and discussed that an event 'would have been the acquiring of belief if belief had not already been acquired'.

In relation to social cognitive theory, a theory from psychology used extensively in this thesis, behaviour adoption can be linked to two primary forms of perception. Outcome expectations consist of beliefs about whether a specific behaviour will lead to given outcomes, while efficacy consists of beliefs about how capable one is of performing that behaviour. And yet, as Bandura (1984) pointed out, both concepts are perceptions, as they reflect a person's beliefs about capabilities, and as such may not necessarily be true. For this reason they are referred to as perceptions of self-efficacy or perceptions of outcome expectancy.

Opinion – One term which has often been confused and used interchangeably with both belief and attitude is that of opinion (Koballa 1988). Indeed, Fleming (1967) argued that opinions are more affective than belief, while being more cognitive than attitudes, whereas Berkowitz (1980) pointed out a similarity in the two terms, by arguing that people can have an opinion or belief without caring deeply. The term opinion is not used in this thesis.

Behaviour - In the psychology literature, a behaviour can be defined as 'the actions by which an organism adjusts to its environment' (Gerrig, et al., 2011). In the field of environmental psychology, and focusing on energy saving in particular, behaviours typically refer to energy saving behaviours, the adoption of which may result in a reduction of greenhouse gas emissions (Gardner and Stern, 2008). Indeed, the behaviours examined in this thesis are taken from the Gardner and Stern (2008) short list of energy saving behaviours.

Linking behaviour to efficacy, Bandura (1984) pointed out that perceptions of self-efficacy relate the performance of specific behaviours. Thus in this thesis perceptions of self efficacy are examined for specific energy saving behaviours taken from the Gardner and Stern (2008) list.

Choice - In the philosophy literature, a choice can be defined as 'a process during which decisions are reduced to a choice between a manageable set of alternatives' (Hanson 1994). Choices are typically conscious and take part when there are a range of options available. Social dilemma situations provide a good example of the importance of choices. Indeed, in the context of climate change mitigation, behavioural choices often take place in a social dilemma situation. Indeed, there are often personal gains from increased energy use (for example, increased comfort when using more energy for heating); yet in the longer term, unrestrained energy usage at the collective level contributes to increased emissions and the negative impacts of climate change that affect both the contributing individuals and the environment and society at large.

Habit – In the psychology literature, a habit can be defined as 'a more or less fixed way of thinking, willing, or feeling acquired through previous repetition of a mental experience**'** (Andrews, 1903). In sociology the term habit became widespread early in this century, with Durkheim (1898, as cited by Camic, 1986) arguing that 'habit has dominion over people and over things' (p.1051). Camic (1986) points out that according to modern psychology, habit is equated with sequences of behaviours which are usually simple and have become virtually automatic. An example of such a habit is of 'putting on a left sock before a right one' (Camic, 1986, p.1045).

This thesis focuses on two types of behaviours: Curtailment behaviours involve energy saving actions that need to be carried out repeatedly, such as altering driving style or turning down the thermostat, while efficiency behaviours are behaviours carried out once, and have a long term effect on energy consumption. As the former are associated with behaviours which are relatively simple and must be carried out repeatedly, in this thesis, these are considered to be habitual behaviours.

Lifestyle – In the sociology literature, lifestyle can be defined as: 'a more or less integrated set of practices which an individual embraces, not only because such practices fulfil utilitarian needs, but because they give material form to a particular narrative of self-identity' (Giddens, 1991, as cited by Spaargaren and Van Vliet, 2000, p.55). In this thesis, lifestyle refers to the collection of energy saving behaviours carried out by people.

Decision making – Decision making involves choosing among alternatives based on the goals and values of the person or group making the decision (Nemeth, 2012). According to Kahneman and Tversky (1983), people make decisions all the time. Economic approaches to decision making generally involve the examination of the efficient allocation of human resources (Jager et al., 2000), while sociology tends to focus on the social and physical context within which individuals act. This thesis follows a psychological approach, by focusing on the decision making of individuals in the context of social dilemma situations, and with the use of a survey, exploring people's views on whether climate change influences people's decisions. Distinguishing between decision making, choice and habit, Lindbladh and Lyttkens (2002) use decision making as a general term for the psychological process that underpins and determines behaviour, choice to involve conscious decision making (e.g. about behaviours) and habit to involve the processes that support non-conscious decision-making.

Practices – In the sociology literature, practices can be defined as: 'a routinized type of behaviour which consists of several elements, interconnected to one another: forms of bodily activities, forms

of mental activities, 'things' and their use, a background knowledge in the form of understanding, know-how, states of emotion and motivational knowledge' (Reckwitz 2002, p.249). The central idea of practice theory is the identification of clusters of activities within the continual flow of activities (Ropke 2009). This thesis takes a psychological approach, and for this reason focuses on particular individual energy behaviours, rather than taking a more holistic sociological use of practices.

As is discussed in Appendix I, psychology typically focuses on the decision making of individuals (Whitmarsh 2011; Jager et al., 2000). Despite this narrow focus, the psychological approach this thesis focuses on helps us to understand, among other things, people's understandings of climate change (including their beliefs and attitudes to climate change), their response to it (by focusing on the adoption of particular energy saving behaviours) along with their willingness to act (by examining their perceptions of efficacy and outcome expectancy for each behaviour). This in turn allows for the design of interventions with 'a theoretically and empirically based understanding of human behaviour at the individual level' (Swim et al., 2010, p.20).

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Part A: Introduction, Background and Methodology

CHAPTER 1. CONTEXT AND RESEARCH APPROACH

1.1 CLIMATE CHANGE

According to the Intergovernmental Panel on Climate Change (IPCC), climate change is 'a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use' (Field et al., 2012, p. 5).

Over the 20th century, the global average surface temperature has increased by about 0.6°C (Houghton et al., 2001). These increasing temperatures over the past 100 years could partly be due to the natural internal variability (e.g. geophysical cycles). However, empirical studies indicate that this warming is likely to be due to external forcing, with evidence pointing to an anthropogenic influence on our changing climate (Houghton et al., 2001). Indeed, since the industrial revolution, human activities have resulted in an increase in the atmospheric concentrations of key greenhouse gases (Solomon et al., 2009, National Research Council, 2010). The concentration of carbon dioxide (CO_2) in particular has increased by 31% in the past 200 years, being at its highest rate in at least the past 20,000 years (Houghton et al., 2001). The main source of these greenhouse gas emissions results from our dependence on fossil fuels (coal, oil, gas). Despite releasing CO_2 into the atmosphere, they power our ever increasing energy use ranging from home use, to transport, to the production of the goods we consume and use, to how our land and forests are managed (IPCC, 2013).

There is now scientific consensus that points to human induced climate change. Doran and Zimmerman (2009) found that 97% of climate scientists agreed that 'human activity is a significant contributing factor in changing mean global temperatures'. However, despite this scientific consensus on anthropogenic climate change, there still remains uncertainty regarding the scientific understanding of the issue and of future predictions. As Houghton (2004) pointed out, these arise from 'our imperfect knowledge both of the science of

climate change and of the future scale of the human activities that are its cause' (p.12). This uncertainty in future predictions can be seen from the predicted effects of climate change presented by the IPCC (2013), which vary in their degree of confidence, ranging from 66-90% of confidence in projected changes, to 90-99%. And yet, as the IPCC (2001) argued, future research is likely to reduce this uncertainly, with the use of climate models allowing for more accurate predictions (e.g. Solomon et al., 2009).

The projected effects of climate change are not evenly spread out, and as such will affect particular locations differently (Bulkeley, 2013). These effects include a decrease in water availability in draught prone areas, an increase in rainfall in other regions increasing the risk of flooding, an increase in storms in coastal zones, and rising sea levels (National Research Council, 2010). However, the severity of anthropogenic climate change is that even if all CO_2 emissions were to cease being released into the atmosphere, its effects are irreversible for 1,000 years (Solomon et al., 2009). Indeed, in a series of models Solomon et al. (2009) found that CO_2 has a lasting effect on atmospheric composition, and as such 'future carbon dioxide emissions would imply further irreversible effects on the planet, with attendant long legacies for choices made by contemporary society' (p.1709).

Thus, with future projections anticipating an additional warming of 1.1ºC to 6.4ºC over the 21st century, a reduction in our current CO_2 emissions is vital. However as Biesiot and Noorman (1999) argued, their reduction is a great challenge. There are a range of geoengineering solutions that are currently able to achieve emission reductions, such as solar radiation management, which reduces incoming solar radiation and carbon dioxide removal, which removes CO_2 from the atmosphere and transfer it to long-lived reservoirs (Vaughan and Lenton, 2011).

Overall, a reduction to below 1990 levels and a stabilization at this level would slow down the temperature increases, to a rate of a few tenths of a degree per century, instead of several degrees per century, as is projected without this stabilization in emissions (Houghton et al., 2001).

1.2 CLIMATE CHANGE MITIGATION ON AN INTER-GOVERNMENTAL AND GOVERNMENT LEVEL

Climate change began to receive wide scientific and political attention in the early 1980s when the severity of its effects were realised (Bulkeley, 2013). Following the recognition that collective action was required to reduce greenhouse gas emissions, the United Nations Framework Convention on Climate Change (UNFCCC) was signed and agreed at the UN Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, with the aim of achieving an international agreement on stabilising greenhouse gas emissions so that they could 'prevent dangerous anthropogenic interference with the climate system' (UNFCCC, 1992, p.4). This then led to the Kyoto Protocol in 1997 which committed 38 industrialised states from 2008 till 2012 to 'reduce their collective emissions of greenhouse gases by 5.2% compared to the year 1990' (Kyoto Protocol, 1997). However, it was only ratified in 2005 when a sufficient number of countries signed up, thereby making the reduction of global CO_2 legally binding.

In 2008 the British government enacted the Climate Change Act of 2008 which sets legally binding national greenhouse gas emissions targets. These involve a 34% reduction in greenhouse gas emissions by 2022 compared with 1990 levels, which is considerably higher than those proposed by the Kyoto protocol (Committee on Climate Change, 2008). This is then followed by an 80% reduction by 2050, which according to the IPCC (2013) is necessary for the stabilisation of future global temperatures. As Oberthür and Ott (1999) argued:

> From the IPCC's analyses of future emission scenarios, it has become obvious that significant reductions of GHG emissions would be needed to stabilise atmospheric GHG concentrations at comparatively safe levels [...]. Based on scientific progress and the well-established precautionary principle, an international consensus has thus emerged that acknowledges the need for action. Deferring action to some future date, when some miracle technology might allow the world to reduce emissions rapidly risks losing the precious time needed to redirect social development patterns and committing Earth to irreversible climate change (p.11).

However, with our modern day lives being energy dependent and as such resulting in an increase in emissions, climate change at the government level must also translate into mitigation at the individual level.

1.3 CLIMATE CHANGE MITIGATION AT THE INDIVIDUAL LEVEL

1.3.1 Rationale for thesis

The aim of this thesis is twofold. Firstly, to examine people's beliefs about whether climate change is occurring (Chapter 3), as previous studies have pointed to climate change beliefs being an important factor in climate change mitigation (e.g. Joireman et al., 2001). This is coupled with the examination of the justification provided for these beliefs, in an attempt to examine whether these vary according to belief. Secondly, to examine mitigation responses in the form of energy saving behaviours carried out by the UK public, the determinants of these (Chapter 5) and the tailored interventions that can be used to encourage people to reduce their energy consumption (Chapter 6). In addressing the second aim of this thesis, I turn to Geller (2002) who argued that the promotion of pro-environmental behaviour change is more effective when a series of steps are followed: Step 1- the behaviours to be changed that may lead to improved environmental quality are chosen carefully. Step 2 - The factors that cause these behaviours are examined. Step 3 – Well tuned interventions are applied to change the chosen behaviours, and Step 4 – These interventions are then evaluated. Addressing step 1, the Gardner and Stern (2008) *short list* of energy saving behaviours, that have the potential of effectively reducing household energy consumption, is used to examine the adoption of these by the UK public (Chapter 5). Addressing step 2, the factors that influence the adoption and non-adoption of these are examined, building on findings of previous research (Chapter 5).

One factor that is given considerable attention in this study is that of the financial savings and the perceptions the respondents had of these savings. Previous studies examining people's motivations for conserving energy have found that most energy-saving behaviours are carried out mainly for financial reasons rather than for environmental ones (Lorenzoni et al., 2007, DEFRA, 2002). In addition to this, studies have also shown that people hold misconceptions regarding the potential savings from the most effective behaviours (Attari et al., 2010). By examining the relationship between actual and perceived savings, along with whether there is a relationship between these savings and frequency of behaviour adoption, this study contributes to understanding how to direct people's efforts to the behaviours that are the most effective.

Addressing step 3, an examination of interventions used to date, as well as the identification of the members of the UK public that could benefit the most from these

interventions to help them reduce their energy consumption (Chapter 6) is also examined. The examination of step 4 is beyond the scope of this thesis.

One further factor that is given considerable attention in this study is that of efficacy and outcome expectancy (Chapter 4). By examining the relationship between these two psychological factors and the adoption of energy saving behaviours, this study forms an original approach to understanding the factors that influence the energy saving behaviours carried out. Despite the literature pointing to their significant role in human motivation and acting, efficacy and outcome expectancy have largely been unaddressed in the context of collective problems, and their influence on specific energy saving behaviours.

1.3.2 Belief, behaviours and energy savers

1.3.2.1 Climate change belief

The first part of this thesis looks into detail at people's beliefs about whether climate change is occurring and to what individuals attribute their beliefs. Climate change beliefs are influenced by a wide range of variables, which are examined in more detail in the third chapter of this thesis. These variables are first hand experiences (such as experiences of local weather events) (e.g. Spence et al., 2011) and second hand experiences (such as media reports) (e.g. Poortinga et al., 2011). However, past research has not examined which factors individuals themselves attribute their beliefs to. This makes it difficult to understand how people with contrasting beliefs (ranging from believers to deniers) differ in the information they use to justify their beliefs, and the possible sources of information used in generating them. This part of the study explored quantitative and qualitative data with an aim of investigating people's beliefs about climate change and to what they attribute their beliefs. More specifically it examines how the justifications used to support these beliefs differ for those who accept climate change versus those who reject climate change. The wider implications of the sources of information used in influencing people with contrasting beliefs are discussed in Chapter 3.

1.3.2.2 Energy saving behaviours

The second part of this thesis examines climate change mitigation responses (with energy use as an example of a mitigation response). Given the need for immediate end-user energy demand reduction, there has been extensive research regarding the energy conservation behaviours currently carried out. Examples of recent studies include Whitmarsh (2009a), who found a divergence between the recommended energy saving behaviours, and those

carried out by the public. And yet, in their study, DEFRA (2009) found a high proportion of respondents stating that they were trying to cut down on the use of gas and electricity at home. This divergence could be explained by the lack of knowledge of the effective behaviours (Steg, 2008), which, despite people's efforts, has led to unprecedented increases in emissions in recent years (Anderson and Bows, 2011).

This part of the study explored quantitative data with the aim of looking into detail at the adoption and non-adoption of behaviours that have the potential to help people reduce their energy consumption the most. This was followed by an examination of the motivations and barriers for these behaviours and of other factors that may influence the adoption or non-adoption of these behaviours. The link between climate change beliefs and behaviour adoption was also examined here. The wider implications of identifying the factors that influence behaviour adoption and that should be targeted in research, science communication and policy are discussed in Chapter 5.

1.3.2.3 Determining the audience for targeted communication messages

An identification of the members of the UK public that could benefit the most from messages aiming to help them reduce their energy consumption (Chapter 6) is also examined.

Despite the acknowledged need for individual climate change mitigation, the UK public currently demonstrates very low engagement with mitigating actions (Ockwell et al., 2009, IPCC, 2013). Indeed, people's willingness to conserve energy does not always translate into action, or rather, effective energy reducing action (Gatersleben et al., 2002). Researchers have speculated that misconceptions exist regarding how effective energy conservation behaviours actually are (e.g. Gardner and Stern, 2008), while others have found both underestimations and overestimations on people's perceptions of energy consumption's potential energy savings (e.g. Attari et al., 2010).

This section of the study examined the members of the UK public that could benefit the most from messages aiming to help them reduce their energy consumption. This involved examining: a) those who want to do a lot more than they are currently doing, b) those who actually save the least, and c) those who make the biggest error concerning actual savings from the adoption of energy saving behaviours. The tailored messages for each group, along with the wider implications of identifying these three segments of the UK public are

discussed in Chapter 6, as this is necessary for developing effective communication and policy strategies with the target of reducing the UK public's energy consumption.

1.4 RESEARCH QUESTIONS, AIMS AND OBJECTIVES

The main purpose of this thesis is to explore climate change beliefs and mitigation responses (with energy use as an example of a mitigation response). More specifically, the thesis aims to: understand people's beliefs about climate change and the kinds of 'evidence' people use to justify these beliefs; examine the energy saving behaviours currently carried out and the determinants of these (with a particular focus on efficacy and outcome expectancy); and to identify who would benefit the most from effective communication and policy strategies. These aims result in six key objectives: to identify the energy saving behaviours that would help people reduce their energy the most; to examine to what extent people carry these out; to establish from the literature and consequently empirically identify the factors that influence these behaviours; to examine if climate change beliefs in particular influence the adoption of behaviours; to identify the interventions that can be used to encourage energy saving behaviours and then identify the potential audience for these interventions.

A number of research questions are addressed that help to meet these objectives:

Objective 1 – Understanding perceptions of climate change

Research question 1 – What is the distribution of responses between different levels of climate change belief among the UK public? (Chapter 3)

Research question 2 – What does the UK public refer to in justifying their particular level of beliefs, and how can these be linked to different levels of acceptance? (Chapter 3)

Objective 2 – Understanding the adoption of energy saving behaviours

Research question 3 - To what extent does the UK public carry out energy saving behaviours that have the potential to effectively reduce energy consumption? (Chapter 5)

Research question 4 - Is energy saving behaviour adoption positively related to a) carbon savings and b) financial savings associated with these behaviours? (Chapter 5)

Research question 5 – Do financial misconceptions exist regarding the potential financial savings from the Gardner and Stern (2008) *short list* of behaviours? (Chapter 5)

Research question 6 - Do the perceived motivations and barriers for behaviour adoption differ between efficiency and curtailment behaviours, and if so, how? (Chapter 5)

Research question 7 – Do sociodemographic variables, environmental beliefs and actions, along with perceptions of efficacy and outcome expectancy predict energy saving behaviour adoption for each of the 21 Gardner and Stern (2008) behaviours? (Chapter 5)

Objective 3 – Encouraging the adoption of energy saving behaviours

Research question 8 - To what extent does willingness to save energy relate to energy saved? (Chapter 6)

Research question 9 – What are possible target groups and which interventions are most appropriate for different target groups? (Chapter 6)

1.5 AIMS AND STRUCTURE OF THE THESIS

This thesis is divided into five parts; *Part A* (Introduction, Background and Methodology), *Part B* (Climate change beliefs and the justifications provided for these beliefs), *Part C* (The development of an efficacy and outcome expectancy framework in the context of climate change mitigation), *Part D* (Energy saving behaviours, their determinants and determining the audience and structure of communication messages), and *Part E* (Discussion and Conclusion). These are discussed in greater detail below.

Both quantitative and qualitative data were collected in order to give an insight into individuals' understanding and behaviours and to analyse the factors that may influence these. Regarding the behaviours carried out; this study explores the factors that past

research has found to be salient influences on energy saving behaviours, with one factor given particular attention; perceptions of efficacy and outcome expectancy. The focus on these two psychological constructs, which have been found to have practical applications in predicting and influencing long-term behaviour change, creates an original approach to understanding the key influences for energy saving behaviours. A better understanding of these constructs should help in encouraging sustainable behaviours, as it could help determine which forms of efficacy and outcome expectancies should be targeted to achieve positive behaviour change.

1.5.1 Part A – Introduction, Background and Methodology (Chapters 1&2)

Part A is made up of this chapter (Chapter 1), which is aimed at providing a general overview of the field of research focused on in this PhD. Chapter two then outlines the methodology of this project. The development of the online questionnaire in discussed, including the use of quantitative and qualitative questions, as well as the sections of the questionnaire that are exploratory and those that are theory based. The design of the questionnaire is then discussed, with attention given to the content of the four sections of the questionnaire (sociodemographic measures, environmental beliefs and actions, energy saving behaviours, and efficacy and outcome expectancy). The following areas discussed are the refinement stage, the host of the online questionnaire, and the ethical approval received. The participants involved in this study are then discussed, along with the use of quotas which allowed a UK representative sample to be achieved. Finally, the process of data collection is then discussed, along with the data input and analysis procedure.

1.5.2 Part B – Climate change beliefs and the justifications provided for these (Chapter 3)

Chapter three focuses on people's beliefs about whether climate change is occurring and to what individuals attribute their beliefs. It goes on to show how those who accept (believers) versus those who reject climate change (deniers) differ in the justifications they use to support their beliefs. A series of regression analysis then examines the sociodemographic variables that were found to predict some of the justifications provided. The inability to distinguish weather from climate is also discussed, along with how scientific evidence is perceived differently between believers and deniers. Additionally, the differences in levels of confidence in scientists are examined between believers and deniers, along with different perceptions of the impact of human activity.

1.5.3 Part C – Efficacy and outcome expectancy perceptions in the context of climate change mitigation (Chapter 4)

Moving on from understanding climate change beliefs, part C of the thesis paves the way for an examination of climate change mitigation responses. In Chapter four a theoretical framework is developed based on perceptions of efficacy and outcome expectancy for large-scale social dilemma situations such as climate change mitigation. This chapter begins by discussing how behaviour change can be encouraged at the collective level. Drawing on the social cognitive theory by Bandura (1995), efficacy and outcome expectancy beliefs at the individual level are discussed, as they have been found to function as important determinants of human motivation and action. However, as climate change mitigation requires collective action, these two constructs are found to have been poorly theorised at the collective level. This chapter then goes on to outline a framework that incorporates collective forms of efficacy and outcome expectancy and also shows how these constructs can be operationalised, thus allowing the identification of the forms of efficacy and outcome expectancy that should be targeted in order to encourage behaviour change.

1.5.4 Part D – Energy saving behaviours, their determinants and determining the audience and structure of targeted interventions (Chapters 5 & 6)

Chapter five focuses on energy saving behaviours, the factors that influence these specific behaviours and then follows on with an analysis of how these behaviours may be affected by different factors. This chapter discusses two types of behaviours; *efficiency behaviours* which require to be carried out only once and *curtailment behaviours* which require to be carried out repeatedly (explained in section 5.3). Using Gardner and Stern's (2008) *short* list of behaviours, it then analyses which behaviours are the most commonly carried out by the UK public, and goes on to present the motivations and barriers per behaviour. Results show that most of the behaviours, regardless of whether they are efficiency or curtailment, are motivated by financial savings. Barriers were found to differ between these two types of behaviours, with financial costs being the main obstacle to efficiency behaviours, and perceptions of not knowing if it matters being the main barrier for curtailment behaviours. This chapter also examines financial misconceptions regarding the actual potential savings from the adoption of the Gardner and Stern's (2008) *short* list of behaviours, with the results showing that that these exist across all behaviours. Finally, this chapter examines

the factors that predict the behaviours carried out, with a focus on efficacy and outcome expectancy, as outlined in Chapter four.

Chapter six goes on to investigate the tailored interventions that may encourage people to reduce their energy consumption, along with the potential audience for these. Three potential groups were identified that could benefit from these messages. Firstly, this involves those who are already motivated and show a desire to change their behaviours, by stating: 'I'd like to do more to help the environment'. Secondly, again using Gardner and Stern's (2008) *short* list of behaviours, those who save the least are also identified, as they have the potential to greatly increase their energy savings. Finally, upon asking participants about their perceptions of the potential annual financial savings resulting from the Gardner and Stern (2008) behaviour adoption, those who make the biggest error compared to the actual potential savings were also identified. The tailored messages for each group, along with the wider implications of identifying these three segments of the UK public are discussed in Chapter 6, as this is necessary for developing effective communication and policy strategies with the aim of reducing the UK public's energy consumption.

1.5.5 Part E – Discussion and conclusions (Chapter 7)

Finally, Chapter seven provides a final overall discussion and a conclusion to the thesis. It begins by considering the nine research questions that were introduced in Chapter 1. In answer to the first two research questions, it argues that the majority of the UK public believe that climate change is happening, even though they were found to be using their personal experiences (weather) as a key stimulus for acceptance of climate change. The implications of this are also discussed, along with where justifications and views differ between believers and deniers.

In answer to the following five research questions on energy saving behaviours (questions three to seven, see page 8), the issue of people not carrying out the most effective of the Gardner and Stern (2008) short list of behaviours is discussed. In addition to this, financial and environmental savings being found to be unrelated to behaviour adoption, along with the findings of financial misconceptions existing across all behaviours, followed by the factors influencing the adoption and non-adoption of these and the motivations and barriers to action, are discussed in terms of how communication messages can encourage a shift towards the adoption of more effective behaviours.

In answer to the final two research questions on determining the audience and structure of targeted communication and policy messages, the finding that willingness to conserve energy does not translate into energy saving is discussed. In addition to this, upon identifying the three potential groups that could benefit the most from tailored communication messages, the interventions that could be used, both generally for the UK public and specifically for these groups, are then discussed in an attempt to understand how to encourage the UK public to become energy savers. This chapter concludes with some final research considerations and ends with some ideas for further research and policy and communication recommendations.

1.5.6 Part F – References & Appendices

This section outlines the bibliography used for this research, along with the additional information gathered as presented in the appendices.

1.6 PUBLICATIONS ARISING FROM THIS THESIS

KOLETSOU, A. and MANCY, R. 2011. Which efficacy constructs for large-scale social dilemma problems? Individual and collective forms of efficacy and outcome expectancies in the context of climate change mitigation. *Risk Management,* 13**,** 184-208 (Chapter 4).

CHAPTER 2. RESEARCH METHODOLOGY

This chapter describes the methods used to answer my research questions, including the development of the questionnaire, along with the methodology used to collect the data. More specifically, it describes the pilot study, the hosting of the online questionnaire, the recruitment of participants and data collection. Following the structure of this thesis (explained in section 1.4), data analysis is examined separately in each of the corresponding chapters.

2.1 METHODOLOGICAL APPROACH OF THE THESIS

The research carried out for this thesis used a 'mixed methods' approach, by combining qualitative and quantitative methods (Bryman, 2012). The combination of quantitative and qualitative research allows researchers to consider multiple viewpoints, perspectives, positions and standpoints (Johnson et al., 2007). Indeed, in support of this combination of methods, Tashakkori and Teddlie (2003) argued that the use of mixed methods incorporates techniques from quantitative and qualitative research traditions and in doing so is able to answer research questions that could not be answered any other way.

For over a century, proponents of quantitative and qualitative methods approaches have been engaged in a debate, as they were viewed to be grounded in incompatible epistemological positions (Henwood and Pidgeon, 1992). Indeed, as Henwood and Pidgeon (1992) pointed out, quantitative methods are generally associated with experimental, hypothetico-deductive or positivist paradigm; while qualitative methods are more typically associated with naturalistic, contextual or interpretative approaches. For example, according to Bryman (2012) 'quantitative researchers are often portrayed as preoccupied with applying measurement procedures to social life, while qualitative researchers are seen as using words in the representation of analyses of society' (p.408).

Nevertheless, qualitative and quantitative methods are able to offer different insights into understanding climate change belief and as such, each is able to answer different types of

research questions. Thus, as part of this research I align myself with researchers who argue a more pragmatic approach, for example Fielding and Fielding (1986) who pointed out that: 'the basic and plausible assertion that life is multifaceted and is best approached by the use of techniques that have a specialized relevance' (p.34).

In the field of climate change mitigation, the use of a mixed methods design enables public understanding of climate change to be approached in ways that are different, yet complementary. More specifically, survey methodology was able to statistically reveal the prevalence with which climate change beliefs are held, and to also examine the relationships between these beliefs and sociodemographic factors hypothesised to influence them. Justifications for these beliefs on the other hand were obtained in an open-ended manner, thus enabling depth and revealing the more salient influences on climate change beliefs.

Different types of research questions can be answered by qualitative and quantitative methods, as both offer different insights into public understanding of climate change and the behaviours carried out (Bryman, 2012). Indeed, in an attempt to answer the research questions of this thesis as presented in Chapter 1 regarding energy saving behaviour adoption, only quantitative data was collected (Chapter 5). The reason for this was that as some questions used in the survey were taken directly, or adapted from previous surveys, this then allowed for the comparison with this data and to statistically examine relationships of interest. The quantitative data were analyzed in IBM SPSS Statistics 19, with details of the analysis explained in each of the corresponding empirical studies/chapters.

The qualitative data collected in this study consisted of one single question in the questionnaire (Chapter 3). This was used in order to discover the unprompted justifications participants provided for their belief about whether climate change is happening, thus allowing for the examination of the justifications people provided for their beliefs in climate change. This was in the form of an open-ended question where the answers provided went through two steps of analysis. The initial step involved the qualitative coding in NVivo, which resulted in 12 themes (see section 3.5.2.2). These 12 themes were then further analysed as quantitative data, with each theme representing a number. This then allowed for the quantitative analysis of the themes, where statistical relationships with the quantitative data were further explored.

However, given the predominantly quantitative nature of the survey data used it should be noted that the approach I used can most appropriately be characterised as 'quantitative dominant mixed methods research'. Johnson et al. (2007) define this type of research as follows: 'Quantitative dominant mixed methods research is the type of mixed research in which one relies on a quantitative, postpositivist view of the research process, while concurrently recognizing that the addition of qualitative data and approaches are likely to benefit most research projects.' (p.124)

In addition to the above methods for data collection, Chapter 4 involves a piece of conceptual analysis. An extensive literature review found that existing theory on efficacy fails to make distinctions required for applications to large-scale social dilemmas and as such, Chapter 4 discusses the development of a theoretical distinction to allow the concept of efficacy to be used in this context (Koletsou and Mancy, 2011). Additionally, Chapter 6 carries out a literature review in order to determine the audiences for behaviour change interventions.

2.2 DEVELOPMENT OF THE QUESTIONNAIRE

Studying energy behaviours ideally warrants actual behavioural measures. The main advantage of such a method is that it allows for a measure of the actual environmental impact of household behaviours. Several studies used meter readings in order to examine households' gas or electricity use (e.g. Katzev and Johnson, 1984). However, one disadvantage of such a method is that by relying on meter readings, the relationship between the behaviours and their environmental impact is not clear (Gatersleben et al., 2002). Thus, understanding which specific behaviour, and which individual of that household is responsible for the energy use, becomes difficult to determine. One study which tried to overcome this barrier examined each household's appliances and devices, along with how often these are used (Gatersleben et al., 2002). This allowed for estimation of the household energy use by taking into account the energy used by each behaviour. The authors go on to point out that even such a method is not capable of determining the entire energy used by households, given that this would result in a very lengthy questionnaire examining details of all possible goods in households.

Gatersleben et al., (2002) concluded by arguing that 'more attention should be paid to behaviours that contribute significantly to the main environmental problems with which

societies and the world are confronted' (p.353). Despite using self-reporting of behaviours (which have been found to be biased as discussed below), this study focused on the behaviours that are capable of significantly reducing households energy consumption (Gardner and Stern, 2008).

Self-reporting is commonly used for the examination of household energy consumption (e.g. Whitmarsh, 2009a), while some studies have used energy readings (e.g. Poortinga et al., 2004) and others have examined this based on the possession and use of household appliances (e.g. Gatersleben et al., 2002). However, as Olsen (1981) argued, self-reported behaviours may not necessarily reflect the actual behaviours carried out, as these reflect people's perceptions of their behaviours, rather than the behaviour itself. For example, Olsen (1981) pointed to a study carried out by Milstein (1978) which found that 'the actual temperature in the homes studied was on the average about 4^{o}F higher than what the respondents gave as their thermostat setting' (p. 121). And yet, other studies have found a high correlations between estimated and actual gas and energy use (Gatersleben et al., 2002).

Questionnaires offer many advantages in social science research and as such are a popular option for collecting social data (Bryman, 2012). For example, they involve low costs and are quicker to administer than interviews (Bryman, 2012). Questionnaires have been widely used in studies examining climate change beliefs (e.g. Whitmarsh, 2011, Read et al., 1994, Lorenzoni and Hulme, 2009), energy saving behaviours and the determinants of these (e.g. Whitmarsh, 2009a, Poortinga et al., 2004) and identifying the profile of energy savers (Barr et al., 2005, Sütterlin et al., 2011). Despite some studies in this field using face-to-face interviews (DEFRA, 2009, Spence et al., 2011, Sardianou, 2007), these are structured and based on a questionnaire. The main limitation of quantitative survey data is that trying to examine the complexity of everyday life through positions on Likert scales, does not allow researchers to explore people's understanding of climate change on a deeper level, nor does it allow the exploration of how decisions to carry out energy saving behaviours are taken during everyday life. However, the main advantages questionnaires can offer include the statistical examination of any relationships between behaviours and factors found to influence these. Additionally, the use of questions from past studies allows the quantitative data to be compared to previous surveys, and to examine any changes in beliefs or responses to climate change.

In addition to surveys, researchers have used interviews to examine people's energy saving behaviours. For example, Gatersleben (2000) used face-to-face computer-based interviews.

The main advantages of interviews are that they allow for participants to ask for clarification and elaborate on ideas. Additionally, in the context of energy saving behaviours, direct feedback could be given to households during the interview process regarding their energy use. However, one main disadvantage of interviews is that due to their interpersonal nature, participants may respond to questions in ways they deem socially desirable (Richman, et al., 1999). One further method used in the field of climate change mitigation includes ethnography. Ethnography allows researchers to 'understand parts of the world as they are experienced and understood in the everyday lives of people who actually 'live them out'' (Cook and Crang 1995, p.4). Indeed, the main advantage of this method is that allows researchers to explore how the context of decision making influences people's attempts to carry out pro-environmental behaviours (Hargreaves 2011). There are currently very few studies that have used ethnography in the context of energy saving behaviours. Hargreaves (2011) used this method to explore the processes of pro-environmental behaviour change in a workplace, and in support of the ethnographic methods argued that: 'focus on individuals' cognitive states and contextual 'barriers', are too narrow to capture the full range of what is involved in behaviour change interventions' (p.95). And yet, the main disadvantage of this method is that due to its very narrow focus, it lacks statistical representativeness and for the generalisation of findings (Hargreaves 2008).

Among the methods examined, I used an online questionnaire, as this seemed the most appropriate because I wanted to obtain data from a UK representative sample. This would in turn allow me to have confidence to generalise my findings in a UK context[1]. The advantages of an online questionnaire include the low cost involved, the high speed at which data can be collected and the elimination of data entry costs as the data can be imported automatically into the statistical analysis software of choice (Fricker and Schonlau, 2002). To date, there is a limited number of studies examining energy saving behaviours that have used online surveys (e.g. Thøgersen and Grønhøj, 2010, Abrahamse and Steg, 2009). In this study, the main reasons for collecting data via an online survey were: a) to achieve a UK representative sample by using a participant recruitment company and by setting population quotas (described later). The importance of using a nationally representative sample lies in the fact that this would allow for a generalization of the

[1] One limitation of basing this research on a single research method (on line questionnaire) is that triangulation of findings is not possible, thus not allowing for a mix of methods (e.g. more in depth interview data in addition to the quantitative data obtained from the online survey), which could have the potential to result in enhanced confidence of findings (Bryman, 2003).

findings in a UK context; b) to tailor questions to respondents, as this would allow home owners to be asked home related questions and car owners to answer car related questions.

One argument against the use of online questionnaires is sample bias, as the sample may be skewed towards those that have a computer and Internet access. However, according to the Office for National Statistics, the vast majority of UK households (84%) have Internet access (ONS, 2014). Thus using an online questionnaire for a UK representative sample is appropriate.

To date, no existing study has examined collectively the three factors addressed in this thesis: i) climate change beliefs and the justifications for these, ii) energy saving behaviours carried out and the determinants of these (with a focus on sociodemographic factors, efficacy and outcome expectancy perceptions, pro-environmental beliefs and perceived financial savings from behaviour adoption), and finally iii) determining the audience and structure of targeted communication and policy messages, whilst examining whether willingness to save energy translates into energy saving. Therefore, this online questionnaire containing specific questions corresponding to the topics of interest was developed and then used in this research.

Response options in the survey vary depending on the question set. The scales that I created had response options with three- or eleven-point scales. Most scales from other sources had between three- and eleven-point scales as well (see Appendix A and D).

2.2.1 Background to the questionnaire design

Justifications for belief (Chapter 3)

One of the main points of focus in Chapter three was to determine the justifications the UK participants provided for their climate change beliefs. This section was exploratory, as the analysis of the qualitative data examining the justifications people provided was open to emerging themes. These were subsequently examined in relation to findings from previous studies, exploring the factors that may influence climate change beliefs.

Adoption of the Gardner and Stern (2008) short list of behaviours (Chapter 5)

One of the main focuses of Chapter five was to determine the energy saving behaviours carried out by the UK public. Gardner and Stern (2008) published a *short list* of behaviours capable of significantly reducing the energy consumption of US households, based on data from various sources, including government, scientific and technical sources. However, despite providing a theoretical distinction between efficiency and curtailment behaviours, Gardner and Stern (2008) did not explore the adoption of these behaviours in terms of predicting adoption or non-adoption and in terms of explaining people's perceptions of these.

However these theoretical distinctions do lend themselves to making predictions:

i. Economic barriers

Gardner and Stern (2008) pointed out that the adoption of efficiency behaviours require an initial investment as they generally involve a purchase, thus offsetting the simplicity they offer. Indeed, with the initial financial investment that energy efficiency behaviours require, income plays a major part in their adoption, with Dillman et al. (1983) having found that those on lower incomes tend to carry out curtailment behaviours while those on higher incomes are more likely to carry out efficiency behaviours. This was not tested by Gardner and Stern (2008) for their short list of behaviours, and as such, the relationship between income and the adoption of these particular efficiency and curtailment behaviours is further examined in Chapter 5.

ii. Continuous repetition of curtailment behaviours

Gardner and Stern (2008) pointed out that curtailment behaviours must be repeated continuously over time to achieve their optimal effect. Perceptions of self-efficacy may have an important role to play in sustaining such behaviours, as one's perceptions of self-efficacy determine whether actions will be initiated, how much effort will be applied, as well as the extent to which actions will be sustained when barriers arise (Conner and Norman, 2005). This was not tested by Gardner and Stern (2008) for their short list of behaviours, and therefore, the analysis of the quantitative data collected allowed to the relationship between perceptions of self-efficacy and the adoption of both efficiency and curtailment behaviours to be further examined in Chapter 5.

The role of efficacy and outcome expectancy in the adoption of energy saving behaviours (Chapter 5)

Past studies have found perceptions of self-efficacy and outcome expectancy at an individual level to function as important determinants of human motivation and action (Bandura, 1995). However, these have not received much attention in the field of energy saving behaviours and have also remained poorly theorised at the collective level. In Chapter 4 a framework that incorporates collective forms of efficacy and outcome expectancy for large-scale, social dilemma situations is presented, along with the operationalisation of these constructs. Analysis of the quantitative data collected allowed for the predictive theory of this framework to be further examined in Chapter 5.

2.3 QUESTIONNAIRE DESIGN

The online questionnaire used in this study consists of four parts (see Appendix A); 1) Environmental beliefs and actions, 2) Energy saving behaviours, 3) Efficacy and outcome expectancy, and 4) Sociodemographic variables:

Environmental beliefs and actions

This section began by asking respondents their beliefs about whether climate change is happening, using a 5-point Likert scale, with the question wording adapted from Spence et al. (2011). This was then followed by an open-ended question asking respondents why they had selected their answer. This was the only qualitative question used in the online survey. It aimed to gain unprompted information on the reasons that people provided for their position on the ontological reality of climate change[2]. These questions were used first in this section in order to avoid biasing responses. More specifically, asking questions about perceptions of anthropogenic climate change and general pro-environmental beliefs prior

[2] A similar study was published by Capstick and Pidgeon (2014). However this was not available when my study was designed. Similar to my study, this study used an online survey with a UK representative sample of 500 participants. This study was able to show that personal experiences, such as weather, may help anchor the abstract nature of climate change. By using a battery of quantitative questions this study found that 'non-sceptics' are as inclined to attribute a meaning to cold weather events as are 'sceptics'. My findings partially align with these findings, as using an inductive/qualitative approach for justifications of belief, I found both believers and deniers to point to weather as evidence for (anthropogenic) climate change, with believers more likely to point to weather. Unfortunately, as I used an open ended question, not all participants pointed to changing weather - or cold winters (as asked by Capstick and Pidgeon (2014) - and as such I was not able to also demonstrate that weather is used by believers and non-believers alike. However in line with the above study, my findings show that, when unprompted, believers in particular tend to point to changing weather as a justification for climate change. Furthermore, participants in my sample often pointed to ideas not included in Capstick and Pidgeon's study, such as the changeability of weather (rather than extreme events).

to asking about climate change beliefs and a justification for these could prompt responses that are socially desirable and in line with popular views about climate change.

Perceptions of anthropogenic climate change were then examined with the use of a 10-point slider with options ranging from 'all human caused' to 'all non-human'. Perceptions of the extent to which one's lifestyle contributes to climate change were examined followed by the examination of whether action is taken out of concern for climate change, thus exploring what Whitmarsh (2009) and Stern (2000) have called 'intent-oriented behaviour'. Perceptions of current lifestyle and the environment were then explored (DEFRA, 2009), followed by questions probing the extent to which respondents perceived climate change to be a big problem for Humanity and Planet Earth. Respondents were then asked to rate how often concern about climate change influences their decisions (question adapted from Spence et al., 2011), how often they talk to friends and family about climate change (question adapted from DEFRA, 2009) and whether they worry about climate change.

The next set of questions was aimed at understanding perceptions of confidence, first in relation to scientists' confidence regarding climate predictions, second in relation to levels of confidence expected by individuals of science that is used as the basis for policy-making, and third in relation to scientists' confidence regarding the link between carbon emissions and climate change. These questions used predefined levels of confidence taken from guidance on how to describe levels of scientific confidence in reports by the Intergovernmental Panel on Climate Change (Le Treut et al., 2007), examined using five categories of confidence.

Energy saving behaviours

The adoption of energy saving behaviours was examined in this section. The behaviours examined were from the Gardner and Stern (2008) *short list* of behaviours. The Gardner and Stern (2008) *short list* was developed in the US, and as such, for the purposes of this study, these behaviours were adapted for the UK public. Examples include adapting: i) the ***terminology*** by changing 'caulk/weather-strip home' to 'draught proof your home', ii) ***terms and spelling*** by changing 'buy low-rolling resistance tires' to 'buy tyres that lessen resistance', iii) ***units of temperature*** by changing 'turn down thermostat from 72^{o}F to 68^{o}F during the day and to 65^{o}F during the night' to 'turn down thermostat from 22^{o}C to 20^{o}C during the day and to 18^{o}C at night (72^{o}F-68^{o}F, 65^{o}F)', iv) ***energy ratings*** by changing 'install a more efficient unit (replace a 19-21.4 cubic feet top-freezer unit bought between

1993 and 2000 with a new Energy Star unit)' with 'an A+ Rated Fridge Freezer, in place of a lower rated one bought between 1993 and 2000'.

The behaviours were further classified as follows: i) *general behaviours*, which were directed at all participants and involved mainly curtailment behaviours resulting in direct cutting down on energy use (e.g. turning thermostat down), ii) *home behaviours*, which were directed to home owners and involve only efficiency behaviours; The aforementioned are behaviours which can indirectly can result in the reduction of energy use (e.g. installing insulation), and iii) *car behaviours* which were directed at car owners and include both efficiency and curtailment behaviours. The reason for the distinction into these three types of behaviours is that regarding domestic energy conservation, curtailment behaviours may be the only option for people renting their homes, as costly efficiency behaviours may only be an option for home owners (Gardner and Stern, 2008). Similarly, car behaviours can only be directed towards car owners.

Adoption of efficiency behaviours was examined in a yes or no format (with the exception of home behaviours examined with 'I have done this/ I have bought property with/ I have not done this') format. Adoption of curtailment behaviours was examined with a 5-point Likert scale (always, often, sometimes, rarely, never). Following from the main motivations and barriers found in past research (Lorenzoni et al., 2007, Whitmarsh, 2009a), the motivations and barriers to behaviour adoption were subsequently examined through the use of 9 statements in a drop down menu:

Motivations - financial reasons, ease, for the environment, convenience, moral obligation, health reasons, habit, comfort, know it matters.

Barriers - financial reasons, difficulty, for the environment, inconvenience, moral obligation, health reasons, habit, comfort, don't know if it matters.

Respondents were asked to select their main and secondary motivations for each of the behaviours carried out, with the main and secondary barriers selected in the case where the behaviour was not carried out. Perceived financial savings from each of the behaviours was then examined, regardless of whether it was carried out or not, with the following options: £0, £1-£5, £5-£10, £10-£20, £20-£40, £40-£80, £80-£160, £160-£320, £320-£640. These responses were then used as part of the analysis in Chapters 5 and 6, where they were compared against the actual potential money saved by carrying out each of the behaviours

examined. Data from government and commercial sources was used for these calculations (see Appendix H).

The 'skip logic' offered by LimeSurvey was applied to ensure respondents answered the questions that were relevant to them (i.e. home energy saving behaviours were answered only by home owners, and car energy saving behaviours were answered only by car owners). Those who did not own a car or a home only answered questions on general behaviours (mostly curtailment behaviours).

Efficacy and outcome expectancy

This section includes measures of self-efficacy, outcome expectancy, personal outcome expectancy, collective efficacy and collective outcome expectancy, for each of the behaviours, using items from other surveys (e.g. Lubell, 2002, Bandura, 2006), and as developed through the literature review which forms the published Chapter 4 (Koletsou and Mancy, 2011).

Sociodemographic measures

These included measures of gender, age, highest qualification, household income, number of people at home, home and car ownership. As explained in more detail in section 2.3.2, the rationale for including these measures was due to evidence relating these to energy use and savings (e.g. Sardianou, 2007).

Questions which were not included in the final analysis

Within the scope of the PhD, the decision was taken to not include some questions in the analysis. These involved: days of travel to work/study, postcode details, usual transport mode to place of work/study, miles driven, car engine size, flights within and outside UK (from the sociodemographic measures section). In addition there was also a social dilemma question on how likely people would be to reduce carbon emissions in 4 different scenarios, followed by 10 questions examining biospheric, egoistic and altruistic concerns (taken from the environmental beliefs section), perceptions of percentage CO_2 reduction per year per behaviour (from the behaviours section). The answers to these questions generated more data which, ultimately, was beyond the scope of this project.

2.3.1 The refinement step

Once the questions had been chosen and the format of the questionnaire had been decided, a meeting was carried out with science education colleagues from the School of Education involving my supervisor, two PhD students and one Masters student. The aim of this meeting was to ensure that the questionnaire was suitable and appropriate for providing the responses required, and to address any problems of comprehensibility. Based on feedback from these colleagues, some revisions were carried out on the wording of questions and on the answer options provided for some questions. Following these changes, the questionnaire was then transferred to the online host (LimeSurvey). One other Master's student and family member were then asked to complete the online survey, as if they were random members of the public in order to ensure the final format was ready for the study participants to complete. The questionnaire took approximately 30 minutes to complete, both by the two people in the final trial, and the actual 501 participants.

2.3.2 Online questionnaire host (LimeSurvey)

Due to the complexity of the questionnaire designed for this study, an online survey provider that allowed a certain degree of flexibility in questionnaire design was required. LimeSurvey (www.limesurvey.org/) was chosen for the following reasons:

a) It is a free open source online survey application.
b) It offers flexible question formats, where response options could range from open ended, to Likert, to slider format.
c) It offers 'skip logic', which involves displaying certain questions depending on answers provided to previous questions (Sjöström et al., 2013). This was particularly important for the tailoring of questions (i.e. home efficiency questions appearing to those who stated that they are home owners).
d) It allows for respondents to remain anonymous.
e) It allows for quotas to be set. This was of key importance as it allowed for the achievement of data collected from a nationally representative sample (see section 2.3.2).
f) It has an export function, allowing the collected data to be transferred directly into SPSS, thus ensuring reliability.
g) It is '100% CO_2 neutral and environment-friendly' (LimeSurvey, 2013).

2.3.3 Ethical approval of the questionnaire

Prior to data collection, ethical approval was requested from the Ethics Committee for Non Clinical Research Involving Human Subjects of the School of Education at the University of Glasgow. The paper format of the online questionnaire was presented, along with the desire to use data archiving for the data collected. This was granted on the 5th of March 2012 with the statement 'this is a low risk application with little ethical concern' thus allowing the research to be carried out.

2.4 PARTICIPANTS

2.4.1 Participant recruitment using ResearchNow

Recruitment was carried out by the research and marketing firm ResearchNow, and respondents received a financial reward for their participation in line with ResearchNow's policies (this worked out to be the equivalent of £2.60 per completed questionnaire for this study).

ResearchNow were initially contacted on the 20th of February 2012. This was mainly to clarify if they were able to recruit participants for this study, whether they could reach the quotas I required, and whether they were able to collaborate with LimeSurvey. As they were able to fulfil these requirements, data collection began 3 months later. During this time, the study received ethical approval and funding for the data collection process, and I worked on solving the technical issues involved in preparing the online survey, the sorting out of the technical issues of setting the quotas in place through LimeSurvey, and the technical issues involved in setting up the collaboration of ResearchNow and LimeSurvey.

The online version of the questionnaire was designed and developed by me using the pre-defined question formats available from LimeSurvey. However, due to certain technical limitations, I worked with JavaScript in order to present certain questions in a more user friendly and compact format. An example of this is the questions relating to behaviours (see Appendix A). The available question format allowed one column for each answer using a drop down menu, however, for each behaviour, I required two columns of possible answers (for the two reasons for behaviour adoption or non-adoption).

2.4.2 Quotas used

Quota sampling, which is a form of stratified sampling, was used in this study (Jupp, 2006). The quotas were used in order to ensure the sample was representative of the UK population. This was carried out by setting and filling quotas (Gilbert, 2008). These quotas are tailored around the topic being researched, which in this case are outlined in the following paragraph. Thus, once the online survey was hosted on LimeSurvey, the respondents were then recruited by ResearchNow, who then proceeded to complete the survey until the quotas were reached.

More specifically, data for this study were obtained from a UK representative quota sample (N=501) of the population of Great Britain (England, Scotland, Northern Ireland and Wales) aged 18 years and older. A nationally representative sampling is sometimes used in survey research (Spence et al., 2011, Poortinga et al., 2011) because it offers the advantage of allowing for generalisable results. Quotas were set for age, gender, highest level of education, UK region, income, home and car ownership, as evidence shows some of these (age, income, home ownership, education) to be related to pro-environmental and energy use behaviours (e.g. Sardianou, 2007) (see table 2.1). Quotas for gender, age, education, location and home ownership were based on Office for National Statistics 2007 mid-year population estimates, while household income figures were drawn from Experian and working status was based on 2010 Census data (see Appendix B).

The use of quotas has its advantages and disadvantages. As Gschwend (2005) pointed out, the main advantage is that the use of quotas may approximate a stratified random sampling scheme by using elaborate and very restrictive quotas (for example gender, age, social class, education and region). And yet, the key disadvantage is that even the use of these elaborate and restrictive quotas may result in a biased selection of respondents within each cell (Gschwend, 2005).

In total, 501 respondents answered the questionnaires from the 1st to the 14th of June 2012. The number 500 was originally chosen, as similar studies have varied in participant numbers from just over 300 (Abrahamse and Steg, 2009, Thøgersen and Grønhøj, 2010), to the range between 500 and 600 (Sardianou, 2007, Whitmarsh, 2009a, Attari et al., 2010), with some studies having over 1,000 respondents (Sütterlin et al., 2011, Poortinga et al., 2011). Due to financial constraints, data collection ceased at the first convenient point after 500, which was 501.

Table 2-1[3] Demographic profile of the UK population and of the survey respondents

	UK population (N=62.3 million)		Survey respondents (N=501)	
	N (x1,000)	%	N	%
Gender				
Male	30,643	49	255	51
Female	31,618	51	246	49
Age				
18-24	5,953	9.6	60	12
25-34	8,140	13	83	17
35-44	8,833	14	91	18
45-54	8,547	14	91	18
55-64	7,341	12	76	15
65+	10,300	17	100	20
Region				
North East	2,607	4	20	4
North West	6,936	11	55	11
Yorkshire and The Humber	5,301	9	45	9
East Midlands	4,481	7	36	7
West Midlands	5,455	9	45	9
East	5,832	9	44	9
London	7,825	13	65	13
South East	8,523	14	72	14
South West	5,274	8	39	8
Wales	3,006	5	25	5
Scotland	5,222	8	40	8
Northern Ireland	1,799	3	15	3
Household income				
<£15,000	12,460	20	103	21
£15,000-£19,999	4,984	8	39	8
£20,000-£29,999	13,083	21	108	22
£30,000-£39,999	10,591	17	86	17
£40,000-£49,999	7,476	12	60	12
£50,000-£59,999	4,361	7	36	7
£60,000-£69,999	2,492	4	22	4
£70,000-£99,999	6,853	11	47	9
Education				
no formal qualification	6,853	11	29	6
GCSE, O-Level, Standard Grade	12,460	20	107	21
A-level, Higher, BTEC	13,083	21	112	22
Vocational, NVQ, Higher National Diplomas	6,230	10	56	11
Degree or equivalent	15,575	25	140	28
Postgraduate qualification	4,984	8	46	9
Car owner				
Yes	46,102	74	385	77
No	16,198	26	116	23
Home owner				
Yes	42,987	69	319	64
No	19,313	31	182	36

[3] 'The differences in all categories (except region) between the population and sample are due to the limitations set by the quotas. Towards the end of the data collection process, as most quotas has been reached, this resulted in specific combinations of demographic characteristics remaining available, and it became impossible to recruit within this set. More specifically, as not enough respondents aged 65+ had answered the questionnaire, Research Now suggested that the quotas be opened on the last day of data collection, thus allowing more questionnaires to be answered. This unfortunately led to the differences reported in this table, resulting in a limitation of this study. However, these differences are relatively small.'

2.5 DATA COLLECTION

Several steps were carried out to ensure the online questionnaire was fit for purpose before ResearchNow launched it to the participants.

Testing stage

On the 29th of May 2012 the survey went live. A project manager from ResearchNow, a consultant from LimeSurvey and I all carried out individual testing of the survey. We answered the survey independently, making notes of any problems. The consultant from LimeSurvey and I went through the data provided by the three of us, and noted that the online instrument was recording as desired. These responses were deleted in order for the next stage to take place.

Soft launch

A 'soft launch' was carried out by ResearchNow on the 30th of May 2012. This soft launch aimed at achieving approximately 10% of completed questionnaires from the required sample (in this case this was 50 questionnaires). The aim of this launch was for ResearchNow to examine the proportion of people on their database that would respond and then fully complete this questionnaire. This process involved sending out the link of the questionnaire to a selected sample of their panellists, allowing them to answer the questionnaire if desired. The following day, on the 31st of May 2012, there were 50 completed questionnaires, and after monitoring the soft launch data on LimeSurvey, I exported the responses into SPSS to check that the data is recording as expected. Upon confirmation of this, the next phase was planned for the following day.

Full launch

The 'full launch' was carried out on the 1st of June 2012. The link to my questionnaire was sent out to panellists from ResearchNow on a nationally representative basis. This meant that the people entering my questionnaire survey were representative of the UK population, by the variables used for my quotas (i.e. by age, gender, highest level of education, UK region, income, home and car ownership).

The identities of the participants were kept confidentially by ResearchNow and were not shared with me. The first page of the online questionnaire informed participants of the purpose of the present study, and they were given contact information of one of the members of ResearchNow should they have any questions or comments. Every couple of days I updated ResearchNow on the progress of data collection, and provided them with a

Word document that I had constructed showing the quotas that had been set, and the number of participants I had for each of these quotas (for an example of this see Appendix C). On the 14th of June 2012, data collection ended as all the quotas had been reached.

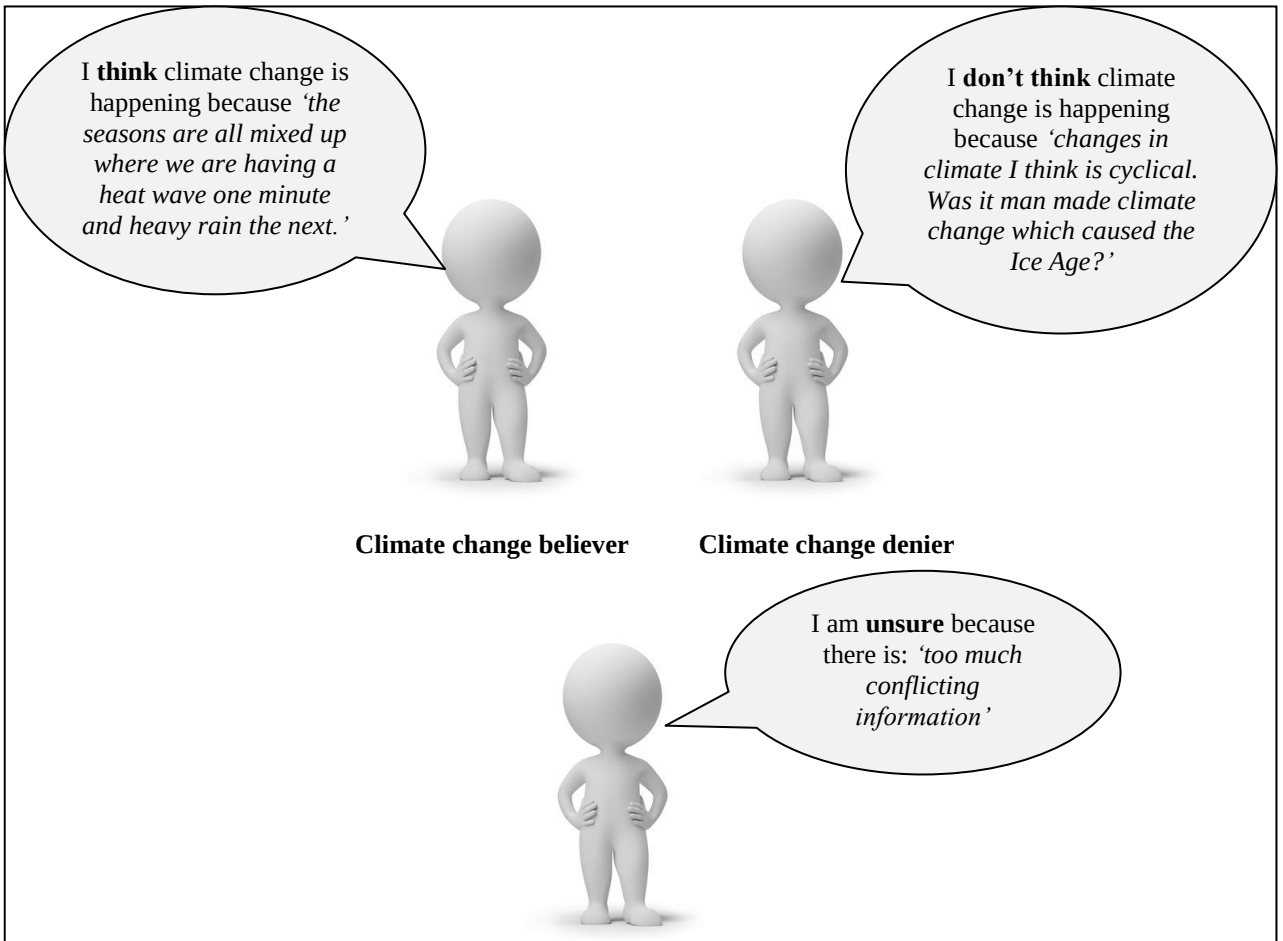
2.6 DATA INPUT AND ANALYSIS

The data collected from the online survey were automatically exported to SPSS Statistics 19, which was then used to conduct statistical analyses (e.g. frequency statistics and regression analyses). Details of the analysis are described in each of the empirical studies.

The qualitative data obtained from the one open-ended question of the survey was exported from SPSS to NVivo for coding and analysis. The qualitative analysis of this question revealed certain commonly emerging words and phrases (e.g. weather, evidence, media). An initial bottom-up coding revealed a distinction between first-hand knowledge or experience (e.g. weather), second-hand knowledge (e.g. media and evidence). These categories were then found to match distinctions found in the literature on knowledge (Wilson, 1983). These first hand and second hand sources of knowledge formed the basis of our coding scheme, which were employed to reveal the justifications of climate change beliefs. The coding structure generated from the qualitative data can be found in Appendix F. Once the coding was completed, the data was entered back into SPSS and treated as quantitative data.

Part B: Climate change beliefs and the justifications provided for these beliefs

How belief attributions and perceptions differ between climate change believers and deniers



Chapter 3 now investigates people's beliefs about whether climate change is occurring and to what individuals attribute their beliefs. Public perceptions of climate change have the potential to form the basis for policy decisions regarding the transition towards low carbon societies (Engels et al., 2013). Indeed, Poortinga et al. (2011) recently argued that: 'It is important to have a detailed understanding of the extent and the reasons why people hold climate sceptical views, as public scepticism and uncertainty about the existence of anthropogenic climate change may become a major barrier to the development of a more sustainable society'.

This inevitably leads to the question as to why some people provide for sceptical views while others provide accepting views.

- In the next chapter I examine the dimensions of belief in climate change amongst the UK public (Research question 1).
- I investigate how those who accept versus those who reject climate change differ in the justifications they use to support their belief (Research question 2)

- I find that the majority of the UK believes that climate change is happening. Justifications for belief differ between those who believe climate change is happening (*weather*) and those who do not think it is happening (*natural process*).
- Several factors investigated differ greatly between believers and deniers (e.g. perceptions of the impact of human activity on climate change, levels of confidence in scientists' confidence both regarding climate predictions and regarding the link between emissions and climate change).

CHAPTER 3. JUSTIFICATIONS OF CLIMATE CHANGE BELIEFS: DIFFERENCES IN BELIEF ATTRIBUTIONS BETWEEN BELIEVERS AND DENIERS

3.1 INTRODUCTION

Over the last few years, climate change has gained increasing attention in the mass media and in politics in the UK. During this time, there has been an increase in public awareness and self-reported knowledge about climate change (DEFRA, 2002, DEFRA, 2007, Upham et al., 2009, Poortinga et al., 2011), with the majority of the UK public believing that climate change is occurring (Spence et al., 2010, Poortinga et al., 2006). However, there exists diversity in public attitudes, with scepticism and uncertainty about climate change found to have increased in recent years (Poortinga et al., 2011, Eurobarometer, 2009). Recent studies have found that climate change concern is influenced by economic downturn and political cues (Brulle et al., 2012; Capstick and Pidgeon, 2014). Part of the heterogeneity can also be explained by relatively stable individual differences such as political views (e.g. Whitmarsh, 2011), environmental values (e.g. Whitmarsh, 2011) and sociodemographic characteristics (e.g. DEFRA, 2007) alongside exogenous influences based on first hand experiences such as local weather events (e.g. Spence et al., 2011) and second hand experiences such as media reports (e.g. Poortinga et al., 2011).

The literature contains a growing number of studies that examine public beliefs on climate change and the factors influencing it. Most of this work is based on statistical associations between responses to questions about climate change belief, demographic and other potential influences. However, these studies have not investigated to which of these factors individuals themselves attribute their beliefs. This makes it difficult to understand how people with contrasting beliefs (ranging from believers to deniers) differ in the information they use to justify their beliefs and the possible sources of information used in generating them.

Joireman et al. (2010) argue that the adoption of climate change mitigating behaviours will depend greatly on one's beliefs about whether climate change is happening and the

perceived impact of human behaviour on generating climate change. Understanding people's beliefs and to what they attribute these is thus important for two reasons. Firstly, it helps us understand how people justify their beliefs about climate change; and secondly, as we expect people to be more likely to take climate change mitigation action if they believe climate change is occurring, it is important to identify what kinds of information influence people's beliefs (Heath and Gifford, 2006). This in turn may influence public-sphere action such as policy support, which ultimately may help guide communication and policy efforts in order to encourage climate change mitigation action amongst the public.

This chapter aims to explore the determinants of climate change belief and to examine the justifications for these beliefs. Here I provide evidence of the forms of information that are most commonly referred to when members of the UK public are asked to justify their beliefs about climate change and the relationship between the form of information and specific climate change beliefs. An on-line survey with 501 respondents from a nationally representative sample in the UK provides evidence that those who accept versus those who reject climate change differ on a range of various sociodemographic characteristics, environmental views but also in the kinds of information underpinning the justifications they use to support their beliefs.

3.2 THE CONCEPT OF BELIEF

A belief can be defined as 'a dispositional state of mind which endures for a greater or lesser length of time, and that may or may not manifest itself (either in consciousness or in behaviour) during that time' (Smith, 2001, p.285). According to Koballa (1988), people can also have beliefs about virtually anything (e.g. people and issues). He went on to point out that beliefs associate attributes or characteristics with an object. For example, the belief 'climate change is happening' links the object 'climate change' with the attribute 'happening'. Additionally, beliefs may be held by people at varying levels of strength. Indeed, Fishbein and Ajzen (1975) pointed out that beliefs associate objects to attributes at a probability level between 0 and 100 percent. For example, one person may be absolutely certain that climate change is happening, whereas someone else may tend to believe it is happening.

Moving onto attitudes, according to Fishbein and Ajzen (1975), an 'attitude can be described as a learned predisposition to respond in a consistently favourable or

unfavourable manner toward an attitude object' (p. 6). They went on to explain that beliefs and attitudes are different, by pointing out that 'whereas attitude refers to a person's favourable or unfavourable evaluation of the object, beliefs represent the information he has about the object. Specifically, a belief links an object to some attribute' (p. 12). Thus, as Koballa (1988) noted, 'a person's beliefs about an object determine how the person feels towards the object (that is, the person's attitude)' (p.121). For example, people's attitudes to energy saving behaviours can be influenced by their beliefs about climate change (Maio and Haddock, 2010). One term which has been confused and used interchangeably with both belief and attitude is that of opinions (Koballa 1988). Indeed, Fleming (1967) argued that opinions are more affective than belief, while being more cognitive than attitudes, while Berkowitz (1980) pointed out a similarity in the two terms, by arguing that people can have an opinion or belief without caring deeply.

When considering how beliefs are constituted, Klein and Kunda (1992) argued that beliefs may be influenced by contextual factors. Indeed, this forms the underpinning of relational ontology, according to which everything is interconnected (Martins 2013). As Schaab (2013, p.1) pointed out, 'relational ontology is the philosophical position that what distinguishes subject from subject, subject from object, or object from object is mutual relation'. Atomistic ontology on the other hand focuses on individual things and considers that the universe consists of certain individuals, each of which exists without reference to others (Rockwell 2004). In relation to beliefs, this would mean that only internal experiences of the self influence beliefs. However, individuals are embedded in social structures and as such as Stern et al., (1995) argued, this social structure 'has substantial influence on all psychological variables. Social structure acts in two ways. It shapes early experience and thus an individual's values and general beliefs or worldview. It also provides opportunities and constraints that shape behaviour and the perceived response to behaviour' (p.726).

Thus as pointed out above, beliefs can be formed by contextual factors, with Klein and Kunda (1992) pointing out that beliefs can be formed on line based on already existing knowledge, with this process being influenced by contextual factors. Indeed, Ajzen (1991) pointed to the field of persuasive communication to mention studies that have found that persuasive messages that attack people's beliefs about an object are actually able to change people's attitudes towards that object. However, this process is not as straight forward, with biased information attention and processing influencing how this information is interpreted. Stern et al., (1995) went on to argue that people's values and worldviews act as

filters to new information, meaning that information that aligns with one's values and worldviews will have more chances of influencing beliefs and attitudes (Stern et al., 1995). Indeed, psychological literature suggests that depending on one's attitudes, the same evidence may be interpreted in different ways (Capstick and Pidgeon, 2014; Lord and Taylor, 2009). Focusing on climate change in particular, this has been demonstrated by experimental work examining individuals' evaluation of conflicting arguments in media articles (Corner et al., 2012).

3.3 CLIMATE CHANGE BELIEFS

Despite the growing scientific consensus that mean global temperatures are rising and that human activity is the principal cause of the rise (Ding et al., 2011), the lay public is known to hold a range of beliefs about climate change. While a study by Doran and Zimmerman (2009) found that 97% of climate scientists agreed that 'human activity is a significant contributing factor in changing mean global temperatures', Poortinga et al (2011) found that just over half of their respondents 'agree that most scientists agree that humans are causing climate change' with 21% of their respondents disagreeing with this statement. Furthermore, although studies over the last two decades show growing awareness and self-reported knowledge of climate change in the UK (Gallup, 2011), recent data reveal a decline in public concern about climate change together with an increase in scepticism about its seriousness and anthropogenic nature (Spence et al., 2011).

In 2005, Poortinga, et al. (2006) found that a majority of the British public (91%) thought that the world's climate is changing, while just 4% did not. Just four years later, Spence, et al (2010) found that the proportion of those thinking the world's climate is changing had dropped to 78%, while the proportion of those who did not had increased to 15%. As Spence, et al. (2010) point out, these results are consistent with those of other studies which have found a decrease in levels of public agreement that climate change is occurring among studies conducted both in the UK (BBC, 2010) and in the US (Leiserowitz et al., 2010). A recent Eurobarometer (2014) found scepticism across Europe, with the proportion of respondents who consider climate change as a serious problem to have decreased from 75% in 2008 to 69% in 2013 (Eurobarometer 2009; 2014). However, in the UK scepticism is higher than in most European countries, but not as high as in the US (Leiserowitz et al., 2010). Indeed, studies examining public attitudes to climate change suggest that climate change is found to not have high priority for most people (e.g., Upham et al.,

2009). It is thus hypothesised that the majority of the respondents stating that they believe climate change is happening, with a possible decline from that found by Spence, et al (2011).

Regarding public perceptions of the causes of climate change, a clear majority of the UK public believes that it is at least partly caused by human activity (Whitmarsh, 2011). However, there exists a minority who are sceptical about the anthropogenic nature of climate change (e.g. Lorenzoni et al., 2006; Downing and Ballantyne, 2007). A recent study by Spence et al (2010) found that in the UK, 31% believe that climate change is caused mostly or entirely by human activity, 47% believe it is due to a combination of human activity and natural processes, while 18% believe it is mostly or entirely natural. Referring specifically to the role of carbon dioxide emissions in climate change, the Eurobarometer (2009) study found that 30% of the European public believed that carbon emissions have only a marginal impact on climate change, with the same question receiving a higher agreement rate of 44% in the UK. Thus, despite 18% of the UK public believing that climate change is mostly or entirely natural, 44% underestimate the impact our carbon emissions have on the environment. It is hypothesised that the majority of respondents will point to a combination of human activity and natural processes as being the source of climate change.

3.4 HETEROGENEITY IN CLIMATE CHANGE BELIEFS

Whitmarsh (2011) reviewed social psychological studies of persuasion and learning and of the risk literature in order to explain the diversity in public attitudes to climate change. These point out that the same information may be processed differently according to cognitive abilities, knowledge, values and worldviews, as well as broader social and institutional factors. Indeed, evidence shows that climate beliefs are based primarily on political affiliation and worldviews, as well as sociodemographic factors (Kahan et al., 2010; Poortinga et al., 2011; Whitmarsh 2011; Leiserowitz et al., 2013). More specifically, examining the loss of trust in experts using a national representative sample survey in the US, Leiserowitz et al (2013) found that 'the loss of trust in scientists [..] was primarily among individuals with a strongly individualistic worldview or politically conservative ideology' (p. 818).

In a study carried out aiming to examine the logics and frames of climate change believers and deniers found believers and deniers to assess climate change evidence using different frameworks (Hoffman, 2011). More specifically, qualitative data was examined from the largest annual climate denier conference in the world (the Fourth International Conference on Climate Change) and from US newspaper editorials with the keywords 'climate change' or 'global warming' (N=795). The results of this analysis highlight the division between the two sides of the debate, with the deniers 'devoting a great deal of attention to the diagnostic frames around whether climate change is actually happening as a man-made phenomena', and believers 'accepting the nature of the problem and attending to solutions' (Hoffman, 2011, p.17).

Rahmstorf (2004) pointed out that 'the various climate sceptics hold very different positions' (p.1). More specifically, Rahmstorf (2004) provided three categorisations of sceptics: a) ***trend sceptics***, who deny the upward trend in global temperatures, b) ***attribution sceptics***, who accept the climate may be changing, however they disagree this may be due to human activity, and c) ***impact sceptics***, who agree the climate is changing as a result of human activity, however they disagree this will lead to substantial detrimental impacts.

With regard to climate change specifically, previous research has shown that public understanding of climate change may be influenced by personal experience, such as weather, or by exogenous influences or second-hand knowledge, such as media communication and perceptions of scientific consensus (Weber and Stern, 2011, Spence et al., 2011, Ding et al., 2011). Qualitative research carried out in 2005 found that uncertainty about climate change may come from various sources, such as perceptions that scientific evidence is conflicting, unreliable or partial, and untrustworthy or misleading sources of information (Whitmarsh, 2005). One recent study found the most important predictors of scepticism to be political views and environmental values, as they accounted for over half the explained variance (Whitmarsh, 2011).

According to Wilson (1983) 'there are two kinds of knowledge: one kind is based on our own personal experience and the other is what others have told us' (Rieh and Belkin, 1998, p.3), with the second type called 'second-hand knowledge' (Wilson, 1983). Factors that help to explain heterogeneity in beliefs is reviewed in more detail in the following sections.

3.4.1 Weather

The variation in climate change belief among individuals may be underpinned by differences in information acquired from personal experience and intermediaries. However, in the context of climate change, personal experience is problematic because climate is a statistical phenomenon consisting of average weather conditions across time and geographical area and climate change refers to changes in average climate conditions over long periods of time (Spence et al., 2011). In order to integrate the large number of data points required to study climate change, the main means for understanding both the climate and climate change are mathematical models and carefully collected scientific measurements (Kollmuss and Agyeman, 2002, Spence et al., 2011). In contrast, personal experience is necessarily limited and can therefore lead to systematic misunderstanding of climatic changes (Weber and Stern, 2011). Nonetheless, first-hand experience of weather is the closest the public comes to directly experiencing climate change. Read et al. (1994) argued that the association of weather and climate change may lead to 'weather-related fluctuations in public concern' (p.973), where public concern about climate change peaks when the weather is unusually hot or cold. Indeed, a recent study carried out in both the US and in Australia found climate change beliefs to be related to local weather conditions. More specifically, greater concern about climate change was expressed by those who perceived the local temperature on the day of the study as being warmer or colder than usual (Li et al., 2011).

Similarly, in the context of extreme weather events, Spence et al. (2011) found that personal experience of flooding was related to increased concern and higher levels of certainty that climate change was occurring. Indeed, the finding that perceptions of weather inform understandings of climate are corroborated by several studies showing that people commonly fail to differentiate between weather, climate and climate change (Bostrom et al., 1994, Read et al., 1994, Bostrom and Lashof, 2004, Bostrom and Lashof, 2007). In one study, where participants were provided with statements about the weather and climate, 35% agreed that 'Climate means pretty much the same thing as weather' (Reynolds et al., 2010, p.1524). Not being able to distinguish between weather and climate increases the potential for misunderstandings in the public understanding of climate change. Indeed, as (Weber, 2010) pointed out, 'people often falsely attribute unique events to climate change and also fail to detect changes in climate' (p.333).

3.4.2 Scientists and scientific evidence

Individual understandings of climate change are also likely to be influenced by secondary sources and representatives, including scientists and the media. Yet, despite the growing scientific consensus about anthropogenic climate change (Solomon et al., 2007), 56% of the UK public agreed with the statement that 'many leading experts still question if human activity is contributing to climate change' (Downing and Ballantyne, 2007, p.7). Despite this widespread scientific consensus, according to Patt (2007), there is scientific uncertainty about climate predictions, and these derive from two sources: (a) *the complexity of the climate system*, resulting in future predictions that display sensitivity to even small differences in assumptions and differences at which scientists model the process, and (b) *the incomplete understanding of many processes involved*, resulting in different projections about future climate.

However, this uncertainty is interpreted differently by scientists and by the public. Lorenzoni et al. (2007) argued that on the one hand, scientists are aware of uncertainty as a key element of the scientific process of discovery, and yet on the other hand, in their study, they found that their participants had a difficulty in interpreting this uncertainty. They went on to state that this led many participants to be unsure about the reality and severity of climate change, as they perceived the scientific evidence to be unreliable. Indeed, this uncertainty was found to be overestimated by the public, with polling agency MORI having found that in 2006, 40% of participants agreed that 'climate change is too complex and uncertain for scientists to make useful forecasts' (Downing and Ballantyne, 2007, p.17).

According to Anderson et al., (2011), people develop basic scientific knowledge through formal and informal education. Regarding the authority of scientific knowledge with a focus on climate change specifically, the IPCC is considered to be the foremost authority on climate science demonstrating a scientific consensus regarding the human impact on climate change (Oreskes, 2004). However, in a study examining people's trust in relation to sources of climate change information, the IPCC was not at the top of the list. On the contrary, Poortinga and Pidgeon's (2003) survey found friends and family to be considered as the most trusted source (4.1 out of 5), followed by environmental organisations (4), doctors (4), and scientists working for universities (3.9).

Due to the complexity of the science of climate change and because the majority of the public is not able to examine the validity of scientists' claims, public perception of scientific agreement has the potential to play an important role in determining the public's climate change beliefs and acceptance towards climate change mitigation measures (Roser-Renouf and Nisbet, 2008). Indeed, when examining the role of perceived consensus among scientists in shaping people's beliefs, Ding, et al. (2011) found perceived scientific agreement to be significantly associated with belief that climate change is occurring. Whitmarsh (2005) also found perceptions of conflict among experts to be related to public uncertainty about climate change, while when examining climate change uncertainty, she found that 25% of those who were uncertain considered the evidence for climate change to be 'unreliable' (Whitmarsh, 2011). As such, I expect believers to point to scientific agreement about climate change, with deniers, on the other hand, pointing to scientific disagreement.

3.4.3 Media

Although perceptions of science and scientists contribute to understandings of climate change, scientists rarely interact directly with the public and as such the media is the most common source of scientific information regarding climate change (Wilson, 2000). The role the media play is one where they tend to present information in an easy to understand manner (Weber and Stern, 2011, Soroka, 2002). Unfortunately, regardless of whether the media is accurate or not about climate change, several authors have commented that media reports may affect people's beliefs about climate change (Krosnick and Kinder, 1990, Weber and Stern, 2011), with just heightened media coverage on an issue potentially leading to increased levels of public interest (Soroka, 2002, Zhao, 2009). Indeed, studies have shown that an issue can be regarded as being more nationally important by people exposed to news stories on the issue than those who were not exposed to such stories (e.g. Miller and Krosnick, 2000, Iyengar and Kinder, 2010).

Poortinga, et al (2011) pointed out that doubts about the scientific consensus may result in uncertainty and scepticism about climate change, which they go on to point out, may be the product of the media presenting climate change as controversial and uncertain, with anthropogenic climate change not being directly experienced (Poortinga et al., 2011, Antilla, 2005). This doubt could have resulted from the media's attempt to adhere to the convention of 'balanced' reporting, in which the views of conflicting sides are provided

with equal attention, with an aim for neutrality (Entman, 1989, Boykoff and Boykoff, 2004). Boykoff and Boykoff (2004) went on to argue that: 'Despite the highly regarded IPCC's consistent assertions that global warming is a serious problem with a 'discernible' human component that must be addressed immediately, balanced reporting has allowed a small group of global warming sceptics to have their views amplified' (p.126). Indeed, one study which examined popular press articles about global warming in the US over the ten year period of 1986 to 1995 found scientific uncertainty to be a salient theme (Zehr, 2000). As the media is the primary source of information about climate change (Whitmarsh 2005; Lorenzoni 2003), I expect this to be the most popular response. However, it is not certain how this will be reported by believers and deniers.

3.4.4 Socio-demographics

Socio-demographic factors, such as age, gender and educational attainment have been shown to be variable in their relationship with views and beliefs about climate change. Some studies have found higher levels of education to be linked to higher probability of belief in climate change (McCright and Dunlap, 2011, Hamilton, 2011). Other studies have found higher levels of education to be negatively associated with concern about climate change (Wood and Vedlitz, 2007, Malka et al., 2009, McCright and Dunlap, 2011). Evidence from the US has indicated that men tend to be more sceptical about climate change compared to women (McCright and Dunlap, 2011), with women more likely to agree that climate change is happening (McCright, 2010). The same situation occurs in the UK, where people over 65 and men in particular are found to be more sceptical (DEFRA, 2002, DEFRA, 2007). Across Europe, according to the Eurobarometer (2009), among other factors, those aged 55+, with low levels of education are the least likely to consider climate change as a serious issue.

3.5 AIMS OF THE EMPIRICAL RESEARCH

Although the public's perceptions of climate change have been studied by a number of researchers (e.g., Spence et al., 2011) and the possible factors that are associated with these beliefs (see above), the importance of these different factors remains unexplored. For example, different individuals experience different weather patterns as a function of their geographic location and different media reports depending on the particular news sources

they use. They may also interpret information differently: the same individual may experience a cold, wet summer as evidence of a change in climate (atypical weather) or as evidence against a change in climate (since the Earth is supposed to be warming up). Finally, such studies tell us little about how individuals rationalise their own beliefs, or the kinds of justifications they employ when discussing their beliefs with others.

In particular, I am interested to know whether the most common justifications provided among people holding different beliefs about climate change are the same, or whether there are differences. This question appears not to have been addressed empirically in the literature. This study therefore aims to address this gap in the literature by investigating the reasons for climate change belief and denial through the examination of different sources of information provided in individual justifications of their beliefs about climate change. This information is important as it helps us to understand the kinds of information that individuals consider to be convincing, both in coming to a decision themselves and in justifying their position to others.

Two specific research questions underpin this study:

Research question 1 - What is the distribution of responses between different levels of climate change belief among the UK public?

Research question 2 - What does the UK public refer to in justifying their particular level of beliefs, and how these can be linked to different levels of acceptance?

3.6 METHODS

3.6.1 Participants and procedure

In June 2012, I conducted an online survey among a nationally representative sample of UK adults (N=501; see Appendix B), using questions designed to examine individual beliefs about climate change (see Table 3.1 for the questions and response options used). In this chapter, I focus on public belief about whether climate change is occurring and the reasons provided for their views. Reasons were provided in an open-ended format and were coded into categories (see section 2.2) that were then analysed statistically. Details of the data collection procedure can be found at section ‘2.4 Data collection’ of this thesis.

3.6.2 Measures

The questions used were from two sections of the questionnaire (see Appendix A). In the first part, participants' climate change related beliefs, knowledge and perceptions were assessed with the use of quantitative questions. In addition to this, there was one open-ended qualitative question used to examine the justifications for people's beliefs in climate change. In the next section of the questionnaire, participants' sociodemographic measures were explored.

3.6.2.1 Climate change related beliefs, knowledge and perceptions

Participants' climate change related beliefs, knowledge about climate change, and perceptions of anthropogenic climate change and the impact of individuals' lifestyle on the environment were assessed. The corresponding items were generated based on items as explained in section 2.2. Initially, one item examined people's belief about whether climate change is happening, while the following examined people's perceptions of anthropogenic climate change. For the first question, respondents had to indicate their degree of agreement on a five-point scale, ranging from 'I am certain or almost certain it is not happening' to 'I am certain or almost certain it is happening'. For the second question, respondents had to indicate their views on an eleven-point scale ranging from 'all human caused' to 'all non-human'[4]. Five items examining people's perceptions about their lifestyle were also examined in this chapter. The items, along with the corresponding questions and response options, are shown in Table 3.1. The three questions aimed to understand perceptions of confidence, first in relation to scientists' levels of confidence regarding climate predictions, second in relation to levels of confidence about scientific predictions about climate change before making recommendations to the public that affect their lifestyle, third in relation to scientists' levels of confidence about the link between carbon emissions and climate change. These questions used predefined levels of confidence drawn from guidance on how to describe levels of scientific confidence in reports by the Intergovernmental Panel on Climate Change (Le Treut et al., 2007). There were five categories of confidence with explicit numerical meanings: *very low* (less than 1

[4] Krosnick and Presser (2010) pointed out that it may be hard for people to define the meaning of the scale points on an 11 or 13 point scale. However for these belief questions I followed the advice given by Bandura (2006) where he argues for the use of 'single unit intervals ranging from 0 to 10' as 'people usually avoid the extreme positions so a scale with only a few steps may, in actual use, shrink to one or two points' (p.312).

out of 10), *low* (about 2 out of 10), *medium* (about 5 out of 10), *high* (about 8 out of 10), *very high* (at least 9 out of 10). The items and response categories are shown in Table 3.1.

Table 3-1 Items used to measure energy saving behaviours including means and standard deviations

Items	Questions	Response categories
Climate change belief	Which of the following statements best describes your beliefs about whether climate change is occurring?	Five-point scale (I am certain or almost certain it is not happening - I am certain or almost certain it is happening
Perceptions of anthropogenic climate change	Position the slider to indicate whether you believe climate change is caused mostly by humans or mostly by other causes.	Eleven-point scale (All human caused-All non-human)
	To what extent do you agree with the statement: 'My lifestyle contributes to climate change'?	Five-point scale (strongly disagree-strongly agree)
	Have you taken, or do you regularly take, any action out of concern for climate change?	Three-point scale (yes/no/don't know)
Perceptions about people's lifestyle and the environment	Which of these best describes how you feel about your current lifestyle and the environment?	Four-point scale (I'd like to continue doing what I'm doing at the moment, I'd like to do a bit more to help the environment, I'd like to do a lot more to help the environment, don't know).
	To what extent do you agree with the statements: 'Climate change is a big problem for Planet Earth?' To what extent do you agree with the statements: 'Climate change is a big problem for Humanity?'	Five-point scale (strongly disagree-strongly agree)
	Rate how often concern about climate change influences your decisions. Rate how often you worry about climate change. Rate how often you talk to your friends and family about climate change.	Five-point scale (never-very frequently)
Perceptions of scientists' confidence	How confident do you think scientists are regarding climate predictions? How confident should we be about scientific predictions about climate change before making recommendations to the public that affect their lifestyle? How confident do you think scientists are about the link between carbon emissions and climate change?	Five-point scale scale (very low confidence, 1 out of 10 - very high confidence, 9 out of 10)

3.6.2.2 Justifications provided for climate change related beliefs

Participants were initially asked to respond on a five-point Likert-scale (five different levels of agreement) to a statement on whether climate change is happening. In order to

explore justifications for climate change related beliefs, participants were then asked to provide reasons for their selection of a particular level with the open-ended question: 'Why have you selected the answer above?'

Justifications were then analysed based on a template analysis approach (Crabtree and Miller, 1999). In this analysis, respondents' justifications were coded in a bottom-up way in order to then organise and analyse them according to themes. The focus of the analysis was on different themes to which participants refer as their justification for making a judgement on the selection of a particular level of agreement with climate change happening. The process of qualitative data analysis was carried out as follows: firstly, I read the data in NVivo and found certain commonly emerging words and phrases (e.g. weather, evidence, media). All the responses of this question were then coded, to familiarise myself with the content and identify the main themes.

This initial bottom-up coding revealed a distinction between first-hand knowledge or experience (e.g. weather) and second-hand knowledge (e.g. media and evidence). Similar distinctions are found in the literature on knowledge (Wilson, 1983). These first hand and second hand sources of knowledge formed the basis of the coding scheme, which were employed to reveal the justifications of climate change beliefs. As a result of this examination, 12 codes were developed: *just because*, *weather*, *some signs*, *evidence general*, *evidence specific*, *natural process*, *scientists*, *media*, *politics*, *filters*, *unsure*, *no answer* (see Appendix F for the coding scheme, with category descriptions and examples). Finally, together with my supervisor, we coded the full dataset independently, with each statement receiving up to three different codes, depending on how many themes were referred to in each statement. Reliability coefficients were then calculated, with percentage agreement ranging from 94%-99%, indicating excellent overall agreement, with an overall Kappa coefficient of 0.97, indicating excellent reliability in coding.

The coding structure generated from the qualitative data can be found in Appendix F. Once the coding was completed, the data was entered back into SPSS and treated as quantitative data.

3.6.2.3 Sociodemographic measures

Several sociodemographic variables were examined[5]. During the data collection process, quotas were set for age, gender, highest level of education, UK region, income, home and car ownership, as evidence shows these to be related to pro-environmental and energy use behaviours (e.g. Sardianou, 2007). The items, along with their response categories (see section 2.3.2 for an explanation how these are used) are detailed in Appendix A.

3.7 RESULTS

In this section, I initially address the first research question posed in Chapter 1: to describe the dimensions of belief in climate change amongst the UK public. This is carried out by presenting the frequencies of the various climate change beliefs, along with perceptions of anthropogenic climate change, and whether there is any association between the two. This section also addresses the second research question posed in Chapter 1: to describe the justifications for climate change belief provided by the UK public, and then to examine the demographics that may predict these justifications. Furthermore, this section examines where climate change believers and deniers differ, with a focus on scientists confidence.

3.7.1 Climate change beliefs

Belief that climate change is occurring is shown in Table 3.2. As expected, similar to previous research (Spence et al., 2011), I found levels of belief that climate change is occurring to be very high. Just 8% were 'certain, almost certain or tended to believe that climate change is *not* happening'; with the majority (75%) stating that they were 'certain, almost certain or tended to believe that climate change is happening'. A further 17% stated that they were unsure whether climate change is happening. For clarity of presentation, I group together as 'believers' those who tend to believe with those who are certain or almost certain that climate change is occurring, and analogously for 'deniers'.

[5] As has been pointed out, media is the primary source of information about climate change (Whitmarsh 2005) and evidence shows that climate beliefs are based primarily on political affiliation and worldviews (Kahan et al., 2010). However, demographic variables were only used as I hoped politics, experience (e.g. weather) and media would come out as justifications for climate change beliefs in the open-ended question. I was interested in the justifications people give about their beliefs, allowing politics/experience/media to come out as dependent variables, as these are the justifications people offer to one another about their beliefs on an informal level.

Table 3-2 Climate change perceptions

	Statement of belief	Frequency (%) of beliefs	
believers	I am certain or almost certain it is happening	35%	75%
	I tend to believe it is happening	40%	
unsure	I am unsure if it is happening	17%	17%
deniers	I tend to believe it is not happening	5%	8%
	I am certain or almost certain it is happening	3%	

3.7.1.1 Perceptions of anthropogenic climate change

With regard to perceptions of the anthropogenic nature of climate change, contrary to what was expected, my results show that 46% believe that climate change is caused mostly or entirely by human activity, 37% believe it is due to a combination of human activity and natural processes, while 17% express doubt about human activities having an influence on climate change, believing it is mostly or entirely natural. These results differ slightly from those found by Spence et al. (2011), with a lower proportion of agreement with the human element (31% compared to my 46%), and a lower proportion of those rejecting the human element (47% compared to my 37%). However, my findings for the perceptions of climate change being mostly or entirely natural are very similar (18% compared to my 17%).

Unsurprisingly, perceptions of the causes of climate change were found to differ amongst the three levels of climate change belief. As figure 3.2 below demonstrates, the majority of believers (55%) pointed to anthropogenic causes, as they stated that they believe climate change to be caused mostly by humans. On the other hand, rejecting the anthropogenic influence on climate change, the majority of deniers (59%), stated that they believe climate change to be mostly caused by other causes. The most uncertain respondents about whether climate change is happening were found to point to both human and other causes. The implications of this are discussed further in Section 3.7 Discussion.

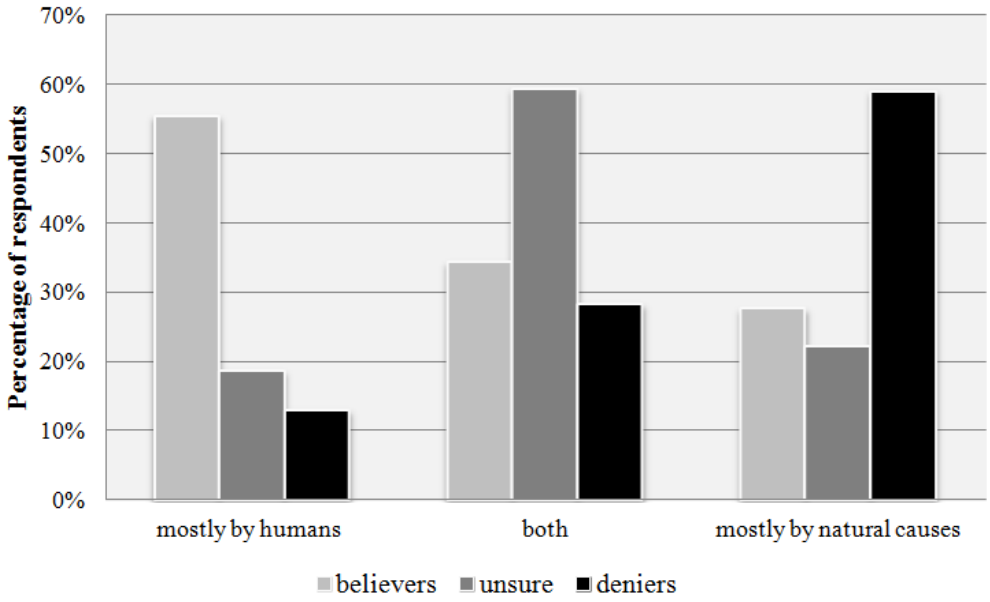


Figure 3-1 Perceptions of anthropogenic climate change for believers, those unsure and deniers.

What is interesting to note is that most of the deniers in this study (N=15, 39%) believe that climate change is a natural phenomenon and thus reject the notion of anthropogenic climate change whilst apparently accepting that climate change is happening. This finding reflects Rahmstorf's (2004) ***attribution sceptics***. Those in this group accept that climate is changing, but reject that it is caused by human activity. A Mann-Whitney test indicated that deniers (Mdn=7) were significantly more likely to believe climate change is mostly or entirely natural compared to believers (Mdn=3), $U=2429$, $p < .001$.

The other distinctions by Rahmstorf (2004) are those of ***trend sceptics*** who deny that the climate is changing and ***impact sceptics*** who agree that the climate is changing as a result of human activity, but do not think it will result in significant harmful impacts. As Poortinga et al. (2011) pointed out, among the general public in the UK, all three types of Rahmstorf's climate scepticism can be found. Indeed, these three categories of deniers were also found in this study (see Table 3.3). In their study, Poortinga et al. (2011) found impact scepticism to be the most common form of scepticism. In this study, the most common form of scepticism appeared to be trend scepticism, involving doubts about the upward trend in global temperatures: 69% of the study respondents agreed and strongly agreed that climate change is not happening, whilst not mentioning natural process in their justification for these beliefs. The second most common form of scepticism was impact scepticism, involving doubts about the severity of impacts of climate change: 62% of study respondents agreed and strongly agreed that climate change is not happening, whilst also disagreed or strongly disagreed with the statement 'climate change is a big problem for

Planet Earth'. A smaller 8% were attribution sceptics, who agreed that climate change is happening, and yet in their justification pointed to only natural process involved.

Table 3-3 Profile of Rahmstorf (2004) deniers

Rahmstorf's climate scepticism	Categorisation of denial in this study	Frequency (%) of beliefs
Trend sceptics - deny the upward trend in global temperatures	Those who believe climate change is not happening, and in their justification did not mention natural process.	69%
Attribution sceptics - accept the climate may be changing, but don't agree this may be due to human activity	Those who believe climate change is happening, and in their justification mentioned natural process.	8%
Impact sceptics - agree the climate is changing as a result of human activity, but disagree this will lead to substantial detrimental impacts	Those who believe climate change is not happening , and rated low on 'climate change is a big problem for Planet Earth'.	62%

The next section considers the justifications for the different levels of belief in climate change. Respondents were asked to provide a justification for their beliefs in climate change. It was expected that relationships would emerge regarding one's belief in climate change and the justifications provided.

3.7.2 Justifications for belief

In this section, justifications for the levels of climate change belief are presented in conjunction with the different levels of belief consisting of believers, deniers, and being unsure. As explained in section 3.5.2.2, responses were grouped into 12 sets of justifications, which are presented in greater detail in Appendix F. Figure 3.2 shows the breakdown by climate change belief. Indeed, the relative use of belief attributions differed considerably depending on climate change beliefs. Overall, the three most popular justifications provided were: *weather*, *natural process*, and *evidence general*. The analysis shows that among 376 believers, the majority (43%) pointed to the *weather*. On the other hand, the majority of the 39 deniers (39%) pointed to *natural process*. Those respondents

who were unsure about whether climate change is happening (N=86) stated that they were either unsure or pointed to *natural process* (39%). The justifications that were found to be expressed equally by both believers and deniers were: *evidence, just because and scientists.*

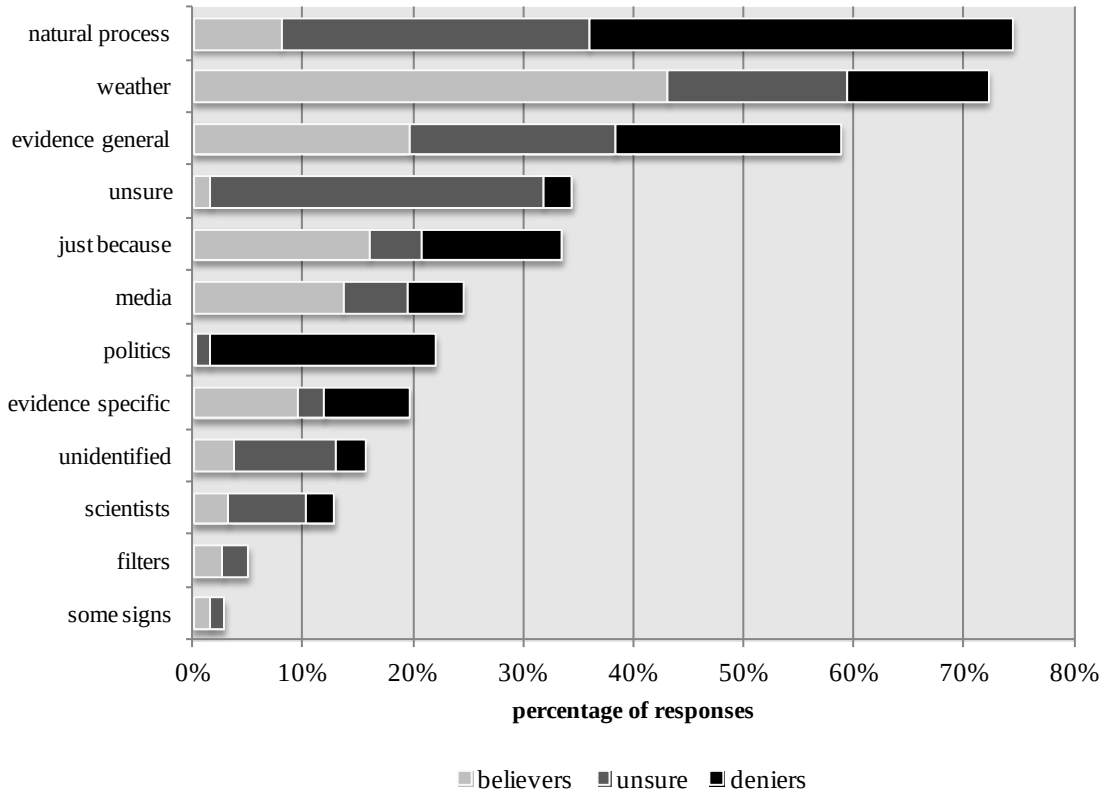


Figure 3-2 Belief attribution about whether climate change is occurring. Differing levels of reasons provided depending on the level of belief in whether climate change is happening.

3.7.2.1 Most common justification by believers - Weather[6]

As expected, the most popular justification for belief from believers was *weather* (43%, see figure 3.3), and in fact, it was the highest proportion of believers that used this category (35%). This association of climate change with changes in weather is consistent with previous research (Bostrom et al., 1994, Read et al., 1994, Bostrom and Lashof, 2004, Bostrom and Lashof, 2007). Responses mainly pointed to:

[6] The media is a primary source of information about climate change (Lorenzoni, 2003). Thus, justifications referring to weather could be labeled as 'media reported weather'. However, most justifications provided expressed a relation to personally experienced weather, and for this reason weather here is discussed in terms of personally experienced weather. Nevertheless, I acknowledge that weather justifications might also be related to media reported weather.

Unpredictable weather: 'The weather in my opinion has become less predictable. The seasons have become very similar to one another where wet damp weather predominates'.

Personal experience of weather changes: 'The winters are more mild than when I was younger and the atmosphere is much more polluted'.

Extreme weather changes: 'Because of all the strange weather we have been experiencing over the UK'.

A number of respondents mentioned the colder winter experienced, with one example being: 'the last couple of winters in Scotland was [sic.] unbearable'. This focus on local weather rather than more serious impacts on other parts of the world could be due to the media, which focuses more on the former rather than the later regarding climate change reporting (Hargreaves et al., 2003). Indeed, in a study of the media's role in the public understanding of climate change, Hargreaves et al. (2003) found that 'the news media pays considerable attention to the consequences of global warming particularly in the British context' (p.39), with local weather related stories being the main focus of climate change stories. This could explain the association the public makes between climate change and local weather. In addition to this, these findings are consistent with previous studies which point out the role personal experiences play in shaping people's perceptions of environmental problems, such as climate change (e.g. Kempton, 1991).

3.7.2.2 Most common justification by deniers – Natural process

Natural process was mentioned as a justification for belief by both believers and deniers, however, it was the most popular response among deniers, with 39% of deniers providing justifications categorised as natural process (see Fig. 2C). Indeed, this reflects one of the categories of deniers (attribution sceptics) as pointed out by Rahmstorf (2004). They accept that climate is changing, but reject the existence of anthropogenic climate change, as has also been found by other studies (Lorenzoni and Pidgeon, 2006, Downing and Ballantyne, 2007, Poortinga et al., 2011). Responses mainly involved:

Deniers: 'Our planet has been through the ice age before any human was polluting the world. I think that was is happening is a natural process of our world'

On the other hand, a minority of believers (8%) use the natural process to justify why they believe climate change is happening.

Believers: ‘Because climate is cyclical and has changed continuously since time began***’.***

What this demonstrates, is that the denial of anthropogenic climate change emerged as a salient feature of deniers’ justification for not believing climate change is happening. Indeed, despite both believers and deniers of climate change accepting climate change as a natural process, deniers were found to deny any human causes. What is interesting to point out is that according to Whitmarsh (2009b) the term ‘global warming’ is more often associated with human causes, while the term ‘climate change’ is more linked to natural causes. And yet, in this study where only the term ‘climate change’ was used, deniers perceived this term to refer to human causes. Indeed, as one respondent from this study pointed out: ‘Well it depends how you define it - I think it's happening but the question could be loaded to include human impact, which I am not so sure about’

3.7.2.3 Justifications expressed equally by believers and deniers - evidence, just because and scientists

Evidence, just because and scientists were found to be expressed almost equally by both believers and deniers. More specifically, *evidence general* was the second most common justification provided by both believers (20%) and deniers (21%). Scientists, despite not being mentioned as often, were mentioned by 3% of believers and deniers. Focusing on believers in particular, using evidence and scientists as justifications for belief demonstrate a trust in science and scientists, which is consistent with the large scale survey carried out MORI (2005). The credibility of evidence and the trust in scientists were used to back up believers’ views, for example: ‘There seems to be compelling evidence that it's happening’, and ‘Because I trust scientists more than rumour or hearsay’. For deniers on the other hand, evidence was used in the context of not believing the evidence, not believing that scientists can ‘prove’ it is happening: ‘Because there is no credible scientific evidence to support a different view’, and ‘Scientists still can't really prove it's happening’. This finding is consistent with that of Whitmarsh (2011) who found that 25% of those uncertain considered the evidence for climate change to be ‘unreliable’.

A reason for evidence and scientists both being used equally to support two opposing beliefs was provided by Hoffman (2011) who argued that believers and deniers assess climate change evidence using different frameworks. Indeed, Corner et al., (2012) explain that ‘a well-established social psychological finding is that people with opposing attitudes often assimilate evidence in a way that is biased towards their existing attitudinal position,

which may lead to attitude polarisation' (p.463). Thus, consistent with these findings, Corner et al. (2012) found those who believed climate change was happening evaluated the convincingness and reliability of editorials on climate change differently from those who were sceptical about climate change.

The category '*just because'* reflects the justification provided by both believers and deniers who were not able to support their views on climate change. These respondents provided responses such as 'because that is my opinion' and 'because I believe!'. This lack of support for their argument could be due to people's misunderstandings regarding climate change. Indeed, Kempton (1991) found that 'laypeople confuse or are unfamiliar with key concepts regarding the causes of global warming, evidence for it to date, and potential policies to mitigate it' (Kempton 1991, as cited by Bostrom et al., 1994, p.960). Future research could examine whether vague responses of this nature are associated with an actual lack of knowledge about climate change.'

3.7.2.4 Overall patterns of justifications

While *weather* was the most common justification among believers, for those unsure, the most common justifications were categorised as *natural process* and *unsure*, and the most common reason for disbelief among deniers was *natural process* (see figure 3.4). A chi square test of independence demonstrated significant differences in the distribution of justifications between belief categories $\chi^2(22, N=501) = 794.5$, $p < .001$. A Kruskal-Wallis test was conducted to evaluate differences among the 3 belief justification groups (believers, uncertain and deniers) and the justifications of beliefs. Grouping by justification, the Kruskal-Wallis analysis indicated that there was a significant difference in median level of belief between the groups, $\chi^2(11, N = 398, p<.001)$. Because the overall test was significant, pair-wise comparisons among the groups were carried out. The results of these tests indicated a significant difference between believers and deniers for weather (U(df)=5113, Z=-3.664, p<.001), natural process (U(df)=5097, Z=-5.821, p<.001) and politics (U(df)=5847, Z=-8.253, p<.001). Between believers and those unsure, the tests indicated significant differences for weather (U(df)=118343, Z=-4.613, p<.001), natural process (U(df)=12946, Z=-5.184, p<.001), unidentified (U(df)=15266, Z=-2.189, p=.29), just because (U(df)= 14340, Z=-2.735, p=.006), unsure (U(df)=11538, Z=-9.426, p<.001) and evidence specific (U(df)=14996, Z=-2.205, p=.027). Between deniers and those unsure, the tests indicated significant differences for politics (U(df)=1564, Z=-3.862, p<.001) and unsure (U(df)=1213, Z=-3.469, p=.001).

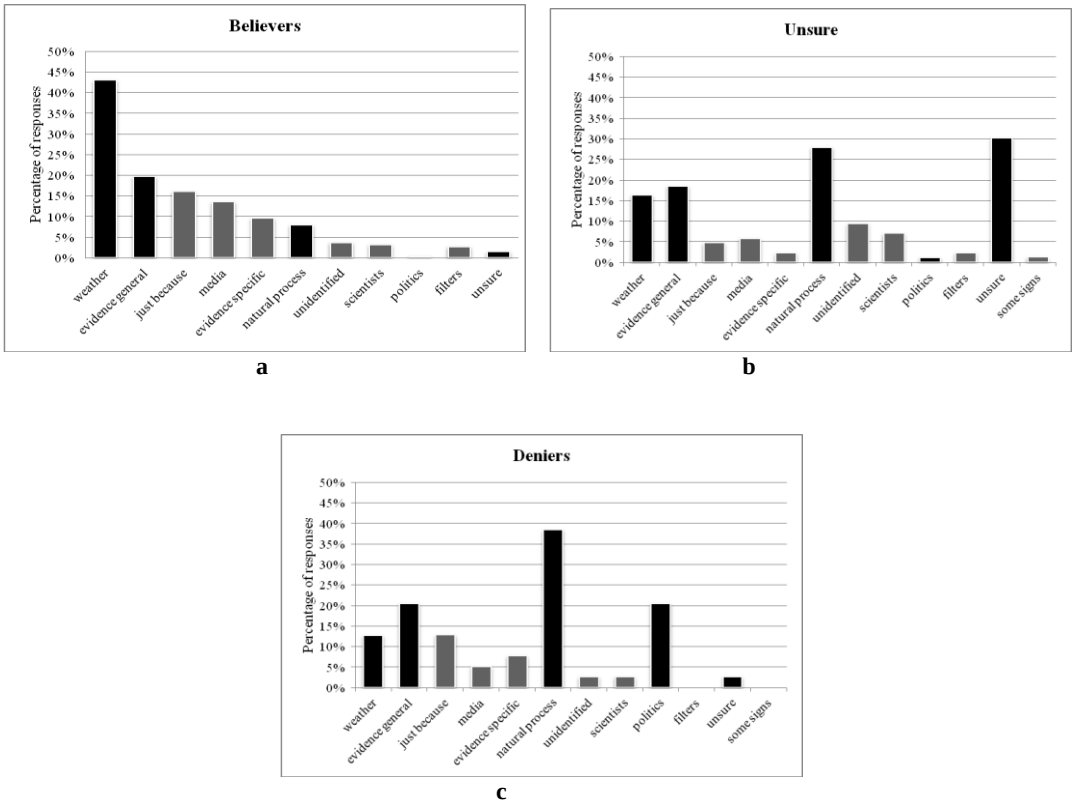


Figure 3-3 Climate change justifications by belief. Justifications for a) believers, b) those unsure, and c) deniers.

These results point to an interesting finding. It shows that the most common justifications provided among people holding varying beliefs about climate change are different. To be more specific, although 75% of the participants accepted climate change, the majority of them justified this belief by pointing to the weather. Indeed, this finding is consistent with previous studies (e.g. Spence et al., 2011) which show a failure to differentiate between weather, climate and climate change (Bostrom et al., 1994, Read et al., 1994, Bostrom and Lashof, 2004, Bostrom and Lashof, 2007). As Hargreaves et al. (2003) found, the association the public makes between climate change and local weather could be due to the media, which focuses on local weather when reporting on climate change.

On the other hand, although the minority of the participants in this study (8%) stated that they do not believe climate change is happening, the most popular justification for this was that climate change is a natural process. This shows that the category of attribution sceptics as previously suggested by Rahmstorf (2004) empirically existed in this study. In fact, including 'anthropogenic climate change' in the question statement could have revealed that those rejecting climate change tend not to reject the whole statement, but only mainly the anthropogenic element.

3.7.2.5 Which demographic variables predict justifications?

As part of my analysis, a series of binary logistic regressions were used to model levels of belief in order to establish the demographics predicting justifications. The outcome measures in these analyses were justifications for belief (12 categories), from which I tested to see what relationships exist with the demographic variables – age, gender, education, income, number of people in household, home owners, car owner, region of residency in the UK. My results show that some demographics are able to predict three of the justifications for belief (*weather*, *evidence general* and *confidence in scientists*).

As shown in Table 3.4, the regression analysis for *weather* found that respondents who are male, respondents from larger households (i.e. respondents with children most likely), and respondents who are not from Scotland are more likely to mention weather as a justification for belief. Other demographic variables – age, income, education, home and car ownership – were non-significant. For *evidence general*, respondents from smaller households, respondents with higher levels of education and income were more likely to mention evidence as a justification for belief. Other demographic variables, age, gender, home and car ownership, were non-significant. For *scientists*, respondents who own their own homes, who are older and female are more likely to mention scientists as a justification for belief.

Table 3-4 Binary logistic regressions - Predicting justifications for belief using demographics

Variable	Weather	Evidence general	Scientists
Age			.612**
			(.238)
Gender	Male		Male
	.594**		-1.296*
	(.205)		(.627)
Income		.178**	
		(.065)	
Education		.265**	
		(.091)	
People in household	.255**	-.426***	
	(.095)	(.127)	
Home owner			1.818**
			(.654)
Scotland	-1.682*		
	(.742)		
Nagelkerke R^2	.108	.173	.299
-2 Log Likelihood	599.548	425.946	117.933
Model χ^2[k]	40.341	56.015	24.365
Prediction accuracy	66.5%	81.8%	96.1%

It is unsurprising that age and gender were found to predict trust in scientists. Indeed, this is consistent with previous studies (e.g. Anderson et al., 2011) in which, similar to my findings, it was found that those who are younger and female are more likely to trust scientists. In their study, Anderson et al., (2011) found income and education to be significantly related to trust in scientists. More specifically, they found that those with higher incomes and more years of education were more likely to trust scientists. And yet, my findings reveal that those with higher incomes and higher levels of education were more likely to employ justifications based on evidence in order to support their beliefs, rather than scientists.

3.7.3 Where believers and deniers differ

In this section, the factors examined in this study where climate change believers and deniers differ are presented. Overall, as expected, the results obtained in this study indicate that perceptions of believers about climate change appeared to be different to those held by deniers. A series of Mann-Whitney *U* tests were conducted to evaluate the hypothesis that believers would score lower (i.e. more agreement), on the average, than deniers on climate change perceptions. The results of the tests were in the expected direction and significant. Regarding impact of lifestyle and action for climate change, believers were more likely to state that they take action out of concern for climate change (Mdn=1) compared to deniers (Mdn=2) (U(df)=1466, Z=-8.858, p<.001), they agreed more that their lifestyle contributes to climate change (Mdn=2) compared to deniers (Mdn=4) (U(df)=3864, Z=-5.581, p<.001). Similarly, believers were more likely to believe that humans can overcome our environmental problems (Mdn=2) when compared to deniers (Mdn=3) (U(df)=4871, Z=-3.824, p<.001). Regarding the problem extent, again as expected, believers were more likely to think that climate change is a big problem for Planet Earth (Mdn=2) and Humanity (Mdn=2) compared to deniers (Mdn=4) (Mdn=4) (U(df)=1411, Z=-8.872, p<.001, and U(df)=1720, Z=-8.490, p<.001 respectively). With regard to the socio-demographic profile of believers and deniers, older (similarly to Whitmarsh et al. (2011) and Poortinga et al. (2011), and male respondents were most likely to be deniers.

Table 3-5 Mann Whitney-U on predictors of climate change beliefs

	Median		Mean Rank		U	Z	p
	Believers	Deniers	Believers	Deniers			
Weather	0	0	151.10	213.90	5113	-3.664	.000
Natural process	0	0	202.06	265.31	5097	-5.821	.000
Politics	0	0	204.05	246.06	5847	-8.253	.000
Gender	2	1	204.52	241.51	6025	-2.118	.034
Age	6	4.5	201.50	270.64	4889	-3.477	.001
Anthropogenic	7	3	194.96	333.71	2429	-6.952	.000
Collective efficacy	3	2	201.45	271.10	4871	-3.824	.000
Lifestyle and the environment	4	2	192.40	358.40	1466	-8.858	.000
Action out of concern for climate change	2	1	198.78	269.92	3864	-5.581	.000
Problem extent: Planet Earth	4	2	192.25	359.81	1411	-8.872	.000
Problem extent: Humanity	4	2	193.07	351.90	1720	-8.490	.000
Concern influences decisions	4	3	193.34	349.37	1818	-8.202	.000
Worry about climate change	5	3	193.33	349.44	1816	-8.255	.000
Talk to family about climate change	4	3	196.31	320.73	2935	-6.588	.000
Scientists confidence regarding climate predictions	4	3	194.75	335.73	2350	-7.636	.000
How confident we should be about scientific predictions about climate change before making recommendations to the public that affect their lifestyle	3	2	203.43	252.03	5615	-2.553	.011
Scientists confidence about the link between carbon emissions and climate change	4	2	193.57	347.13	1906	-8.082	.000

3.7.3.1 Scientists' confidence

A Mann-Whitney U was conducted to evaluate the hypothesis that believers would have a more accurate understanding of the status of the certainty of the science than deniers (Fig. 3.5). More specifically, the Mann-Whitney U test was used to evaluate the hypothesis that believers would score higher than deniers on scientists' confidence. Consistent with previous findings about the importance of perceived scientific agreement (Ding et al., 2011, Whitmarsh, 2005), the results of the test were in the expected direction and significant for both beliefs about scientists' confidence regarding climate predictions ($U = 2350$, $p<.001$) and for the link between carbon emissions and climate change ($U = 1906$, $p<.001$). More specifically, believers had higher confidence regarding both climate predictions and the link between carbon emissions and climate change, with an average rank of 4 for both. Deniers on the other hand had an average rank of 3 and 2 respectively.

A Spearman's correlation was carried out between belief and the two questions examining beliefs about levels of scientists' confidence (one regarding climate predictions, and the other regarding the link between carbon emissions and climate change). There was a

positive correlation between belief that climate change is occurring (M=2.01, SD=.998) and i) perceptions of scientists' confidence regarding climate predictions (M=2.85, SD=.883), r=.425, p=≤.001, n=501, ii) perceptions of scientists' confidence regarding the link between carbon emissions and climate change (M=2.66, SD=.974), r=.465, p≤.001, n=501. This result supports the research hypothesis that believers tended to have a more accurate understanding of the status of the certainty of the science than deniers.

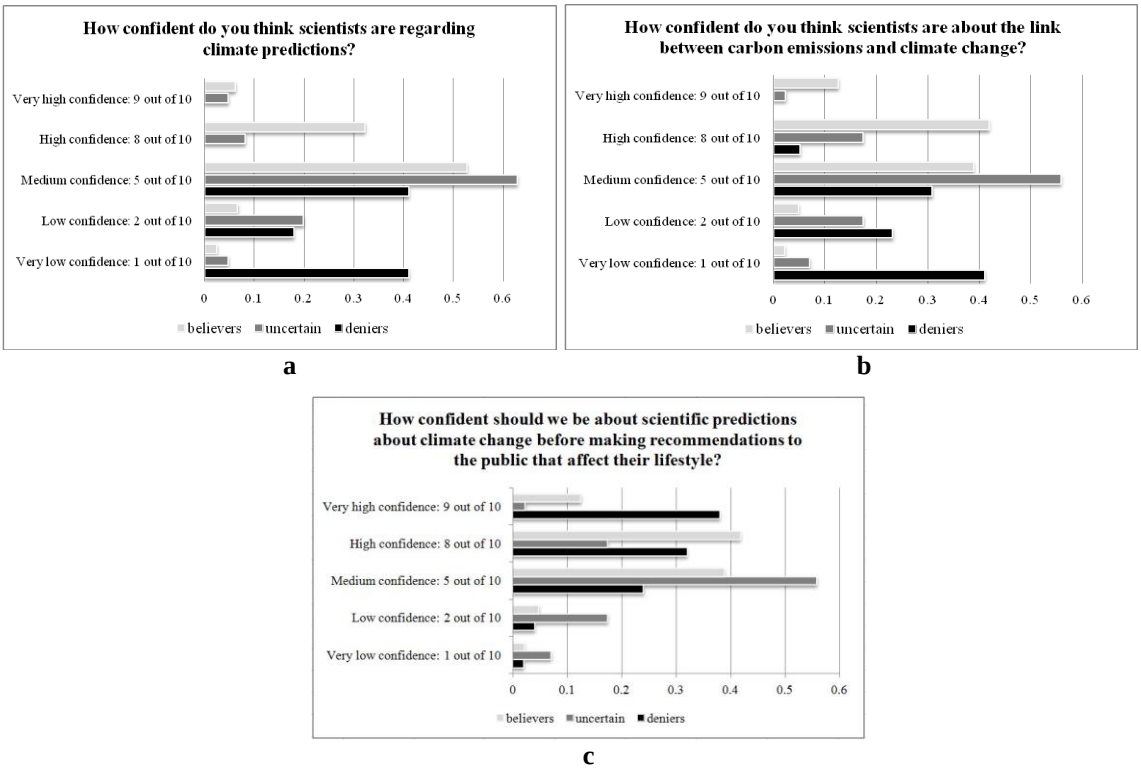


Figure 3-4 Levels of scientific confidence. a) Perceptions of scientists' confidence regarding climate predictions, b) Perceptions of scientists' confidence regarding the link between carbon emissions and climate change. c) Perceptions of how confident we should be about scientific predictions about climate change before making recommendations to the public that affect their lifestyle.

A Mann-Whitney U was also conducted to evaluate the hypothesis that in comparison to believers, deniers would require higher levels of confidence about scientific predictions about climate change before making recommendations to the public that affect their lifestyle (Fig. 3.5c). As predicted, the results of the test were in the expected direction and significant (U = 5615, p<.05). More specifically, the perceived burden of proof is higher for deniers than for believers when advocating lifestyle change. Deniers had an average rank of 2, while believers had an average rank of 3.

3.8 DISCUSSION

Climate change mitigation requires a transition to a low carbon society. However, as Poortinga et al. (2011) argued: 'perceptions of the need to take mitigating action against climate change, and of the ability to act on this, can be key precursors to personal behaviour change and compliance with wider policies aimed to motivate such changes' (p. 1016). Thus in order to encourage behaviour change, people must be aware of the need to change their behaviours. To date there are conflicting findings regarding the association of climate change beliefs and willingness to take action (e.g. Heath and Gifford, 2006, Spence et al., 2011). The aim of this study was to examine levels of belief in climate change among members of the public in the UK and then examine the different sources of information people use as justifications of their beliefs about climate change.

My findings show that those who are more likely to believe climate change is occurring have a more accurate understanding of the certainty levels of the science (predictions and anthropogenic aspect link) but base their judgement on something that is a very poor indicator of this (weather). Indeed, respondents who believed climate change was happening were found to use their personal experiences as a key stimulus for acceptance of climate change.

An inability to distinguish weather from climate was found in this study, as weather was found to be the main justification for belief in climate change occurring. This is consistent with previous studies (e.g. DEFRA, 2002) in which respondents mentioned weather changes as the effects of climate change. Two main issues however arise from this association; firstly, climate change and weather are two separate concepts and yet people think they are the same thing (Bostrom and Lashof, 2004). *As Hargreaves et al. (2003) found, the association the public makes between climate change and local weather could be due to the media, which focuses on local weather when reporting on climate change.* This contrasts with the official scientific understanding of climate change, in which scientific measurements and modelling are the main sources of evidence, as opposed to our personal experiences (Benton, 2001). Given the media is a primary source of information about climate change (Lorenzoni, 2003), the reporting of climate change reporting will likely continue to play a part in shaping the publics' view of climate change, not only on linking climate change with weather. Secondly, as Kempton (1997) argued, this integration may be problematic, as it may lead people to perceive it as not being a serious problem, in particular where the weather has large natural fluctuations. This may explain why those

from Scotland were the least likely to mention weather as a justification for belief, as in addition to the weather being known to fluctuate in this region, climate change is often associated with hotter weather, which may not have been experienced in Scotland as much as elsewhere. As Weber (2010) pointed out, this lack of distinction between the two 'increases the potential bias in public understanding of climate change'. Indeed, my results mirrored the 'weather-related fluctuations in public concern' as pointed out by Read, et al. (1994, p.974), and as such policy and communication efforts should point out this confusion and focus on educating people on the distinction between weather and climate change.

One interesting finding was that those who tend to believe climate change is not occurring have a less accurate understanding of the certainty levels of the science. And yet, by mainly pointing to *natural process* in their justifications for denial, this demonstrates that they are not denying climate change, but fall into the category of *attribution sceptics,* who 'accept that the world's climate may be changing but do not think that it is caused by human activity' (Poortinga et al., 2011, p.1016). As such, their justifications for belief point to the scientifically established process of climate change (*natural process*), minus however, the human element.

One further interesting finding was the use of evidence as a justification for belief was provided by both believers and deniers, with the former stating their agreement with the evidence and the latter referring to the flaws in it. That identical justifications (evidence/scientists) may be used to draw contradictory conclusions, is likely an expression of motivated reasoning'. Indeed studies have found this to play a significant role in the evaluation of scientific evidence (Munro et al., 2004). Motivated reasoning entails the evaluation of evidence in ways that appears to validate prior beliefs, and has recently been linked to climate change beliefs (Whitmarsh 2011).

The identical justifications from both believers and deniers could also be linked to the media portrayal of climate change, which has a tendency to emphasize the scientific and political disagreement (Carvalho and Burgess, 2005, Lorenzoni et al., 2007). In fact, focusing on the importance of perceived scientific agreement by the public, Ding et al. (2011) found that those who do not think there is scientific agreement for climate change are also less certain that climate change is actually occurring. Indeed, my findings show that the deniers in this study showed low confidence in scientists' confidence both regarding climate predictions and regarding the link between emissions and climate

change, with the opposite found for believers. As Ding et al. (2011) went on to argue, given that the majority of the public is not in a position to evaluate the evidence on their own, their perceptions of the scientific agreement play a key role in shaping beliefs on the matter[7]. As such, the misunderstanding of this widespread scientific agreement (Doran and Zimmerman, 2009) is a serious misperception, which may lead to reduced levels of belief in climate change, which in turn are required for the support of climate change mitigation (Ding et al., 2011). Thus given the importance of scientific certainty on people's beliefs and climate change and the impact this may have on climate change mitigation behaviours, policy and communication interventions must take these into account and 'incorporate the guidance of a broad range of social scientists to understand the psychological, social, and political nuances of scientific communication' (Patt, 2007, p.45).

This research suggests that justifications for or against climate change are evaluated and used in diverse ways depending on individual beliefs. This highlights the need for communication campaigns to differentiate messages according to these diverse beliefs and justifications provided. Furthermore, it suggests a need for information and education techniques in order to stress the scientific agreement about climate change. However, information alone is unlikely to be sufficient to engage deniers, as this should be expected to be interpreted depending on their existing views. Consistent with past studies (e.g. Anderson et al., 2011) age, gender, education and income were found to predict whether people point to evidence and scientists as justifications for their climate change beliefs. For example, those with higher levels of education were more likely to refer to evidence when justifying their beliefs. Given that media is the primary source of information about climate change (Whitmarsh 2005), and that other than formal education, people typically acquire knowledge about specific science topics through mass media (Brossard and Shanahan, 2003), it is likely that media engagement is required to highlight the evidence supporting climate change, as well as the scientific agreement. Thus, given that perceptions of scientific agreement have been found to influence climate change beliefs, being aware of the demographic profiles and the justifications they use to support their beliefs could be important for policy and communication interventions, and information campaigns, as targeted information could be provided in an attempt to stress the difference between

[7] It is important to point out that according to Koballa (1988) 'a person's beliefs about an object determine how the person feels towards the object (that is, the person's attitude). Thus as scientific agreement is able to shape people's beliefs about climate change, this relationship can be reversed, with people evaluating scientific agreement based on their pre existing beliefs. This indeed was found in this research, whereby 20% of believers and deniers pointed to evidence when justifying their beliefs.

climate and weather and to clarify the widespread scientific agreement and the validity of the evidence gathered.

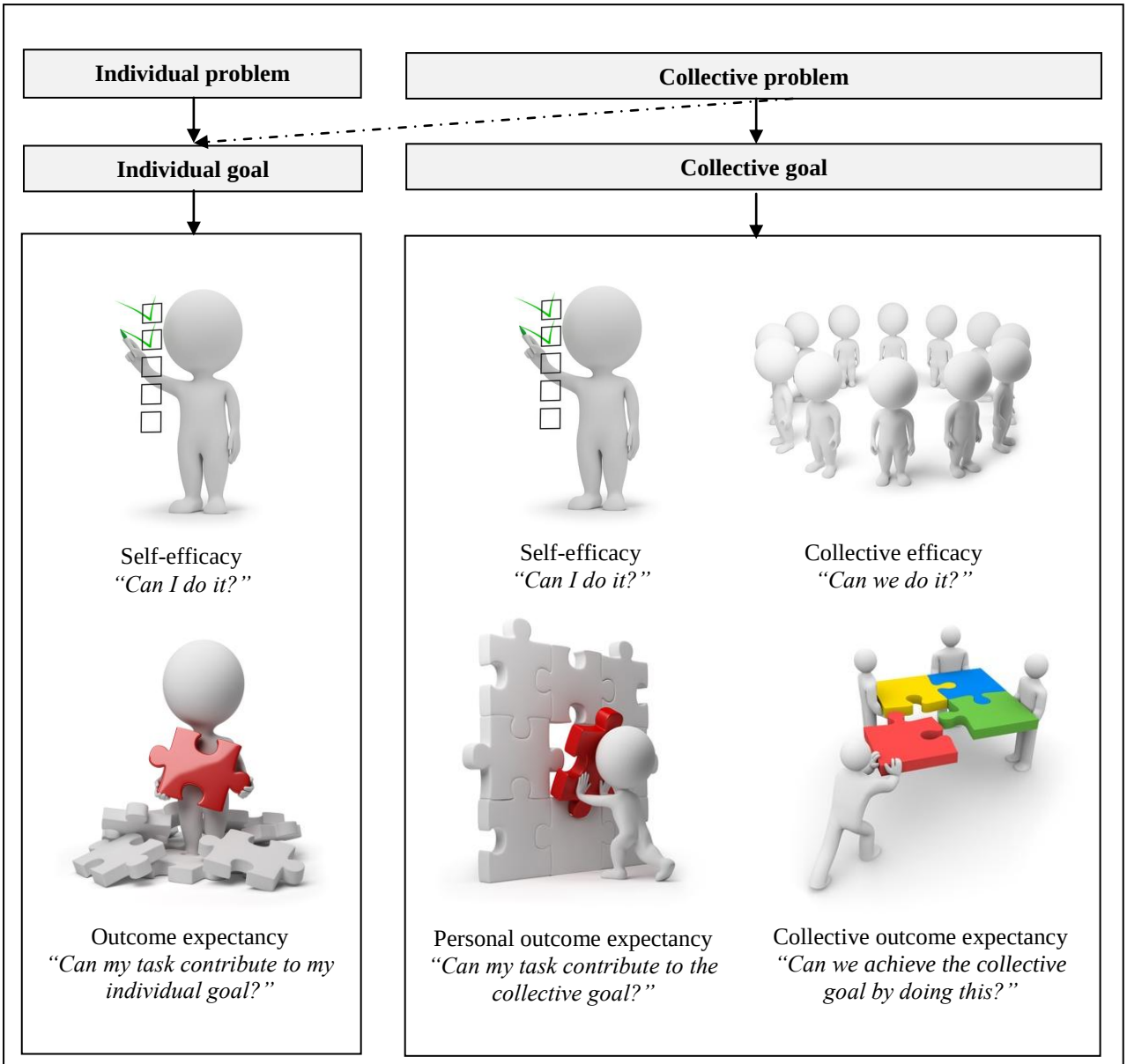
3.9 CONCLUSION

Perceptions of the impact of human activity differ greatly between believers and deniers, with the former believing the human activity impacts on the environment, and the latter disagreeing[8]. Understanding the differences in climate change perceptions and justification for beliefs amongst believers and deniers is important as 'It will be a difficult task to convince the public to make sacrifices in terms of their lifestyle and to support renewable energy developments in their community if they do not believe the climate is changing or will have a real impact on their lives' (Poortinga et al., 2011, p.1016). In agreement with Poortinga et al. (2011) it is important for climate change communication campaigns to be tailored to different audiences and 'take into account the reasons of different publics for expressing doubt or disengagement from climate change, as they are likely to require very different approaches for re-engagement or behavioural change' (p.1022).

[8] It is important to point out that the results are correlational, so the denied link between emissions and lifestyle may be a cause, rather than consequence, of belief in anthropogenic climate change (as suggested by motivated cognition theory).

Part C: The development of an efficacy and outcome expectancy framework in the context of climate change mitigation

The role of efficacy and outcome expectancy for large-scale social dilemma problems



Moving on from the first aim of the thesis, which is to understand climate change beliefs, this part of the thesis paves the way to address the second aim of the thesis, which is to understand climate change mitigation responses. Effective management of climate change risk requires an understanding of how to encourage positive behaviour change at the collective level. Evidence reveals that efficacy beliefs (judgements of the ease of carrying out a particular act) and outcome expectancy beliefs (judgements of the value of acts in reaching goals) function as important determinants of human motivation and action (Bandura, 1995). However, as climate change mitigation requires collective action, these two constructs are found to have been poorly theorised at the collective level.

However, efficacy and associated constructs remain poorly theorised at the collective level, particularly in social dilemma situations where goals may exist at both individual and collective levels.

- In the next chapter I develop a framework that incorporates collective forms of efficacy and outcome expectancy for large-scale, social dilemma situations, and operationalise these constructs.
- I then discuss how this framework can support us in managing climate change risk by allowing us to identify the specific forms of efficacy and outcome expectancy that should be targeted in research, science communication and policy.

CHAPTER 4. WHICH EFFICACY CONSTRUCTS FOR LARGE-SCALE SOCIAL DILEMMA PROBLEMS? INDIVIDUAL AND COLLECTIVE FORMS OF EFFICACY IN THE CONTEXT OF CLIMATE CHANGE MITIGATION[9]

4.1 INTRODUCTION[10]

The Earth's population is at the point of crossing the threshold of 7 billion people and United Nations projections estimate that the population will rise to 9 billion by 2050. It is currently unclear whether the Earth's ecosystems will be able to sustain such large numbers, at least assuming continuation of or improvement upon current standards of living. A particularly critical sustainability problem with potentially catastrophic outcomes is posed by climate change. Human activities contribute to climate change primarily in the form of greenhouse gas emissions resulting from energy use for heat, electricity and transport, and management of energy use is therefore crucial. Growing recognition of the risks associated with climate change has led to important policy responses including the *Kyoto Protocol to the United Nations Framework Convention on Climate Change* (UNFCCC) and the more recent *Cancún Agreement*. The tendency in most policies has been to set climate change targets to be achieved over the long term (10–50 years). However, because CO_2 remains in the atmosphere for 200–2000 years, climate change due to CO_2 emissions is largely irreversible for 1000 years after emissions cease (Solomon et al., 2009). This means that the longer CO_2 continues to be emitted at current rates, the larger the total carbon burden and the harsher future cuts will need to be in order to avert the worst consequences. Anderson et al. (2008) argue that the time lags involved in converting to sustainable energy supply make end-user energy demand reduction the only viable strategy for reducing CO_2 emissions in the short term. Risk management through behaviour change therefore has a vital role to play in climate change mitigation. Despite

[9] This chapter formed the basis for the publication: KOLETSOU, A. & MANCY, R. 2011. Which efficacy constructs for large-scale social dilemma problems? Individual and collective forms of efficacy and outcome expectancies in the context of climate change mitigation. *Risk Management,* 13**,** 184-208. I have the agreement to include it in my thesis from the publishers (see Appendix E).

[10] As this was a joint publication, the terms 'we' and 'our' are used throughout this chapter.

the acknowledged need for immediate action and government calculations that energy consumption by private individuals accounts for 51 per cent of the total energy use of the UK (Hillman and Fawcett, 2004), the evidence demonstrates that the UK public currently shows very low engagement with mitigating actions (IPCC, 2007, Ockwell et al., 2009) and energy use is actually rising (Whitmarsh, 2009a). There is therefore an urgent requirement to increase engagement with mitigating behaviours.

As part of broader strategies to limit the risks associated with climate change, involving structural changes and various forms of incentives, governments are demonstrating increasing interest in approaches to encourage behaviour change. However, the Science and Technology Committee's second report on *Behaviour Change* (2011) recently concluded that our understanding of how to effectively influence behaviour at the population level remains underdeveloped. The situation is further complicated by the fact that in the context of climate change mitigation, behavioural choices often take place in a social dilemma situation. Indeed, there are often personal gains from increased energy use (for example, increased comfort when using more energy for heating); yet in the longer term, unrestrained energy usage at the collective level contributes to increased emissions and the negative impacts of climate change that affect both the contributing individuals and the environment and society at large. The social dilemma nature of decisions about whether to engage in climate change mitigation behaviours makes the difficulty of encouraging action particularly acute.

A key area of psychological theory that has the potential to provide insight into population level behaviour change is that of *Social Cognitive Theory* (*SCT*), originally developed by Bandura (1986b). This theory has been repeatedly demonstrated to have practical applications in predicting and influencing long-term behaviour change at an individual level, and has been applied in a wide variety of contexts, including health and pro-environmental behaviours. However, current SCT theory presents certain limitations for applications in large-scale collective problems, and particularly those that involve social dilemmas. Although the literature contains references to both individual and collective forms of efficacy and outcome expectancies, the terms are often poorly distinguished and theoretical distinctions remain weak.

The remainder of this chapter is structured as follows. We begin by describing and evaluating existing SCT and efficacy theory. We then review the literature and identify the inconsistencies in efficacy and outcome expectancy constructs as applied to collective

situations. Our analysis leads to the development of an integrated framework in the form of a matrix consisting of individual and collective forms of efficacy and outcome expectancies. The main aim of this framework is to allow those involved in designing risk management interventions to identify the forms of efficacy that are most problematic for particular climate change mitigation behaviours, such that these can be appropriately targeted by policy interventions. The framework also serves to focus future research efforts, and in the final section of this chapter we identify several research questions, the answers to which will contribute to ensuring the effective operationalisation of the framework in a practical risk management context.

4.2 EFFICACY IS A USEFUL CONSTRUCT FOR UNDERSTANDING INDIVIDUAL BEHAVIOURAL CHOICES IN RELATION TO CLIMATE CHANGE MITIGATION BEHAVIOURS

SCT, first introduced by (Bandura, 1986b), provides a theoretical framework for understanding, predicting and influencing human behaviour (Bandura, 1997). It has been shown to have predictive value in areas as diverse as school achievement, physical health and socio-political change (Luszczynska and Schwarzer, 2005) and its main constructs have recently begun to attract attention in studies of pro-environmental behaviour (Lubell, 2002, Lam, 2006, De Groot and Steg, 2007).

SCT involves two core constructs: *self-efficacy*, which is concerned with people's beliefs about their capabilities to perform a specific behaviour; and *outcome expectancies*, which are concerned with people's beliefs about the likely consequences of their action (Luszczynska and Schwarzer, 2005). Since there are limits to individuals' objective knowledge of their abilities and expected outcomes, SCT focuses on individual perceptions of these as mediators of behaviour (Strecher et al., 1986). Indeed, evidence from diverse lines of research reveals that perceptions in the form of efficacy beliefs function as important determinants of human motivation, affect, thought and action (Bandura, 1995). Nonetheless, efficacy beliefs do not function alone, but in conjunction with outcome expectancies, and specifically whether the latter are aligned with desired outcomes or goals (Luszczynska and Schwarzer, 2005). Particular behaviours are therefore enacted only when they are both viewed as possible, and are expected to achieve desired outcomes (e.g. Strecher et al., 1986).

Given the focus on perception of capabilities and consequences for predicting specific behaviours, self-efficacy and outcome expectancies are generally assessed using self-report measures (Bandura, 2006) which take the form of questionnaires that are used to collect quantitative data by asking participants to rate their level of agreement with a set of statements. Bandura (2006) provides guidance on how to construct reliable and valid instruments for measuring efficacy and outcome expectancies. In relation to self-efficacy, Bandura (2006) argues that efficacy is a judgement of capability and so statements should use the formulation *can do*, rather that *will do*, since the latter forms a statement of intention. Luszczynska and Schwarzer (2005) provide sample statements for efficacy based on the following formulation: 'I am confident that I can … (perform an action), even if … (a barrier)' (p. 148). Bandura (2006) argues that including the barrier component is important as 'efficacy should be measured against levels of task demands that represent gradations of challenges or impediments to successful performance' (p. 311). In relation to outcome expectancy, the usual approach to measurement involves providing participants with statements that relate to the extent to which they agree or disagree that a stated outcome will occur as a result of a particular behaviour or task. For example, Luszczynska and Schwarzer (2005) provide a structure for outcome expectancy statements: 'If … (a behaviour), then … (consequences)' (p. 148).

Response categories generally take the form of a Likert scale, although the number of categories and their labels differ between efficacy and outcome expectancies, as well as among authors. According to Bandura (1997), the standard methodology for efficacy measurement involves a 100-point scale, according to which individuals rate the strength of their efficacy beliefs according to 10-unit intervals ranging from 0 ('cannot do') to 50 ('moderately certain can do') to complete assurance at 100 ('certain can do'). Bandura (1997) argued that wider scales should be preferred in that there are gains in both reliability and sensitivity when a larger number of categories are used. Nonetheless, authors vary in their use of response categories. For example, Luszczynska and Schwarzer (2005) provided a response scale from 1 to 4. Outcome expectancies are generally measured using a Likert scale with category labels running from 'totally disagree' to 'totally agree' (Williams and Bond, 2002) or from 'completely false' to 'exactly true' (Luszczynska and Schwarzer, 2005), although the number of categories differs among authors.

4.2.1 Further environmental theories

Two behavioural theories that have been extensively been applied to energy behaviours include the Theory of Planned Behaviour (Ajzen, 1991) and the Norm Activation Theory (Schwartz, 1977).

The core of the theory of planned behaviour centres on the premise that behaviours are guided by three types of considerations: a) beliefs about the likely consequences or other attributes of the behaviour, which result in a favourable or unfavourable attitude toward the behaviour, b) beliefs about the normative expectations of other people, which result in perceived social pressure or subjective norm, and c) beliefs about whether the behaviour is under an individual's control, which result in the perceived ease or difficulty of performing the behaviour (Ajzen, 1985). The latter refers to one's perceived behavioural control and relates to an individual's belief that the behaviour can successfully result in desired goals.

Since its inception, a wide array of studies has demonstrated the theory's value in predicting behaviours, such as weight loss and leisure participation (Armitage and Conner, 2001; Ajzen and Driver, 1991). The theory has also been successfully applied in the area of pro-environmental behaviours (e.g., Bamberg and Schmidt, 2003; Taylor and Todd, 1995). For example, Bamberg and Schmidt (2003) found that intentions were able to predict car use of students for university routes. In another study, Taylor and Todd (1995) found attitudes toward recycling along with perceived behavioural control to be positively related to individuals' intentions about recycling and composting. Armitage and Conner (2001) pointed out that the two factors that are more strongly related to behaviours and intentions are perceived behavioural control and attitudes, with subjective norms related to a lesser extent.

Linking the theory of planned behaviour with the social cognitive theory, the perceived behavioural control component of the theory of planned behaviour has sometimes been used synonymously with Bandura's (1986) self-efficacy beliefs (Ajzen and Fishbein, 2005). Indeed, both components are concerned with individuals' perceptions of how likely they could exercise control in order to make a desired outcome occur (Lee, 2008). However, self-efficacy focuses more on perceptions of internal control factors, whereas perceived behaviour control also rejects external factors as it focuses more on the social context (Armitage and Connor, 2001). Indeed, several researchers have found that perceived behavioural control and self-efficacy are not entirely synonymous (e.g.,

Dzewaltowski et al., 1990; Terry and O'Leary, 1995). For example, Terry and O'Leary (1995) found self-efficacy to be able to predict exercise intentions, with perceived behavioural control able to predict behaviour, not intentions.

Aiming to explain social and psychological antecedents of pro-environmental behaviours, value belief norm theory links value theory (Stern and Dietz, 1994), ecological worldview (Dunlap and Van Liere, 1978) and the norm-activation theory (Schwartz, 1977). The core of value belief norm theory centres on the premise that values and ecological worldview affect beliefs about environmental problems, beliefs about responsibility for the problem, and carrying out pro-environmental behaviours (Stern et al., 1999; Stern, 2000). More specifically, personal norms (sense of obligation to act) are triggered when individuals believe environmental conditions threaten things they value (awareness of consequences), and that the individuals' actions have contributed to (responsibility for causing threat) or could alleviate the consequences (perceived ability to reduce threat) (Stern et al., 1999).

Value belief norm theory has been able to successfully explain human responses to many environmental issues, ranging from reduced car use (Nordlund and Garvill, 2003), to household energy conservation (Ibtissem, 2010) and pro-environmental behavioural intention (Garling et al., 2003). More specifically, Garling et al., (2003) found that intention to carry out collective pro-environmental behaviours depends on personal norms, ascribed responsibility, and awareness of consequences for oneself, for others, and for the biosphere. In another study, Nordlund and Garvill (2003) found that values and problem awareness influenced personal norm, which in turn influenced willingness to reduce personal car use.

The 'perceived ability to reduce threat' component of the value belief norm theory can be considered to be similar to the social cognitive outcome expectancy component. Indeed, perceived ability to alleviate the threat increases the perception of being able to cope with the danger. According to social cognitive theory, higher outcome expectancy is expected to lead to increased persistence and effort, as belief that a behaviour will have a desired outcome may lead to the individual working harder to carry out the desired behaviour (Bandura, 1977). Although Bandura's outcome expectancy is a more general construct than the 'perceived ability to reduce threat', which focuses on behaviours related to alleviate a threats (and thus puts weight on the negative consequences of climate change and therefore ignores the positives for individuals of e.g. saving money through their actions), both reflect a belief that the behaviour will have the desired outcome.

Both the value belief norm theory and the theory of planned behaviour have been used extensively to investigate pro-environmental behaviour (Ajzen and Fishbein, 2005). However, despite decades or research reporting that perceptions of efficacy guide and motivate actions (e.g., Roser-Renouf and Nisbet, 2008), very few studies have applied this to the problem of climate change, with even less research examining perceptions of efficacy in relation to pro-environmental behaviours. This research aims to fill this gap by examining the predictive power of efficacy on the adoption of specific energy saving behaviours. Indeed, in relation to the value belief norm theory, the social cognitive theory accommodates positive goals (e.g. saving money) and motivations other than 'a sense of obligation to act', while in relation to the theory of planned behaviour, due to the difference of internal versus external drivers amongst the two theories, I was more interested in individual motivations than barriers'

4.2.2 Evidence for the importance of self-efficacy for behaviours

Conner and Norman (2005) argue that one's self-efficacy beliefs determine whether actions will be initiated, how much effort will be applied, and the extent to which actions will be sustained when barriers arise. Indeed, empirical research shows strong support for a positive relationship between self-efficacy and different motivational and behavioural outcomes in clinical, educational and organisational settings (Stajkovic and Luthans, 1998). Further, Bandura (2002) discussed a range of large-scale meta-analyses which support this claim across diverse spheres of functioning including personal health management (Holden, 1992), sport performance (Moritz et al., 2000, Ashford et al., 2010), academic performance (Multon et al., 1991) and work-related performance (Stajkovic and Luthans, 1998).

Focusing more specifically on *changes* in behaviour, Bandura (1995) argues that the evidence for a close association between efficacy beliefs and behaviour change is overwhelming. Indeed, based on their review of health behaviour change studies, Luszczynska and Schwarzer (2005) concluded that 'the construct of perceived self-efficacy has been the most powerful single resource factor in predicting the process of behaviour change' (p. 158). Furthermore, work on behaviour change in health contexts demonstrates not only short-term predictive value, but also a robust relationship between efficacy and long-term maintenance of behaviours (Strecher et al., 1986).

Evidence for the importance of efficacy in predicting behaviour change has led to its use in behaviour change interventions. According to Bandura (1977), four main influences on self-efficacy can be identified. In making self-efficacy judgements, individuals interpret their capabilities in relation to: (a) their *enactive mastery experience* that consists of interpretations of past personal experiences of the task or behaviour; (b) their *vicarious experience* that leads to the appraisal of capabilities in relation to the achievement of others; (c) *verbal persuasion* by others of their faith in the individual's capabilities; and (d) their *physiological state*. Thus in general, having successful personal experiences of the task or behaviour, seeing others perform successfully, hearing others profess their faith in one's abilities, and being in a nonanxious physiological state, all contribute to more positive appraisals of one's own capabilities.

Each of these influences can be used to design interventions to enhance self-efficacy. Studies have examined the variables that have the greatest influence on self-efficacy beliefs. Interventions targeting enactive mastery experience have generally been shown to be the most influential as they provide observable evidence of one's own capabilities, with vicarious experience also having an important role in enhancing efficacy beliefs (Bandura, 1997, Luszczynska and Schwarzer, 2005).

The evidence reviewed above demonstrates that efficacy is an important predictor of both short-term behaviour change and the longer-term maintenance of behaviours, and that interventions aimed at increasing efficacy can have important effects on behavioural outcomes. These findings therefore point to the potential value of efficacy beliefs for risk management through behaviour change in the context of problems that require long-term maintenance of alternative behaviours, such as those required in the context of climate change mitigation. Although the studies described above focus on behaviour change in relation to individual problems (for example, individual health), Kerr (1989) and Kollock (1998) hypothesise that self-efficacy could provide a key insight into large-scale and social dilemma problems (Weber et al., 2004), and thus hint at applications for climate change mitigation.

4.2.3 Evidence for the importance of outcome expectancy for behaviours

Alongside efficacy, Gao et al. (2008) argue that outcome expectancies should also have an impact on behaviour, with positive outcome expectancies functioning as an incentive while

negative expectancies function as a disincentive to action. Although there has been less research on outcome expectancies than on the role of self-efficacy on behaviours (Gao et al., 2008), there is good evidence for the role of outcome expectancies in predicting behaviour. Specifically, this research points to the importance of outcome expectancies in the early stages of behaviour change and especially the initial formation of intentions (Bandura, 1986a, Conner and Norman, 2005, Williams et al., 2005). For example, Damush et al (2001 cited by Williams et al., 2005) found that positive outcome expectancy resulted in increased attendance at an initial exercise class, but not in subsequent class participation, and Rodgers and Brawley (1996) report similar findings.

The interaction between self-efficacy and outcome expectancies

Bandura (1982) argued that behaviour is best predicted by considering both self-efficacy and outcome expectancies. Specifically, people tend not take action when they perceive themselves as unable to influence situations that affect their lives, but this inaction can spring from either low self-efficacy beliefs or low outcome expectancies (Bandura, 1982). In the cases where efficacy and outcome expectancies are aligned, high efficacy beliefs combined with positive outcome expectancies can be expected to lead to action, productive engagement and personal satisfaction (Bandura, 1982, Bandura, 1997); in contrast, low efficacy beliefs combined with low outcome expectancies lead to inaction and the belief that no amount of effort applied will produce the desired outcomes (Bandura, 1997).

However, when efficacy beliefs and outcome expectancies are misaligned, the situation is more complex. The combination of high efficacy beliefs and low outcome expectancies does not necessarily lead to inaction, and, under certain circumstances, can actually lead to increased efforts, through the adaptation of tasks to those that are believed to be more effective for attaining desired outcome (Bandura, 1982), for example by making tasks more challenging. However, low self-efficacy combined with high outcome expectancies is likely to lead to self-devaluation, as people may perceive themselves as inadequate (Bandura, 1997).

In empirical work, Williams and Bond (2002) found that self-efficacy showed a stronger relationship with behavioural outcomes in the context of diabetes self care when outcome expectancy beliefs were high. This effect was partially due to not only a positive relationship between high self-efficacy beliefs and better self-care, but also to low self-efficacy beliefs and poorer self-care, among participants whose outcome expectancies were

high. In other words, the belief that the recommended behaviours will lead to desired outcomes was likely to promote self-care, but only when combined with high self-efficacy beliefs (Williams and Bond, 2002).

Furthermore, the joint role of efficacy and outcome expectancy is particularly important when the recommended behaviours do not guarantee positive outcomes (Bandura, 1977). For example, Strecher et al. (1986) suggested that health behaviours which are not difficult to change but whose outcomes are perceived as being uncertain, such as compliance with taking medication to control hypertension, may depend more strongly on outcome expectancies.

The studies described above demonstrate an important role for outcome expectancies in predicting behaviour and particularly the early stages of behaviour change. Furthermore, it has been suggested that outcome expectancies will have particular importance in the situation where desired behaviours are relatively easy to implement, but where perceived outcomes are uncertain. These characteristics therefore suggest an important role in predicting and influencing behaviour change in relation to climate change mitigation. However, the collective nature of climate change mitigation means that as for efficacy, a collective form of outcome expectancy is required. In the sections below, we review the more limited literature on group efficacy and group outcome expectancy.

4.2.4 Collective efficacy

Climate change, like many large-scale problems, induces a situation in which individuals have only a small influence and goals can only be achieved through collective action. As a result, the individual beliefs measured by self-efficacy and outcome expectancy judgements described above are unlikely to be sufficient for predicting behaviour change. Bandura (1982) therefore introduced the notion of group efficacy as a group level extension to SCT. He defined it as ‘a group’s shared belief in its conjoint capabilities to organise and execute the courses of action required to produce given levels of attainments’ (Bandura, 1997, p.447). As with self-efficacy, group efficacy beliefs are expected to influence the behaviours people carry out through collective effort, the effort applied, how well resources are used and persistence when collective efforts face obstacles (Bandura, 2006).

There is a growing body of research demonstrating the impact of group efficacy on group functioning, including group performance (Bandura, 1997, Bandura, 2000, Little and Madigan, 1997, Feltz and Lirgg, 1998, Gully et al., 2002, Jung and Sosik, 2003, Collins and Parker, 2010). Stajkovic et al. (2009) carried out a meta-analysis of laboratory and field studies and found group efficacy to be significantly related to group performance. Bandura (2006) argued that, taken together, the findings demonstrate that 'the higher the perceived collective efficacy, the higher the group's motivational investment in their undertakings, the stronger their staying power in the face of impediments and setbacks, and the greater their performance accomplishments' (p. 318).

Given the collective nature of climate change mitigation efforts, collective efficacy is likely to be important in understanding behaviour, and we thus develop this idea in more detail below. In this discussion, we make a key distinction between teams and collectives, and thus where appropriate, between *team efficacy* and *collective efficacy*, and use the term *group* to refer to both teams and collectives. Although all these terms are used in the literature, they are poorly delineated and are often used interchangeably; however, we believe that this distinction is important. Specifically, our distinction centres around what we believe are two key differences between teams and collectives: firstly, the level of interdependence among individuals, and secondly the extent to which goals are shared.

According to Deutsch (1949, cited by Katz-Navon and Erez, 2005), the idea of interdependence between individual behaviours could relate to either the inter dependence of *tasks* themselves or to the interdependence of *outcomes*. Tasks are interdependent when one person's actions directly affect the performance of another, perhaps because their task needs to be completed before another task can be undertaken. Outcomes are interdependent when the successful accomplishment of a goal relies on the combined achievement of individuals, even if each individual can complete the task successfully, independently of the actions of others. In general, teams are likely to be characterized by interdependent tasks, whereas within collectives, tasks may be independent, even while outcomes are interdependent. A similar distinction is used by (Katz-Navon and Erez, 2005).

In relation to the second characteristic, while goals are likely to be shared within a team, this may not be true of collectives. In the extreme case of social dilemmas, some individuals may hold a collective goal leading to action in a particular direction (for example, reduction in energy use) whereas others may hold individual goals that lead to directly opposed action (increase in energy use).

These distinctions mean that findings that relate to efficacy in team and collective situations may differ. Alavi and McCormick (2008) summarise the findings of a range of studies (e.g. Gibson, 1999) testing the first distinction between levels of interdependence, and conclude that when group members work independently (that is, task interdependence is low), group efficacy is not related to group effectiveness. However, when groups work interdependently (that is, there is high task interdependence), group efficacy is related to group effectiveness (Gibson, 2001 as cited by Alavi and McCormick, 2008). However, the extent to which these findings can be generalised to climate change mitigation is limited by the fact that in these studies, it is unclear to what extent participants shared the goal of high performance, the fact that participation was compulsory and not optional, and the small group size. To our knowledge, the second variable distinguishing teams from collectives – that of the extent to which goals are shared – has not been experimentally manipulated. However, in studies relating to environmental problems that may involve a social dilemma aspect, findings relating to collective efficacy are mixed. Bonniface and Henley (2008) found that collective efficacy was low among both environmental activists and non-activists (and therefore did not predict pro-environmental behaviour). Truelove (under review) found relatively high collective efficacy amongst all respondents, but this again was not linked to intentions to engage with pro-environmental behaviours.

The evidence appears to point to the importance of considering group efficacy for understanding *group* performance when task interdependence is high and goals are shared. However, in relation to problems such as climate change where mitigation behaviours are optional and goals are not necessarily shared, the role of group efficacy in predicting *individual* participation is currently unclear and findings in the literature are mixed. The situation is further complicated by the range of ways in which group efficacy can be measured and the effect that different measurements may have on the relationship between group efficacy and behavioural outcomes, either at individual or at group level.

Group efficacy may be measured in three ways. Firstly, collective efficacy may be measured via a process that Bandura (2000) calls the aggregation of personal efficacies. For this measure, an index of group efficacy is determined by calculating the arithmetic mean of standard individual self-efficacy ratings. Secondly, group efficacy can be based on questions that explicitly refer to the group in the form ‘How certain you are that your group can … (task)’ (Bandura, 2006). An index, called the Aggregated Holistic Index (Bandura, 2000), can be calculated by taking the mean of individual ratings of expected group

performance; alternatively, as in the case of Riggs and Knight (1994), the individual judgements of expected group performance can be used directly.

Finally, an approach called the consensus or discussion approach (Bandura, 2000, Katz-Navon and Erez, 2005) uses a single judgement per group that is arrived at through group discussion and negotiation.[1] Bandura (2000) argues that decisions about which method is appropriate depend at least to some extent on the level of interdependence of tasks. Specifically, when systems have low interdependence he advocates the use of the first approach (aggregated personal efficacies), but when systems are highly dependent he advocates the use of the holistic aggregated index. Although Gist (1987) has argued for the use of the consensus method, Bandura (2000) and Katz-Navon and Erez (2005) argue that it suffers from serious limitations, such as the problem of influential group members who command power and may ultimately pressurise individuals into conformity.

In summary, the literature on collective efficacy remains difficult to interpret, partially due to the effect of structural properties of groups and the tasks in which they are engaged, and partially due to the different methods of measuring the construct. The work on collective outcome expectancies presents a clearer picture, as now described below.

4.2.5 Collective outcome expectancy

Given the importance of distinguishing between efficacy and outcome expectancy at the individual level, several researchers have tried to make the same distinction at the collective level (Carrico and Riemer, 2011). Collective outcome expectancy refers to the beliefs individuals hold about 'the likely consequences their group will experience as a result of the group's performance of work tasks' (Riggs and Knight, 1994, p.756). Collective outcome expectancy can be measured in a similar way to individual outcome expectancy, with statements focusing on the effects of behaviour carried out at the collective level, and should therefore refer explicitly to the group or collective. For example, Truelove (under review) uses wording of the form 'if the majority of Americans adopted each behaviour, how effective would each action be in reducing global warming'.

Empirical evidence demonstrates that group outcome expectancies reliably predict behavioural outcomes in group situations. Specifically in relation to collective pro-environmental behaviours, among other variables, Carrico and Riemer (2011) examined

the role of collective outcome expectancy in energy conservation in the workplace. Collective outcome expectancy was measured by asking participants about the extent to which they agreed with the statement: 'By changing our behaviour, employees and students like me can reduce [the University's] energy use'. Responses were made on a five-point scale ranging from 'disagree strongly' to 'agree strongly' (Carrico and Riemer, 2011). The authors found that higher levels of collective outcome expectancy during baseline assessment were related to higher self-reported energy conservation behaviour at follow-up (Carrico and Riemer, 2011). Furthermore, Truelove (under review) found collective outcome expectancy to be associated with greater perceived moral obligation to take actions to reduce greenhouse gas emissions and, ultimately, intentions to perform these. This work provides evidence that collective outcome expectancy is associated with behavioural outcomes and intentions in potential social dilemma situations, specifically in the context of pro-environmental behaviour.

4.2.6 Theoretical difficulties of efficacy constructs for collective situations

As reviewed in earlier sections, research on self-efficacy and personal outcome expectancies makes clear distinctions between these constructs and offers relatively clear guidance on how to construct standardised self-report questionnaires to assess them. Furthermore, it provides a fairly coherent set of evidence demonstrating the link between the two constructs and behaviour, including behaviour change, and there is a growing body of evidence that shows that interventions that address these two constructs can lead to behaviour change in a range of situations, at least at the individual level.

The literature in relation to efficacy in group situations is currently less developed. Group efficacy is addressed in a relatively large number of studies and there is a growing body of evidence that demonstrates a positive relationship between higher group efficacy and desired behavioural outcomes when task interdependence is high, but findings are less clear for social dilemma situations.

Group efficacy is operationalised in a range of ways, via at least three methods of assessment (aggregation of personal efficacies, holistic aggregated index, consensus), making a synthesis of findings difficult (Jung and Sosik, 2003).

Only very few authors have discussed the notion of group outcome expectancies (sometimes referred to as collective response efficacy) (Riggs and Knight, 1994, Collins

and Parker, 2010), or used it to examine environmental behaviours (Lubell, 2002, Bonniface and Henley, 2008, Lam, 2006, Truelove, under review). Empirical work in this area is limited to a small number of studies, many of which employ non-standard methodologies for the research area. Finally, none of the authors who discuss group outcome expectancies make the distinction between level of interrelatedness of tasks or behaviours.

We hypothesise that all four constructs – personal efficacy, personal outcome expectancies, group efficacy and group outcome expectancies – have the potential to influence behaviours in the context of climate change mitigation. Furthermore, we expect that the distinctions between situations with high and low interrelatedness are particularly important for social dilemma situations. In the remainder of this chapter we present an attempt to unify the constructs and operationalise them in a manner that is consistent with the needs of those attempting to understand and influence behaviours in the context of large scale, collective social dilemma situations such as climate change mitigation. We present theoretical arguments for our choice of particular efficacy constructs and their operational forms. We then identify research questions that are raised by the framework, the answers to which should help those involved in developing solutions to manage risks, such as those involved in developing policy and communication materials to encourage climate change mitigation.

4.3 FORMS OF EFFICACY AND OUTCOME EXPECTANCY WITHIN LARGE-SCALE, COLLECTIVE PROBLEMS

The aim of this chapter is to identify the appropriate efficacy and outcome expectancy constructs for large-scale collective problems and to use these to develop a research approach that supports the investigation of policy-relevant questions for risk mitigation in the context of climate change and sustainable development. We begin by describing this framework, moving on to highlight a number of theoretical and applied questions raised that will form a productive focus for future research.

4.3.1 Concerns and orientations as predictors of goal attractiveness

Decisions about whether to engage in climate change mitigation actions are often provided to illustrate the concept of social dilemma situations. According to Dawes (1980), social

dilemmas are defined by two simple properties: firstly, each individual benefits more by pursuing a personal (socially 'defecting') choice rather than a collective (socially 'cooperative') choice, regardless of what others in the society do; and secondly, all individuals will be better off if they all choose to cooperate rather than to defect (Dawes, 1980). According to the standard presentation of the situation, actions that could be taken to mitigate climate change are costly to individuals, while significant benefits are only reaped if sufficiently large numbers of individuals choose to reduce their emissions. Although in general this is true, the social dilemma aspects of climate change mitigation apply differently to different mitigation actions, and to different perceptions of costs and benefits.

Decision-making about whether to engage in certain mitigation behaviours does indeed present individuals with a social dilemma situation. For example, the decision of whether to take flights for overseas holidays can be thought of as placing individuals in a social dilemma situation where the cost of not flying is either that of forfeiting the overseas holiday itself, or the time required by alternative modes of travel. However, for other decisions, the social dilemma aspect may be minimal. For example, when deciding between comparable appliances with different energy efficiencies, if choosing a more energy efficient appliance is no more expensive to purchase, then in the long run the consumer actually benefits from reduced energy bills. Finally, for some behaviours, individuals may weigh the costs and benefits differently, and thus for some individuals a situation may present a social dilemma, while for others, it does not. For example, some individuals may view installing insulation as financially costly, leading to a social dilemma situation, whereas others may value it as conferring them direct benefits – a warmer house in winter – and thus not find themselves in a social dilemma situation. In other words, the same mitigation behaviour might present itself as a social dilemma to some, but not to others. As a result, individuals who have an interest in mitigation may engage in an action for the purpose of mitigation in the context of a social dilemma, for personal reasons alone, or for both. Furthermore, individuals who have no interest in mitigation may nonetheless engage in mitigating actions, but for personal reasons only. In the situation where taking mitigating action benefits individuals, we would expect minimal link between the collective forms of efficacy and outcome expectancies; however, we would expect collective efficacy and outcome expectancies to show a stronger relationship with pro-environmental behaviours in the case where goals or concerns are at the collective level, and decisions are taken in the context of a social dilemma.

In the following sections, we describe a process for establishing the role of individual and collective forms of efficacy and outcome expectancies, taking into account individual and collective goals.

4.3.2 Environmental concern

When considering motivations for performing pro-environmental behaviours, it is important to distinguish people's reasons for doing so. Stern et al. (1993) distinguished between three environmental value orientations, comparable to Merchant's (1992) environmental ethics. Schultz (2000) refers to these as *environmental concerns* that affect behaviour: (a) *egoistic*, according to which people base their decisions to act on the costs and benefits of the behaviour for them personally, (b) *altruistic* , according to which people base their decision to act on the costs and benefits of the behaviour for others, and (c) *biospheric*, according to which people base their decision to act on the costs and the benefits for the environment. As De Groot and Steg (2007) have pointed out, the validity of this distinction has been empirically verified in a range of studies (e.g. Schultz, 2001), although Stern and Dietz (1994) find that altruistic and biospheric concerns cannot be distinguished in the general population.

This distinction provides one explanation for the fact that people may carry out the same behaviour, but for different reasons. For example, if the behaviour is to turn down the thermostat at home, individuals may perform this to save money (egoistic), they may do so because high energy use affects and endangers other people (altruistic), or they may do so because the emissions are harmful to the environment and other species living in it (biospheric). As De Groot and Steg (2007) point out, those with egoistic concerns do not necessarily engage in fewer ecologically sound behaviours than those with altruistic and biospheric concerns, since the end result may be the same. Importantly though, egoistic concerns exist at a personal level, whereas altruistic and biospheric concerns are collective level constructs. Thus, in order to select the appropriate efficacy and outcome expectancy constructs, it is important to understand people's motivations and concerns, and whether these exist at the individual or collective level.

4.3.3 Goal attractiveness

As a first step to understanding efficacy and outcome expectancies in social dilemma situations, we therefore believe that it is important to distinguish between individual and collective reasons for engaging with particular actions. Specifically, while some may have individual goals such as saving energy or feeling warmer in winter, others may engage with the same behaviours for the explicit aim of mitigating climate change, while still others may have both goals. When only individual goals are involved, the relevant efficacy constructs reduce to those of standard self-efficacy and outcome expectancies at the individual level. In this situation, therefore, many of the findings established in the literature on individual efficacy are likely to apply. However, when the goals include explicit reference to climate change mitigation, collective efficacy constructs are required. When both individual and collective goals are present, individual goals are expected to align with collective goals (and may therefore be thought of as subgoals), and both sets of constructs may be needed. In other words, the efficacy constructs of relevance to individual decision-making about mitigation behaviours depend on goals and whether these exist at the individual or collective level.

The above discussion suggests that an initial analysis of goals is important to understanding which efficacy constructs are most likely to be associated with behaviour. Carrico and Riemer (2011) provide a way to measure what they term 'goal attractiveness' to determine the relative salience for participants of individual or collective goals.[2] Their approach uses a five-point scale, and three items to measure the degree to which participants value the goal of reducing energy use, both at the personal level: 'I would like to reduce the amount of energy that I personally use', and at the collective level: '[The university] should do more to save energy' (Carrico and Riemer, 2011).

However, while Carrico and Riemer (2011) simply used these questions to measure the degree of interest in reducing energy consumption, we further suggest that a measure of this type should be used to establish which efficacy constructs are likely to be of relevance, adapting subsequent questions accordingly. We suspect that answers to this type of question would vary depending on the particular action under consideration, but that there would be a general tendency for each individual to be attracted to individual or collective goals according to their environmental concerns (egoistic, altruistic or biospheric). However, this suggestion awaits empirical validation.

4.4 CONSTRUCTION OF PRECISE MEASURES OF CONSTRUCTS

Once the level attractiveness of individual and collective goals has been established, the focus then shifts to the efficacy constructs of importance and their assessment. One of the difficulties of much of the work on SCT in the context of pro-environmental behaviours is a lack of clarity about the particular actions or behaviours. For example, one might expect participants to provide different levels of agreement with the following two statements: 'I can turn my thermostat down' and 'I can turn my thermostat down by 1°C'. Therefore, in order to be able to make predictions about behaviour that can be used to inform policy – where precise targets are required – goal attractiveness and efficacy statements need to be expressed to a sufficient level of specificity. We therefore suggest that all behaviours be specified as quantitatively as possible, in statements used to assess goal attractiveness, efficacy and outcome expectancies. Furthermore, Luszczynska and Schwarzer (2005) suggest that efficacy statements include a reference to barriers, with statements taking the form: 'I am confident that I can … (perform an action), even if … (a barrier)' . We believe that this approach is valuable, but would require a focus on identifying the barriers to particular pro-environmental behaviours. As Bandura (1997) pointed out, these barriers can be identified through preliminary work, where the challenges are identified and are then 'imported' into the efficacy items. This results in a set of items allowing people to judge their capabilities in carrying out the behaviours when faced with a range of barriers.

In relation to the constructs of interest, in the case of individual goals, the self-efficacy (SE) and outcome expectancy (OE) constructs are the same as those used within individual situations: self-efficacy refers to judgements of how well one can execute courses of action, while outcome expectancy refers to estimations of which behaviours will lead to the desired outcomes. For example, if the personal goal is to save money (for example £50 per year) by turning the heating down by 1°C, the efficacy statement should begin 'I am confident that I can turn my thermostat down by 1°C', followed by particular barriers. The outcome expectancy statement then becomes 'If I turn my heating down by 1°C, then I can save £50 per year'.

In the case of collective goals, the situation is more complex. Behaviours can be expected to depend on efficacy judgements at both the individual and collective level, as well as judgements of outcome expectancies at both scales. In other words, there are four constructs of interest: self-efficacy (SE), personal outcome expectancy (POE), collective

efficacy (CE), collective outcome expectancy (COE). We now explain what is meant by each of these, and how they can be operationalised. The discussion is summarised in Table 4.1.

Table 4-1 The matrix of the forms of efficacy and outcome expectancy for social dilemmas and/or large scale collective problems

Goal	Level	Efficacy	Outcome expectancy
Individual goal	Individual	Individual efficacy (SE) *Can I do it?*	Outcome expectancy (OE) *Will my behaviour contribute meaningfully to me achieving my personal goal?*
Collective goal	Individual	Personal efficacy (PE) *Can I do it?*	Personal outcome expectancy (POE) *Will my behaviour contribute meaningfully to achieving the collective goal?*
	Collective	Collective efficacy (CE) *Will we be able to do it?*	Collective outcome expectancy (COE) *Will our behaviour contribute meaningfully to me achieving my personal goal?*

The questions in italics are provided for illustrative purposes.

4.4.1 Self-efficacy (SE) and personal outcome expectancy (POE)

In the case of collective goals, self-efficacy is defined and assessed in exactly the same way as for individual goals. However, unlike the OE construct employed in individual situations, within collective problems, we propose the use of personal outcome expectancy (POE). POE is defined as a measure of individual judgements about the likely consequences the collective will experience as a result of the individual performance. Since the outcomes of individual behaviours contribute towards the collective goal, this means that POE relates to perceptions of how much the individual action contributes towards the collective goal. Therefore, we follow Lubell (2002) and define POE as a judgment of the extent to which individuals ' actions can contribute to the collective goal.

Lubell (2002) examined POE by asking participants to respond to the following statement: 'It is just too difficult for someone like me to do much for the environment' with answers ranging from 1 for strongly agree to 5 for strongly disagree. Lubell (2002) found that this component had a significant and positive effect on behaviour as 'people who believe the environment is unhealthy and that they can do something about it are more likely to express intentions to engage in environmental activism and to actually act on those intentions' (Lubell, 2002, p.441). Furthermore, Heath and Gifford (2006) examined the

role of POE (which they refer to as self-efficacy) in environmental behavioural intentions. They found POE to explain the most variance in behavioural intentions and went on to argue that 'it appears that before individuals are ready to act against climate change, they must believe that even a small thing one individual can do will make a meaningful difference' (p. 64).

POE is also an important component within social dilemma situations. Steg (2003) argued that cooperation decreases within large-scale problems involving many people partly due to reduced beliefs in the degree to which an individual's contribution makes a difference (Steg (2003) refers to this idea as self-efficacy). Discussing low participation rates within social dilemmas, Kerr (1996) pointed out that low POE functions as a barrier to action: 'When confronted with the genuine threats posed by many such large-scale and seemingly intractable social dilemmas, which of us has not responded to appeals for contributions of effort, time, or money with the not-entirely self-serving question, 'Does my contribution really matter?' (p. 210). In other words, the definition of POE provided above is the right construct for large-scale collective problems as the question of whether a person believes individual actions can have an impact on the problem is likely to contribute to his or her decision making.

We therefore suggest that POE should be operationalised via statements that measure perceptions of the extent to which the outcomes of individual behaviours contribute to achieving collective goals using the statement: 'If … (an individual behaviour), then … (contribution to collective goal)' modified from Luszczynska and Schwarzer (2005, p.148).

4.4.2 Collective efficacy (CE)

Several different group efficacy constructs and operational measures are provided in the literature. Among the different measures of group efficacy, the discussion or consensus method is inappropriate for large-scale problems due to the practical difficulties of communication among individuals in collective situations. The aggregated individual efficacy method of assessing collective efficacy is also inappropriate as it is based on judgements of individual competency to carry out a behaviour, and does not measure the capabilities of the whole group to carry out actions at the collective level (Alavi and McCormick, 2008). Thus, in the context of a collective problem, the most pertinent measure is that of the aggregated holistic index (Bandura, 2000), calculated as the mean of individual ratings of the capacity of the collective to carry out the behaviour. If the aim is

to predict *individual* behaviour, we suggest using individual ratings of CE, whereas if the aim is to predict *collective* response, the aggregated holistic index should be used. Thus, in our framework, collective efficacy is defined as a measure of individual judgements of the ability of the collective to conduct a particular behaviour.

We note that although Bandura (2006) argues that individual efficacy judgements can be aggregated to give a measure of collective efficacy when there is low task or behavioural interdependence, we argue that this measure is inappropriate in social dilemma situations. Although individual actions can be independent of one another in social dilemma situations (for example, I can install insulation even if you do not), the decision to cooperate may depend on the decisions of others, especially when the benefit is only attained if a threshold of cooperation is achieved. Therefore, while individual cooperative behaviours can be carried out largely independently of cooperative behaviours of others, the *decision* to cooperate is not independent of the decision of others to cooperate. Therefore, interdependence is shown at the level of decision to cooperate rather than the behaviours themselves. Using the aggregated holistic index as a basis for measuring collective efficacy, one might suggest using the format proposed by Bandura (2006, p.334): 'For each situation please rate how certain you are that … (the collective), working together as a whole, can … (behaviour)' . However, the social dilemma nature of the problem means that responses to this statement fail to capture beliefs about trust in others to carry out the behaviour.

Dawes (1980) pointed to two possible effects of individual decisions to cooperate in social dilemma situations: (a) the 'free-rider' effect, and (b) the 'avoid being a sucker effect'. The *free-rider effect* exists when individuals believe others will cooperate (that is, high levels of trust in others' cooperation) and they believe they can defect without significantly hurting others. Truelove (under review) used this idea to explain her finding of a negative relationship between CE and pro-environmental behavioural intentions. The *avoid being a sucker effect* exists when individuals believe others will not cooperate (that is, low levels of trust in others ' cooperation) such that they believe they should also defect so as to avoid incurring costs with limited or no gain. It is currently unclear how this effect relates to pro-environmental behaviours since Bonniface and Henley (2008) examined CE perceptions of environmental activists and non-activists and found that *both* groups had low collective efficacy.

As a result of considerations of this type, Lubell (2002) argues that CE (which he refers to as citizen efficacy) is concerned with trust in other people to carry out the behaviours required for influencing collective outcomes. He goes on to point out that people cooperate 'if they trust others to cooperate' (Lubell, 2002, p.436). Indeed, extensive research in social dilemmas has found trust to be a key construct in cooperative behaviours (Dawes, 1980, De Cremer et al., 2001, Van Vugt, 2009).

We therefore suggest that it may be more meaningful to operationalise CE via statements that refer to levels of confidence that other individuals can and will carry out the behaviour. Although Bandura (2006) makes a point of insisting that efficacy statements should refer to ability as opposed to intention, the construct we are interested in falls somewhere between these ideas and is akin to the 'self-trust' that is embodied in much of the work on efficacy in the health literature. For example, when individuals are asked the extent to which they are *able* to refrain from smoking, this taps psychological willpower and issues of 'self-trust' as much as physical capability. We therefore suggest that establishing the appropriate wording to capture trust should form a focus of future work. We anticipate that using the future tense of the verb 'to be able', giving rise to statements of the form 'I am confident that (a collective) will be able to … (perform an action), even if … (a barrier)' would capture this effect, while also tapping persistence in relation to the long-term nature of many mitigation behaviours, but this would need to be tested empirically.

4.4.3 Collective outcome expectancy (COE)

The question of whether individuals believe that collective actions can have a significant impact on the collective problem is likely to contribute to their decision-making in the context of large-scale problems. The collective outcome expectancy (COE) construct of the framework introduced here is defined as a measure of people's judgements of whether collective action can help achieve the collective goal. As has already been found by other researchers (Bonniface and Henley, 2008, Carrico and Riemer, 2011), collective outcome expectancy is linked to pro-environmental behaviour. Truelove (under review) also found that collective outcome expectancy (referred to in her work as collective response efficacy) was associated with intentions to perform mitigation actions. Here, we propose that COE be operationalised via questions that relate to perceptions of how well the outcomes of collective actions will help to meet collective goals and that statements should be worded

'If … (collective behaviour), then … (achievement of collective goal)'. It is not currently clear how the 'collective behaviour' aspect of the above statement should be worded. For example, it would be important to test whether statements that refer to *most* individuals engaging in the behaviour elicit different responses from versions that refer to *all* individuals, or to the broader idea of *everyone*. We expect that a version that refers to *most* individuals engaging in the behaviour is likely to provide the most meaningful responses since a small number of defectors are likely to have only a small impact on overall outcomes; however, this would need empirical validation. Table 4.2 provides an example of the framework applied to one of the climate change mitigation behaviours recommended by the Energy Saving Trust (2011).

Table 4-2 The matrix of forms of efficacy and outcome expectations. Each may be high or low in social dilemmas and/or large-scale collective problems (illustration of the particular behaviour of turning down the thermostat by 1^{o}C)

Goal/concern	Level	Efficacy	Outcome expectancy
Individual goal/ egoistic concern (e.g. save money)	Individual	Individual efficacy (SE) *Can I turn down my thermostat by 1 ^{o}C?*	Outcome expectancy (OE) *Will turning down my thermostat contribute to me saving money (£50 per year)?*
Collective goal/ biospheric or altruistic concern (e.g. help reduce end-user energy use and carbon emissions)	Individual	Personal efficacy (PE) *Can I turn down my thermostat by 1 ^{o}C?*	Personal outcome expectancy (POE) *Will turning down my thermostat by 1 ^{o}C contribute meaningfully to reducing carbon emissions?*
	Collective	Collective efficacy (CE) *Will most people be able to turn down our thermostat by 1 ^{o}C?*	Collective outcome expectancy (COE) *Will most people turning down our thermostat by 1 ^{o}C contribute meaningfully to reducing carbon emissions?*

The questions in italics are provided for illustrative purposes.

4.5 FUTURE RESEARCH

The framework described above, consisting of the particular efficacy constructs outlined, can help us to understand barriers to behaviour change, to formulate particular research questions and to form hypotheses in relation to these. We now identify specific research questions that should be addressed in order to use the framework above to generate responses to policy-relevant questions.

It is important to construct valid and reliable measures for efficacy and outcome expectancies at the collective level. This requires testing different formulations of goal attractiveness, efficacy and outcome expectancy statements. Firstly, it would be useful to evaluate the importance of level of specificity on response patterns. For example, it would be helpful to investigate whether different results are obtained for different levels of engagement with behaviours (for example, by referring to turning the thermostat down by 1°C or 2°C), and whether it is therefore useful to ask about these goals separately. Secondly, it would be helpful to understand how we might be able to capture the element of trust in collective efficacy judgements, and specifically whether the 'I am confident that (a collective) will be able to…' wording taps this construct. Finally, it is important to understand how best to formulate statements relating to collective behaviour, and whether it is most helpful to refer to 'most people', 'everyone', and so on.

A further issue that requires empirical work before complete efficacy statements can be constructed is that of assessing the barriers to behaviour change, since these are integrated into the second clause of efficacy statements. On the basis of a particular set of suggested behaviours, such as those proposed by the Energy Saving Trust (2011), barriers could be identified via mini-interviews or focus group discussions to gain responses from a broad range of respondents. Once reliable and valid tools for assessment of both individual and collective forms of efficacy and outcome expectancies have been constructed for climate change mitigation behaviours, particular research questions can then be addressed. Firstly, there are questions relating to the level of heterogeneity among individuals and their responses to behaviours. Secondly, it would be useful to understand how the different forms of efficacy relate to behavioural outcomes. Finally, we would hope to explore questions relating to the effectiveness of interventions designed to change behaviours by attempting to influence on efficacy constructs.

It would be useful for risk managers to understand the extent to which individuals differ in their efficacy and outcome expectancy perceptions and their behavioural response to different behaviours, as answers to these questions will determine the level of personalisation of policies aimed at encouraging individuals to engage with new behaviours. For example, it would be useful to know whether the environmental concern characteristics (egoist, altruist or biospheric) can be used to predict goal attractiveness, and whether this in turn predicts the particular forms of efficacy that are high or low. Alternatively, it may be that individuals differ more in their responses to particular

behaviours (for example travel versus heating-related behaviours) than among environmental concern types.

In attempting to design behavioural interventions, it would be useful to know which forms of efficacy are most strongly related to behaviour change and how these depend on individual versus collective goal types. This information will allow those designing interventions to focus on influencing those forms that are most likely to have a positive impact on behaviour. For example, it may be that the confluence of high efficacy and outcome expectancies are required in order for individuals to engage with mitigating behaviours. However, work with individual problems (for example, health) suggests that efficacy may have more influence when outcome expectancies are high, and the relationship between the different forms may be complex. Indeed, in evaluating this relationship, it is likely to be necessary to understand the bottlenecks that cause inaction, rather than simply investigating correlations between factors. Furthermore, there may be a temporal aspect to the relationship between efficacy and behaviour, as is the case with individual forms whereby outcome expectancies come into play primarily at early stages. It would be helpful to know whether the same applies to collective forms.

Finally, the introduction of new forms of efficacy raises new questions relating to forms of intervention. In particular, it would be useful to establish to what extent it is possible to use communication-based interventions or other policy strategies to influence people's perceptions of goal attractiveness, especially if it emerges that those who hold both individual and collective goals are more likely to engage in pro-environmental behaviours. It would also be useful to know whether interventions that aim to influence goals are more or less effective than those that aim to increase the different forms of efficacy beliefs and outcome expectancies. It would also be helpful to establish whether the same pattern of effectiveness of intervention types (for example those using enactive mastery versus vicarious experience) applies to collective efficacy as well as to individual forms. This is particularly true given that current climate change communication relies on verbal persuasion, which has been shown to be relatively ineffective in work in individual situations.

4.6 CONCLUSION

This chapter proposes an integrated framework based on the distinction between individual and collective goals that encompasses individual and collective levels of efficacy and outcome expectancy. This is intended to be applicable primarily in large-scale collective problems, and especially those with a social dilemma aspect. Many studies to date have used each of these constructs separately, with results demonstrating their effect on individual and group functioning. Only one study to date has used all four collective constructs (Truelove, under review), but did not distinguish between individual and collective goals. A better understanding of the constructs should help in encouraging sustainable behaviours and in practical applications, and the framework should allow policy-makers to determine which forms of efficacy and outcome expectancies should be targeted to achieve positive behaviour change. It seems likely that to be effective, climate change communications should instil in people the belief that they have the capability to change their behaviours (SE). Moreover, they might also be used to encourage people that these behaviours will contribute meaningfully to achieving the collective goal (POE), that others are also capable of changing their behaviours (CE) and that our collective actions will help achieve the collective goal (COE). We have identified particular questions for future research that will allow us to understand whether, and to what extent, this suggestion is correct, and thus to allow risk managers and those involved in designing interventions to do so in the most productive way.

Notes

1 Guzzo et al. (1993) refer to a related concept entitled group potency, which concerns individual assessment of group perceptions of the group' s capability. Jung and Sosik (2003) carried out a study measuring group potency which was measured using eight items developed by Guzzo et al. (1993) using statements such as 'No task is too tough for our group'. However, group potency is a general evaluation of the groups' capability (Collins and Parker, 2010), whereas group efficacy beliefs, similarly to self-efficacy, are much more specific and focus on a specific task (Bandura, 1997, Collins and Parker, 2010).

2 This approach is similar to Ajzen and Fishbein' s (1980) measurement of 'valence' or the desirability of particular outcomes, but applied to the individual versus collective nature of outcomes.

Part D: Energy saving behaviours, their determinants, the role of efficacy and outcome expectancy and determining the audience and structure of communication messages

The energy saving behaviours carried out by the UK public, and their determinants

Which are the **energy conservation behaviours** the public carry out, and what is the most commonly cited **reason** for doing so?

Recycling is the most commonly carried out behaviour, and was the only behaviour carried out **environmental reasons.** All other behaviours were carried out for **financial reasons**.

Self-efficacy was found to be the key predictor for behaviour adoption across most behaviours examined.

Chapter 3 indicated that the majority of the UK public believes that climate change is happening, with those who accept versus those who reject climate change differing in the justifications they use to support their beliefs. And yet, when considering the relationship between climate change beliefs and climate change mitigation, Spence et al. (2011) found people's willingness to reduce energy use not to be related to their climate change beliefs. This implies that climate change beliefs may not predict the adoption of energy saving behaviours. In addition, chapter 4 examined the literature and revealed that psychological factors, and more specifically efficacy and outcome expectancy, have the potential to influence household energy use and conservation. However, this has not been examined on

the adoption and non-adoption of the behaviours found to be the most effective at reducing energy consumption.

These points inevitably lead to the questions of whether the UK public is carrying out the most effective behaviours at reducing their energy consumption, what the key motivations and barriers are to action, and whether behaviour adoption is predicted by climate change beliefs, efficacy and outcome expectancy, or other factors found to influence behaviours in the literature.

In the next chapter:

- I examine the adoption and non-adoption of a variety of energy saving behaviours by the UK public using the short list of efficiency and curtailment behaviours developed by Gardner and Stern (2008) (Research question 3).
- I determine whether energy saving behaviour adoption is positively related with a) carbon savings and b) financial savings associated with these behaviours (Research question 4).
- I examine the motivations, barriers, along with the possible financial misconceptions that may exist regarding the potential financial savings, concluding with an examination of the impact of the factors that may predict behaviour adoption (Research questions 5-7).
- The most popular behaviours carried out are not the most effective (environmentally and financially).
- 'Financial reasons' is the main motivation for behaviour adoption for both efficiency and curtailment behaviours.
- 'Financial reasons' is the main barrier for efficiency behaviours while 'don't know it matters' is the main barrier for curtailment behaviours.
- Financial misconceptions, regarding the potential savings from energy saving behaviour adoption, exist across all behaviours.
- Self-efficacy was found to be the strongest predictor for behaviour adoption.

CHAPTER 5. HOUSEHOLD ENERGY USE AND ENERGY CONSERVATION IN THE UK: WHICH BEHAVIOURS DO THE PUBLIC CARRY OUT AND WHAT ARE THE DETERMINANTS OF THESE BEHAVIOURS?

5.1 INTRODUCTION

Unsustainable behaviours at individual and global scales are leading to changes in the conditions of the Earth, one of which is climate change. Increasing energy use by households is resulting in households being responsible for a substantial number of greenhouse gas emissions, which have been increasing in recent years (Abrahamse et al., 2005). End-user energy demand reduction is the only viable short-term strategy for reducing our current CO_2 emissions.

Research into the promotion of household energy conservation has been carried out for the last three decades, beginning from the oil crisis in the 1970s through to the 1980s, when the negative consequences of fossil fuels began a quest for lowering our emissions and our dependence on fossil fuels (Poortinga et al., 2003). The literature to date contains a growing number of studies that examine energy conservation behaviours carried out by the general public (e.g. Abrahamse et al., 2005), studies that examine the factors that influence energy conservation (e.g. Steg, 2008), and others that explore people's perceptions of energy consumption and savings (e.g. Attari et al., 2010).

However, these studies have largely been carried out independently from each other. This makes it difficult to compare results and obtain a clear and aggregated picture of what energy saving behaviours the public carry out, people's perceptions of these, and what the determinants of these behaviours are. Such an aggregated picture is important for two reasons: firstly, it allows us to examine the adoption and non-adoption of the behaviours found to be the most effective at reducing energy consumption, whilst also understanding the motivations behind the adoption and non-adoption of these behaviours; and secondly, as people's perceptions affect investment in energy conservation, understanding the factors

that predict the adoption of the most effective behaviours is vital for directing communication and policy efforts where needed.

This chapter aims to explore four things: a) the adoption and non-adoption of a variety of household and transport activities by the UK public using the short list of efficiency and curtailment behaviours developed by Gardner and Stern (2008) and adapted for the UK public, b) the perceived financial savings the adoption of these behaviours may result in, c) the motivations and perceived barriers to carrying out or not carrying out these behaviours, and d) the impact of the factors that predict behaviour adoption, focusing on sociodemographic factors, pro-environmental beliefs, perceptions of money saved by carrying out the behaviours, and finally the impact of perceived efficacy and outcome expectancy perceptions (as discussed in Chapter 4) all of which should allow us to identify the factors and specific forms of efficacy that should be targeted in research, science communication and policy.

The results of this study show that there was no correlation between the most effective behaviours (both financially and environmentally) and those carried out. Additionally, there was no statistical correlation between the actual money saved, and the money that respondents perceived that they saved. However, across most behaviours, there is consistent evidence for associations between perceived self-efficacy and the adoption of behaviours. Self-efficacy thus has the potential to be a useful construct in the reduction of end user energy consumption. Despite the errors in perceived financial savings, estimates of financial savings were found to be the second main determinant of carrying our energy saving behaviours, followed by perceptions of climate change as influencing one's decisions. Saving money, rather than the environment, was found to be the main motivation for carrying out behaviours. These distinctions can support us in managing climate change risk by allowing us to identify the psychological constructs, potential financial gains, and the sociodemographic and environmental factors that should be targeted in research, science communication and policy.

The rest of the chapter is structured in the following way: A review of the research that has been conducted to date is initially presented; on the energy saving behaviours the UK public carry out[11], the role of efficiency and curtailment behaviours in this energy

[11] This study focuses on energy saving behaviours as past studies suggest that without waiting for new technologies or policy regulations, behavioural changes involving the adoption or altered use of available technologies, have the potential to result in large near-term emission reductions (Dietz, et al., 2009).

reduction, the perceptions of financial savings from behaviour adoption, along with the factors that have the potential of influencing energy saving. This is then followed by a description of the methodology used for the present study on energy saving behaviours. The findings from this study are then divided into two sections; Section 1 explores energy saving behaviour adoption (Research question 3) along with whether energy saving behaviour adoption is positively related to carbon savings and financial savings (Research question 4). Section 2 explores the potential financial misconceptions (Research question 5), perceived motivations and barriers to behaviour adoption (Research question 6), along with the factors that may help predict which behaviours are carried out (Research question 7). Finally, a discussion of the key findings and arguments is then presented offering policy and communication recommendations.

5.2 ENERGY SAVING BEHAVIOURS CARRIED OUT

In 2013, 29% of total UK energy was consumed by households, while transport consumed 36% of total UK energy (Department of Energy and Climate Change, 2013b). This energy use amounted to 43,8 thousand tonnes of oil equivalent (ktoe), which according to the Department of Energy and Climate Change (2014a), is stable compared to the consumption in 2012. Energy used by households is used for a range of activities. More specifically, 65% of household energy use was from space heating, 16% for water heating, 13% for appliances, and 3% for cooking (Department of Energy and Climate Change, 2014a).

Behaviour changes on the household level have the potential to impact overall UK emission reduction. Past studies suggest that without waiting for new technologies or policy regulations, behavioural changes involving the adoption or altered use of available technologies, have the potential to result in large near-term emission reductions (Dietz, et al., 2009). Recognizing this potential, and in line with the Climate Change Act (2008), the UK Government has tried to introduce initiatives to encourage the reduction of household energy consumption (e.g. the Green Deal). Indeed, according to the UK Energy Research Centre, changes in household and transport behaviours could reduce national energy use and carbon emissions by 30% by 2050 (UKERC, 2009).

This need to respond to climate change and encourage the public to reduce their energy consumption has led to studies exploring energy use and the determinants of this, mainly

through the use of surveys (e.g. DEFRA, 2009). According to recent studies, recycling and energy conservation at home are the most frequently mentioned as being the behaviours that the public would be most willing to carry out, or are already being carrying out. Indeed, a study carried out by Whitmarsh (2009a) in 2003 examining the behaviours carried out by 589 residents of Hampshire (a county in southern England) found the most popular behaviours carried out to be: turning off lights they are not using (95.7%), recycling items other than glass (93.1%), recycling glass (85.6%), buying energy efficient light bulbs (66.2%).

In a more recent survey of 2,009 adults in England, DEFRA (2009) also examined energy conservation behaviours currently being carried out. Using the categorization of behaviours I adopted for my study (general, home and car, see Section 2.2), this study found the general behaviours respondents were most likely to be doing were: only boiling the kettle with as much water as needed (84%), washing clothes at 40^{o}C or less (77%), turning down the thermostat (66%). Moving specifically to home behaviours, in the study carried out by DEFRA (2009), the most commonly carried out behaviour was that of double glazing (89%), followed by loft insulation (82%), with a smaller proportion of home owner respondents stating that they had installed a condensing boiler (31%). Regarding car behaviours, the vast majority of car driver respondents stated that they drove in a fuel efficient manner (78%), and 62% stated that they walked or cycled instead of driving for short, regular journeys (DEFRA, 2009). Overall, interestingly, a very high proportion of respondents stated that they were trying to cut down on the use of gas and electricity at home (76%). This last question demonstrated a large increase in the number of participants responding positively in relation to the corresponding number of 58% in the previous survey carried out just a couple of years earlier (DEFRA, 2007).

However, despite this desire to reduce energy consumption, studies reveal that household and transport energy demand is rising (Oliver et al., 2013), and energy conservation behaviours are carried out by only a minority of the public (Whitmarsh, 2009a). Whitmarsh et al. (2011) recently argued that surveys are showing that when asked which behaviours contribute most to mitigating climate change, the public shows a relatively high level of understanding of the ones involved. Whitmarsh et al. (2011) backed this up by showing that in a UK-based study of 3,600 participants carried out by DEFRA (2007), responses showed that more than 75% of respondents correctly identified ‘using a car less’ and ‘flying less’ as having a ‘medium or major impact’ on reducing emissions. And yet, despite recycling being an indirect energy saving measure, which is not as effective as

many other recommended behaviours (e.g. driving less), a number of studies have found it to be one of the more popular climate change mitigation behaviours (e.g. Whitmarsh, 2009a). Thus, it is hypothesized energy saving behaviour adoption is not positively related to carbon or financial savings resulting from these behaviours.

On the other hand, despite the correct identification of the high impact behaviours, and the adoption of non-effective behaviours, the motivation to carry these out is another hurdle. Additionally, in the DEFRA (2007) study, less than a quarter of participants believed that the UK public would be willing to carry out these behaviours (Whitmarsh et al., 2011). In her study, Whitmarsh (2009a) found a divergence between the behaviours which have a potential for reducing energy consumption, and those taken by the public (with recycling being one of the most popular behaviours carried out). Thus, it is hypothesized that the UK public is not carrying out the most effective behaviours.

When aiming to reduce environmental impact, the identification of behaviours that can result in a relatively large energy-saving potential is essential (Abrahamse et al., 2005). However, one limitation found from past research, is that behaviour adoption is not examined using a defined list of behaviours with the potential for large near-term emission reduction. This could help explore whether the most effective behaviours are actually carried out, and to investigate the possible reasons for non-adoption. One such list of behaviours, which does not involve waiting for new technologies but involves the altered use of technologies at home and for transport, is the Gardner and Stern (2008) short list of energy saving behaviours which is discussed in the next section.

5.3 REDUCING ENERGY CONSUMPTION – THE GARDNER AND STERN (2008) SHORT LIST OF BEHAVIOURS

Recent studies suggest emission reductions can be implemented from behaviour changes at home and when driving, making use of already available technologies at home and in vehicles, without the need for 'waiting for new technologies or regulations or changing household lifestyle' (Dietz et al., 2009, p. 18452). Thus, there are ways in which people can reduce their energy consumption with virtually no change in lifestyle at all (Mugdan and Howe, 2010). Energy saving involves a wide variety of behaviours that range from the easy to carry out and habitual (e.g. wash clothes at 30^{o}C instead of 40^{o}C) to the more costly yet more effective behaviours (e.g. install/upgrade loft insulation and ventilation).

Upon identifying that the majority of energy consumed by US households was for heating and cooling homes and to run cars, Gardner and Stern (2008) produced a *short list* of 27 of the most effective actions households in the US could take in order to efficiently reduce their energy consumption. The *short list* focuses on car use, heating and cooling, including several other actions like water heating and lighting. Gardner and Stern (2008) argued that households could reduce their energy consumption by 30% if they managed to implement all recommended actions, without the need to wait for new technologies, nor make major economic sacrifices, nor lose a sense of well-being (Attari et al., 2010).

Household energy conservation behaviours can be divided into two categories: efficiency and curtailment behaviours (Gardner and Stern, 2008). ***Curtailment behaviours*** involve energy saving actions that need to be carried out repeatedly, such as altering driving style or turning down the thermostat, while ***efficiency behaviours*** are behaviours carried out once, and have a long term effect on energy consumption. The former are associated with changes in people's lives, as the adoption of new energy use habits is required, while the latter generally involve the purchase of energy efficient equipment, such as buying a more efficient car, or insulation in one's home (Abrahamse et al., 2005, Sütterlin et al., 2011, Gardner and Stern, 2008). Although efficiency behaviours require an initial investment, they eventually tend to result in higher savings (Sütterlin et al., 2011).

Table 5-1 Short list by Gardner and Stern (2008)

Curtailment	Efficiency
Motor vehicle use	
Carpool to work with one other person	Buy a more fuel-efficient automobile (30.7 vs. 20 mpg EPA average-adjusted composite)
Alter driving (avoid sudden acceleration and stops)	Get frequent tune-ups, including air filter changes
Combine errand trips to one half of current mileage	Buy low-rolling resistance tires
Cut highway speed from 70 to 60 mph	Maintain correct tire pressure
Inside the home	
Heating and air conditioning	
Heat: Turn down thermostat from 72° F to 68° F during the day and to 65° F during the night - A/C: Turn up thermostat from 73° F to 78° F	Heat (&A/C): Install/upgrade attic insulation and ventilation
	Heat: Install a more efficient heating unit (92 percent efficient) - A/C: Install a more efficient A/C unit (SEER 13 or EER 12)
	Heat: Replace poor windows with high-efficiency windows
	Heat (&A/C): Caulk/weather-strip home
Water heating	
Turn down water heater thermostat from 140° F to 120°F	Install a more efficient water heater (EFS .7 unit)
Lighting	
Do not leave one 60-watt bulb on all night	Replace 85 percent of all incandescent bulbs with equally bright compact fluorescent (BCF) bulbs
Replace two 100-watt kitchen bulbs with 75-watt bulbs	
Refrigeration/freezing	
Turn up the refrigerator thermostat from 33° F to 38° F and the freezer thermostat from –5° F to 0° F	Install a more efficient unit (replace a 19–21.4 cubic feet top-freezer unit bought between 1993 and 2000 with a new Energy Star unit)
Clothes washing and drying	
Change washer temperature settings from hot wash, warm rinse to warm wash, cold rinse	Install a more efficient washer (replace a 2001 or older non– Energy Star washer with a new Energy Star unit)
Line-dry clothing (do not use dryer) 5 months of the year	
Colour TV	
Watch 25 percent fewer hours of TV each day	Purchase (or trade in) 52’ Projection HD TV instead of a 48’ Plasma HD TV

Several studies have since then used the *short list* to examine potential of adoption of these behaviours. Dietz et al. (2009) examined the potential implementation of 17 household behaviours in the US, along with the potential energy reduction this could result in. As a first stage this involved estimating the emissions reduction that could be achieved from 100% adoption of the action. This was then followed by estimating the plasticity, ‘the

proportion of current non-adopters that could be induced to take action' using data from the most effective proven interventions, thus adding a 'behaviour realism' to the estimates (Dietz et al., 2009, p.18453). Their results revealed that if the most effective interventions were used, 20% of direct household emissions (or 7.4% of US emissions) could be reduced within 10 years with 'little or no reduction in household well-being' (Dietz et al., 2009, p.18453).

Attari et al. (2010) carried out a study examining people's perceptions of the energy consumption and savings from various household and transportation activities. The 505 participants were asked with an open-ended question, what the most effective thing they could do to conserve energy was. Their responses were grouped into 17 categories, which were further classified as curtailment action or efficiency. Most participants mentioned curtailment behaviours (55.2%) whereas fewer mentioned efficiency behaviours (11.7%). The remaining responses were classified as ambiguous (e.g. conserve energy, recycle) and as such, they were not added in the efficiency/curtailment categorization.

Attari et al. (2010) went on to stress the problem in people's misconceptions, as in fact, despite efficiency behaviours not being mentioned much as being the most effective, they are actually the behaviours that have the potential to save more energy. And yet, when the behaviours are provided in the form of a list, people are able to identify the efficiency behaviours as having a high impact on reducing emissions (DEFRA, 2007). Thus despite this correct identification, the most effective behaviours are not the ones most commonly carried out (Whitmarsh, 2009a). However, stressing the importance of adopting not only efficiency behaviours, Gardner and Stern (2008) argued that curtailment behaviours have the potential to provide immediate savings, and for this reason households have the potential to benefit from the adoption of both types of behaviours.

It is important to point out that households use energy in a direct way (i.e., the use of gas, electricity and car fuel) but also in an indirect way (embedded in the production, transportation and consumption of goods) (Abrahamse and Steg, 2009). In the UK, approximately half of average household energy use can be defined as direct energy use (Steg 2008). Thus substantial energy savings can result from both direct and indirect energy conservation. Most studies have focused on direct energy use, with a limited number of studies examining indirect energy use (Abrahamse et al., 2007; Gatersleben et al., 2002). The lack of attention indirect energy savings have received could be due to the difficulty in calculating and addressing the wide range of activities that contribute to

indirect energy use (Benders 2006). This study focused on direct energy use, and specifically on the Gardner and Stern (2008) short list of actions, as their implementation could reduce household energy consumption by 30% without the need to wait for new technologies, nor make major economic sacrifices, nor lose a sense of well-being (Attari et al., 2010).

Considering that the adoption of both the efficiency and curtailment behaviours from the Gardner and Stern (2008) *short list* of behaviours have the potential for large near-term emission reduction, I wished to examine if these behaviours were carried out by the UK public, as these have the potential to help result in a great reduction of UK CO_2 emissions. I now review the literature relating to the factors that may affect behaviour adoption.

5.4 PERCEPTIONS OF ENERGY SAVINGS

Gardner and Stern (2008) speculated that there are misconceptions regarding the actual effectiveness of these behaviours. Indeed, as Attari et al. (2010) pointed out, research shows that the public not only have a deficient understanding of the processes involved in climate change (Sterman and Sweeney, 2007, Bostrom et al., 1994), but also of the energy consumed by various frequently carried out behaviours (Leiserowitz, 2005). A study carried out in the US in 1985 compared respondents' estimates of potential savings from various energy saving behaviours, with estimates from the literature (Kempton et al., 1985). Kempton et al. (1985) found a poor understanding of the energy consumed by the behaviours, with overestimations on some and underestimations on others. For example, 'turning off lights when leaving a room' was the most frequently mentioned behaviour for conserving energy, even though it saves very little (Kempton et al., 1985). Indeed, according to MacKay (2009), the use of lighting contributes to only 3% of the total energy used per day per person in the UK. However, Kempton et al. (1985) did not specify if there was any correlation found between the over/under estimations, and whether or not these behaviours were carried out by the participants.

One further study in the US examined 505 participants' perceptions of energy conservation and savings for various activities at home and for transportation (Attari et al., 2010). Twenty five years after the study by Kempton et al. (1985), Attari et al. (2010) also found 'turn off lights' to be the most popular behaviour respondents pointed to as 'the the most

effective thing they could do to conserve energy'. More specifically, participants mainly mentioned curtailment rather than efficiency behaviours as a way to conserve energy. Attari et al. (2010) also found misconceptions when participants were asked to estimate the energy used by nine devices and appliances and the energy saved by the adoption of six behaviours. More specifically, when participants were then asked about the energy use and savings of 15 activities, they overestimated the potential savings for behaviours that were the least effective, and yet underestimated the potential savings for the most effective behaviours. Thus, it is hypothesized that there exist financial misconceptions, as past studies have found people to exhibit 'relatively little knowledge regarding the comparative energy use and potential savings related to different behaviours' (Attari et al, 2010, p.16057).

5.5 FACTORS INFLUENCING HOUSEHOLD ENERGY USE AND ENERGY CONSERVATION

Previous studies have shown that the public does not focus on the most efficient behaviours (Whitmarsh, 2009a). In order to elucidate this, the literature points to a wide range of factors that have been found to explain the divergence between the recommended energy conservation behaviours, and those carried out by the public (Stern, 2000, Whitmarsh, 2009a, Abrahamse et al., 2005, Sardianou, 2007). As categorised by Steg (2008), the main factors influencing people's energy use are: knowledge, motivation and ability.

5.5.1 Knowledge

In order to be effective at reducing energy consumption, people need to be aware of the need to reduce energy and they need to know the various ways to do this (Steg, 2008). Regarding the first point, the UK public are regularly exposed to messages about climate change, and this has resulted in an improvement in public awareness of climate change (Ockwell et al., 2009, Steg, 2008). However, despite the growing awareness, the behaviours people carry out to conserve energy does not show this, as there is a lack of focus on the most effective behaviours (Whitmarsh, 2009a).

Regarding the second point, Gardner and Stern (2008) argued that communication campaigns may have contributed to the divergence in people's actions. They went on to point out that information from the media generally points to curtailment behaviours, with '*The Live Earth Global Warming Survival Handbook'* used as an example of a publication including only three efficiency behaviours in their 77 behaviours suggested to stop climate change (Gardner and Stern, 2008). A stronger focus on curtailment rather than efficiency behaviours, may lead to misconceptions about the impact people's actions actually have. Attari et al. (2010) also argued that communication campaigns focus on behaviours that have little impact (e.g. switching off lights when not in use) whilst neglecting the most effective behaviours. Indeed, this confusion over perceptions of the most effective behaviours was found by Attari et al. (2010), thus pointing to, amongst lack of interest, a possible lack of knowledge about which the most effective behaviours actually are (DEFRA, 2002, Whitmarsh, 2009a, Attari et al., 2010).

5.5.2 Motivation

Energy conservation may involve habitual changes (curtailment behaviours) or financial investments (efficiency behaviours). On an individual level, reducing energy use can have benefits in other areas of one's life, such as health benefits from walking and driving less, and financial benefits which result from reduced energy bills. Stern (2000) went on to argue that 'environmentally beneficial actions may also follow from non-environmental concerns, such as a desire to save money' (p.415). Indeed, studies examining people's motivations for conserving energy have found that these tend to be unconnected to the environment (e.g. Whitmarsh, 2009a), with most energy-saving behaviours being carried out for financial and health reasons rather than for environmental ones (Lorenzoni et al., 2007, DEFRA, 2002). In 2002 DEFRA (2002) found that 40% of the English public claimed to 'regularly cut down the amount of electricity/gas your household uses', with 81% doing so to save money, and only 15% doing so to 'help the environment/reduce pollution'. More recently Whitmarsh (2009a) found the most popular behaviour carried out in her study was a curtailment behaviour ('turn off lights I'm not using') which was carried out 'to save money'. The following two behaviours, and the only ones which were carried out 'to protect the environment' were recycling ('items other than glass' and 'glass'). The only efficiency behaviour ('buy energy efficient light bulbs') was also carried out 'to save money'. Walking/cycling to work, on the other hand, was found to be generally health-

related, and the use of public transport was generally carried out for convenience. Thus, it is hypothesized that financial reasons will be the main motivation for all behaviours (with the exception of recycling. However, I would expect this to be more dominant for efficiency behaviours, as these have the potential to result in higher savings (Sütterlin et al., 2011). Similarly to Whitmarsh (2009) I would expect recycling to be motivated by environmental reasons.

Indeed, there is a lack of knowledge of the most effective behaviours (see previous section), and when energy saving is carried out, it is done for reasons unrelated to the environment, but related to personal gains (e.g. saving money). However, when energy conservation involves high costs, such as in financial terms, effort or convenience, people are less likely to reduce their energy use (Steg, 2008). This could explain why people are more likely to carry out the behaviours that have a low financial cost and are carried out with little effort (such as recycling or domestic home energy use), rather than those which come with higher financial (e.g. buying a more efficient car) and lifestyle costs (e.g. altering car use) (Steg, 2008, Lindenberg and Steg, 2007). However, it would be interesting to examine the tendency to prefer the adoption of low cost and little effort behaviours requiring very little effort over those which require more money and effort based on a list of behaviours able to make a difference in emissions (e.g. the Gardner and Stern (2008) *short list*).

5.5.3 Ability

As Poortinga et al. (2011) argued, 'perceptions of the need to take mitigating action against climate change, and of the ability to act on this, can be key precursors to personal behaviour change and compliance with wider policies aimed to motivate such changes' (p.1015).

However, aside from knowledge and motivation, people need to have the ability to act, and as such there are various contextual and psychological factors that may influence energy conservation behaviours. The contextual conditions that may influence the adoption of these behaviours include *economic factors*, which are discussed in the next chapter and

infrastructure, availability of products and cultural norms, which however, are beyond the scope of this research[12].

5.5.4 The psychological factors influencing energy conservation: efficacy and outcome expectancy

The psychological factors influencing behaviours involve the two core constructs of social cognitive theory (SCT): *self-efficacy* and *outcome expectancies.* Efficacy beliefs are concerned with people's beliefs about their capabilities to perform a specific behaviour, while *outcome expectancies* are concerned with people's beliefs about the likely consequences of their action[13] (Luszczynska and Schwarzer, 2005). These two constructs are clearly distinguished from one another, with the former being the perceived ability to carry out a behaviour, and the latter being the judgments of the extent to which outcomes will flow from carrying out the behaviour (Bandura, 1977, Bandura, 1986a, Bandura, 1997).

The large-scale nature of the climate change problem means that individual action has a negligible effect on outcomes. Collective action is required for us to reach our goal of reducing our energy consumption, and thus reducing our impact on the environment. However, the standard notions of self-efficacy and outcome expectancy are limited to predicting behaviour at an individual level. For this reason, Koletsou and Mancy (2011) developed a framework consisting of individual and collective forms of efficacy and outcome expectancy (*self-efficacy (SE), outcome expectancy (OE), personal outcome expectancy (POE), collective efficacy (CE), collective outcome expectancy (COE*).

[12] Focusing on economic factors means that attention was not directed towards these contextual factors that have been found to influence behaviours. Indeed, pointing out the influence of cultural norms on behaviour adoption, Kollmuss and Agyeman (2002) argued that 'social norms [..] influence and shape people's attitudes, e.g. if the dominant culture propagates a lifestyle that is unsustainable, pro-environmental behaviour is less likely to occur' (p.242). In support of this, Kollmuss and Agyeman (2002) reported a study examining the history of policy reactions to acid rain in Germany and the UK, and found the high cultural value of the forests in Germany, among other factors, to result in these countries taking different approaches to the problem (Boehmer-Christiansen and Skea, 1991, as cited by Kollmuss and Agyeman, 2002). The implications of not including the influence on contextual factors (e.g. social norms) means that in this thesis I cannot draw conclusions about these factors.

[13] 'The notion of outcome expectancy is broader than that examined in this chapter. The outcome from one's behaviour could be in terms of financial savings, or in terms of one's principle-based goal, and as such that person may get a lot out of doing the right thing. However, for simplicity, outcome expectancy was labelled in terms of financial savings. People acting on principle could be visible in the motivations section (see Section 5.8.4.1)'.

Stressing the importance of self-efficacy and outcome expectancies in determining people's behaviours, Sütterlin et al. (2011) argued that positive attitudes toward pro-environmental behaviours will not convert into action if people do not believe they can carry out the required behaviour (SE) and that their efforts can result in the desired effect (OE if the motivation is financial and POE if the motivation s environmental). As Ek and Söderholm (2010) argued, people must believe that the actions they take to conserve energy will actually have an impact (POE, COE). Indeed, in the UK, a study by the BBC in 2004 revealed that 54% of the public believed that 'changing their own behaviour would have no impact on climate change' (Ockwell et al., 2009, p.318). This is also demonstrated by a survey carried out by the University of East Anglia which found that although 91% of respondents thought that the climate is changing, most respondents did not think individuals have the main responsibility (Poortinga et al., 2006). Thus, as UK households are responsible for 29% of UK emissions - which including direct transport emissions and indirect emissions could be as high as 95% (Druckman and Jackson, 2010) - it is of great importance that people become aware that their energy saving behaviours have the potential to play a key part in reducing UK emissions.

Thus positive self-efficacy and outcome expectancy beliefs on both individual and collective levels are vital for the adoption of pro-environmental behaviours (Sütterlin et al., 2011). Indeed, studies have found both efficacy and outcome expectancy to play a part in human behaviour. For example, in their study, Spence et al. (2011) found that for those who had been affected by flooding, believed they were more able to have an impact on climate change (among other things) and were thus were more willing to reduce their energy use. Thus, it is hypothesized that efficacy will predict behaviour adoption, as other studies have found this to influence behaviour adoption in the health literature (Strecher et al., 1986) and in the environmental behaviour literature (Thøgersen and Grønhøj, 2010).

5.5.5 Sociodemographic influences

As Abrahamse and Steg (2009) argued, research shows sociodemographic variables to influence household energy use, as these 'shape the opportunities and constraints for energy use' (p.711). The key variables found to have a relationship to energy conservation are: home ownership, income, family size and age (Barr et al., 2005), however, the research is currently limited in explaining the predictive power of these variables on particular behaviours. ***Home ownership*** has been found to be an important factor when explaining energy conservation at home (Barr et al., 2005, Painter et al., 1983, Black et al.,

1985). Moving on to ***income and household size***, Abrahamse and Steg (2009) found these to be dominant predictors of energy use. Regarding income, Dillman et al. (1983) found that those on lower incomes were more likely to carry out curtailment behaviours, while, rather as expected, those on higher incomes were those who could take up the costly efficiency behaviours. ***Age*** has been found to have a link with energy conservation more generally (Ritchie et al., 1981, Sardianou, 2007) and more specifically, in one study, older respondents were shown to be more likely to purchase energy-saving light bulbs (Whitmarsh, 2009a)[14].

5.6 AIMS OF THE EMPIRICAL RESEARCH

According to the literature explored in this chapter, people appear to be aware of the behaviours that contribute the most to climate change (DEFRA, 2007), and yet, when asked which behaviours are the most effective at reducing energy respondents pointed to curtailment behaviours (Attari et al., 2010). Additionally, recent research has shown that there is a divergence between recommended energy conservation behaviours and those carried out by the public (Whitmarsh, 2009a). Understanding which behaviours the public carry out and their reasons for doing so is vital if we are to encourage people to live more sustainable lifestyles.

Past research leaves a number of unclear answers to the question about energy saving behaviour adoption. First, as Stern et al. (1997) argued, despite studies examining energy saving behaviour adoption (e.g. Whitmarsh, 2009a), these were not examined using a defined list of behaviours with the potential for large near-term emission reduction (such as the Gardner and Stern (2008) *short list of behaviours*). This could help explore how to significantly reduce households' environmental impact. Secondly, despite Gardner and Stern (2008) speculating that misconceptions exist regarding how effective energy conservation behaviours actually are, they did not examine people's perceptions of the potential savings from the behaviours on their short list. Attari et al. (2010) went on to find misconceptions regarding the perceived potential savings from carrying out the behaviours, but this was not examined in relation to behaviour adoption.

[14] Rurality has been shown to be an important predictor, particularly for car behaviours, given that those who live in rural areas are most likely to drive as there are few alternatives available (Whitmarsh 2009). However, this factor was not examined in this research, but could be important to consider for future research'

Thirdly, despite studies exploring the motivations and barriers influencing behaviours (Lorenzoni et al., 2007), this has not been explored on a defined list of behaviours with the potential for large near-term emission reduction. This could help investigate whether these behaviours are actually carried out, and to investigate the possible reasons for adoption and non-adoption. Fourthly, despite studies having shown the factors that influence energy saving behaviour adoption (e.g. Gatersleben et al., 2002), these did not include a measure of the influence of perceptions of self-efficacy and outcome expectancy.

Therefore, in this study, I investigated 21 household and transportation behaviours that have the potential for greatly reducing our energy consumption -with the exception of recycling- (Gardner and Stern, 2008), all of which use available technologies and involve either low or no cost, or have the potential for promising returns of investment. I examined whether people carry these out, their perceptions of the potential financial savings from carrying these out, their reasons for doing so (e.g. to save money, to save the environment). I also examined how the different types of energy use are related to different contextual and psychological factors.

The importance of this study lies in the fact that in order to effectively reduce household energy use, it is vital to understand the variables that influence energy saving behaviours that are capable of significantly reducing individuals emissions (such as the Gardner and Stern (2008) *short list* of behaviours). This information will allow for the provision of tailored information capable of helping people reduce the environmental impact on their household. This study focuses on UK households due to the ambitious mitigation targets set by the UK Climate Change Act (2008).

Four specific research questions underpin this study:

Research question 3 - To what extent does the UK public carry out energy saving behaviours that have the potential to effectively reduce energy consumption?

Research question 4 - Is energy saving behaviour adoption positively related with a) carbon savings and b) financial savings associated with these behaviours?

Research question 5 – Do financial misconceptions exist regarding the potential financial savings from the Gardner and Stern (2008) *short list* of behaviours?

Research question 6 - Do the perceived motivations and barriers for behaviour adoption differ between efficiency and curtailment behaviours, and if so, how?

Research question 7 - What factors predict energy saving behaviour adoption for each of the Gardner and Stern (2008) *short list* of behaviours?

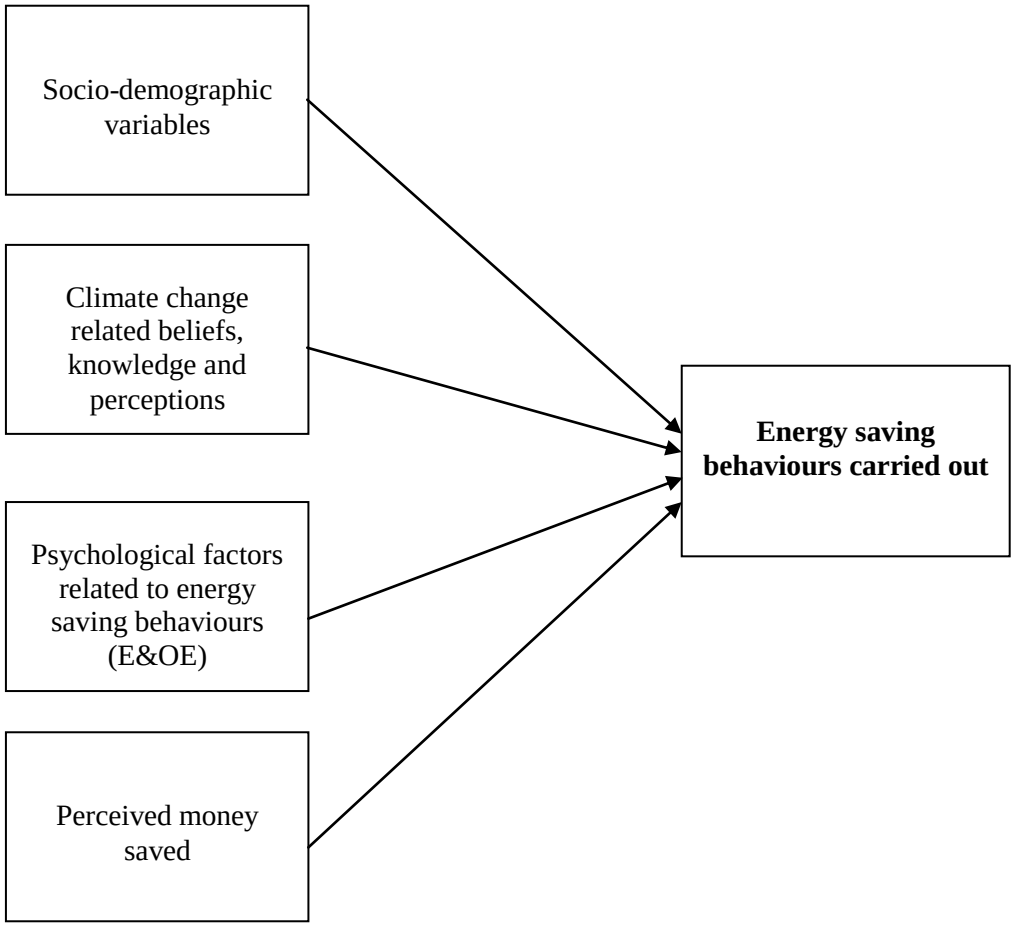


Figure 5-1 Illustrative model of the factors hypothesised to influence the energy saving behaviours carried out (which are examined in this thesis).

5.7 METHODS

5.7.1 Participants and procedure

In June 2012, I conducted an online survey among a nationally representative sample of UK adults (N=501; see Appendix B), using questions designed to examine energy saving behaviours carried out and the determinants of these. Details of the data collection procedure can be found in section 2.4 Data collection of this thesis.

5.7.2 Measures

The questionnaire comprised quantitative questions grouped into five sections. In the first part, participants' climate change related beliefs, knowledge and perceptions were assessed. Subsequently, participants' energy saving behaviours were examined, along with their frequency, the main and secondary reason for carrying out or not carrying out the behaviour. In the following section the perceived financial savings from behaviour adoption were examined. Efficacy and outcome expectancy perceptions, based on the framework described in Chapter 4 (Koletsou and Mancy, 2011) were also examined. A final section explored participants' sociodemographic characteristics.

5.7.2.1 Energy saving behaviours

This section explored the energy saving behaviours carried out, for both curtailment and efficiency behaviours. These were further categorised as home behaviours, car behaviours and general behaviours. All participants answered the general behaviours, while home owners answered home and general behaviours and car owners answered car and general behaviours (see table 5.2 below). Non-home and non-car owners only answered the general behaviours. In order to limit the amount of the behaviours answered by those who were both home and car owners, as table 5.2 shows, the survey was set up in a way where on a random basis, these participants were assigned on a random basis to either home or car behaviours, which they answered in addition to the general behaviours.

Table 5-2 Selection process for behaviours answered

	Home behaviours	Car behaviours	General behaviours
Home owner	✓		✓
Car owner		✓	✓
Home and car owner	*	*	✓
Neither home nor car owner			✓

*On a random selection basis participants were assigned to one or other category

Curtailment energy saving behaviours related to general behaviours

The general curtailment behaviours were assessed by asking participants to indicate, on a five-point Likert scale, how often they perform the behaviour; for example, 'Turn down thermostat from 22^{o}C to 20^{o}C during the day and to 18^{o}C during the night'. The scale included the following response options: never, rarely, sometimes, often, always. Overall,

the questionnaire consisted of 8 items to assess general energy saving curtailment behaviours. The behaviours, along with the corresponding questions and response categories are presented in Table 5.3.

Efficiency energy saving behaviours related to general behaviours

The only efficiency behaviour amongst the general behaviours was investigated by asking participants to indicate whether they adopted or engaged in the behaviour ('Use 85% bright compact fluorescent bulbs or LEDs instead of incandescent bulbs') by choosing the answer options yes or no. The behaviours, along with the corresponding questions and response categories are presented in Table 5.3.

Curtailment energy saving behaviours related to car use

For car owners, questions focusing specifically on curtailment behaviours related to car use and car purchase were included. Participants were asked to indicate on a five-point Likert scale, ranging from 1 (never) to 5 (always), how frequently they engaged in the curtailment behaviours related to car use. Overall, the questionnaire consisted of 4 items to assess car energy saving curtailment behaviours.

Efficiency energy saving behaviours related to car use and purchase

The second set of car related part behaviours contained two items with regard to efficiency energy-saving behaviours related to car use and purchase. Participants answered with the answer options yes or no. The behaviours, along with the corresponding questions and response categories, are presented in Table 5.3.

Efficiency energy saving behaviours related to home behaviours

Home-related efficiency energy saving behaviours were investigated using six items. Participants answered with the answer options: installed or upgraded, bought property with, or not done this. These were then binary coded for ease of analysis into yes and no. The behaviours, along with the corresponding questions and response categories, are presented in Table 5.3.

Table 5-3 Items used to measure energy saving behaviours

Items	Question	Response categories
Curtailment behaviours (general)		
Carpool to work with one other person Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night) Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F) Recycle paper, glass, and plastic[15] Reduce standby use of electricity by appliances and electronics by 90% Wash clothes at 30°C instead of 40°C Do not use clothes (tumble) dryer for 5 months of the year Wait until there is a full load for washing	'How often do you do these?'	Five-point scale (Never-Always)
Efficiency behaviours (general)		
Use 85% bright compact fluorescent or LED bulbs instead of incandescent bulbs	'Do you do this?'	Yes/No
Curtailment behaviours related to car use		
Drive to avoid sudden acceleration and stops Combine errand trips to halve current mileage / car use	'How often do you do these?'	Five-point scale (Never-Always)
Efficiency behaviours related to car use		
Service your car regularly Buy tyres that lessen resistance Maintain correct tyre pressure Use a more efficient car (30.7 MPG* vs. 20 MPG) – *Miles Per Gallon	'Do you do these?	Yes/No
Efficiency behaviours in the housing domain		
Loft insulation and ventilation A more efficient central heating boiler (92% efficient, e.g. condensing boiler) Double or triple glaze windows Draught proofing of home An A+ Rated Fridge Freezer, in place of a lower rated one bought between 1993 and 2000 An AAA rated washing machine to replace an old model	'Have you done these?'	Three-point scale (installed or upgraded, bought property with, not done this)*

* These response options were recoded into dichotomous variables to facilitate interpretation of the results. More specifically, the response options 'installed or upgraded' and 'bought property with' were coded as 'yes' (i.e. carried out this behaviour), while 'not done this' was coded as 'no' (i.e. not carried out this behaviour).

Seven behaviours from the Gardner and Stern (2008) short list were not included in this study: 1. Watch 25 percent fewer hours of TV each day, 2. Purchase (or trade in) 52' Projection HD TV instead of a 48' Plasma HD TV, 3. Turn up the refrigerator thermostat from 33° F to 38° F and the freezer thermostat from –5° F to 0° F, 4. Replace two 100-watt kitchen bulbs with 75-watt bulbs, 5. Do not leave one 60-watt bulb on all night, 6. Install a

[15] Recycling was added to the behaviours examined in this thesis for two reasons. Firstly, it is more widespread than energy conservation in the UK (Whitmarsh, 2009). Secondly, recycling is not as effective as the energy saving behaviours from the Gardner and Stern (2008) short list. Adding this behaviour to the study allowed me to examine the adoption of this behaviour and the rationale provided by respondents, in respect to the behaviours that have the potential to reduce people's energy consumption.

more efficient water heater (EFS .7 unit), 7. Cut highway speed from 70 to 60 mph. These were excluded for two reasons: a) Their adoption resulted in the lowest savings across all behaviours (less than 0.6%) (Gardner and Stern, 2008), b) None of these behaviours was included in the top behaviours to be carried out according to the Energy Saving Trust.

5.7.2.2 Motivations and barriers to behaviours

To examine the motivations and barriers for each behaviour, participants were provided with a list of possible motivations and barriers to action, as discussed in section 5.5. Participants had the option to select the main reason for carrying out each behaviour (motivation) or the main reason for not carrying out each behaviour (barriers). In addition to this, the option to select a second motivation or barrier was also provided. The following items are the options provided: 'financial reasons', 'ease/difficulty', 'for the environment'', convenience/inconvenience', 'moral obligation', 'health reasons', 'habit', 'comfort', 'know/don't know if matters' and only for the secondary reason, 'no other reason'.

5.7.2.3 Climate change related beliefs, knowledge and perceptions

Participants' climate change related beliefs, knowledge, and perceptions were assessed. These were discussed in Section 3.5.2.1. The specific questions used and the corresponding response categories are listed in Table 5.4 below.

Table 5-4 Items used to examine climate change beliefs and perceptions

Items	Questions	Response categories
Climate change belief	Which of the following statements best describes your beliefs about whether climate change is occurring?	Five-point scale (I am certain or almost certain it is not happening - I am certain or almost certain it is happening
Perceptions of anthropogenic climate change	Position the slider to indicate whether you believe climate change is caused mostly by humans or mostly by other causes.	Eleven-point scale (All human caused-All non-human)
	To what extent do you agree with the statement: 'My lifestyle contributes to climate change'?	Five-point scale (strongly disagree-strongly agree)
	Have you taken, or do you regularly take, any action out of concern for climate change?	Three-point scale (yes/no/don't know)
Perceptions about people's lifestyle and the environment	Which of these best describes how you feel about your current lifestyle and the environment?	Four-point scale (I'd like to continue doing what I'm doing at the moment, I'd like to do a bit more to help the environment, I'd like to do a lot more to help the environment, don't know).
	To what extent do you agree with the statements: 'Climate change is a big problem for Planet Earth?' To what extent do you agree with the statements: 'Climate change is a big problem for Humanity?'	Five-point scale (strongly disagree-strongly agree)
	Rate how often concern about climate change influences your decisions Rate how often you worry about climate change Rate how often you talk to your friends and family about climate change	Five-point scale (never-very frequently)
Perceptions of scientists' confidence	How confident do you think scientists are regarding climate predictions? How confident should we be about scientific predictions about climate change before making recommendations to the public that affect their lifestyle? How confident do you think scientists are about the link between carbon emissions and climate change?	Five-point scale scale (very low confidence, 1 out of 10 - very high confidence, 9 out of 10)

5.7.2.4 Psychological factors related to energy saving behaviours (E&OE)

The questionnaire also assessed efficacy beliefs regarding the energy saving behaviours. For each of the behaviours, the five forms of efficacy (self-efficacy, outcome expectancy, personal outcome expectancy, collective efficacy and collective outcome expectancy) were assessed (see Chapter 4 for definitions and how these were operationalised).

5.7.2.5 Perceived financial saving perceptions per behaviour

Perceived financial savings of energy saving behaviours were examined. Regardless of whether the behaviour was carried out or not, participants answered the following question 'How much money you believe you save (or could save) per year by doing these?' with options being: £0, £1-£5, £5-£10, £10-£20, £20-£40, £40-£80, £80-£160, £160-£320, £320-£640. The reason the bands provided increase as the possible savings increase, is because the more effective behaviours (resulting in higher savings) are a lot more effective than the ineffective ones, so using equal-sized bands would have required a very large number of categories.

5.7.2.6 Sociodemographic measures

Sociodemographic measures were examined for a range of variables. During the data collection process, quotas were set for age, gender, highest level of education, UK region, income, home and car ownership, as evidence shows these to be related to pro-environmental and energy use behaviours (e.g., Sardianou, 2007). The items, along with their response categories, are detailed in Appendix A.

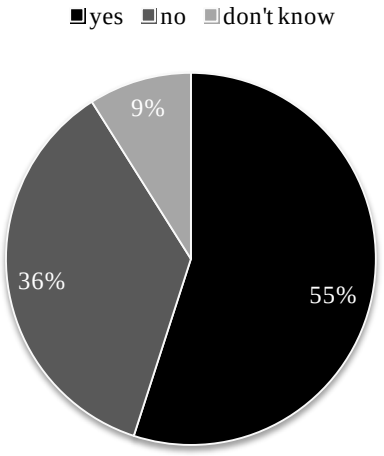
5.8 RESULTS

The findings of this study are presented in two sections. ***Section 1*** is analysed using descriptive statistics in order to ascertain the frequency of the Gardner and Stern (2008) *short list* of behaviours. I then examine whether there is any relationship between the most effective behaviours (both in terms of saving money and CO_2 emissions), and any financial misconceptions that may exist regarding the potential savings resulting from behaviour adoption. ***Section 2*** then presents the perceived motivations and barriers per behaviour as reported by participants, followed by an examination of the factors that predict behaviour adoption.

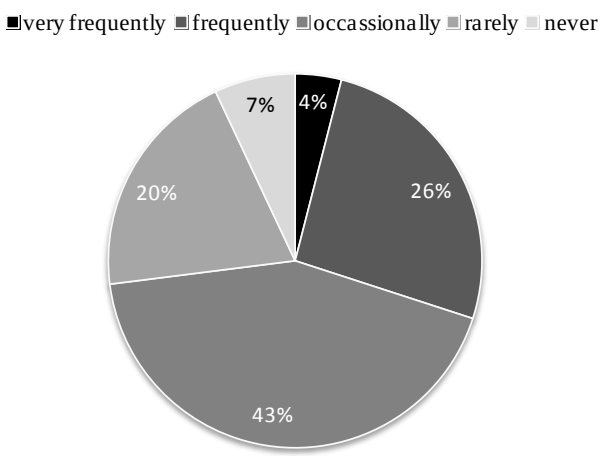
The behaviours examined in the results section of this study are broken down in two ways: (1) curtailment versus efficiency behaviours and (2) location (car, home, general), which is a questionnaire/data gathering dimension.

5.8.1 Action for climate change

Three variables were used to examine willingness to carry out action for climate change. My survey indicated that just over half of the respondents (55%) state that they take, or regularly take, action out of concern for climate change (Fig. 3.1a). This value is much higher than the 31% found several years ago by Whitmarsh (2009a), where the same question was set. This may represent a change in response patterns since 2003 (when Whitmarsh carried out her study). This difference could be explained by the fact that in my sample fewer people (17%) were uncertain about climate change when compared to the 20% found by Whitmarsh (2009a). A much larger proportion of 73% claim that concern about climate change influences their decisions very frequently, frequently or occasionally (Fig. 3.1b). Respondents recognized that their lifestyle contributes to climate change, with the majority (48%) stating that they agree or strongly agree with the statement to this effect (Fig. 3.1c).



a



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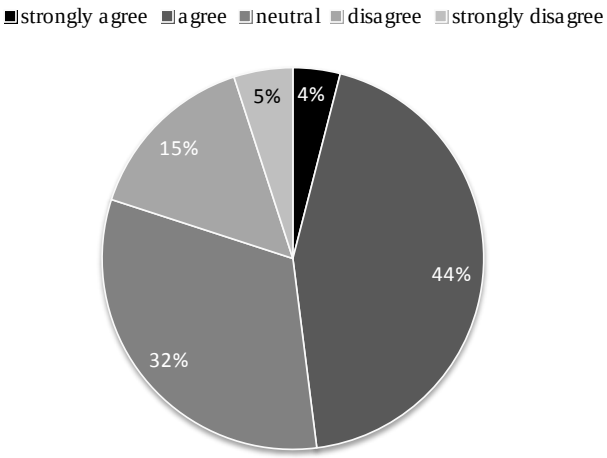

c

Figure 5-2 Responses to the questions: a) 'Have you taken, or do you regularly take, action out of concern for climate change?' b) 'Rate how often concern about climate change influences your decisions' c) 'My lifestyle contributes to climate change'.

5.8.2 Energy conservation behaviours carried out

The online survey demonstrates that the most commonly carried out general behaviour is recycling, which is carried out by 81% of the respondents (see Fig. 5.2). This is followed by buying BCF bulbs (N=369, 74%) and waiting till these is a full load for washing (N=316, 63%). The most commonly carried out home behaviour is installing double glazing windows (N=165, 93.1%), followed by installing loft insulation (N=150, 85%), and purchasing an A+ fridge freezer (N=136, 77%). The most commonly carried out car behaviours are maintaining correct tyre pressure (N=232, 93.9%), followed by servicing of car (N=219, 88.7%), and buying a more efficient car (N=169, 68.4%).

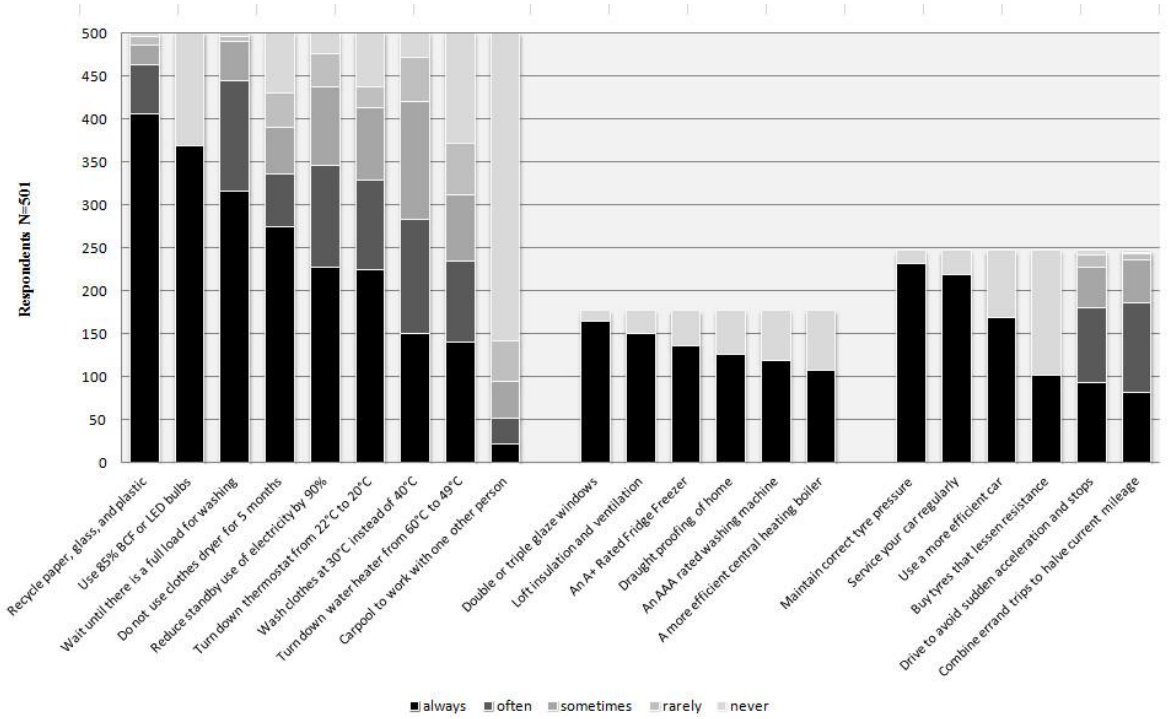

Figure 5-3 The behaviours carried out along with their frequency. The 21 behaviours were asked on a frequency scale, with the exception of 11 behaviours ('Use 85% BCF or LED lights', 'Double or triple glaze windows', 'loft insulation and ventilation', 'An A+ rated Fridge Freezer', 'Draught proofing of home', 'An AAA rated washing machine', 'A more efficient central heating boiler', 'Maintain correct tyre pressure', 'Service your car regularly', 'Use a more efficient car' and 'Buy tyres that lessen resistance'). These are efficiency behaviours and as such their adoption was based on a binary yes/no scale. For presentation purposes in this graph, 'yes' was categorised as 'always', while 'no' was categorised as 'never'.

Looking at figure 5.2 in more detail, we can see from figure 5.3 below, the percentages of behaviour adoption. These findings are partially consistent with previous research, in which replacing bulbs and recycling were also found (Whitmarsh, 2009a) to be the two most popular energy conservation behaviours, at 74% and 92% respectively, which people claim to carry out. Similarly, regarding home behaviours, proportions of the population installing double glazing and insulation were close in value to those found by DEFRA (2009) at 93% and 85% respectively. Replacing one's boiler on the other hand was found in this study (61%) to be almost twice as high when compared to that found by DEFRA (2009) at 31%. One reason for this difference could be the various government initiatives which aim to help households reduce their energy use. One such initiative is the 'boiler scrappage scheme', introduced in 2010, which allowed households to claim £400 towards a new and efficient boiler (The Guardian, 2010). Regarding car behaviours, the only behaviour that can be compared to the DEFRA (2009) findings is that of driving to avoid sudden acceleration and stops, for which my result of 72% is similar to that found by DEFRA (2009).

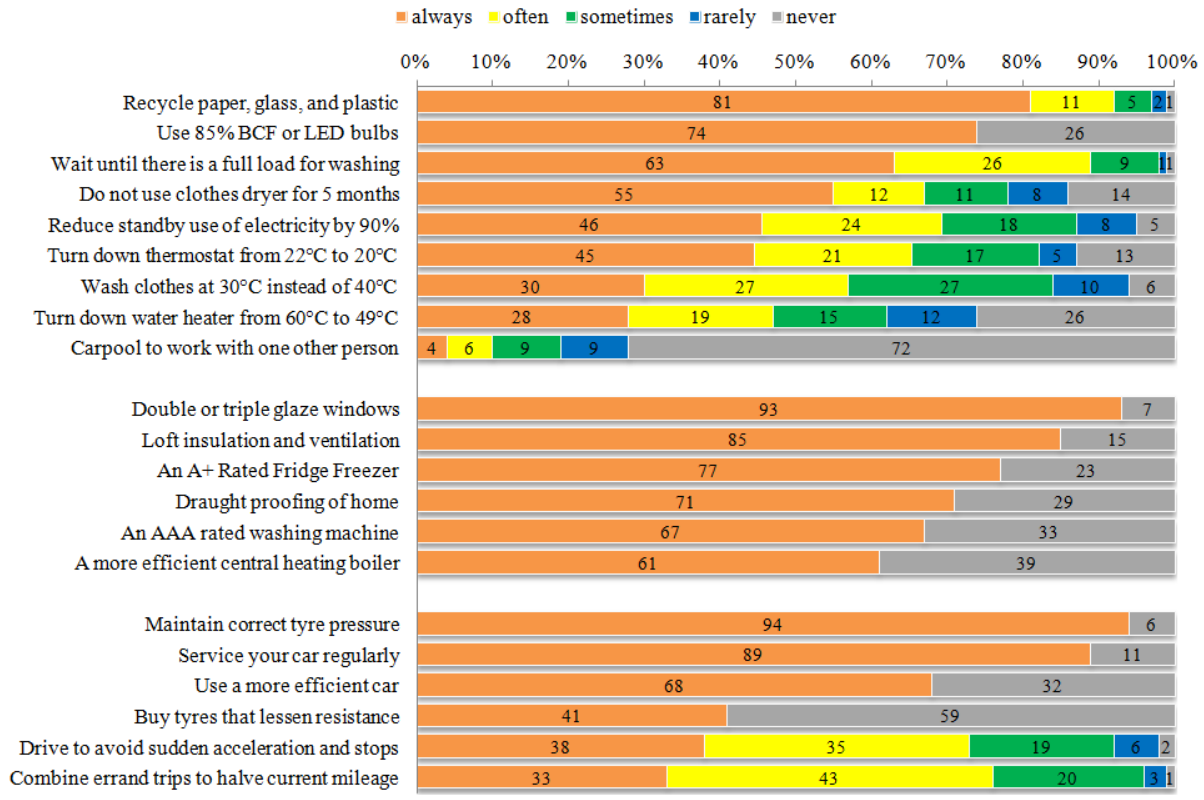

Figure 5-4 The behaviours carried out along with their frequency (percentage).

5.8.2.1 Efficiency and curtailment behaviours carried out

The previous analysis revealed the most commonly carried out behaviours across the three domains; general, car and home. I now explore whether there was any difference in the frequency of behaviours carried out when comparing efficiency and curtailment behaviours. For the purposes of visualising this (see figure 5.4), the percentages of behaviour adoption were examined across the three locations (general, car and home), assuming that the populations across these three locations is the same. For example, the general behaviours were answered by 100% (N=501) respondents, while the home behaviours were answered by 35% (N=177) of the respondents, and the car behaviours were answered by 49% (N=247) of the respondents. However for demonstration purposes, the percentages presented in the following figure correspond to the percentage from that domain (e.g. maintaining correct tyre pressure was carried out by 94% of car owners, as shown in figure 5.4, but amongst the total number of respondents this is just 46%). This was carried out to only examine efficiency and curtailment behaviour adoption overall, and not amongst the three domains.

As figure 5.4 below shows, when looking at the percentage of behaviour adoption for efficiency behaviours (answer selected 'yes') and curtailment behaviours (answer selected 'always' or 'often') the two most popular behaviours are efficiency behaviours: one relating to car use (maintaining correct tyre pressure) and the other to home use (installing double glaze windows). The next most popular behaviour is a general curtailment behaviour (recycling). The behaviours after these appear to form an alternation pattern between efficiency and curtailment behaviours, with each behaviour type following the next.

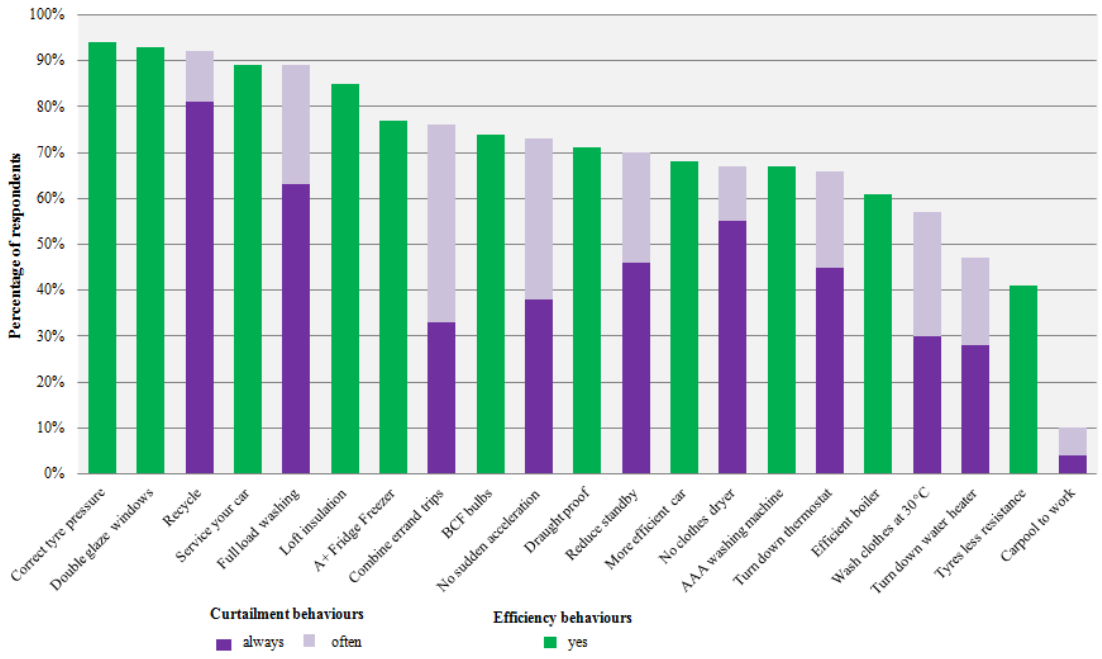

Figure 5-5 The behaviours carried out (curtailment vs. efficiency) along with their frequency (percentage).

This finding shows that, contrary to previous findings (Poortinga and Steg, 2002), efficiency behaviours are the two most commonly carried out. Indeed, the alternation pattern between efficiency and curtailment shows that both efficiency and curtailment behaviours are adopted by the participants in this study. One reason for this difference could be that previous studies have not typically made relative estimates regarding the sample (as my findings presented in Figure 5-4 do not represent the absolute percentage of the sample)[16].

[16] Two independent-samples t-tests were conducted to compare the differences between income for home owners and non-home homers, and car owners and non-car owners. There was a significant difference ($p < 0.01$) in the scores for income of home owners (M=4.1, SD=2.2) and non-home owners (M=3.3, SD=2), and also for car owners (M=4.1, SD=2.1) and non-car owners (M=2.9, SD=2.1).

Based on these findings, it is possible to conclude that the percentages of behaviour adoption of the most popular behaviours across the three locations (general, home and car) are consistent with those found by DEFRA (2009). In addition, similarities were found, with respect to the two most popular general behaviours, to those found by Whitmarsh (2009a). However, the next step is to examine whether the most popularly carried out behaviours are actually the ones that will help reduce CO_2 emissions and help individuals save money. This then follows on to the next section where I then examine whether there is any relationship between the most effective behaviours (both in terms of saving money and CO_2 emissions) and those carried out.

5.8.3 Relationship between most effective behaviours and those carried out

This relationship is separated into two sections, both demonstrating that the most effective behaviours are not those carried out; one section focuses on the percentage of behaviour adoption with respect to the potential actual CO_2 emissions saved (environmental impact), and the other with respect to the potential actual money saved (financial impact).

5.8.3.1 Environmental impact

The relationship between the most effective behaviours (in terms of potential percentage of CO_2 reduced) and those carried out by the respondents in this survey was explored (Fig. 5.5). The actual CO_2 emissions saved, which are presented below in figure 5.5, relied on information taken from the Energy Saving Trust, and are presented in Appendix H.

The results presented here may help shed light on why, despite people's desire to reduce energy consumption, studies have found that household and transport energy demand is rising (Oliver et al., 2013). Indeed, aside from a few bright spots (e.g. double glazing, servicing the car and installing loft insulation being both effective and commonly carried out) there appears to be no relationship between the most effective behaviours (in terms of reducing people's CO_2 emissions) and those carried out. As figure 5.5 shows, of the 6 most popular behaviours (installing loft insulation, service car, waiting till these is a full load for washing, recycle, double glazing and maintaining correct tyre pressure), only 2 (installing loft insulation and double glazing) have the potential to significantly reduce people's CO_2 emissions by around 7% each.

The desired pattern would be a positive relationship between the effectiveness of behaviours and their adoption. This would mean that the more effective a behaviour is, the more people carry it out. These findings mirror those of Attari et al. (2010), who found that participants largely underestimate high energy activities, while demonstrating small overestimations on low energy activities. One reason for this lack of relationship between the most effective behaviours and those carried out could be due to misconceptions over the effectiveness of behaviours, as was speculated by Gardner and Stern (2008). The existence of misconceptions is examined in section 5.8.3 below.

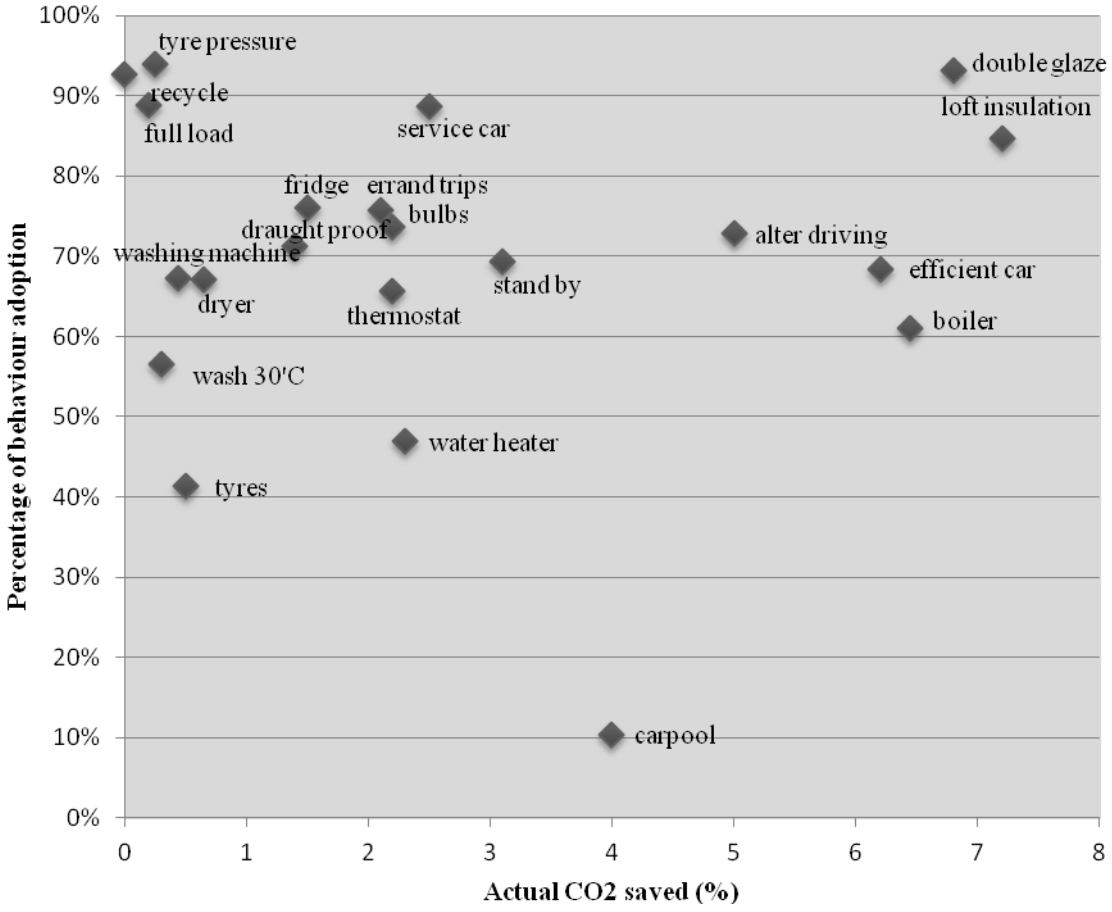

Figure 5-6 Scatter plot showing the relationship between most effective behaviours (environmentally) and those carried out.

5.8.3.2 Financial impact

This section explores whether there is a relationship between the money saved and the behaviours carried out. Similarly to the actual CO_2 emissions saved, the actual money saved, which is presented below in figure 5.6, relied on information taken from the Energy Saving Trust, and are presented in Appendix H.

As figure 5.6 shows, respondents carry out a variety of financially rewarding and less financially rewarding behaviours. Of the 6 most popular behaviours (maintaining correct tyre pressure, double glaze, recycle, waiting till these is a full load for washing, service car and loft insulation), only 3 (installing loft insulation, service car and double glazing) are effective at providing people with potential savings of around £150 and £200 each. What is interesting to point out is that of the 21 behaviours, the 10 least effective (potential savings less that £50) are carried out by more than 50% of the respondents.

Similarly to figure 5.5, the desired effect of this graph would be a positive relationship between the effectiveness of behaviours and their adoption. However in reality, again, this is not the case.

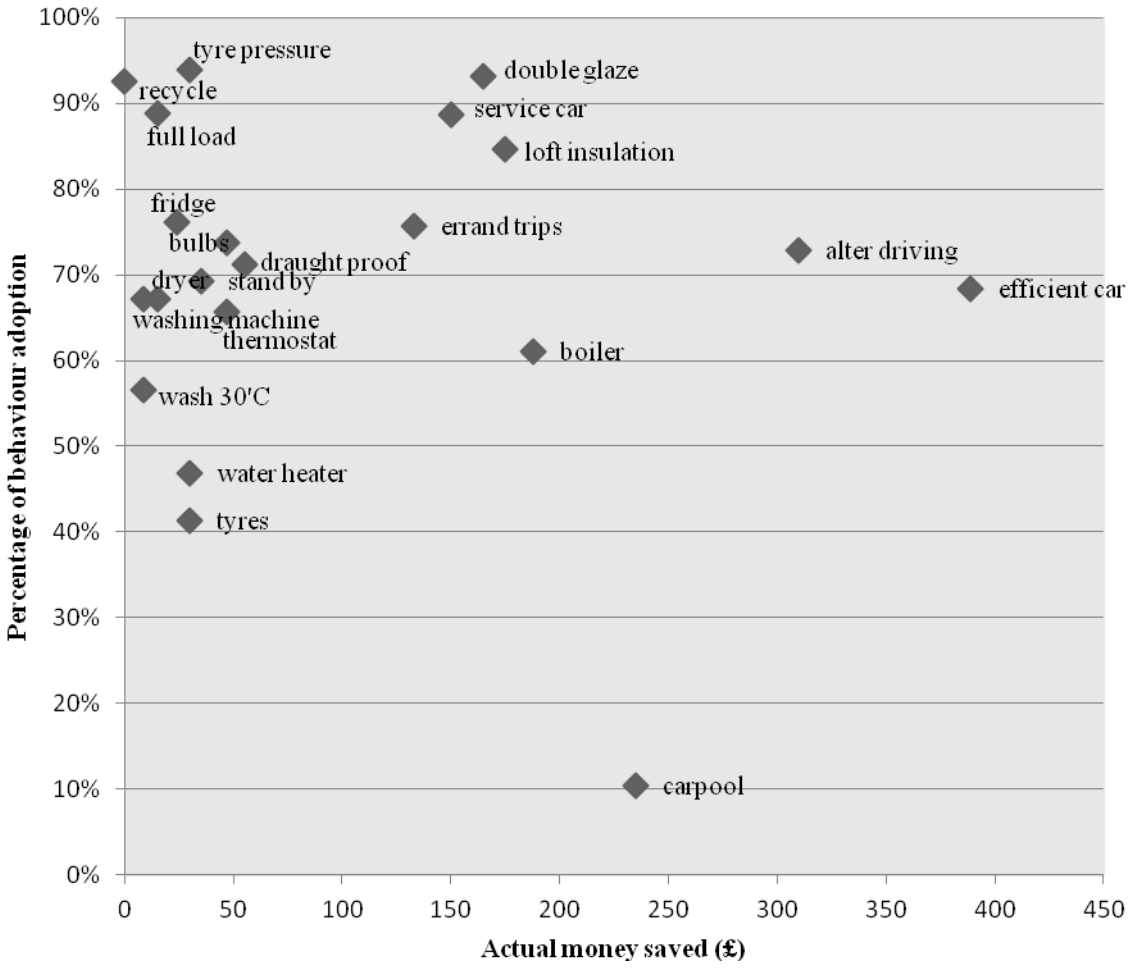

Figure 5-7 The relationship between most effective behaviours (financially) and those carried out.

To sum up, the analysis of this section suggests that the behaviours that have the potential for saving people money and reduce CO_2 emissions the most are not actually the most popular behaviours. This suggests that, despite the effort people state they are taking to cut

down on the use of gas and electricity at home (DEFRA, 2009), people are not reducing their CO_2 emissions as much as they could and they are not saving the money they potentially could. Thus, there is potential for further end-user energy demand reduction for reducing our current CO_2 emissions.

The next section considers the perceived motivations and barriers to action. This may help elucidate why certain behaviours are more commonly carried out than others. This is because understanding what motivates people and what discourages them, may help in directing communication and policy efforts where needed.

5.8.4 Financial misconceptions of perceived money saved

The financial misconceptions of perceived money saved were then examined. This follows on from past studies (Attari et al 2010; Kempton 1985) which found people to overestimate the least effective behaviours whilst underestimating the most effective ones.

In order to investigate the financial misconceptions about the potential financial savings when carrying out the 21 energy saving behaviours, respondents were asked to indicate how much money they save, or would save, per year by carrying out each of the behaviours. Pre-defined categories were used, and grouped into 9 categories, £0, £1-£5, £5-10, £10-20, £20-40, £40-£80, £80-£160, £160-£320, £320-£640. The aim of this was to explore Kempton et al.'s (1985) speculation of some behaviours being estimated at higher energy saving potential than what happens in reality, with the opposite applying to other behaviours. Attari et al. (2010) explored this in terms of energy use and savings of 15 behaviours and found underestimations by a factor of 2.8 on average. Using estimates from the literature and government sources of the potential financial savings for the 21 behaviours (see Appendix H), this was then compared to the participants' estimates of potential financial savings (see Table 5.5 and Fig. 5.7).

Table 5-5 Financial misconceptions

	Respondents who carry out the behaviour		Respondents who don't carry out the behaviour		Actual annual saving	Actual savings MINUS perceived (adopters)	Actual savings MINUS perceived (non-adopters)
Behaviour	N	%	N	%			
Recycle paper, glass, and plastic	464	93	13	3	£0	-£3	-£3
Wash clothes at 30°C	284	57	81	16	£8	-£7	-£1
Wait until full load for washing	445	89	11	2	£14	-£2	£11
Do not use dryer for 5 months a year	367	67	111	22	£15	-£3	£5
Correct tyre pressure*	232	94	15	6	£16	-£1	£8
AAA washing machine**	119	67	58	12	£20	£3	£10
Turn down water heater thermostat	235	47	189	38	£30	£12	£21
Tyres less resistance*	102	41	145	59	£32	£13	£24
Reduce standby by 90%	347	69	63	14	£35	£20	£27
Use 85% BCF or LED bulbs	369	74	132	26	£47	£37	£39
Turn down thermostat	229	66	87	17	£55	£37	£46
Draught proofing**	126	71	51	29	£55	£37	£39
A+ Fridge Freezer**	136	76	41	8	£86	£69	£71
Combine errand trips*	187	76	11	4	£133	£98	£115
Service car regularly*	219	89	28	11	£158	£140	£150
Double glaze**	165	93	12	7	£165	£133	£149
Loft insulation**	150	85	27	15	£175	£143	£160
Efficient boiler**	108	61	69	39	£250	£216	£218
Carpool to work	452	10	405	81	£259	£224	£250
Avoid acceleration and stops*	180	73	19	4	£316	£285	£282
More efficient car*	169	68	78	32	£396	£331	£361

* For car behaviours, the percentage of adoption or non-adoption is calculated using N=247
** For home behaviours, the percentage of adoption or non-adoption is calculated using N=324

Overall, there are very minor overestimates when financial savings are low and large underestimates when financial savings are high (Fig. 5.7). This is consistent with the findings by Attari et al. (2010), as I also found small overestimates for low-energy behaviours (mainly by those carrying out the behaviours) and large underestimates for high-energy behaviours. The difference between those who carry out the behaviours and those who do not is not significant[17].

[17] The lack of significant difference between adopters and non-adopters in their estimates could indicate that it is not motivated cognition underpinning misperceptions.

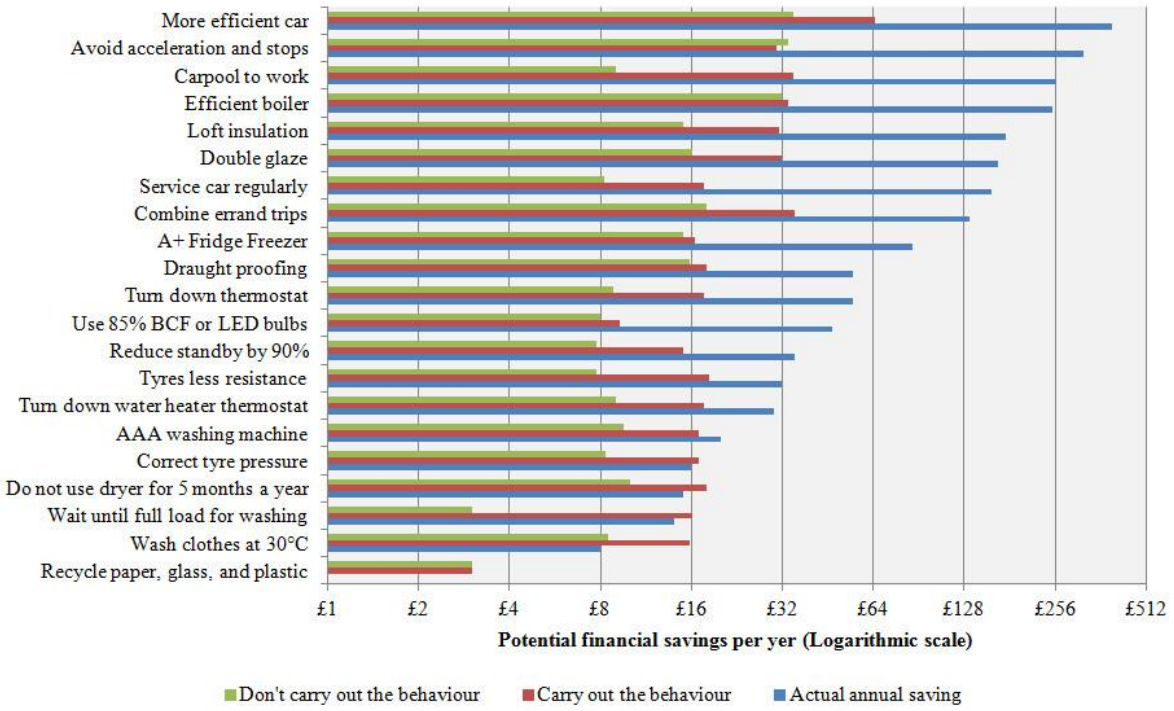

Figure 5-8 Misconceptions of financial savings.

Across general behaviours, younger respondents on higher incomes who worry more about climate change were more likely to have more accurate predictions. Across home behaviours, younger respondents on lower incomes, but not from Scotland were more likely to have more accurate predictions. This could partially be explained by previous findings which have found younger people to be more likely to carry our efficiency behaviours at home (e.g. Sardianou, 2007). Across car behaviours, those on lower incomes were found to have more accurate predictions. This could be explained by the immediate savings these behaviours can result in. Indeed, as is found in Section 5.8.6, those on lower incomes are more likely to buy a more efficient car, perhaps due to the potential savings from the reduced fuel consumption, or due to the smaller size and cheaper cost of low consumption cars. The role income has been found to play in accuracy of predictions can be explained by past studies which have found income to be able to determine energy use (e.g. Abrahamse and Steg, 2009). And yet, my findings reveal that this relationship appears to be limited to predicting overall desire to do more for the environment, save the least amount of energy and make the biggest error regarding potential financial savings

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The most common barriers to behaviour adoption were financial and not knowing if it matters. These in particular, could potentially make good candidates for investigating self-efficacy barriers by integrating into self-efficacy phrasing in future work.'

(see Chapter 6), and not to being able to predict the adoption of the specific curtailment and the efficiency behaviours examined (see Section 5.8.6).

Section 2

5.8.5 Motivations and barriers to action

Motivations and barriers are examined separately in the following two sections. Nine predefined categories were used in the following way: when respondents stated that they carry out the behaviour, they could then choose the primary and, if they wanted, secondary reason for doing so (motivation). On the other hand, when respondents stated that they do *not* carry out the behaviour, they could then choose the primary and, again, if they wanted, secondary reason for *not* doing so (barrier).

Financial reasons were found to be the main motivation for behaviour adoption, while *financial reasons* and *don't know it matters,* were the key barriers to efficiency and curtailment behaviours respectively. These findings are explained in greater detail in the corresponding sections.

5.8.5.1 Motivations

For the behaviours that participants stated they carry out ('yes' for efficiency behaviours and 'always'/'often' for curtailment behaviours) participants were then asked about the main reason and the secondary reason for carrying these out. Nine categories were provided (based on previous research): 'financial reasons', 'ease', 'for the environment', 'convenience', 'moral obligation', 'health reasons', 'habit', 'comfort', 'know it matters'.

As expected, consistent with previous research on energy saving motivations (e.g. Whitmarsh 2009), my results show that, with the exception of recycling, the behaviours were motivated by benefits to the individual. Indeed, across all behaviours, saving money was the main motivation for behaviour adoption (see Table 5.6). More specifically, when asked about the reasons for carrying out the various behaviours, 'financial reasons' was the most common motivation, with recycling being the exception to this, as it was the only behaviour carried out with the main motivation being 'for the environment'. Across most behaviours, 'for the environment' was the second most popular motivation reported. For

home behaviours, financial motivation ranged from 44.1% for installing/having bought a property with an A+ fridge freezer, to 65.7% for installing/having bought a property with an efficient boiler. For car behaviours, this ranged from 27.4% for servicing car regularly, to 69.8% for buying a more efficient car. For general behaviours, this ranged from 36.5% for carpool to work, to 68.9% for turning down the thermostat. Recycling was carried out for financial reasons for 3.4% of respondents.

Table 5-6 Percentage of motivations - main reason cited for motivations to carrying out behaviours.

	Behaviour	Financial reasons	Ease	For the environment	Convenience	Moral obligation	Health reasons	Habit	Comfort	Know it matters
Home	Double glaze	42.4	3.0	4.8	3.6	1.2	1.2	2.4	37.6	3.6
	Loft insulation	57.3	3.3	6.0	1.3	0.0	1.3	0.7	27.3	2.7
	A+ Fridge Freezer	44.1	2.9	19.9	9.6	4.4	1.5	0.0	10.3	7.4
	Draught proofing	44.4	4.8	4.8	0.8	0.8	4.0	1.6	35.7	3.2
	AAA washing machine	47.1	10.1	16.0	11.8	1.7	0.8	0.0	6.7	5.9
	Efficient boiler	65.7	6.5	9.3	4.6	0.0	0.9	0.0	11.1	1.9
Car	Correct tyre pressure	33.2	12.5	6.5	8.6	5.2	5.6	10.8	12.9	4.7
	Service car regularly	27.4	13.7	4.1	11.0	10.5	1.8	15.1	11.9	4.6
	More efficient car	69.8	3.6	13.6	5.3	1.2	0.0	1.8	2.4	2.4
	Tyres less resistance	36.3	8.8	16.7	13.7	3.9	2.9	5.9	4.9	6.9
	Avoid acceleration and stops	46.7	8.3	11.1	2.8	2.8	2.8	12.8	12.2	0.6
	Combine errand trips	58.8	9.6	12.3	9.1	2.1	0.5	6.4	0.5	0.5
General	Recycle paper, glass, and plastic	3.4	6.7	66.8	3.4	11.0	0.0	7.3	0.0	1.3
	Use 85% BCF or LED bulbs	39.3	8.4	35.0	8.1	2.4	0.3	2.7	1.1	2.7
	Wait until full load for washing	45.6	10.8	13.5	11.7	2.0	0.2	12.1	0.2	3.8
	Do not use dryer for 5 months a year	48.2	6.5	20.2	3.0	2.1	1.2	8.3	0.3	10.1
	Reduce standby by 90%	57.6	3.7	24.5	1.7	2.6	0.9	6.1	0.6	2.3
	Turn down thermostat	65.3	4.0	12.5	1.8	1.2	2.7	3.3	6.7	2.4
	Wash clothes at 30°C	44.0	8.8	31.3	3.5	1.1	0.0	8.1	0.7	2.5
	Turn down water heater thermostat	68.9	2.6	15.3	1.3	1.7	1.7	3.4	3.8	1.3
	Carpool to work	36.5	19.2	13.5	0.0	7.7	0.0	1.9	1.9	0.0

Most popular behaviours	Least popular behaviours
Most popular reason	Most popular reason
Second most popular reason	Second most popular reason
Third most popular reason	Third most popular reason
Fourth most popular reason	Fourth most popular reason

The finding that financial motivation was the key driving force for carrying out energy conservation behaviours is consistent with past research (e.g. DEFRA, 2002). The second most popular reason varied across the behaviours. After financial reasons, home

behaviours were motivated mainly by comfort, which is consistent with past research (Organ et al., 2013). One interesting finding, which could result from misconceptions of the environmental impact of behaviours, is that out that the two home behaviours that save the least CO_2 (purchasing an A+ fridge freezer and purchasing an AAA washing machine), were carried out 'for the environment'. After financial reasons, car behaviours were motivated by a combination of 'for the environment', 'habit', 'ease' and 'comfort'. General behaviours on the other hand, after financial reasons, were motivated by 'for the environment', with the exception of carpooling which was carried out for ease.

Stern (2000) classified pro-environmental behaviours as: *Impact-oriented*, which focus on the actual environmental impact of behaviours (e.g. energy use), and *intent-oriented*, which are concerned with environmentally significant behaviours from the point of view of the individual (e.g. recycling). Based on this distinction, recycling is the only behaviour examined in this study that can be classified as intent-oriented. We can see, from table 5.6, that moral obligation was not selected as a primary motivation for any of the behaviours. The only behaviour that had moral obligation as a secondary motivation was that of recycling. Indeed, similar to past research (Whitmarsh, 2009), the response of *for the environment* and *moral obligation* could imply that moral obligation is perceived by respondents as an environmental obligation.

Habit was identified as a reason for carrying out 9 behaviours, all of which were curtailment behaviours. This is consistent with Gardner and Stern (2008) who argued that curtailment behaviours require establishing new habits, as they entail behaviour repetition in order for their optimal outcome to be achieved. Research into the factors that influence household energy saving also found that habit most commonly underpinned curtailment behaviour adoption (Barr et al., 2005). However, contrary to expectations, habit was not identified as a key barrier to curtailment behaviour adoption. Furthermore, although health was identified as a reason for draught proofing one's home, this was not a popular motivation for action[18].

As pointed out, Stern (2000) argued that *'environmentally beneficial actions may also follow from nonenvironmental concerns, such as a desire to save money'* (p.415). These findings on motivations suggest that environmental concern is not the strongest motivation

[18] Habits influence behaviours carried out, as behaviour adoption is not necessarily preceded by conscious intention or a process of rational decision-making in relation to the options available (Jensen, 2002). However past studies (e.g. Whitmarsh 2009), which this study has been heavily influenced by, have used examined the motivation to action by asking respondents to select the option 'habit'.

for carrying out energy saving behaviours. Indeed, in most cases, financial reasons were found to be the main motivation for action, which is consistent with previous studies on energy saving behaviours (Lorenzoni et al., 2007, DEFRA, 2002, Whitmarsh, 2009a).

5.8.5.2 Barriers

Similarly to the motivations, for the behaviours that participants stated they don't carry out ('no' for efficiency behaviours and 'rarely'/'never' for curtailment behaviours) participants were then asked about the main reason and the secondary reason for not carrying these out. The nine categories provided were: 'financial reasons', 'difficulty', 'for the environment', 'inconvenience', 'moral obligation', 'health reasons', 'habit', 'comfort', 'don't know it matters'.

When asked for the reasons for not carrying out the various behaviours, the data in table 5.7 clearly demonstrate a division in the main barriers cited between efficiency and curtailment behaviours. A combination of 'financial reasons' and 'don't know if it matters' were the most commonly cited barriers. As expected, financial reasons were the main barriers to efficiency behaviours, as they require an initial financial investment. On the other hand, curtailment behaviours were perceived to be less effective, and as such 'don't know if it matters' was the key barrier to curtailment behaviours. The next most popular barrier was inconvenience and that of habit.

Efficiency behaviours are generally more effective than curtailment behaviours; however, they are more costly. This is reflected in the main barriers cited for both types of behaviour. That is, financial reasons were the main barrier to not carrying out efficiency energy conservation behaviours. The finding of financial reasons being the key barrier to carrying out mostly efficiency energy conservation behaviours is consistent with past research. Examining the barrier to wall insulation, DEFRA (2009) also found that not being able to afford wall insulation was the main reason people had not done it.

In contrast, uncertainty regarding 'whether it matters' was the main barrier cited to not carrying out curtailment energy conservation behaviours. This reflects the question Kerr (1996) used as the title to his paper 'Does My Contribution Really Matter?'. This finding can be explained by the social cognitive theory (Bandura, 1977) (see Chapter 4). From the health literature Strecher et al. (1986) suggested that *health behaviours which are not difficult to change but whose outcomes are perceived as being uncertain may depend more*

strongly on outcome expectancies. Indeed, curtailment behaviours, despite being easy to carry out, do not result in significant savings. Thus low perceptions of curtailment behaviours being worth it to carry out due to the insignificant savings they produce appear to be the main barrier for these behaviours.

Table 5-7 Percentage of barriers - main reason cited for barriers to not carrying out behaviours.

	Behaviour	Financial reasons	Difficulty	For the environment	In-convenience	Moral obligation	Health reasons	Habit	Comfort	Don't know if it matters
Home	Double glaze	50.0	8.3	0.0	0.0	0.0	0.0	0.0	16.7	25
	Loft insulation	40.7	18.5	0.0	0.0	3.7	0.0	0.0	3.7	33.3
	A+ Fridge Freezer	63.4	2.4	2.4	9.8	0.0	0.0	0.0	0.0	22.0
	Draught proofing	16	5.9	3.9	13.7	0.0	3.7	0.0	2.0	39.2
	AAA washing m	39.7	1.7	1.7	5.2	3.4	0.0	0.0	1.7	46.6
	Efficient boiler	59.4	4.3	1.4	7.2	1.4	0.0	1.4	4.3	20.3
Car	Correct tyre pressure	26.7	6.7	0.0	33.3	13.3	0.0	0.0	6.7	13.3
	Service car regularly	67.9	0.0	3.6	7.1	0.0	3.6	3.6	3.6	10.7
	More efficient car	38.5	7.7	6.4	6.4	1.3	0.0	3.8	0.0	35.9
	Tyres less resistance	26.9	2.1	2.1	5.5	1.4	0.0	1.4	1.4	59.3
	Avoid acceleration and stops	21.1	5.3	5.3	0.0	0.0	0.0	26.3	10.5	31.6
	Combine errand trips	9.1	9.1	9.1	18.2	0.0	0.0	9.1	0.0	45.5
General	Recycle paper, glass, and plastic	7.1	14.3	14.3	7.1	0.0	7.1	14.3	0.0	35.7
	Use 85% BCF or LED bulbs	21.2	4.5	14.4	9.8	2.3	0.8	6.8	6.1	34.1
	Wait until full load for washing	0.0	0.0	0.0	45.5	0.0	0.0	18.2	0.0	36.4
	Do not use dryer for 5 months a year	27.0	6.3	8.1	12.6	0.9	1.8	10.8	2.7	29.7
	Reduce standby by 90%	12.7	6.3	4.8	11.1	4.8	1.6	17.5	7.9	33.3
	Turn down thermostat	26.4	5.7	2.3	10.3	0.0	2.3	9.2	14.9	28.7
	Wash clothes at 30°C	18.5	4.9	13.6	6.2	1.2	3.7	17.3	4.9	29.6
	Turn down water heater thermostat	32.8	8.5	6.3	9.5	0.5	1.1	7.4	10.1	23.8
	Carpool to work	11.6	18.6	3.5	15.8	1.0	1.5	3.5	2.0	43

Most popular behaviours	Least popular behaviours
Most popular reason	Most popular reason
Second most popular reason	Second most popular reason
Third most popular reason	Third most popular reason
Fourth most popular reason	Fourth most popular reason

5.8.5.3 Financial and environmental motivations per behaviour type

Based on table 5.6 it is interesting to see that regardless of the potential financial savings resulting from behaviour adoption, all behaviours (with the exception of recycling) are carried out for financial reasons. Environmental reasons were found to be the second most popular motivation reported across most behaviours. Focusing only on the financial and environmental reasons behaviour adoption, similarities or differences were examined between these motivations for curtailment and efficiency behaviours. Like figure 5.8 shows, it appears that a relatively larger number of participants selected financial reasons as a motivation for efficiency behaviours when compared to curtailment behaviours.

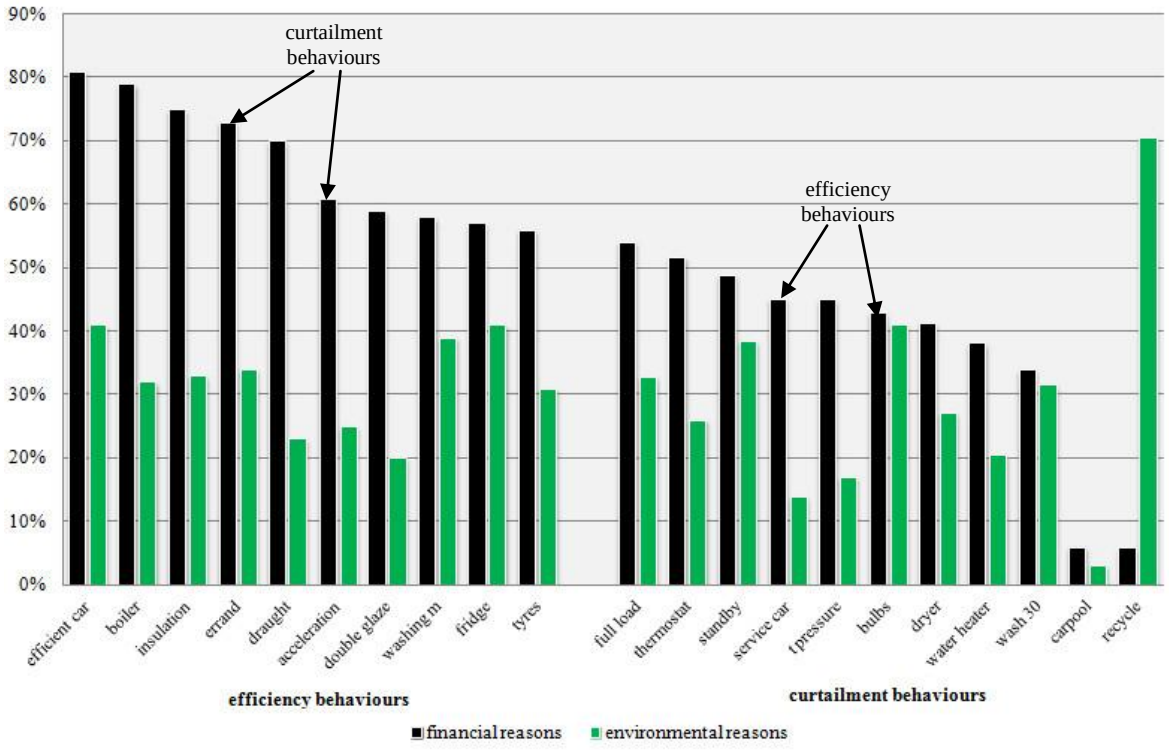

Figure 5-9 How reasons for carrying out behaviours differ between efficiency (left) and curtailment behaviours (right). The black bars represent the financial motivations while the green bars represent the environmental motivations for each behaviour. The arrows point to the behaviours which are exceptions to the pattern, where for example the financial motivation for 'errand trips' is particularly high, despite it being a curtailment behaviour.

Indeed, efficiency behaviours, which are generally more effective than curtailment, were found to be mainly motivated by financial reasons, and more commonly so than when compared to curtailment. This becomes clear as for efficiency behaviours the main motivation was financial. Thus, this points to financial reasons being the key motivation for efficiency behaviours, which is then followed by environmental reasons. For curtailment behaviours on the other hand, despite being also mainly motivated by financial reasons, the motivations are more spread out.

An independent-samples t-test was conducted to compare the differences between financial motivations and environmental provided between the two types of behaviours (efficacy and curtailment). There was a significant difference ($p < 0.01$) in the scores for efficacy behaviours (M=39, SD=11) and curtailment behaviours (M=14, SD=26).

Interestingly, there were two behaviours from each behaviour type that did not adhere to this pattern. Specifically, the reasons for combining errand trips and altering driving from the curtailment group resemble those of the efficiency group, as more than 50% of responses pointed to financial motivations. The same case applies to servicing one's car and buying BCF bulbs from the efficiency group, which despite being efficiency behaviours, the motivation for carrying these out is not dominated by financial savings. One possible explanation for this result could be that participants conceive these to be curtailment behaviours as you have to keep servicing the car (making it a bit like a habit) and bulbs only last so long (so you have to replace a bulb or two fairly often).

Overall, these results point to at least two important findings. First, it suggests that the main motivation for carrying out energy saving behaviours is the same, regardless of whether it is a curtailment behaviour or an efficiency behaviour. This is an interesting finding, as efficiency behaviours have the potential to result in significantly higher savings than curtailment behaviours, and yet these findings show people to be motivated even by lower potential savings. This could be explained by the overestimation of potential savings from curtailment behaviours, and the underestimation of potential savings from efficiency behaviours that were found in this study, consistent with past studies (e.g. Attari et al, 2010). However, to date, no previous studies have examined the perceived financial savings for the Gardner and Stern (2008) *short list* behaviours examined in this study, nor have they been examined in association with the perceived motivations and barriers to action. The implications of these findings are discussed in the Discussion of this chapter (see section 5.9).

Second, contrary to motivation, the findings show that there is a clear split for perceived barriers between efficiency and curtailment behaviours. To be more specific, *financial reasons* were found to be the main barrier for efficiency behaviours, which is expected considering the initial financial investment required for these behaviours. For curtailment behaviours on the other hand, the main perceived barrier was *don't know if it matters.* This suggests that perceptions of low potential savings are able to act as a barrier to action for those who do not carry out the behaviour, and yet are enough to encourage behaviour for

those who do carry out the behaviour. In addition, although curtailment behaviours require habit changes (Barr et al., 2005), this was not selected as a barrier to action. In fact, it was because people were not convinced that these behaviours really make a difference. This reflects what Kerr (1996) pointed out: '*When confronted with the genuine threats posed by many such large-scale and seemingly intractable social dilemmas, which of us has not responded to appeals for contributions of effort, time, or money with the not-entirely self-serving question, 'Does my contribution really matter?*' (p. 210). The implications of these findings are discussed in the Discussion of this chapter (see section 5.9).

5.8.6 What factors predict behaviour adoption?

I now explore the factors that may help predict behaviour adoption. A series of regression analyses were used to examine the influence of demographic and environmental belief variables on respondents' adoption of energy saving behaviours. The variables selected for analysis were identified from the empirical and theoretical review to have an impact on energy saving behaviour adoption. This analysis shows that perceptions of self-efficacy are able to predict most behaviours, and in the majority of cases, are actually the strongest predictor for behaviour adoption.

The energy saving behaviours used as the dependent variables in the regressions fall into two categories:

i. Efficiency behaviours which are dichotomous variables with responses varying from 1 (carry out the behaviour) and 2 (don't carry out the behaviour). For this set of behaviours, the dependent variable is dichotomous, and as such binary logistic regression was used.

ii. Curtailment behaviours which are multivariate with responses ranging from 1 (always carry out this behaviour) to 5 (never carry out this behaviour). For this set of behaviours, the dependent variable is ordered and as such ordered logistic regression was used.

Variables analysed as independent variables with the largest regression coefficients can then be said to have the greatest influence in predicting the dependent variable.

The independent variables used here were: beliefs about whether climate change is occurring, beliefs about anthropogenic climate change, perceptions of humans being capable of overcoming environmental problems, perceptions of lifestyle contributing to climate change, action taken out of concern for climate change, feelings about current lifestyle and the environment, perceptions of climate change being a big problem for Planet Earth/Humanity, frequency of concern about climate change influencing decisions, frequency of worrying about climate change, frequency of talking to friends and family about climate change, perceptions of scientists' confidence regarding climate predictions, perceptions of levels of confidence of scientific predictions about climate change needed before making recommendations to the public that affect their lifestyle, perceptions of scientists' confidence regarding the link between carbon emissions and climate change, demographic variables (gender, age, education level, household income, region of the UK), and finally, perceived money saved annually by carrying out the behaviours.

5.8.6.1 General behaviours

As shown in Table 5.8, the regression analysis suggests a relatively strong role of self-efficacy as a basis for carrying out general behaviours. Strong perceptions of SE are the most salient positive correlations of action across all the general behaviours, while perceived money saved and perceptions of climate change as influencing decisions are also significant positive predictors for most behaviours. Some demographic variables (gender, age, household income, and region of the UK), environmental variables (perceptions of lifestyle contributing to climate change, feelings about lifestyle and the environment, perceptions of climate change being a big problem for humanity, perceptions of scientists regarding climate predictions, perceptions of confidence in scientific predictions about climate change, perceptions of scientists' confidence regarding carbon emissions and climate change) and further psychological variables (OE, POE, CE, and COE) also exert a significant positive influence on some of the behaviours. Other demographic variables (education) and environmental variables (belief about climate change happening, belief about anthropogenic climate change, perceptions of humans being capable of overcoming environmental problems, action taken out of concern for climate change, frequency of worry about climate change, frequency of talking to friends and family about climate change) are non-significant for all behaviours analysed.

Efficacy and outcome expectancy beliefs, displayed in Table 5.9, showed that across almost all behaviours, efficacy and outcome expectancy beliefs were higher for those that carried out the behaviours, when compared to those that do not. Thus, when comparing

those who carry out the behaviours and those who do not, respondents who carried out the behaviours examined in this study were more likely to have stronger beliefs about being capable of carrying out the behaviour (self-efficacy), have stronger beliefs that their behaviour would contribute enough financially and environmentally enough to make it worth it (personal outcome expectancy and outcome expectancy), have stronger beliefs that most people would be capable of carrying out the behaviour (collective efficacy), and have stronger beliefs that if most people carried out the behaviour, it would contribute environmentally enough to make it worth it (collective outcome expectancy). Interestingly, there were two behaviours that formed the exception to the above pattern: installing a more efficient boiler, and installing an AAA rated washing machine. Self-efficacy, outcome expectancy and personal outcome expectancy were higher for those who did not install a new boiler. Perhaps these respondents perceive this particular behaviour to be easy to carry out, and expect this behaviour to lead to significant savings. On the other hand, personal outcome expectancy, collective efficacy and collective outcome expectancy were higher for those who did not install an AAA rated washing machine. This could reflect people's (accurate) perceptions of this behaviour not resulting in significant savings.

Five separate independent-samples t-tests were conducted to compare the differences between the efficacy and outcome expectancy perceptions between adopters and non adopters. Across all variables examined, the differences were found to be significant ($p < 0.01$) in the scores for self efficacy for adopters (M=8.4, SD=1.9) and non adopters (M=5.6, SD=1.6). , outcome expectancy for adopters (M=7.7, SD=1) and non adopters (M=5.4, SD=0.8), personal outcome expectancy for adopters (M=7.4, SD=0.9) and non adopters (M=5.1, SD=0.7), collective efficacy for adopters (M=7.1, SD=1.1) and non adopters (M=6, SD=0.8), collective outcome expectancy for adopters (M=7.5, SD=0.8) and non adopters (M=5.6, SD=0.8).

Table 5-8 Regression results for general behaviours

Variable	Bulbs	carpool	thermostat	water heater	recycle	standby	wash 30	dryer	full load
Gender (women)				.467* (.185)		.392* (.197)		.450* (.209)	
Age		-.251*** (.077)			.386*** (.092)		-.126* (.057)		
Income					.211** (.072)		-.097* (.044)		
Region of the UK	(3) 1.001* (.906)								
Lifestyle contributing to climate change						-.285* (.136)			
Lifestyle and the environment ('I'd like to do a bit more for the environment')	1.605* (.678)						-1.437*** (.492)		
Climate change big problem Planet Earth							.292* (.132)		
Climate change big problem Humanity					.570* (.238)				
Climate change influences decisions	.693** (.232)		.543*** (.159)	.445** (.152)		.610*** (.162)			
Scientists confidence in predictions	.488* (.232)								
Confidence of scientific predictions			.262* (.109)						
Scientists confidence about link (emissions and climate change)	-.643** (.222)						-.300* (.144)		
Perceived Money saved		.123** (.050)	.200*** (.065)	.233*** (.060)			.180** (.060)		
SE	.460*** (.080)	.306*** (.046)	.353*** (.050)	.156*** (.060)	.418*** (.082)	.386*** (.058)	.367*** (.050)	.356*** (.044)	.401*** (.064)
OE				.147*** (.045)		.114** (.042)		.090* (.046)	
POE			.123* (.054)	.167** (.056)	.164* (.072)	.123* (.055)			
CE		-.139* (.056)	-.128** (.049)			-.118* (.052)	-.134** (.046)		
COE			-.128* (.058)	-.137* (.058)					
Nagelkerke R^2	.422	.366	.359	.355	.367	.409	.333	.382	.246
-2 Log Likelihood	398.168	.776.663	482.880	1331.043	501.042	1091.937	1250.993	1059.115	819.022
Model χ^2[k]	166.747***	184.807***	147.174***	202.995***	154.758***	235.619***	185.641***	213.908***	115.310***
Prediction accuracy	80%	-	75%	-	-	-	-	-	-

Variables not reported due to no significance: Education, household size, belief about climate change happening, belief about anthropogenic climate change, humans capable to overcome environmental problems, action out of concern for climate change, frequency of worrying about climate change, frequency of talking to friends and family about climate change.

Table 5-9 Items used to measure beliefs in energy saving behaviours along with the corresponding mean values for those who carry out the behaviours (y) and those who do not (n).

Items	SE [a]		OE [b]		POE [c]		CE [d]		COE [e]	
	y	n	y	n	y	n	y	n	y	n
Curtailment behaviours (general)										
Carpool to work with one other person	8.3	3.4	8.4	4.7	8.6	5.1	4.7	5.8	6.6	8.4
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	4.3	3.8	8	5.4	7.4	5	6.1	7.9	6.3	7.6
Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F)	9.3	7.6	8.4	5.8	7.9	5.3	7.9	6.4	6.2	7.9
Recycle paper, glass, and plastic	8.1	6.9	6.7	5.5	7.8	4.7	6	8.9	5.3	8
Reduce standby use of electricity by appliances and electronics by 90%	10	9.5	8.1	4.8	7.7	4.4	6.2	8.1	5.1	7.7
Wash clothes at 30°C instead of 40°C	9	8.1	8.1	5.4	7.5	5.2	6.3	7.9	6	7.7
Do not use clothes (tumble) dryer for 5 months of the year	9.7	5.6	7.6	6.7	7.8	5.6	5.4	7.4	6.2	8.2
Wait until there is a full load for washing	9.7	6	8.1	4.7	7.6	4.6	6	8	3.9	7.8
Efficiency behaviours (general)										
Use 85% bright compact fluorescent or LED bulbs instead of incandescent bulbs	9.5	6.4	7.7	5.4	7	5.2	6.5	8.6	5.6	7.3
Curtailment behaviours related to car use										
Drive to avoid sudden acceleration and stops	9.3	5.6	8.2	5.2	7.6	5.5	6.8	7.1	6.2	7.5
Combine errand trips to halve current mileage / car use	9	4.9	8.8	6.7	8.2	6.5	4.2	6.9	6.1	8.1
Efficiency behaviours related to car use										
Service your car regularly	8.4	4.4	7.5	4.1	6.5	3.7	5.8	6.5	4.8	6.6
Buy tyres that lessen resistance	8.2	5.5	7.2	4.9	6.6	4.7	5.7	6.4	5.2	6.9
Correct tyre pressure	9.3	6.5	7.8	5.5	6.8	4.8	6.2	8.1	4.9	6.9
Efficiency behaviours in the housing domain										
Loft insulation and ventilation	7.3	3.9	7.3	4.6	6.6	5	5.6	6.7	5.6	7
A more efficient central heating boiler (92% efficient, e.g. condensing boiler)	3.4	5.6	4.6	7.4	5	7.1	4.7	5.6	7.3	5.6
Double or triple glaze windows	5.5	3.5	7.1	6.6	6.8	5.1	4.3	4.8	5.6	7
An A+ Rated Fridge Freezer, in place of a lower rated one bought between 1993 and 2000	7.9	6.6	6.8	5.4	6.5	5.4	6.6	7.1	5.5	6.7
An AAA rated washing machine to replace an old model	6.9	6.7	5.7	5.6	5.7	5.8	6.4	6.5	5.9	5.8

Highest perception of efficacy/outcome expectancy

The scale ranges from 1 (no confidence) through to 6 (moderate confidence) to 11 (high confidence).

[a] Participants were asked to rate their degree of confidence for each behaviour about: I am able to do this

[b] Participants were asked to rate their degree of confidence for each behaviour about: If I do this, it will contribute financially enough to make it worth it

[c] Participants were asked to rate their degree of confidence for each behaviour about: If I do this, it will contribute environmentally enough to make it worth it

[d] Participants were asked to rate their degree of confidence for each behaviour about: Most people/car owners/home owners will be able to do this

[e] Participants were asked to rate their degree of confidence for each behaviour about: If most people/car owners/home owners do this, it will contribute environmentally enough to make it worth it

5.8.6.2 Home behaviours

As shown in Table 5.10, regression analyses suggest a different relationship between home behaviours and the variables used to predict action when compared to general behaviours. Interestingly, different variables appear to predict each of the home behaviours examined (with the exception of loft insulation and boiler installation which are both predicted by belief in climate change and outcome expectancy). Overall, worry about climate change was the most salient positive correlation for the behaviour 'A+ fridge', while belief that climate change is happening and gender are also significant predictors for 'installing insulation' and 'draught proofing of home' respectively. Other demographic variables (age, income), environmental variables (perceptions of humans being capable to overcome environmental problems, perceptions of lifestyle contributing to climate change, perceptions of climate change being a big problem for humanity, perceptions of scientists' confidence regarding climate predictions, perceptions of levels of confidence of scientific predictions about climate change needed before making recommendations to the public that affect their lifestyle) and psychological variables (POE, CE, COE) are non-significant. Out of 6 home behaviours, there were 2 that were not predicted by any of the variables examined in this study (double glazing and purchasing an AAA washing machine).

Table 5-10 Regression results for home behaviours

	Insulation	Boiler	Glazing	Draught	A+ fridge	AAA washing machine
Gender			-	-1.389* (.584)		-
Education	-1.271** (.527)		-			-
Region of UK		(1) (3) (5)*	-			-
Belief climate change is happening	3.528** (1.176)	.712* (.295)				
Perceptions of anthropogenic climate change				-.297* (.146)		
Action for climate change	(5) .440* (2.395)					
Lifestyle and the environment ('I'd like to do a lot more for the environment')		2.673* (1.278)				
Perceptions of climate change being big problem for planet Earth		-.992* (.406)				
Climate change influences decisions	-2.187* (.927)			.904* (.451)		
Worry about climate change					2.094*** (.551)	
Talk to friends about climate change	2.644* (1.250)					
Scientists confidence about link (emissions and climate change)		-.898* (.391)				
Perceived Money saved	1.267** (.424)					
SE	.598* (.255)					
OE	.686* (.333)	.233* (.103)				
Nagelkerke R^2	.718	.368	-	.457	.420	-
-2 Log Likelihood	56.912	177.770	-	143.201	131.171	-
Model χ^2[k]	93.277***	55.079*	-	67.306**	56.449*	-
Prediction accuracy	92%	74%	-	81%	85%	-

Variables not reported due to no significance: Age, income, household size, humans capable to overcome environmental problems, perceptions of lifestyle and the environment, perceptions of climate change being a big problem for Humanity, sscientists' confidence in predictions, confidence of scientific predictions, POE, CE, COE

5.8.6.3 Car behaviours

As shown in Table 5.11, regression analysis suggests a strong relationship between efficacy (self and collective) and car behaviour adoption. Strong SE is the strongest

positive correlate of action, across all but one of the car behaviours, followed by CE (which exerts a negative influence). Perceived money saved, region of the UK and perceptions of lifestyle and the environment are also significant positive predictors for some of the behaviours. Fewer demographic variables than compared to general and home behaviours (age and income), and again fewer environmental variables (perceptions of lifestyle contributing to climate change, feelings about lifestyle and the environment, perceptions of climate change being a big problem for Planet Earth, frequency of climate change influencing decisions, perceptions of levels of confidence of scientific predictions about climate change needed before making recommendations to the public that affect their lifestyle, perceptions of scientists' confidence regarding the link between carbon emissions and climate change) and further psychological variables (OE, POE, and COE) also exert a significant positive influence on some of the behaviours. Other demographic variables (gender, education) environmental variables (belief about climate change happening, belief about anthropogenic climate change, perceptions of humans capable to overcome environmental problems, action out of concern for climate change, frequency of worrying about climate change, frequency of talking to friends and family about climate change, perceptions of climate change being a big problem humanity, perceptions of scientists confidence of climate predictions) are non-significant.

Table 5-11 Regression results for car behaviours

Variable	Service car	Buy tyres	Tyre pressure	Efficient car	Alter driving▼	Errand trips▼
Age			1.633* (.680)		.381*** (.094)	
Income				-.309** (.109)		
Region of the UK		(10) 4.230** (1.602)			(3) 2.128* (.924)	(10) 3.485** (1.164)
Lifestyle contributing to climate change	1.688** (.593)					
Lifestyle and the environment ('I'd like to continue doing what I'm doing at the moment')			-5.904* (3.017)		-1.781* (.768)	
Lifestyle and the environment ('I'd like to do a lot more for the environment')						-1.957* (.826)
Perceptions of climate change being big problem for planet Earth						-.475* (.191)
Climate change influences decisions						.806** (.278)
Confidence of scientific predictions					.485** (.171)	.411* (.172)
Perceived Money saved	.474* (.225)	.494*** (.112)				.258*** (.080)
SE	.524*** (.155)	.296*** (.088)		.507*** (.093)	.366*** (.074)	.623*** (.086)
OE				.342*** (.102)		
POE	.611* (.251)					
CE		-.196* (.093)		-.275* (.108)	-.155** (.060)	-.198** (.073)
COE	-.810** (.280)					
Nagelkerke R^2	.632	.536	.666	.531	.465	.520
-2 Log Likelihood	76.652	204.333	43.559	187.126	488.580	433.841
Model χ^2[k]	92.408***	122.050***	68.790**	114.844***	135.458***	155.191***
Prediction accuracy	95%	82%	96%	81%	-	-

Variables not reported due to no significance: Gender, Education, belief about climate change happening, belief about anthropogenic climate change, perceptions of humans capable to overcome environmental problems, action out of concern for climate change, frequency of worrying about climate change, frequency of talking to friends and family about climate change, perceptions of climate change being a big problem Humanity, perceptions of scientists confidence regarding climate predictions.

▼ denotes efficiency behaviours.

The results from this section reveal that SE was found to predict most behaviours, and in the majority of cases, it was the strongest predictor for behaviour adoption (with the exception of home behaviours). This means that carrying out the behaviours examined is strongly influenced by whether people think they can carry out the particular behaviour. When considering barriers to behaviours, participants were found to attribute non-behaviour adoption for curtailment behaviours to the barrier of thinking it is not worthwhile carrying out (i.e. low perceptions of OE/POE). The implications of this are discussed in the following Section 5.9 Discussion.

5.9 DISCUSSION

The aim of this study was to identify to what extent members of the UK public carry out the 21 household and transportation behaviours identified by Gardner and Stern (2008) as having the greatest potential for reducing energy consumption (Gardner and Stern, 2008). The reason for focusing on these particular behaviours is that they all use available technologies and involve either low or no cost, or have the potential for promising returns of investment. The research reported here examined whether people carry out these behaviours, and their reasons for doing so (e.g. to save money, to save the environment), as well as factors that may predict the adoption of these: psychological variables, sociodemographic variables, perceived financial savings and climate change related beliefs, knowledge and perceptions predict behaviours.

5.9.1 Is the UK public carrying out the behaviours that will help reduce their impact the most?

The findings show that people are not carrying out the most effective of the Gardner and Stern (2008) short list of behaviours. The most commonly carried out general, home and car behaviours are ‘recycling paper, glass, and plastic’, ‘double or triple glaze windows’ and ‘maintaining correct tyre pressure’ respectively. However, with the exception of ‘double or triple glaze windows’, these behaviours are not the most effective, either environmentally or financially.

These findings are consistent with Whitmarsh (2009a) who found people to not be carrying out the most effective behaviours. One possible explanation of my findings could be that people have misconceptions regarding behaviours' effectiveness as no correlation was found between the most effective behaviours (environmentally and financially) and those carried out. Indeed, Gardner and Stern (2008) speculated that misconceptions exist regarding how effective energy conservation behaviours actually are. Regarding the general behaviours, the most popular one carried out (always and often) by 92% of respondents is recycling, which, despite being the only behaviour mainly carried out for the environment, it is the least effective behaviour in terms of saving CO_2 emissions (see figure 5.5). This is followed by waiting till there is a full load for washing, and then buying BCF bulbs. And yet, the three most effective general behaviours are carpooling to work, reducing the use of standby and turning down the water heater thermostat. The image is different for home behaviours, where the two most popular behaviours carried out (double glaze and installing loft insulation) are also the two most effective both financially and environmentally. This could be a consequence of better regulation and government incentives in relation to these. An example of these initiatives is the Green Deal, which aims to help people make energy-saving home improvements such as insulation and doubling (Department of Energy and Climate Change, 2014b). Regarding car behaviours, similar to the general behaviours, the most popular behaviour (maintaining correct tyre pressure) is actually the least effective. This is then followed by service car and then buying a more efficient car, which are the most effective behaviours. In their study, DEFRA (2009) found that the vast majority of car driver respondents stated that they drove in a fuel efficient manner (78%). However, despite this being the second most effective car behaviour, it was not one of the most popular behaviours in this study. Thus education efforts are needed to educate people in how driving can be carried out in a fuel efficient manner.

The two types of behaviours examined are able to reduce people's energy consumption in two different ways. While efficiency behaviours require an initial one-off investment and have the potential for high energy savings, which then lead to high financial and environmental savings, curtailment behaviours offer lower savings and require repeated behaviours but are carried out at no extra cost. This could explain why, despite the most popular motivation (financial reasons) being the same for both types of behaviours, this motivated efficiency behaviours by over 50%, while for curtailment behaviours the motivations were more spread out, thereby resulting in financial reasons being mainly under 50%. Thus, individuals appear to understand the high potential savings resulting

from efficiency behaviour adoption, and as such, are mainly motivated by financial reasons. Regarding the barriers to action for efficiency behaviours, the initial investment required was reflected in the main barrier cited for these behaviours, which was 'financial reasons'. Considering the energy saving potential of efficiency behaviours, this finding emphasises the importance of financial incentives, which have the potential to help overcome financial barriers for the investment in energy efficient behaviours, thus encouraging behaviour changes (Swim et al., 2009).

On the other hand, 'don't know if it matters' reflects the perceived lower impact of curtailment behaviours as this was the main barrier cited for curtailment behaviours. This finding reflects the low predictive power of POE and COE as discussed in the next section and points to the need for communication efforts to stress the importance of curtailment behaviours, as the adoption of some can lead to significant immediate savings (Gardner and Stern, 2008).

Overall, efficiency and curtailment behaviours differ with respect to the initial investment, the subsequent effort required and the potential savings. These differences are reflected in the corresponding perceived motivations and barriers to their behaviour adoption. Indeed, both behaviours have the potential in resulting in financial savings, albeit much higher for efficiency behaviours and as such both were found to be mainly motivated by financial savings. The initial investment required for efficiency behaviours was translated into the main barrier for these behaviours being 'financial reasons'. On the other hand, the lower potential savings from curtailment behaviours resulted in their main barrier being 'don't know if it matters'. *This suggests that perceptions of low potential savings are able to act as a barrier to action for those who do not carry out the behaviour, and yet are enough to encourage behaviour for those who do carry out the behaviour.*

5.9.2 Financial misconceptions

Consistent with past research (Attari et al., 2010, Kempton et al., 1985) my results show that the respondents of this study exhibited relatively little knowledge regarding the potential savings of different efficiency and curtailment behaviours. Indeed, Attari et al. (2010) found that participants underestimate energy saving potential, with participants being least accurate when energy use and savings were high. This mirrors the findings of this study and is an interesting result, considering saving money was found to be the main motivation for behaviour adoption. This means that people's perceptions of financial

savings is worse when the potential for financial and environmental savings is large, and this is regardless of whether the behaviour is carried out or not. However, the significant contribution of this study is that these financial misconceptions were examined on behaviours of which their adoption was also taken into consideration. As such, my findings show that financial misconceptions are very similar between people who carry out the behaviours and those who do not. This shows that adopters make only slightly smaller underestimates of the effectiveness of behaviour adoption. And yet, the money people think they save (for those who act) and the money they know they're not saving (for those who don't act) is much higher that what they think. Perhaps, considering Chapter 5 found saving money to be the key motivation for carrying out behaviours, clarifying the actual financial savings may encourage non energy savers to think again.

5.9.3 The factors that predict the behaviours carried out

This study also examined the extent to which environmental beliefs, sociodemographic and psychological variables, along with perceived financial savings were related to energy saving behaviours. For this purpose a series of regression models were carried out (one per behaviour examined) which aimed to identify the factors influencing the adoption of the 21 behaviours examined. The strongest predictor of general and car behaviours, across the majority of general and car behaviours is **self-efficacy**: those who have high perceptions of self-efficacy are much more likely to carry out all the general behaviours and all but one of the car behaviours.

The important role of self-efficacy in intention to carry out energy saving behaviours has been demonstrated in the environmental literature. For example, Thøgersen and Grønhøj (2010) examined people's perceptions of efficacy and intentions to save energy by carrying out a list of 17 curtailment behaviours, and found self-efficacy to be strongly related to energy saving intentions. However, perceptions of efficacy were not examined for each of the behaviours, instead, they were measured against four general energy saving intention statements, such as: 'I believe that I'm able to avoid all unnecessary electricity consumption in my home'. Surprisingly, only one other study in the US examined perceptions of efficacy for each individual behaviour, and found it to have a significant effect on the intention to carry out energy saving behaviours (Truelove, submitted).

My results add further empirical support to the important role self-efficacy has to play in the context of energy saving and it has important implications for encouraging behaviour

adoption. Interestingly, however, there was a distinction regarding the predictive power of SE depending on the behaviour type. Indeed, SE predicted all the curtailment behaviours (9 general and 2 car behaviours) and yet it did not predict all efficiency behaviours (3 out of 4 car behaviours and 1 of the 6 home behaviours). This could be explained when considering that the adoption of curtailment behaviours require conscious efforts to continuously carry out the behaviour and as such confidence in being able to carry these out is necessary. And yet, for efficiency behaviours it appears that confidence to carry them out is not the main predictive variable. This may be explained by the financial savings that were found to be the key motivation for the adoption of efficiency behaviours. Thus, being financially able could be the main drive for the adoption of efficiency behaviours. This is reflected in the financial barriers to efficiency behaviours.

Table 5-12 Efficacy and outcome expectancy found to predict the 10 curtailment and 11 efficiency behaviours.

Behaviour type	SE	OE	POE	CE	COE
Curtailment behaviours	10/10	3/10	4/10	6/10	2/10
Efficiency behaviours	5/11	3/11	1/11	2/11	1/11

Most popular predictor
Second most popular predictor
Third most popular predictor

In relation to the other efficacy and outcome expectancy variables, **collective efficacy** was found to be the second strongest predictor for curtailment behaviours, after self-efficacy, predicting 6 out of 10 curtailment behaviours (see table 5.12), namely 'carpool to work with one other person', 'turn down thermostat', 'reducing the use of standby', 'wash clothes at 30^{o}C', 'buy tyres that lessen resistance', 'buying a more efficient car', 'drive to avoid sudden acceleration and stops' and 'combine errand trips to halve current mileage/car use'. This pattern was not as strong for efficiency behaviours for which collective efficacy was the third strongest predictor, predicting 2 out of 11 behaviours. Interestingly, for both types of behaviours, when significant, collective efficacy was negatively associated with the behaviours, implying that those who carried out the behaviours were less likely to believe that others would carry them out. This is consistent

with the findings of Bonniface and Henley (2008), who carried out a study with 6 focus groups exploring efficacy beliefs of environmental activists and non-activists in Western Australia. They found that all participants expressed pessimistic views regarding the abilities of others to perform pro-environmental behaviours. Additionally, a UK survey carried out by DEFRA (2007) found that despite the majority of the participants correctly identifying the efficiency behaviours that could help reduce energy use, less than a quarter of participants believed that the UK public would be willing to carry these out.

These results may suggest that increased perceptions of others being capable of carrying out the behaviours, lead to decreased behaviour adoption. This could result from free riding, which according to Dawes (1980) exists when *individuals believe others will cooperate (that is, high levels of trust in others' cooperation) and they believe they can defect without significantly hurting others*. Indeed Truelove (submitted) also found a negative relationship between CE and pro-environmental behavioural intentions and used the above idea to explain her findings. Alternatively, one possible explanation for this could be that people think that they might save some money by carrying out curtailment behaviours (hence the financial motivation), and consider that they are able to carry this out (with SE being the strongest predictor), and yet think that other people will not think it's worth it, either individually or at the collective level (which could explain low perceptions of collective efficacy). Indeed, as table 5.9 demonstrates, levels of self-efficacy were found to be higher for most behaviours carried out, when compared to perceptions of collective efficacy. A communication focus towards collective efficacy may not necessarily help encourage the adoption of energy saving behaviours, due to a lack of trust due possibly to the social dilemma nature of energy conservation.

Outcome expectancy was found to be the second strongest predictor for efficiency behaviours after self-efficacy, predicting 3 out of 11 efficiency behaviours, namely 'buying a more efficient car', 'insulation' and 'installing a more efficient boiler'. This could be expected considering the high potential financial gains the adoption of these behaviours can result in and considering that financial motivations for these behaviours was mainly over 50% of all other motivations provided. For curtailment behaviours outcome expectancy was the third strongest predictor, predicting 3 out of 10 curtailment behaviours, namely 'turn down water heater', 'reducing the use of standby' and 'not using the clothes dryer'. With the exception of 'not using the clothes dryer', each of these efficiency and curtailment behaviours led to the highest potential financial savings in their respective categories (general, home and car). This outcome is interesting as it indicates that for these

behaviours, respondents show an understanding of the most effective behaviours financially when asked outcome expectancy questions (i.e. 'If I do this, it will contribute financially enough to make it worth it').

Yet, despite OE being the second and third strongest predictor for efficiency/curtailment behaviours respectively, it appears to have limited predictive power as it does not appear to predict more than half of the behaviours in each category. For curtailment behaviours, this could be explained by the perceived barriers. Indeed, people did not perceive these behaviours as being worth carrying out and thus as expected, perceptions of financial savings were found to not predict the adoption of these behaviours. On the other hand, for efficiency behaviours, this could be explained by the large underestimates found of financial savings when these are high (i.e. for efficiency behaviours). Thus, given that people underestimate the money they can save by adopting the efficiency behaviours, this could explain why perceptions of the behaviours being financially worth carrying out is not able to predict more of these behaviours.

Personal outcome expectancy was the third strongest predictor for curtailment behaviours, predicting 4 out of 10 curtailment behaviours, namely 'turning down the thermostat', 'turning down the water heater thermostat', 'recycle', and 'reducing the use of standby'. Consistent with other studies, (Whitmarsh, 2009a, Gatersleben et al., 2002) this indicates that environmental attitudes are more relevant to curtailment behaviours, which are easy to carry out. And yet, despite people's perceptions that by doing these 'it will contribute enough environmentally to make it worth it' attention should be directed to the environmental impact of those behaviours which actually have the potential of significantly reducing people's environmental impact (efficiency behaviours). Indeed, POE had limited predictive power for efficiency behaviours, as it only predicted 1 behaviour out of 11. This, again, could be explained by the limited predictive power of OE as discussed above. The development of targeted information on the high potential environmental savings resulting from the adoption of efficiency behaviours may be fruitful.

Finally, surprisingly, perceptions of **collective outcome expectancy** appeared to be of limited importance. For the behaviours that COE predicted, it was negatively associated (turning down the thermostat, turning down the water heater thermostat for general behaviours, and service car for car behaviours). That is, participants who were more likely to carry out these behaviours were less likely to believe that they would make a difference at the collective level. One possible explanation is that people may adopt these behaviours

for their own motivations (e.g. SE/POE) and as such, COE does not affect behaviour adoption.

Moving on to the predictive power of **perceived money saved**, consistent with other studies (e.g. DEFRA, 2002, Whitmarsh, 2009a), perceived money saved was the second strongest predictor after SE, ranging over general, home and car behaviours. This finding reflects the importance placed on saving money and what the actual drivers of energy saving behaviours are. Thus, the two strongest predictors being perceptions of self-efficacy and perceived money saved imply that people will carry out the behaviours that they believe they can do and that they believe will save them the most money. However, as was found in this chapter, there are many misconceptions regarding actual potential money saved. Therefore, communication and policy programs could lead campaigns informing people more accurately about what really saves money, since we know that they get it wrong. This has the potential of redirecting people's efforts to the behaviours that are the most effective.

Regarding **sociodemographic variables**, the findings indicate that different variables predict the two types of behaviours (see table 5.12). Curtailment behaviours were mainly determined by age and gender. Indeed, Sardianou (2007) argued that older people are more likely to carry out curtailment rather than efficiency behaviours, as 'they do not relate well to conservation's 'spend now to save later' philosophy' (p.3782). Additionally, in their study, Poortinga et al. (2003) found older people to be more likely to adopt curtailment behaviours and to be less accepting of efficiency measures than younger respondents. Regarding gender, past research has found women to be more likely to want to do more for the environment (e.g. Kollmuss and Agyeman, 2002). This finding, paired with the fact that curtailment behaviours are those that people point to as being the most effective (Attari et al., 2010) could help explain why women are more likely to adopt curtailment behaviours.

On the other hand, amongst the sociodemographic variables examined, region of the UK was able to predict the largest number of efficiency behaviours (3 out of 11, compared to gender, age, income and education which were only able to predict one behaviour). These findings paint a different picture of the role of sociodemographic variables and energy saving behaviour adoption to those found by previous studies. For example, Abrahamse and Steg (2009) examined the relationship between sociodemographic variables in relation to household energy use. Their results indicated that income determines household energy

use. Surprisingly, this was found to have little to no predictive power over the adoption of the specific curtailment and the efficiency behaviours examined. One explanation for the disparity found between my findings and previous research on the role of income could be that only a sub-set of participants were examined for home and car behaviours (i.e., those on higher incomes). This was necessary since only those who owned a car or a home could meaningfully answer these questions. Nonetheless, two independent-samples t-tests were conducted to compare the differences between income for home owners and non-home homers, and car owners and non-car owners. There was a significant difference ($p < 0.01$) in the scores for income of home owners (M=4.1, SD=2.2) and non-home owners (M=3.3, SD=2), and also for car owners (M=4.1, SD=2.1) and non-car owners (M=2.9, SD=2.1). And yet, as Chapter 6 will go on to discuss, income is actually found to be related to overall desire to do more for the environment, save the least amount of energy and make the biggest error regarding potential financial savings.

It is worth pointing out the lack of predictive power of income on home behaviours in particular, which were all efficiency behaviours. Due to the initial financial investment required for these and along the lines of previous research (Gatersleben et al., 2002) I expected adoption to depend on contextual factors such as income and yet this was not found to have a relationship. On the other hand, for one of the car efficiency behaviours (buying a efficient car), this was found to be negatively predicted by income. This means that those on lower incomes are more likely to adopt this behaviour, perhaps due to the potential savings from the reduced fuel consumption, or due to the smaller size and cheaper cost of low consumption cars.

Table 5-13 Sociodemographic variables found to predict the 10 curtailment and 11 efficiency behaviours.

Behaviour type	gender	age	income	Region of UK	education
Curtailment behaviours	3/10	4/10	2/10	2/10	-
Efficiency behaviours	1/11	1/11	1/11	3/11	1/11

Most popular predictor
Second most popular predictor

The sociodemographic measures found to be statistically significant predictors for behaviours in this study were: gender, age, income, region, education (see table 5.13). Amongst the sociodemographic variables examined, age was the most significant predictor for curtailment behaviours, namely 'carpool to work', 'recycle', 'wash at 30^{o}C' (for general behaviours), and 'maintain correct tyre pressure' and 'drive to avoid sudden acceleration and stops' (for car behaviours). Gender was the second most significant predictor for curtailment behaviours amongst the sociodemographic variables examined, namely 'turn down water heater thermostat', 'reducing the use of standby', 'do not use dryer for 5 months of the year' (for general behaviours), and 'draught proof your home' (for home behaviours).

The other sociodemographic measures found to influence behaviours were income (recycle, washing clothes at 30°C, buying a more efficient car), region (buying BCF bulbs, reducing the use of standby, installing a more efficient boiler, buying tyres that lessen resistance, avoiding sudden acceleration, combining errand trips) education (insulation). Indeed, those on higher incomes are more likely to recycle, and less likely to wash at 30^{o}C and buy a more efficient car, while those with higher education are less likely to install insulation in their homes. These findings as a whole are partially consistent with past studies that have found a varied relationship between sociodemographic measures and the adoption of energy saving behaviours (e.g. Sardianou, 2007).

The results of this study point to the weak predictive power found between climate change related beliefs, knowledge and perceptions, and the energy saving behaviours examined. A minority of the behaviours were influenced by these factors. This is consistent with previous studies, as some have found motivations for conserving energy to be unconnected to the environment (Whitmarsh, 2009a, DEFRA, 2002, Norton and Leaman, 2004). Amongst the climate change related beliefs, knowledge and perceptions examined, that found to predict curtailment and efficiency behaviours was perceptions that 'climate change influences my decisions' as it predicted 4 out of 10 curtailment behaviours (buying BCF bulbs, turning down the thermostat, turning down the water heater thermostat and reducing the use of standby), and 3 out of 11 efficiency behaviours (insulation, draught proofing of home, combining errand trips). Interestingly, it was a negative predictor for installing insulation. An explanation for this can be found in the motivation for this behaviour. Amongst the home behaviours, it is the second most motivated behaviour by financial reasons. So perhaps this behaviour is understood more as an electricity and heating bill saving behaviour, rather than one to reduce our home's CO_2 emissions. This, in

turn, would suggest a lack of understanding of the connection between financial savings and CO_2 emissions. In joint first place for efficiency behaviours and the second strongest predictor for curtailment behaviours were feelings about their current lifestyle and the environment. More specifically feelings of wanting to do a lot more for the environment predicted installing a more efficient boiler and combining errand trips, feelings of wanting to do a bit more predicted maintaining correct tyre pressure, avoiding sudden acceleration, while wanting to continue to do what is already being done predicted buying BCF bulbs.

An interesting finding of this study was the weak predictive power found between climate change related beliefs and the energy saving behaviours examined. There are conflicting findings regarding this, as some studies (e.g. Joireman et al., 2010) have found belief in climate change specifically to be a prerequisite for willingness to take action. *However these studies examined the relationship between climate change belief and intention to act, rather than actual behaviours.* And yet, others have found motivation to carry out energy savings behaviours not linked to beliefs about whether climate change is happening (e.g. Spence et al., 2011). One explanation for this could be that there is likely to be some cognitive dissonance (i.e., attitude-attitude or attitude-behaviour inconsistency) associated with behaviours carried out and people's beliefs (Cary 1993). Indeed, this may result in a divergence between beliefs and behaviours carried out (Festinger, 1957). In terms of climate change mitigation behaviours, in order to reduce cognitive dissonance between climate change beliefs and energy saving behaviour adoption, people may deny the existence of climate change or the need to act (Lorenzoni et al., 2007). In this study, the main motivation for carrying out behaviours was to save money. This could explain the low predictive power of climate change beliefs. Additionally, in this study perceptions of effectiveness of behaviours on climate change was measured by POE, and yet it was SE that was found to have the strongest influence on behaviour adoption.

5.10 CONCLUSION

The research reported here found people to not be carrying out the most effective of the 21 energy saving behaviours examined (Gardner and Stern, 2008). Money was found to be the main motivator for behaviour adoption, and yet the results revealed that the behaviours carried out do not correspond to the ones that are the most effective for saving money, nor those perceived to be the most effective. Financial misconceptions were found regarding

the effectiveness of behaviours, with small overestimates when the savings were low, and high underestimates when the savings were high. Additionally, perceptions of self-efficacy for the majority of behaviours, were found to be the strongest predictor for behaviour adoption.

These results have ramifications for influencing people's energy saving behaviours. Regardless of beliefs in climate change and anthropogenic climate change, behaviours are primarily motivated by confidence to carry behaviours out and perceptions of money saved. Therefore, a transition to a low carbon society has the potential to be achieved by communication campaigns increasing self-efficacy perceptions and awareness of actual money saved.

Determining the audience and structure of targeted communication and policy massages

Which interventions would be most effective for the following three groups of people?

Group One: Those who **want to do more** to help the environment.

Group Two: Those who make the **biggest error** regarding the potential annual savings.

Group Three: Those who **save the least** amount of energy.

Research has shown that in western and more industrialized societies, despite 60% of people stating they recognize climate change as a problem, their actions show they are doing very little to address it (Woodside, 2011). Indeed, despite a very high proportion of the UK public stating that they were trying to cut down on the use of gas and electricity at home (DEFRA, 2009), energy use is still rising (Oliver et al., 2013), and people may not always be aware of the most environmentally and financially effective behaviours (see Chapter 5). This is supported by the financial misconceptions found between respondents' actual and perceived financial savings from the Gardner and Stern (2008) short list of behaviours. The most commonly carried out behaviours are not the most effective. As

such, people are not conserving as much energy as they could. This inevitably leads to the question of how to encourage people to adopt more efficient energy saving behaviours.

The development of interventions aimed at encouraging households to reduce their energy use seems vital. Indeed, studies have shown that interventions can be used to encourage households to reduce their energy use (e.g. Abrahamse et al., 2005). Additionally, authors have argued that interventions can be enhanced by tailoring these to specific characteristics of target groups (e.g. Abrahamse et al., 2007, Steg and Vlek, 2009). However, more research into the determination of these target groups that have the potential to benefit the most from tailored interventions is needed. In the next chapter:

- I analyse the adoption and non-adoption of a variety of energy saving behaviours by the UK public using the short list of efficiency and curtailment behaviours developed by Gardner and Stern (2008), and then go on to examine whether willingness to save energy translates into energy saving (Research question 8).
- I carry out a literature review to determine the interventions that have been used to date to encourage a reduction in energy use. I also carry out a literature review to determine the potential audience that could benefit the most from targeted interventions. This is then followed by an analysis of my data in order to explore whether it is possible to identify likely members of these groups from demographic variables (Research question 9).
- The first group consisted of those that are already motivated and show a desire to help the environment, by stating: 'I'd like to do a lot/bit more to help the environment'. This group consists of women with many people living at home.
- The second group consisted of those who make the biggest error compared to the actual potential savings. This measure relied on questions asking participants for their perceptions of the potential annual financial savings resulting from the Gardner and Stern (2008) behaviour adoption. This group consists of car owners and those who do not live in London.
- The third group was identified using Gardner and Stern's (2008) *short list* of behaviours. This involved identifying those who save the least and thus have the potential to greatly increase their energy savings. This group consists of car owners and those who do not live in London.
- I then discuss the potential tailored interventions for each group, along with the wider implications of identifying these three segments of the UK public, as this is necessary for developing effective communication and policy strategies with the aim of reducing the UK public's energy consumption.

CHAPTER 6: DETERMINING THE AUDIENCE AND STRUCTURE OF TARGETED ENERGY SAVING COMMUNICATION MESSAGES

6.1 INTRODUCTION

Our modern lives are energy dependent, with electricity and gas required in our homes for the performance of a wide range of everyday activities and with oil required for our cars. The energy consumed by households has seen increasing attention from applied social and environmental psychological research, with the energy crisis in the 1970s in the US and the possible depletion of fossil fuels marking the beginning of this field of research (Abrahamse et al., 2005). Since then, in the quest to lower our emissions and our dependence on fossil fuels, research has expanded considerably, with the ever growing attention to environmental problems such as climate change (Abrahamse et al., 2005). Growing scientific evidence is pointing to a significant human contribution to climate change (IPCC, 2007). For this reason the UK has put in place the Climate Change Act (2008), with a target of an 80% reduction in emissions by 2050 compared to 1990 levels. This ambitious target will require changes in our everyday energy-dependent behaviours.

Recent studies have found an increase in public awareness of climate change (Ockwell et al., 2009, Steg, 2008), and DEFRA (2009) found the majority of their respondents claimed that they were trying to cut down on the use of gas and electricity at home (76%). And yet, despite the increasing public awareness of climate change and people's efforts to reduce their energy use, household and transport energy demand is rising (Oliver et al., 2013). This suggests that efforts must be made to encourage households to reduce their energy use. However, the fact that the public has a poor understanding of the energy consumption associated with everyday activities (Leiserowitz, 2005), means that efforts must be made to educate (for example through interventions), guide (for example through 'nudge' type interventions – see Appendix I) and encourage people to reduce their energy consumption as UK households can make an important contribution to UK energy saving efforts (UKERC, 2009).

A large number of studies have been carried out investigating the effects of interventions to reduce energy use. These studies have examined a wide range of interventions including the provision of tailored information on energy saving (e.g. Winett et al., 1982), the provision of feedback (Grønhøj and Thøgersen, 2011), the setting of energy saving goals (McCalley and Midden, 2002), as well as structural strategies involving, among other factors, the availability of products and services (Steg and Vlek, 2009). However, regarding the effectiveness of these interventions, evidence reveals that these have provided varying degrees of success (Abrahamse et al., 2005).

Upon reviewing the literature on the promotion of pro-environmental behaviours, Steg and Vlek (2009) follow Geller (2002) and point out four steps that may result in more effective behaviour change promotion: a) identification of the behaviours to be changed, b) examination of the factors that influence these behaviours, c) design of interventions to help change the behaviours, and d) examination of the effects these interventions have on behaviour change. Chapter 5 initially addressed the first step as it identified *21 household and transportation behaviours that have the potential of greatly reducing our energy consumption (Gardner and Stern, 2008), all of which use available technologies, and involve either low or no cost, or have the potential for promising returns of investment*. Addressing the second step, through a series of regression analyses, the factors influencing these behaviours were also examined and discussed in Chapter 5. This chapter aims to address step c, by examining the literature on interventions carried out to date, and examining possible tailored intervention strategies for specific target audiences.

Once they had identified the behaviours to be targeted, Steg and Vlek (2009) went on to argue that 'valid behavioural measures are needed to decide which (groups of) individuals should be targeted, and whether target group-specific interventions may be worthwhile' (p.310). However, to the best of my knowledge, past research has not examined the effect of customized interventions on the specific needs of target groups. As Abrahamse et al. (2007) argued, the identification of target groups and their barriers to behaviour adoption has the potential to enhance the effectiveness of interventions as it may help address the barriers that exist for different groups.

This chapter focuses on determining the possible groups to be targeted, along with the interventions that would be the most effective at encouraging these potential audiences to reduce their energy consumption. In order to explore the interventions, I examine the literature in order to examine the intervention methods, along with their effectiveness, that

have been used to date. The three potential audiences are examined through an analysis of my data: the first group includes those who want to do more for the environment, the second are those who make the largest error regarding potential financial savings, while the third group consists of those who save the least amount of energy. The calculations used for determining the second and third groups are based on the behaviour adoption and perceived financial savings of 21 behaviours from Gardner and Stern's (2008) *short list*. The overall aim is to direct tailored interventions to the audience that would benefit the most from them.

The rest of the chapter is structured in the following way. Firstly, literature on perceptions of anthropogenic climate change and their link to energy consumption are presented. Secondly, UK household energy consumption is presented, demonstrating the potential of a 5-20% emission reduction through energy efficient behaviour adoption. Thirdly, a review of the research on interventions to encourage people to reduce their energy consumption is then presented. As Abrahamse et al. (2007) have pointed out: 'by customising interventions to specific characteristics of target groups, the effectiveness of interventions in promoting energy conservation may be further enhanced' (p.274). For this reason, the potential audiences for these interventions are presented as this will allow for an examination of tailored interventions that is hoped might increase their effectiveness. Fourthly, a description of the methodology used in order to identify the potential audiences for tailored interventions is also provided. Finally, the findings from this study are used to determine whether willingness to save energy translates into energy saving (research question 8). More specifically, regression models are used to identify the characteristics of possible target groups that could be used in targeted interventions. I conclude with a discussion of possible intervention types that might be beneficial for individuals in the different groups considered, based on their demographic characteristics (research question 9).

6.2 HOUSEHOLD ENERGY CONSUMPTION

Everyday life in the UK is highly dependent on electricity. More specifically, in 2011, the electricity consumed in UK households amounted to about 20,721 kWh, which is 16% higher than the EU27 average of 17,793 kWh (Nikiel and Oxley, 2011). These values demonstrate the important role the household sector can play in reducing the UK's dependence on energy as certain behaviour changes in households can have an immediate

effect in lowering electricity consumption (Thøgersen and Grønhøj, 2010). Indeed, recent studies suggest that emissions can be reduced by 5-20% through behaviours involving the adoption and altered use of energy at home and for transport (Gardner and Stern, 2008). As Dietz et al. (2009) argued, the key advantage of these behaviours is that their adoption can lead to significant reductions of energy consumption. These do not involve waiting for new technologies, but instead involve the curtailment of existing energy behaviours, or adopting or installing more energy efficient equipment (Gardner and Stern, 2008).

As discussed in Chapter 5, household energy conservation behaviours can be divided into two categories: a) *curtailment behaviours*, which involve repetitive actions in order to reduce energy use, such as reduce the use of standby, and b) *efficiency behaviours*, which are 'one-shot' behaviours, generally linked to the purchase of energy efficient equipment, such as installing a more efficient boiler (Abrahamse et al., 2005). However, even though efficiency behaviours have the potential to result in higher energy-savings compared to curtailment behaviours (Gardner and Stern, 2008), Chapter 5 found that *people* are *not carrying out the most effective of the Gardner and Stern (2008) short list of behaviours (i.e. the efficiency behaviours)*. For instance, households may save more energy by installing insulation in their homes rather than by lowering thermostat settings (Abrahamse et al., 2005). Indeed, as discussed in Chapter 5, one explanation of my findings could be that *consistent with past research, my results show that the respondents of this study exhibited relatively little knowledge regarding the potential savings of different efficiency and curtailment behaviours.*

Non-adoption of the most effective behaviours could explain the rise in household and transport energy demand (Oliver et al., 2013). Climate change communicators and policy makers need a better understanding of how to encourage people to reduce their energy consumption as this can lead to the development of targeted energy conservation campaigns. This need has resulted in an area of growing research, aiming to examine the interventions that will encourage people to reduce their energy consumption, as will be explained in the following section.

6.3 INTERVENTIONS

There is a growing body of research examining the interventions that can be used to encourage households to reduce their energy use (for a review see Abrahamse et al., 2005). A distinction has been made for two types of interventions as proposed by Geller et al. (1990), depending on the type of behaviour change: a) ***Antecedent interventions***, which are aimed at influencing factors prior to the behaviour performance. These types of interventions may lead to increased awareness about the given problem, and to information about the options available. Examples of antecedent interventions are information, workshops, mass media campaigns and goal setting; b) ***Consequence interventions***, which are aimed at changing the consequences after the behaviour performance. These types of interventions are based on the assumption that positive or negative consequences will influence behaviours (Abrahamse et al., 2005). Examples of consequence interventions are feedback and rewards (Steg and Vlek, 2009). The following sections provide a brief overview of studies that have used these kinds of interventions and examined their effect on energy saving behaviour adoption.

6.3.1 Antecedent interventions

6.3.1.1 Information

Information is used extensively to encourage energy conservation behaviours (Stern, 1992, Abrahamse et al., 2005, Abrahamse et al., 2007). This information may be general, informing about the energy related problems, or specific about the possible behaviours households can adopt (Abrahamse et al., 2005).

The main aim of information strategies is to increase people's knowledge and thus increase[19]: a) the awareness of environmental problems, b) the awareness of the environmental impact of behaviours, and c) the knowledge of the behaviours that may help reduce the environmental problems (Steg and Vlek, 2009). According to Kollmuss and Agyeman (2002), information strategies are the oldest and simplest strategies of pro-environmental behaviour change interventions, based on the principle that new knowledge and better information results will encourage people to conserve energy. However, information campaigns rarely result in behaviour changes (Steg and Vlek, 2009). Indeed, past research has pointed to differences in the effectiveness of information programs

[19] Assuming there are some environmental motives.

depending on the type of information provided and also the manner in which the message was delivered (Delmas et al., 2013).

Information strategies are diverse. One strategy used extensively to encourage energy saving behaviour adoption is that of ***pricing information*** (Delmas et al., 2013). However, despite financial savings that result from reducing energy use, past studies have found that the provision of information on the cost of energy does not necessarily lead to behaviour changes (Lindén et al., 2006).

The message delivery form of information can be communicated to households in several ways:

a) ***Workshops*** - Geller (1981) carried out a study examining the effectiveness of workshops on behaviour change. During these workshops, information on energy saving at home was presented and each participant was given a shower flow restrictor along with a booklet on energy conservation. However, despite an increase in concern about the energy crisis found amongst attendees, follow-up home surveys did not demonstrate an increased adoption in the energy saving behaviours emphasised at the workshops.

b) ***Mass media campaigns*** - Hutton and McNeill (1981) evaluated the Low Cost/No Cost energy conservation program. This was developed by the US Department of Energy, and was aimed at encouraging homeowners to implement several free or inexpensive behaviours with a potential 25% reduction of their energy use. As part of this program, a booklet of energy saving tips was sent to almost 5 million households across 6 US states, along with a shower flow restrictor. A telephone survey carried out revealed that those who had received the booklet and the shower device reported that they implemented the energy saving tips more often than households who had not (Abrahamse et al., 2005). However, Abrahamse et al (2005) went on to argue that the main limitation of mass media campaigns is that 'they tend to result in an increase in attitudes or knowledge' with no clear evidence that it may help result in reduced energy use (p.278).

c) ***Tailored information*** - Scholars have pointed to tailored information being a more effective method to encourage behaviour change (Abrahamse et al., 2007, Steg and Vlek, 2009). The reason for this lies in the fact that this approach allows for the information to be personalised and specifically tailored to the needs, desires, and perceived barriers of the individual or of the individual segments of the population (Steg and Vlek, 2009). One key

advantage of this method is that it allows for people to receive only relevant information, thus avoiding an overload of irrelevant information (Abrahamse et al., 2005). Indeed, Brandon and Lewis (1999) found people to want customized advice, as opposed to general or unsuitable information with vague statements.

Tailoring has been frequently used across health behaviours as part of interventions aimed at changing unhealthy behaviours (e.g. smoking, diet and exercise) (Kreuter et al., 2013). Evidence has shown that the tailoring of information has beneficial effects across a number of health related behaviours (Rimer and Kreuter, 2006). Unsurprisingly, this approach has also been applied to energy conservation both in the workplace (Daamen et al., 2001) and at home in the form of energy audits, where energy experts provide information on a range of energy-saving behaviours (both efficiency and curtailment) based on their current situation (Abrahamse et al., 2005).

Various studies have investigated the effect of energy audits on behaviour change and have found these to lead to significant energy savings and increased knowledge about energy conservation (e.g. Delmas et al., 2013, Winett et al., 1985). Winett et al. (1982) examined the effect of energy audits on household energy use. Tailored information was provided by home visits on heating and air conditioning for each apartment. The results showed that, compared to control groups, those who had received the energy audit reduced their electricity use by 21% (up to 24% on warm days and down to 9% on cooler days).

6.3.1.2 Goal setting

Goal setting has been frequently used to encourage the adoption of energy saving behaviours with positive results (Abrahamse et al., 2007, McCalley and Midden, 2002). It involves giving households an energy saving goal to aim for. For instance, to aim to save 5% to 15% of energy (Abrahamse et al., 2007, Abrahamse et al., 2005). Goals are often used in combination with other consequence interventions (as explained in the next section), such as feedback, as this allows households to see how their performance is going relative to the goal set (Abrahamse et al., 2005). As Grønhøj and Thøgersen (2011) pointed out, these goals must be challenging in order to be effective. Indeed, Becker (1978) carried out a study examining the effect of feedback on performance related to both easy (2% energy reduction) and difficult goals (20% energy reduction). Eighty households took part in this study, half of which received the difficult goal and the other half which received the easy goal. Both goal types were either combined with feedback 3 times a week, or no

feedback at all. The results of this study revealed that those who received the difficult goal and feedback saved the most energy (15.1%). As Abrahamse et al. (2005) argued, this study demonstrates that for a difficult goal to work, people must have feedback on how well they are performing in relation to their goal. Additionally, given that an easy goal was found not to be effective in energy conservation, this could result from people's perceptions of 2% not being seen as being worth the effort (Abrahamse et al., 2005). Interestingly, this mirrors the main barrier to curtailment behaviours as found in Chapter 5, where perceptions of low savings result in people thinking the behaviour is not worth carrying out.

6.3.2 Consequence interventions

6.3.2.1 Feedback

Feedback has been applied frequently to encourage energy conservation behaviours (Abrahamse et al., 2005). Feedback entails providing people with information on their energy consumption or energy savings and has been found to be an effective strategy in encouraging energy saving behaviours as it allows people to observe the effectiveness of their behaviours (Abrahamse et al., 2007).

Reducing energy use leads to immediate financial savings for the individual. For this reason, monetary feedback provision has been a commonly used strategy in energy conservation studies (Delmas et al., 2013). However, it has been argued that providing financial feedback may be counterproductive for energy conservation. Firstly, this is because the monetary savings that result from everyday behaviours are usually small (e.g. curtailment behaviours). Indeed, as the average monthly household energy bill (gas and electricity) in the UK is £105 (BBC, 2014), saving 5% or 10% energy results in a financial saving of £5 or £10 monthly. Secondly, framing the potential savings in terms of financial benefits may 'signal that selfishness is an appropriate response' (Bowles, 2008), and thus crowd out those with more altruistic or biospheric concerns (Bénabou and Tirole, 2005). Another risk of focussing on financial gains is of rebound effects, which are 'a behavioural or other systemic response to a measure taken to reduce environmental impacts that offsets the effect of the measure' (Hertwich, 2005, p.86). Therefore, as Grønhøj and Thøgersen (2011) argued, the neutral kWh unit is generally preferred, despite studies comparing the alternative ways of presenting potential savings not registering any differences in the

savings based on the units presented (in terms of £ or kWh) (Grønhøj and Thøgersen, 2011, Abrahamse et al., 2005).

Direct and indirect feedback

The effect of feedback depends on whether it is direct or indirect (Grønhøj and Thøgersen, 2011). ***Direct feedback*** involves providing households with information that is provided immediately at the time of energy use. One example of direct feedback is a smart meter, where continuous, real-time feedback of household electricity use is displayed on a display monitor (Darby, 2006). ***Indirect feedback*** involves providing households with information on their electricity use after the energy was used. One example of indirect feedback is specific billing on a daily, weekly or monthly basis (Grønhøj and Thøgersen, 2011).

Geller (2002) argued that ideally feedback should be given immediately the behaviour is carried out. Indeed, reviewing the literature on the effect of direct and indirect feedback on energy saving, Darby (2006) found direct feedback to be associated with energy savings in the region of 10-20%, while indirect feedback resulted in savings in the region of 0-10%. Darby (2006) pointed out that direct feedback does require participants to be motivated as the meter must be read regularly; however as Grønhøj and Thøgersen (2011) went on to argue, this allows for 'a better connection between behaviour and effect' (p.139). Adding support to the effectiveness of the use of direct feedback, Grønhøj and Thøgersen (2011) recently carried out a study over a five-month period with 20 households. This study examined the effect of providing these 20 households with direct detailed feedback on their electricity consumption using a smart meter. A control group was also used in this study allowing for a comparison of the electricity consumption between these two groups. The control group consisted of 163 households from the same area as those households participating in the study, and complied with the same screening criteria used for the 20 households. The results revealed that the average electricity saved was 8.1%, compared with an average of 0.8% savings found in the control group.

Regarding indirect feedback effectiveness, studies have found daily and weekly feedback interventions to have produced some positive results (Grønhøj and Thøgersen, 2011, Ehrhardt-Martinez et al., 2010, Hayes and Cone, 1981). Hayes and Cone (1981) examined the effect of monthly feedback on energy consumption. They found that the participants who received feedback reduced their electricity use by 4.7%, while the control group, who received no feedback, increased their electricity use by 2.3%.

However, one key disadvantage of feedback provision is that of the limited studies that have examined the long-term effect on behaviours. They have found the effect to not be sustained once the feedback ends (Van Dam et al., 2010, Hayes and Cone, 1981). Interestingly, Hayes and Cone (1981) found the withdrawal of feedback to result in an increase of levels of energy use. Indeed, after the feedback was withdrawn, electricity use was monitored for both sets of participants over a 2 month period and an increase in energy use was found in the feedback group (by 11.3%), while a decrease was found in the energy use in the control group (0.3%).

6.3.2.2 Rewards

Rewards, typically financial rewards, are extrinsic motivators for energy savings (Abrahamse et al., 2005, Geller, 2002). The amount rewarded may be dependent on the amount of energy saved, or a fixed amount when a set amount has been saved (Abrahamse et al., 2005). Past studies have found rewards to result in energy savings (e.g. Winett et al., 1978). Winett et al. (1978) examined the effect of financial rewards (high vs. low) in combination with feedback and information on 129 households in Texas. Demonstrating the effect of high rewards on energy saving, the results of this study revealed that over the 8 week course of the study, it was only the high reward group that significantly reduced their energy use by 12%.

However, there is evidence that rewards may actually reduce intrinsic motivation to act pro-environmentally, as people may end up attributing their behaviour change to the reward and not their personal convictions (Stern, 1999, Steg and Vlek, 2009, Frey and Oberholzer-Gee, 1997). Thus, as some studies have suggested, rewards tend to have short-term effects (i.e. the duration the reward is provided) (e.g. McClelland and Cook, 1980).

6.3.3 Structural strategies

As Stern (2000) argued ‘interventions do little or nothing until one of them removes an important barrier to change’ (p.419). When energy saving behaviour adoption is costly or difficult due to external barriers, a third type of strategy exists which involves reducing constraints and removes these barriers (Steg and Vlek, 2009). These structural strategies exist to try to reduce some of the external constraints that make energy saving behaviour adoption difficult (Thøgersen, 2005, Stern, 1999). Indeed, as Roberts and Bacon (1997) argued:

> Environmental campaigns must avoid 'blaming the victim' strategies. Individual behaviour change strategies are inappropriate if macro conditions exist which can be blamed for contributing to the problem or constraining the effectiveness of individual efforts (e.g., companies do not provide ecologically friendly products, government inactivity). Under these conditions companies and the government must get involved before individuals are expected to modify their behaviour (p.89).

As discussed in Chapter 5, despite the high potential savings from the adoption of efficiency behaviours, the initial investment required was found to be the main barrier to efficiency behaviour adoption. The aim of structural strategies is to remove these barriers, by altering the availability and costs of behavioural alternatives, in order to make energy saving behaviour adoption more attractive (Steg and Vlek, 2009).

There are several ways in which structural strategies may take place. This may involve offering new and beneficial technology (e.g. more efficient boilers), the reduction of financial barriers (e.g. government funding for efficiency behaviour implementation), or pricing policies which decrease the cost of efficiency behaviours (Steg and Vlek, 2009). Focusing on transport behaviours in particular, research has shown that a quarter of UK CO_2 emissions come from transport, with emissions still rising (Chapman, 2007). Technological changes, have the potential to play a major role in the medium term reduction of transport related emissions, given that modern cars emit less CO_2 emissions than those manufactured a decade ago (Department of Transport, 2004; Chapman, 2007). However, there are also several short term structural interventions, which involve relatively simple improvements, and aim to provide an alternative to local car trips (Chapman, 2007). These include the promotion of walking and cycling (Anable and Boardman, 2005). For example, in order to increase the use of bicycles, interventions have focused on constructing dedicated cycle lanes (Lindsay et al. 2011), while interventions aiming to promote walking have focused on the reallocation of road space to pedestrian zones (Ewing and Cervero 2001).

6.4 EFFICACY AND OUTCOME EXPECTANCY INTERVENTIONS

As was discussed in Chapter 4, the four main influences on self-efficacy are: *enactive mastery experience, vicarious experience, verbal persuasion*, and *physiological state* (Bandura, 1977). Research in the health and vocation domain has examined the effect of

interventions on increasing one's self efficacy using these four influences. For example, Betz and Schifano (2000) examined the effect of interventions to increase self-efficacy levels with respect to the adoption of engineering related activities. These interventions involved instructors demonstrating each behaviour (vicarious experience), followed by the successful adoption of each behaviour by the participants (enactive mastery experience), during which the instructors encouraged and supported the participants (verbal persuasion), with verbal praise and rest allowed during the interventions (physiological state). The results revealed a statistically significant increase in participants' self-efficacy and confidence in adopting each of the behaviours. This suggests that tailored information campaigns could include such a strategy when encouraging behaviour adoption.

6.5 AUDIENCE FOR INTERVENTIONS

Stern (1999) argued that 'interventions are most effective when designed from the consumer's perspective. This is the case because it is from that perspective that the chief barriers to behavioural change are most easily seen' (p.475). By examining the effectiveness of energy monitors at reducing people's energy use, Van Dam et al. (2010) found certain people to be more receptive to interventions than others. He went on to argue that a 'one-size-fits-all' approach cannot be justified (Van Dam et al., 2010, p.468). Indeed, considering interventions in general, as several authors have argued, the effectiveness of interventions may be enhanced by tailoring these to specific characteristics of target groups, as different groups of people have different reasons for behaviour adoption, or non-adoption (e.g. Abrahamse et al., 2007, Steg and Vlek, 2009). Thus understanding which groups of people to target with specific interventions is vital as this will allow the effectiveness of interventions to be further enhanced.

When determining the different groups of people for targeted interventions, it is important that this involves: a) those who may be able to change their behaviours, and b) there exists a relatively clear strategy for tailored intervention for each of these groups that we can reasonably expect to be effective. From a literature review, I identified three potential groups of people who may benefit from targeted interventions: 1. Those who want to do more for the environment; 2. Those who make the biggest error in financial savings assessments; 3. Those who save the least. The following sections explain the reasoning for the selection for each of these groups.

6.5.1 Those who want to do more for the environment

The majority of the UK public claim to be trying to cut down on the use of gas and electricity at home (DEFRA, 2009). However, this willingness to save energy and actually carrying out the behaviours that will have an impact are two separate things.

In relation to the behaviours that may be carried out to protect from climate change, Stern (2000) offered a classification of two distinct behaviour types; impact-oriented and intent–oriented behaviours. *Impact-oriented behaviours* take into account the actual impact of these behaviours (e.g. energy use). Stern (2000) argued that: 'environmentally significant behaviour can reasonably be defined by its impact: the extent to which it changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself'. Indeed, the inefficient use of energy resulting from the adoption of household behaviours, directly or proximally contribute to environmental change. *Intent-oriented behaviours* take into account the participant's standpoint, and are concerned with behaviours carried out from the point of view of the individual to benefit the environment (e.g. recycling). As Stern (2000) went on to argue, the intention to benefit the environment does not necessarily translate into environmental impact. Indeed, as discussed in Chapter 5, Whitmarsh (2009a) *found a divergence between the behaviours which have a potential of reducing energy consumption, and those taken by the public with this aim in mind (with recycling being one of the most popular behaviours carried out).* These findings show that motivation and willingness to conserve energy do not necessarily result in energy saving. Thus, we can expect that individuals who state they would like to do more would benefit from targeted interventions as they are already motivated to do more for the environment. However, it is likely that without interventions these individuals may employ this motivation in ways which are ineffective. This means that educating these people on the most effective behaviours has the potential to greatly reduce their individual energy consumption.

Past research has found that the majority of the UK public state that they are trying to cut down on the use of gas and electricity at home (DEFRA, 2009), and yet energy use is rising (Oliver et al., 2013). Additionally, due to the results of chapter 5, pointing to financial misconceptions of energy saving along with the most effective behaviours not actually carried out, it is hypothesized that willingness to save energy to translate into energy saving.

Past research has found female gender and household size to be positively related to willingness to do more for the environment (e.g. Sardianou, 2007, Kollmuss and Agyeman, 2002). For this reason it is hypothesized that women and those from larger households to be more likely to be part of the group of those who 'want to do more for the environment.

6.5.2 Those who make the biggest error

According to Attari et al. (2010), most people demonstrate a difficulty in judging energy use and savings. This was reflected in their study of 505 participants' perceptions of energy conservation and savings for various activities at home and for transportation (Attari et al., 2010). Mirroring my findings from Chapter 5, Attari et al. (2010) *found misconceptions when participants were asked to estimate the energy used by nine devices and appliances and the energy saved by the adoption of six behaviours. More specifically, when participants were then asked about the energy use and savings of 15 activities, they overestimated the potential savings for behaviours that were the least effective, and yet underestimated the potential savings for the most effective behaviours.*

Chapter 5 also found 'saving money' to be the most popular motivation for carrying out energy saving behaviours and yet people are not saving as much as they could. This result, in combination with the finding that people misjudge the possible savings and do not carry out the most effective behaviours, suggests that people have the potential to save more money than they perceive they can. One might predict that in order to tap into this motivation to save money, people must be aware of the behaviours that will lead to higher financial savings, as currently they are not (see Chapter 5). Thus interventions that target those who make the biggest error have the potential to result in large energy savings by steering any efforts made away from the least effective behaviours and towards the most effective.

6.5.3 Those with the greatest potential to save

According to Abrahamse et al. (2005), attention should be directed towards those who save the least energy. They support this by pointing to a study which found a 'differential effect' for high and low energy users. More specifically, after feedback, high energy users were

found to have reduced their energy use, while the low energy users had increased their energy use (Bittle et al., 1979).

It is thus important to identify those who consume the most amount of energy, as a reduction in their energy use has the potential to help the UK reach the 34% targets by 2022 set in the Climate Change Act of 2008 (Committee on Climate Change, 2008). Guidance is thus required to encourage those who save the least amount of energy and to motivate them to reduce their energy consumption. One might predict that those who save the least will adopt more behaviours as they have not yet exhausted the list of behaviours for which they have sufficient agency [20]. Thus, given this higher energy-saving potential from low energy savers, interventions that target those that save the least may lead to great energy savings.

Past research has found age of respondents and income to be negatively associated with energy saving (e.g. Sardianou, 2007, Van Raaij and Verhallen, 1983). Thus, it is hypothesized that older people and those from higher income households to belong to the group of those with the greatest potential to save.

6.6 AIMS OF THE EMPIRICAL RESEARCH

A growing number of studies have examined the interventions that can be used to encourage households to reduce their energy use. And yet, these have resulted in varying degrees of success (Abrahamse et al., 2007).

Authors have found that the effectiveness of interventions may be enhanced by tailoring these to specific characteristics of target groups (e.g. Abrahamse et al., 2007, Steg and Vlek, 2009). Even so, the examination of tailoring interventions to specific target groups has not received much attention. This is of great importance as understanding which groups of people to target with specific interventions is vital to maximizing their impact. Furthermore, Curtis et al. (1984) argued that 'by examining socio-economic factors, we can identify "target groups" and other factors which may influence energy conservation

[20] Where they save little, it was assumed that this was at least in part due to not wanting to or not doing so rather than not being able to do so. The idea is that they have more scope/potential to engage in further behaviours through inform campaigns.

awareness programmes' (p. 452). The key justification for using sociodemographic data in this study is that it is the data believed to be available of those designing interventions.

The purpose of the empirical work in this chapter is to characterize the potential audiences for specific interventions with the use of sociodemographic variables, based on the data collected on the adoption and non-adoption of the 21 *short list* behaviours as proposed by Gardner and Stern (2008) and associated data. Suggestions are given on how to apply general large-scale interventions along with specific interventions to specific target groups that may respond most positively to these interventions. The importance of this study lies in the fact that in order to effectively encourage people to reduce their energy use, it is vital to understand the factors that can be used to encourage the different target groups identified in Section 6.5. This information will allow for the improvement of current intervention studies by addressing the barriers that may exist for different audiences.

Two specific research questions underpin this study:

Research question 8 – To what extent does willingness to save energy relate to energy saved? (This question is a precursor, as it helps examine whether those in the target group 'willing to do more', actually save the most energy).

Research question 9 – What are possible target groups and which interventions are most appropriate for different target groups?

6.7 METHOD

This section describes the questions used to collect the data for the purposes of this chapter. Data collection was based on the online survey of which the questions of particular interest were those that could help determine the three target groups. These questions were developed based on conclusions drawn from the literature review in the previous section (see section 6.5).

6.7.1 Measures

In order to determine the three groups for the targeted messages, the questionnaire comprised quantitative questions grouped into three sections. In the first part, participants'

climate change related beliefs, knowledge and perceptions were assessed. Subsequently, participants' energy saving behaviours were examined, along with their frequency. In the following section the perceived financial savings from behaviour adoption were examined. A final section explored participants' sociodemographic characteristics.

6.7.1.1 Those who want to do more for the environment

In order to identify the members of the group of those who want to do more for the environment one question was used: 'Which of these best describes how you feel about your current lifestyle and the environment?'. Answer options were: 'I'd like to do a lot more', 'I'd like to do a bit more', 'I'd like to continue what I'm doing', 'Don't know'. This was then used in a regression analysis to determine the factors that predict willingness.

6.7.1.2 Those who make the biggest error regarding potential financial savings

In order to identify those who make the biggest error, I initially examined perceived financial savings of energy saving behaviours. Regardless of whether the behaviour was carried out or not, participants answered the following question 'How much money you believe you save (or could save) per year by doing these?' with options being: £0, £1-£5, £5-£10, £10-£20, £20-£40, £40-£80, £80-£160, £160-£320, £320-£640. The reason the bands provided increase as the possible savings increase, is because the more effective behaviours (resulting in higher savings) are a lot more effective that the ineffective ones, so using equal-sized bands would have required a very large number of categories.

Those who make the biggest error was found by calculating the difference between people's Perceived Financial Savings (PFS) and the actual savings resulting from behaviour adoption. Frequency of energy adoption was also taken into account.

More specifically, I asked respondents how often they carry out each of the energy saving behaviours (for curtailment behaviours), or whether the behaviours are carried out (for efficiency behaviours). Perceived financial savings from carrying out each of the behaviours were also examined. In order to examine this, a Pro-environmental Index was developed (see Appendix G), which calculated the potential money saved across all behaviours for each respondent. In order to examine the errors in judgement, a Perceived Financial Savings Index (PFSI) was then developed which took into account respondents' perceived money saved across all behaviours. A PFSI was calculated for each respondent, and the difference between this and respondents potential savings (PEI as explained more in the next section) was then used as a dependent variable in the regression analysis carried

out determining the factors that predict error. This index took two things into consideration:

1. The perceived financial savings by each behaviour annually

2. The frequency at which this behaviour was carried out (an example shown below)

Table 6-1 Example of the calculation of the Perceived Financial Savings Index (PFSI)

Behaviour	Frequency and perceived potential savings				
Efficiency	Yes (×1)		No (×0)		
e.g. Replace 85% of bulbs (perceived money saved £47)	£47		£0		
Curtailment	Always (×1)	Often (×0.75)	Sometimes (×0.5)	Rarely (×0.25)	Never (×0)
e.g. Turn down thermostat (perceived money saved £55)	£55	£41.25	£27.5	£13.75	£0

6.7.1.3 Those with the greatest potential to save

In order to identify those with the greatest potential to save, I initially examined the amount of energy saved by the 501 respondents of this study based on the adoption and non-adoption of the 21 *short list* behaviours as proposed by Gardner and Stern (2008). This was achieved by developing a Pro-environmental Index (PEI) (see Appendix G), which is an expected saving index, based on average annual household financial savings associated with the behaviours weighted by respondents' stated frequency of conducting the behaviours. This index allowed me to examine the potential savings (in terms of both CO_2 saved and money saved – as part of this analysis only money saved was taken into consideration). A PEI index was calculated for each respondent and was then used as a dependent variable in the regression analysis carried out determining the factors that predict energy savings. This index took two things into consideration (see table 6.1 below for an example):

1. The actual financial savings by each behaviour annually

2. The frequency with which this behaviour was carried out

Table 6-2 Example of the calculation of the Pro-environmental Index

Behaviour	Frequency and actual potential savings				
Efficiency	Yes (×1)		No (×0)		
e.g. Replace 85% of bulbs (money saved £47)	£47		£0		
Curtailment	Always (×1)	Often (×0.75)	Sometimes (×0.5)	Rarely (×0.25)	Never (×0)
e.g. Turn down thermostat (money saved £55)	£55	£41.25	£27.5	£13.75	£0

6.7.1.4 Sociodemographic measures

Sociodemographic measures were examined for a range of variables. During the data collection process, quotas were set for age, gender, highest level of education, UK region, income, home and car ownership, as evidence shows these to be related to pro-environmental and energy use behaviours (e.g., Sardianou, 2007). The items, along with their response categories, are detailed in Appendix A.

A series of regression analyses were then used (described in the following sections) to test if demographics predicted: those willing to do more for the environment, those who save the least, and those who make the biggest error.

6.8 RESULTS

In this section, I address the last two research questions posed in Chapter 1: Firstly, I determine the extent to which willingness to conserve energy relates to energy saved (research question 8). Secondly, I determine the key demographic characteristics of the members of the UK public who are expected to respond most positively to interventions aiming to help them reduce their energy consumption (research question 9). This is carried out by identifying three target groups: a) those who would like to do more; b) those who

save the least; and c) those who make the biggest error concerning potential financial savings from the adoption of energy saving behaviours.

6.8.1 Examining whether willingness to do more for the environment relates to energy saved.

In order to determine those who want to do more, the question: 'Which of these best describes how you feel about your current lifestyle and the environment?' was used. In the questionnaire, 4 possible answer options were provided: a) I'd like to do a lot more, b) I'd like to do a bit more, c) I'd like to continue doing what I'm doing, and d) Don't know.

Just under half of the respondents (44%) stated that they would like to do more for the environment (see figure 6.1). More specifically, 21% reported that they would like to do a bit more, almost half of what DEFRA (2009) found a few years ago. Interestingly, a massive 23% stated they would like to do a lot more, a lot more than the 8% found by DEFRA (2009). These results may demonstrate an increase over recent years of the general awareness of the need to save energy by a portion of the public, and a willingness to so.

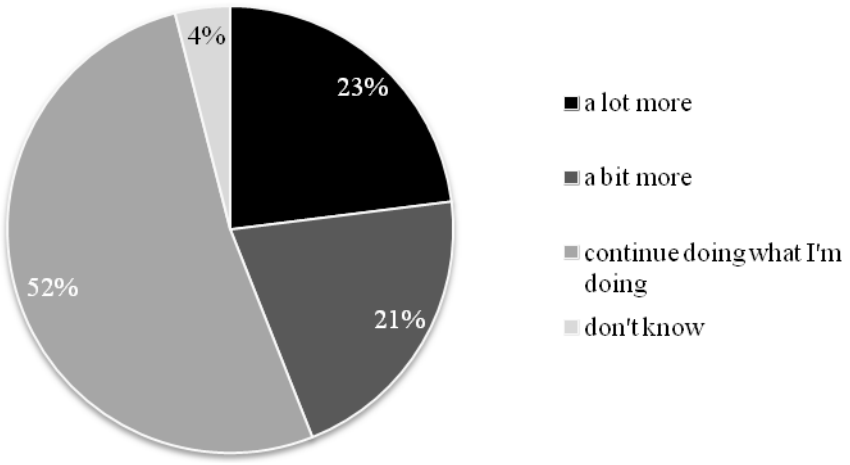

Figure 6-1 Willingness to do more for the environment. Responses to the question: 'Which best describes how you feel about your current lifestyle and the environment?'

In order to examine whether willingness to conserve energy translates into energy conservation, the potential energy conserved by the 501 participants of this study was initially examined using the Pro-environmental Index (PEI) (see Appendix G).

A series of Spearman correlations were then carried out examining whether any correlation exists between willingness to conserve energy and the energy saved (PEI). One correlation was for the PEI for the total energy saved (including general, home and car behaviours), while the other three related to the energy saved across each of the three domains separately. As expected, the Spearman's rho revealed there was no statistically significant relationship between willingness to conserve energy and the actual energy saved for all behaviours (*rs*=.084, *p*=.06), home behaviours (*rs*=.032, *p*=.235) and car behaviours (*rs*=.081, *p*=.055). The strongest relationship was between willingness to conserve energy and actual energy saved for general behaviours (rs=.159, p<.01). However, as this effect size (of .159) was small (Cohen, 2013), this indicates that willingness to conserve energy does not fully translate into energy saving. This could be explained by the finding reported in Chapter 5; when examining the relationship between the most effective behaviours environmentally and financially, and those carried out, this research found that people are not carrying out the most effective of the Gardner and Stern (2008) short list of behaviours.

Overall, this finding shows that statements about one's willingness to do more for the environment have either no relationship with the energy saved or only a very weak positive relationship. One possible explanation for this is the lack of knowledge about the most effective behaviours at reducing one's energy use (see Chapter 5). This is supported by the underestimations of financial savings across the majority of the behaviours examined (see Chapter 5).

6.8.2 Operationalising the three groups

Those who want to do more

In order to determine those who want to do more, the question: 'Which of these best describes how you feel about your current lifestyle and the environment?' was used, with answer options outlined in section 6.8.1. A binary logistic regression analysis was then carried out (described in section 6.8.3). The dependent variable was recoded as a dichotomous variable (1=(a) and (b); 0=(c) and (d)) to facilitate interpretation of the results. Thus, willingness to do more – a) a lot more and b) a bit more) - was coded as '1', those not willing to do more – c) continue doing what I'm doing and d) don't know was coded '0'.

Those who make the biggest error

Those who make the biggest error were found by calculating the difference between people's Perceived Financial Savings Index (PFSI) and the potential savings resulting from behaviour adoption (PEI). Frequency of energy adoption was also taken into account.

PEI (as described previously) was used to examine who are the energy saved based on the behaviours carried out.

Thus:

Error in financial savings
=
potential savings (PEI) – perceived savings (PFSI)

The larger this value, the larger the error.

A linear regression analysis was then used (described in section 6.8.3) to test if demographics predicted those who make the biggest error in perceptions of own savings, with PEI-PFSI as the dependent variable.

Those who save the least

In order to identify those who save the least the Pro-environmental Index, as described in section 6.7.2.3, was used, thus allowing me to examine the actual potential savings (in terms of money saved). This was then used as a dependent variable in the linear regressions.

6.8.3 Regression analysis of the three groups

A series of regression analyses were carried out. In each case, the group characteristic (as explained above) was used as the dependent variable, while demographic measures were used as independent variables in each model. The reason for only using demographics was that in order to actually carry out the targeted intervention, it is important that each group is able to be identified independently, without them completing a survey. The demographic variables included were: gender, age, education, income, region of the UK, number of

people in the household, and home and car ownership. These data were believed to be available to those designing interventions.

Characteristics of those who want to do more

A logistic regression analysis was conducted (see table 6.3) to predict those who want to do more using only demographic variables as predictors. A test of the full model against a constant only model was statistically significant, indicating that the set of predictors reliably distinguished between those willing to do more and those willing to continue doing what they are doing, or those who do not know if they want to do more (chi square=39.409, p<.01 with df=18).

Nonetheless, the Nagelkerke's R^2 of .103 indicated a weak relationship between prediction and the independent variables examined. Prediction success overall was 62% (57% for lack of willingness and 67% for willingness). The Wald criterion demonstrated that only gender (p=.001) and number of people at home (p=.020) made a significant contribution to prediction. The rest of the variables were not significant predictors. Women with children[21] are more willing to do more for the environment. More specifically, the value of the odds ratio -EXP(B)- indicates that women are 1.7 more times likely to be willing to do more. Similarly, the more people at home, the more likely they will be willing to do more.

[21] 'women with children' is an assumption of this group, as the question involved asking the size of household they live in. So this could indeed involve shared/student households.

Table 6-3 Regressions determining the audience of the three target groups

Variable	Those who want to do more	Those who save the least	Those who make the biggest error
Gender (female)	.689***		
	(.196)		
People at home	.292*		
	(.091)		
Car owner		419.821***	401.944***
		(31.006)	(28.365)
London		-105.757*	-97.921*
		(45.574)	(41.692)
	Binary logistic regression	Linear regression	Linear regression
-2 Log likelihood	639.353		
Nagelkerke R^2	.103	.388	.392
Adjusted R^2		.364	.369
Chi-square	39.409		
df	18	471	471
% predicted	62%		
SE of regression		247.20388	236.80992
Sum Squares residual		28782695.51	26413179.38

Statistically significant variables listed; all other independent variables not significant at 0.05 level.

As the model for 'willingness to do more' was able to only predict only 10% of variance, I then examined the proportion of responses for those willing to do more and those not willing to do more. The reason for this was to examine if the weak predictive power of the model was due to the majority of respondents having selected either of the responses. However, my results showed that approximately half of the respondents stated that they were willing to do more, with the other half stating that they are not, by selecting the response: 'I'd like to continue with what I'm doing at the moment'. These results reveal that willingness to do more is not well predicted by the demographic variables used in this study. Perhaps other demographic variables, not used in this study, may be able to add to the predictive power of this model. Alternatively, one possibility is that willingness to do more is not a characteristic that is easily predicted by demographic variables.

Characteristics of those who make the biggest error

The sociodemographic variables were then used in a linear regression analysis to predict those who make the biggest error regarding potential financial savings from the adoption of energy saving behaviours (Table 6.3). As can be seen, car ownership and the region of London were statistically significant. The prediction model was statistically significant, $F(18, 471)=16.854$, $p<.001$, and accounted for approximately 37% of the variance in errors made ($R2=.392$, Adjusted $R2=.369$). Car ownership ($b=37.062$, $t(18)=14.171$, $p<.001$, and

living in London (b=-97.921, t(18)=-2.349, p<.05) are all significant predictors of the error made regarding the potential savings. Car owners and those who do not live in London tend to make larger errors.

In order to examine perceptions of errors amongst the specific domains (general, car and home) a series of linear regression analyses were then used to test if demographic variables predicted errors. Analysis was conducted on the energy saving behaviours examined for general behaviours (9), car behaviours (6) and home behaviours (6) using the corresponding error in financial savings (*potential savings (PEI) minus perceived savings (PFSI)*) as the dependent variable in each of these linear regressions across general, home and car behaviours. Home and car ownership (from the predictors in the models for the previous group) were removed from the regressions.

Table 6-4 Regressions determining those who make the biggest error amongst general, car and home behaviours

Variable	Biggest error (general)	Biggest error (home)	Biggest error (car)
Age	6.438** (2.600)	34.705*** (7.147)	-
Income		13.707* (5.417)	-
People at home	11.956*** (3.552)		-
North West	35.359* (14.995)		-
	Linear regressions		
Nagelkerke R^2	.090	.070	
Adjusted R^2	.060	.039	
df	473	473	
SE of regression	80.76998	227.86610	
Sum Squares residual	3085752.425	24559559.64	

As can be seen from table 6.4, there was a variation amongst the demographic variables that predict the perceived errors in each of the behaviour domains. Overall, age was found to be a significant predictor for biggest error made for both general and home behaviours. Beyond this, each domain was predicted by different variables, with number of people at home and the region of North West predicting error across general behaviours, and income predicting error across home behaviours. More specifically, for ***general behaviours***, age, number of people at home and living in the North West were statistically significant. The prediction model was statistically significant, F(16, 473)=2.940, p<.001, and accounted for

approximately 7% of the variance in error made (R2=.090, Adjusted R2=.060). Age (b=-6.705, t(16)=-2.647, p<.01), number of people (b=11.297, t(16)=3.264, p=.001, and living in the North West (b=34.896, t(16)=2.388, p=.05) were all significant predictors of the error made regarding the potential savings of general behaviours. Older respondents with more people living at home and who live in the North West tended to make larger errors for general behaviours. For ***home behaviours***, age and income were statistically significant. The prediction model was statistically significant, F(16, 473)=2.232, p=.004, and accounted for approximately 5% of the variance in error made (R2=.070, Adjusted R2=.039). Age (b=34.705, t(16)=4.856, p<.001) and income (b=13.707, t(16)=2.530, p<.05) were all significant predictors of the error made regarding the potential savings of home behaviours. Older respondents with higher incomes tended to make larger errors for home behaviours. For ***car behaviours***, London and Scotland were statistically significant. However, the prediction model was not statistically significant.

Characteristics of those who save the least

The sociodemographic variables were then used in a linear regression analysis to predict those who save the least (Table 6.3). As can be seen from, table 6.3 car ownership and the region of London were statistically significant for saving the least overall. The prediction model was statistically significant, F(18, 471)=16.574, p<.001, and accounted for approximately 37% of the variance in error made (R2=.388, Adjusted R2=.364). Car ownership (b=415.093, t(18)=14.019, p<.001) and living in London (b=-.104.766, t(18)=-3.038, p<.05) were all significant predictors of saving the least energy. Car owners and those who do not live in London tended to save the least.

In order to examine energy savings amongst the specific behaviour domains (general, car and home) a series of linear regression analyses were then used to test if demographics, predicted errors. Analysis was conducted on the energy saving behaviours examined for general behaviours (9), car behaviours (6) and home behaviours (6) using the corresponding PEI scale (PEI general, PEI home and PEI car) as the dependent variable in each of these linear regressions.

Table 6-5 Regressions determining those who save the least amongst general, car and home behaviours

Variable	Save the least (general)	Save the least (home)	Save the least (car)
Age	7.202**	-	24.620*
	(2.764)		(10.370)
People at home	12.351***	-	16.362*
	(3.776)		(8.159)
North West	35.939*	-	
	(15.943)		
Nagelkerke R^2	.090		.131
Adjusted R^2	.059		.061
df	471		197
SE of regression	88.13146		211.38354
Sum Squares residual	3673863.743		8802551.577

As can be seen from table 6.5, there was little variation amongst the demographic variables that predict saving the least energy in each of the behaviour domains. Overall, age and number of people at home were found to be significant predictors for saving the least energy across both general and car behaviours. In addition to this, saving the least across general behaviours was also predicted by the region of North West. More specifically, for ***general behaviours***, age, number of people at home and living in the North West were statistically significant. The prediction model was statistically significant, F(16, 473)=2.974, p<.001, and accounted for approximately 7% of the variance in energy saved (R2=.090, Adjusted R2=.060). Age (b=-7.434, t(16)=-2.710, p<.01), number of people (b=11.297, t(16)=3.264, p=.001, and living in the North West (b=34.896, t(16)=2.388, p=.05) were all significant predictors of energy saved across general behaviours. Older respondents with more people living at home and who live in the North West tended to save the least across general behaviours. For ***home behaviours***, age and income were statistically significant. The prediction model was statistically significant, F(16, 473)=2.217, p=.004, and accounted for approximately 5% of the variance in error made (R2=.070, Adjusted R2=.038). Age (b=36.231, t(16)=4.826, p<.001) and income (b=14.543, t(16)=2.556, p<.05) were all significant predictors of those who save the least across home behaviours. Older respondents with higher incomes tended to save the least across home behaviours. For ***car behaviours***, London and Scotland were statistically significant. However, the prediction model was not statistically significant.

The independent variables that predicted those that make the biggest errors and those that save the least were very similar. For this reason, a Pearson correlation was then carried out

in order to examine whether any correlation existed between making errors regarding savings, and the actual energy saved (PEI). As expected, making errors was significantly correlated with saving the least energy, $r = .347$, $ps < .001$. We can conclude from this result that those who make the biggest errors tend to be those who save the least.

6.9 DISCUSSION

Understanding the relationship between sociodemographic variables and behaviours may assist in the promotion of environmentalism and have implications for policy recommendations and interventions (Zelezny et al., 2000). Indeed, as *Curtis et al. (1984) argued that 'by examining socio-economic factors, we can identify "target groups" and other factors which may influence energy conservation awareness programmes' (p. 452).* The first aim of this chapter was to review the literature on interventions used to encourage households to reduce their energy consumption and identify possible target groups, and secondly, with the use of sociodemographic variables, characterise the groups of people that may respond most positively to these interventions.

The promotion of pro-environmental behaviours involves a series of steps (Steg and Vlek, 2009, Geller, 2002). Once the behaviours that have a relatively large energy-saving potential have been selected and the factors influencing these identified (see Chapter 5), intervention strategies can be used to help change these behaviours. Two types of interventions were distinguished, depending on the type of behaviour change. The first type involves antecedent interventions, aiming to influence behaviours before they have been carried out. Information provision and goal setting are the main examples of antecedent interventions. The second type of interventions is that of consequence interventions, aiming to influence behaviours the next time they are to be carried out. Feedback and rewards are the main examples of consequence interventions. Both types of interventions have frequently been used to encourage energy saving behaviour adoption (Abrahamse et al., 2007, McCalley and Midden, 2002, Stern, 1992, Grønhøj and Thøgersen, 2011). A third strategy exists which involves structural changes. These involve the reduction of constraints and external barriers and are aimed at a situation where the availability and costs of behavioural alternatives are required to be changed or adjusted (Steg and Vlek, 2009).

6.9.1 Interventions aimed at everyone

Chapter 5 found that despite the majority of respondents stating that they 'have taken, or regularly take action out of concern for climate change', the most popular behaviours carried out were found not to be the most effective (environmentally and financially). Therefore, the action respondents claim to carry out does not seem to be directed towards the most effective behaviours. Additionally, Chapter 5 found that *despite money being found to be the key motivator for behaviour adoption, the behaviours carried out do not correspond to the ones that are the most effective for saving money, nor those perceived to be the most effective.* This finding could be due to misunderstandings of the effectiveness of behaviours, as people have the potential to save more money than they perceive they can.

In order to address the issue of people not carrying out the most effective energy saving behaviours, interventions could involve the antecedent intervention of ***tailored information***, in the form of personalised and specifically tailored information to the public, guiding action towards more effective behaviours. The main reason for this form of intervention is the positive effect this form of intervention has been found to have, especially regarding the adoption of efficiency behaviours (Abrahamse et al., 2005, Gonzales et al., 1988). This would allow for personalised information to be provided on the efficiency behaviours that can be carried out. The information provided could also address the actual energy that can be saved, and thus tap into people's motivation to save money (Chapter 5) by making people aware of the behaviours that will lead to higher financial savings and thus steer their efforts in the right direction.

Personalised information could be provided by energy experts, as studies have shown that these may lead to significant energy savings (e.g. Delmas et al., 2013, Winett et al., 1985). Abrahamse et al. (2007) argued that the internet could be an effective medium for the delivery of targeted messages, as it has the ability to reach a large number of households. And yet, in their meta-analysis of information strategies on energy saving behaviours, Delmas et al. (2013) found that information delivered in person has the potential to be more effective than information provided indirectly (for example via mail or e-mail).

Goal setting, another antecedent intervention, could also be used to encourage energy savings, as it has been frequently used to encourage the adoption of energy saving behaviours with positive results (Abrahamse et al., 2007, McCalley and Midden, 2002).

Challenging goals could be set for each household during the provision of the tailored information, as these have been found to be more effective than easy goals (Becker 1978).

However, moving beyond antecedent methods, Abrahamse et al. (2005) reviewed the interventions used to encourage a reduction in energy use and found the effectiveness of antecedent interventions to increase when combined with consequence strategies, such as feedback. ***Feedback*** and ***direct feedback*** in particular, could be also used, as studies have found it to lead to significant energy savings (e.g. Darby, 2006). The provision of feedback could be through the use of 'smart meters', especially considering the fact that the UK intends to install these in all UK households by 2020 (Department of Energy and Climate Change, 2009). Including a display or Smart Energy Monitor (SEM) will allow for households to have real-time feedback about their energy consumption and ultimately encourage people to reduce 'unnecessary and wasteful energy use' as was found by Hargreaves et al. (2013, p.132).

Combinations of interventions could be employed, as these have the potential to be the most effective, as they are able to address the different barriers to behaviour change (Steg and Vlek, 2009). In this way, combining all three interventions could provide positive results since reviews on interventions have indicated that interventions incorporating tailored information, goal setting and feedback are successful in reducing household energy use (Abrahamse et al., 2007). Indeed, in their study, Abrahamse et al. (2007) used a combination of tailored information, goal setting and feedback. After 5 months they found that households exposed to this combination of interventions saved 5.1% of energy, while the control group increased their energy used by 0.7%.

Chapter 5 discussed the fact that despite the potential that efficiency behaviours have to result in higher savings (than curtailment behaviours), they require an initial investment. This initial investment was then found to be the main barrier to efficiency behaviour adoption. As most of the interventions discussed above generally target the reduction of curtailment behaviours, policy efforts could aim towards employing more structural strategies. Thus a move from the actor (micro-scale) to the structure (macro-scale) side of climate change mitigation requires the scale and agency of decision-making to be shifted from the individual to the structure surrounding the individual. Indeed, structural limitations mean that even (bounded) rational agents are unable to make optimal decisions, which has implications for environmental policy design. This thesis focused on the agency perspective of energy saving behaviour adoption. However, by taking a more macro-scale

view of climate change mitigation reveals that, as pointed out in Appendix F, 'the social system and structures exist as a given reality and determine to a large extent the actions of individuals' (Ropke 2009, p.2491). Thus policy efforts could be targeted towards changing the contextual factors under which behaviours are carried out, and this could also be promoted in order to encourage the adoption of efficiency behaviours (Abrahamse et al., 2005). This could include initiatives where environment friendly technology (Steg and Vlek, 2009), ranging from energy efficient cars to boilers could be widely promoted to the public.

Focusing on home behaviours in particular, initiatives such as the Green Deal, could be widely promoted, as it helps householders install a variety of efficiency measures, most of which have been examined in this study. Indeed, the Green Deal Home Improvement Fund, which is a new incentive from the UK Government, is applicable from June 2014, and states: 'householders, landlords and tenants can claim back up to £7,600 towards energy efficiency improvements such as solid wall insulation, heating and glazing' (Department of Energy and Climate Change, 2014b). Thus, considering the money saving potential this deal offers, it should be advertised widely across the UK.

Focusing on transport behaviours, policy efforts could aim to make changes in infrastructure or pricing policies could be used (Steg, 2008). Stressing the importance of contextual factors on the adoption of certain behaviours, Steg and Vlek (2009) illustrated this by pointing out that 'one cannot travel by bus when no bus service is available' (p.312). Transport related structural interventions are being carried out in cities all around the world, aiming to reduce the extent of car use, with projects including the application of congestion charging in London, establishing car-free districts in New York City, and the organisation of car-free days in various cities around the world (Zipori and Cohen, 2014).

6.9.2 Tailored interventions

Abrahamse et al. (2007) pointed out that: 'by customising interventions to specific characteristics of target groups, the effectiveness of interventions in promoting energy conservation may be further enhanced' (p.274). Thus, target groups were identified, thereby allowing for the development of effective interventions to be customised to address the characteristics and barriers of each of these groups. Three target groups were identified through an examination of the literature. Their characteristics were then analysed on the basis of the data collected in this PhD on demographic characteristics of energy saving

behaviour adoption, perceptions of potential financial savings and willingness to do more for the environment: 1. Those who want to do more for the environment; 2. Those who make the biggest error in financial savings assessments; and 3. Those who save the least.

However, the demographic variables used in this study were only able to explain a relatively small part of the variance in the dependent variables. More specifically, demographic variables were able to explain only 10% of the variance of those who want to do more, 37% of those who make the biggest error regarding financial savings, and 37% of those who save the least energy. The demographic variables found to help predict the three target groups of this study include: age, household size, income, car ownership, North West, London and gender. These demographic variables are discussed below, along with how the general interventions could be tailored to the needs of each segment of the population. It is worth pointing out that the demographics that were not found to be significant in any of the models were education and home ownership. And yet both variables have been found to be related to pro-environmental and energy use behaviours (e.g. Sardianou, 2007).

Interventions for those willing to do more

The regression findings from this study found that two demographic factors influence willingness to do more for the environment: gender and number of people at home. More specifically, women and respondents from larger households (probably respondents with children more commonly) reported that they would like to do more for the environment.

Consistent with past research (e.g. Kollmuss and Agyeman, 2002), this study found women to be more likely to want to do more for the environment. Zelezny et al. (2000) carried out a review of the studies on gender differences regarding environmental attitudes and behaviours. From the 6 studies on environmental attitudes reviewed, 4 studies found that women expressed greater concern for the environment than men. The other two studies found no significant difference between men and women. Interestingly, as Zelezny et al. (2000) point out, no studies found men to express greater environmental concern than women. Women's willingness to do more for the environment can also be explained by the three environmental value orientations as proposed by Stern et al. (1993) and discussed in Chapter 4: egoistic, altruistic, and biospheric values. From their study on 349 students, Stern et al. (1993) found women to have stronger beliefs than men about the potentially harmful environmental consequences for themselves, others, other species or the biosphere. In attempting to explain why women have higher environmental values than

men, Whitmarsh (2011) pointed out that explanations include 'the role of socialisation, higher emotional content of environmental perceptions, increased ability to make connections between environmental conditions and one's values, and/or differences in power relations with, and trust in, risk producers and managers' (p.698).

Past studies have examined the effect of household size on energy behaviours and use (Sardianou, 2007) and have found the number of people at home to positively predict energy use. Indeed, past studies examining the effects of sociodemographic variables on household energy use, have found family size to be related to energy behaviour and use (Van Raaij and Verhallen, 1983). Sardianou (2007) carried out a study examining the effects of sociodemographic variables on household energy use in Greece and found a positive relationship between household size and decisions regarding energy saving behaviours. Consistent with these findings, this study examined willingness to protect the environment, and found it to be positively predicted by the number of people at home. Future research could examine whether willingness to protect the environment can positively predict willingness to reduce energy use.

Larger households were also found to be more likely to make bigger errors regarding potential savings across general behaviours, as well as to save the least regarding general behaviours. Additionally, this group (women with children) shows motivation to act and as Chapter 5 found, gender was able to predict the adoption of 3 out of 10 curtailment behaviours and 1 out of 11 efficiency behaviours. Therefore, this motivation does not seem to be directed towards the most effective behaviours. Consequently, the antecedent intervention of tailored information is important for this group as it may offer personalised and specifically tailored information this segment of the population requires, thus guiding the already existing motivation to act towards more effective behaviours. Additionally, goal setting could also be tailored to households with children. The use of goal setting could be used with the children of the family, as a way to get them involved in the energy saving process. Indeed, goal setting for children has been examined in laboratory and classroom settings, and it was found to be an effective motivational technique for children across a wide range of ages (Miller and Kelley, 1994). Involving the children in the goal setting process provides them with a framework around which they can get involved in the energy saving process.

Direct feedback could be also be tailored for this group. Similar to goal setting, the use of SEMs could be used to include the children of the family in the energy saving efforts. As

Hargreaves et al. (2010) found, concerning young children, the colours, dials and simple tick and cross symbols which can be included in the SEMs, display the information in a child friendly and easy format to understand. The older children in their study were motivated to engage with the energy saving efforts by allocating the value of the energy savings achieved, as displayed by the SEMs, as their pocket money (Hargreaves et al., 2010). Finally, structural strategies could also be used with this group, in order to encourage the adoption of efficiency behaviours. These have the potential to be applied successfully, given that Poortinga et al. (2003) found families to be relatively more accepting of efficiency measures compared to single individuals.

Once the variables able to predict this section of the population are found (in this case the demographic variables of women with children were used), the next step for designing tailored interventions involves determining the channels of communication in order to reach the audience. Targeted information has been used extensively in the field of health communication, with research pointing to it having resulting in the change of health related behaviours (e.g Rimer and Kreuter, 2006). For example, one study examined the impact tailored print materials plus tailored telephone counselling had on, among other things, the use of mammography (Rimer, et al., 2002). The information was tailored based on information from telephone interviews, regarding participants' relevant breast cancer risk factors, knowledge and perceived risk. The results of this study revealed that women who received tailored print materials plus tailored telephone counselling were 40% more likely to have had mammograms than those who did not receive the above. Thus, a similar campaign could be used to educate women on the need to reduce their energy use by stressing the link between energy use and climate change, given that this study found women to be more concerned about climate change than men, and emphasising the most effective options for those in large households, or pointing out the benefits of using feedback SEMs and the benefits involved in goal setting with children. Census data could be used to identify the potential audiences for such an intervention.

Interventions for those who save the least and make the biggest error

The regression findings from this study examined the sociodemographic variables that predict those who make the biggest error regarding potential financial savings and those who save the least. The results of these regressions indicate that these two groups were predicted by the same variables: car ownership and the region of London. More

specifically, those who own cars and those who do not live in London were found to make the biggest errors and save the least energy.[22]

The relationship[23] between car ownership and error regarding potential savings could be explained by the fact that the adoption of two car behaviours (purchase an efficient car and alter driving by) result in the highest savings across all behaviours examined in this study (see Fig. 5.7). However, as Chapter 5 found, the potential savings resulting from the adoption of these behaviours was grossly underestimated by participants. Furthermore, the relationship between saving the least overall and car ownership could be explained again by the findings of Chapter 5, which revealed that despite two car behaviours resulting in the highest savings across all behaviours examined in this study, these behaviours were not the most popular.

Tailored information could be provided to car owners with accurate information on actual savings. This could be applied particularly to the potential savings resulting from the behaviour 'avoid sudden acceleration and stops'. This is because the adoption of this behaviour costs nothing to adopt and yet has the potential to result in high financial savings. More specifically, this behaviour has the potential to result in the second highest savings across all behaviours, and yet was underestimated by a factor of 8. One further information strategy that could be used involves guidance on how to drive in a fuel efficient manner. For example, initiatives such as the EcoWill project could be promoted, which provides drivers with information and training on 'smarter and more fuel-efficient driving' which may result in a 20% reduction of consumption (EcoWill 2014). These interventions could be promoted at petrol stations, garages or at car dealerships, alongside car labelling, an EU initiative, aiming to help drivers choose new cars with low fuel consumption. This targeted approach involves displaying cars' fuel efficiency and CO2 emissions (European Commission, 2015). These interventions could encourage the purchase of an efficient car along with the altering of driving, which together could help people significantly reduce their energy use.

[22] The tailored interventions for those making the greatest errors and those using most energy have been combined. The reason for this is that regardless of the reasoning and motivations, they both results in the lowest energy savings, and are both predicted by the same variables. It is important to point out that the former may benefit more from informational interventions, with the latter requiring motivational and structural interventions. For this reason all types of interventions are provided for these two groups of people, as I consider both groups will benefit greatly from these.

[23] One further explanation of this relationship involves motivated reasoning (which would also explain the relationship between the errors made and the lack of energy saved) (see Druckman, J. N., & Bolsen, T., 2011. Framing, motivated reasoning, and opinions about emergent technologies. *Journal of Communication*, *61*(4), 659-688).

Furthermore, aiming to reduce the use of car use overall, several structural strategies could be employed to encourage this reduction. This is particularly important given that in the UK a quarter of all car journeys are under 2 miles (Mackett, 2000). One method which has been commonly used is to reduce car use by encouraging the use of public transport. This can be done by offsetting the affordability of owning a car with the use of indirect taxation (for example a 10% increase in fuel prices may result in a 1-3% reduction of car use) (Anable and Boardman, 2005). Efforts to encouragement people to reduce their car use and instead walking or cycling, is one further method that could be directed towards this group of people. Bicycles are being increasingly used for urban travelling in cities across Europe and North America (Zipori and Cohen, 2014). Thus, in an attempt to encourage the use of bicycles, dedicated bicycle lanes could be installed, along with cycle-share programmes. Efforts to encourage walking could involve the pedestrianisation of public spaces. This has been carried out in major cities around the world, including the Trafalgar Square in London and Times Square in New York City (Zipori and Cohen, 2014).

One further intervention that could be used for this group of high energy users involves feedback provision. The main reason this form of intervention could be successful for this group is that past research has found high energy users reduce their energy use as a result of feedback (Bittle et al., 1979, Abrahamse et al., 2005, Brandon and Lewis, 1999). Additionally, feedback provision allows individuals to monitor their energy consumed, and encourages them to reduce their energy use as it increases people's self-efficacy (Abrahamse et al., 2005). Abrahamse et al. (2005) supported this increase in self-efficacy by arguing that feedback provision increases people's perceived possibilities to save energy. Ultimately, as Grønhøj and Thøgersen (2011) argued, feedback 'empowers' people to save energy.

Focusing on car behaviours specifically, advances in technology have allowed for in-car feedback systems, which involve devices able to accurately measure and display fuel use (Barkenbus, 2010). To date, a number of car manufacturers (including Toyota and Honda) have already installed them on some of their models (e.g. Toyota Prius), with the purpose of these displays being to help car owners monitor their fuel consumption habits, thus allowing drivers to experience better fuel-economy (Barkenbus, 2010). Stressing the importance of such systems, a recent study examined the effect of in-car feedback in city buses in Helsinki, and found fuel consumption to be reduced by 3.8% on average (Innamaa, et al., 2013).

Interestingly, the region of London was negatively associated with overall errors made and saving the least amount of energy. This could be explained by the fact that London has the highest percentage of renters among English regions and Wales (Office for National Statistics 2013). More specifically, according to the Department for Transport (2013), across England and Wales, the average proportion of people living in rented accommodation is 35.7%. In London, however, this percentage is as high as 50.4%. Regarding car ownership, across the entire UK, London has the highest percentage of people without a car (44%), with the next highest region being the North East at 31%. Those with one car in London represent 39% of the population, which is also the lowest across the UK. Stressing the importance of car and home ownership for energy saving, Stern and Gardner (1981) argued that home and car ownership are critical determinates of energy efficiency behaviours, as they determine the behaviours people can adopt. Regarding home behaviours in particular, as Sardianou (2007) went on to argue, curtailment behaviours may be the only option for those who rent. Thus across the behaviours examined in this study, those from London were most likely not to be home and car owners and as such were more likely not to be high energy users. Regarding the error in savings, given that those from London are most likely to adopt curtailment behaviours, this could be explained by the fact that across curtailment behaviours, financial misconceptions were found to be low. This in turn would explain the negative relationship between residents of London and errors made regarding financial savings.

Looking into those who save the least and those who make the biggest error in more detail, the regression findings from this study found different sociodemographic variables to predict these factors across the three domains (general, car and home). The variables found to have predictive power were: age, number of people at home, and the region of North West).

Consistent with past research (e.g. Sardianou, 2007), this study found the age of respondents to be negatively associated with energy saving. Indeed, studies have found older people to be more likely to consume more energy (Ritchie et al., 1981, Brandon and Lewis, 1999, Sardianou, 2007, Lindén et al., 2006). Sardianou (2007) found age to be negatively associated with the number of energy saving behaviours people want to carry out. Pointing to a number of studies, Sardianou (2007) went on to point out the reasons older people not save energy: i) their housing is generally older with decayed insulation, (ii) their diminished physical ability does not allow for conservation

improvements, (iii) they tend to have fewer years of formal education and thus lack know-how, and (iv) they do not relate to the 'spend now to save later' philosophy (p.3782).

Smart meters with SEMs could also be used for this group in order to provide direct feedback. However, as the needs and abilities of older adults differ from those of younger ages, key features must be taken into account when designing such systems for this age group (Wagner et al., 2010, Nawaz et al., 2014). Following a review of the literature on the use of computers by older people, Wagner et al. (2010) concluded that when developing systems for older people, certain features should be taken into account: a) training should be provided in order to increase the user's self-efficacy regarding the use of the technology as this has been found to result in increased use of the technology; b) training should emphasise the benefits of using the technology as this has been found to be a key barrier amongst older people; and c) systems should be designed with the needs of older people taken into consideration. The training could take place during the energy audit when the tailored information is provided. Regarding the user interface, Nawaz et al. (2014) found elements such as the size of icons and the distinction of the foreground and backgrounds colours to be important when designing technologies for older people. Additionally, from the field of healthcare for older people, Nawaz et al. (2014) reported that participants suggested that reminders of the behaviours to be carried out were found to be useful. Thus, a reminder feature could be incorporated into the smart meters designed to encourage older people to curtail their everyday use of energy.

Income was also found to be positively associated with errors made regarding the potential financial savings. This means that the higher the income of the respondent, the larger the errors made. This finding could be explained by the fact that energy bills are a relatively small part of the income of higher income households. Linking income to energy use, Van Raaij and Verhallen (1983) pointed to a study by Newman and Day (1975, as cited by Van Raaij and Verhallen, 1983) which found lower income households to use less energy than higher income households, as they use it only for essentials. They went on to point out that higher income households use more energy for heating as their homes are larger and the cost of heating is a relatively small part of their income (Van Raaij and Verhallen, 1983). Thus, one possible explanation for larger errors made in high income households is a limited understanding of the saving potential of various behaviours (Gatersleben et al., 2002, Attari et al., 2010). This is supported by the underestimations of financial savings across the majority of the behaviours examined (see Chapter 5), as they were generally grossly underestimated by all respondents and always less than the actual savings.

Surprisingly, those from the North West were found to be more likely to make errors across the general behaviours, as well as saving the least across the general behaviours. Further research could try to explain the relationship between this region of the UK and the adoption of general behaviours.

6.10 CONCLUSION

Through a literature review this chapter initially examined the interventions (both antecedent and consequence) that could be applied in order to encourage the general public to reduce their energy consumption. A further examination of the potential audiences that could benefit the most from targeted interventions, revealed that certain sociodemographic variables were able to partially identify the groups of people that may respond most positively to targeted interventions: those who want to do more for the environment; those who save the least amount of energy; and those who make the biggest error regarding the potential financial savings.

These results have ramifications for developing future interventions. Chapter 5 revealed that not only are the most effective behaviours examined in this study not carried out, but money was found to play a key part in behaviour adoption and as a barrier to efficiency behaviour adoption. Therefore, general interventions and those directed towards target groups have the potential to guide people's efforts towards the most effective behaviours, while policy campaigns could promote structural strategies (such as the Green Deal) thus encouraging the adoption of efficiency behaviours.

Part E: Discussion and Conclusion

CHAPTER 7 – OVERALL DISCUSSION, RECOMMENDATIONS AND CONCLUSION

7.1 INTRODUCTION

In 1988 The New York Times published an article titled: 'Global Warming Has Begun, Expert Tells Senate' (Shabecoff, 1998). The expert this article was referring to was James Hansen, the first scientist to testify in front of the US Congress on the dangers of anthropogenic climate change as an issue which needs immediate action (Boykoff and Boykoff, 2004, Ungar, 1992). More specifically, the article stated that:

> Today Dr. James E. Hansen of the National Aeronautics and Space Administration told a Congressional committee that it was 99 percent certain that the warming trend was not a natural variation but was caused by a buildup of carbon dioxide and other artificial gases in the atmosphere (Shabecoff, 1988, p.1).

Twenty-six years have passed since that testimony, and yet despite growing scientific certainty regarding the anthropogenic nature of climate change (Doran and Zimmerman, 2009) a) the majority of the UK public question this certainty (Downing and Ballantyne, 2007), b) climate change mitigation, in the form of energy conservation behaviours, is carried out by a minority of the UK public (Whitmarsh, 2009a), c) despite reported growing awareness of climate change in the UK (Gallup, 2011), household and transport energy demand is rising (Oliver et al., 2013), and d) there is a decline in public concern about climate change (Spence et al., 2011).

The research reported in this thesis is based on an online study using a UK representative sample with 501 respondents, aiming to examine climate change beliefs and energy saving behaviours with an aim to encourage the reduction of end user energy consumption. The data were analysed mainly through quantitative methods, with the exception of one question analysed using content analysis, as explained in Chapter 2 (*Research Methodology*). This research examined people's beliefs about whether climate change is occurring and to what individuals attribute their beliefs (Chapter 3), the extent of and the factors influencing the adoption and non-adoption of behaviours that have the potential to help people reduce their energy consumption the most (Chapter 5). This is followed by a

review of interventions aimed to encourage households to reduce their energy consumption, along with an examination of the potential audiences that could benefit the most from targeted interventions (Chapter 6). Additionally, a framework that incorporates collective forms of efficacy and outcome expectancy that could be used to encourage behaviour change is operationalised and presented (Chapter 4). This in turn guided data collection towards examining the effect of efficacy beliefs on behaviour adoption (Chapter 5).

This chapter aims to summarise the key findings in relation to the nine research questions posed in Chapter 1, which in turn address the aims of this research. Their importance and possible similarities and divergence from past research are also discussed, along with the implications, possible future research that may arise from them and the limitations of this current study.

7.2 RESEARCH AIM ONE: TO UNDERSTAND PEOPLE'S BELIEFS ABOUT CLIMATE CHANGE AND THE KINDS OF 'EVIDENCE' PEOPLE USE TO JUSTIFY THESE BELIEFS

Public perceptions of climate change have the potential to form the basis for policy decisions regarding the transition towards low carbon societies (Engels et al., 2013). And yet, *despite the growing scientific consensus that mean global temperatures are rising and that human activity is the principal cause of the rise (Ding et al., 2011), the lay public is known to hold a range of beliefs about climate change.* Consistent with past research (e.g. Spence et al., 2011), the majority of the respondents reported a belief that climate change is happening (described in this thesis as *believers*), with a smaller proportion either denying climate change (described in this thesis as *deniers*) or being unsure it is happening. This study also explored how perceptions of the anthropogenic nature of climate change varied amongst believers and deniers. Unsurprisingly, perceptions of the causes of climate change were found to differ amongst the levels of climate change belief. The majority of believers pointed to anthropogenic causes, while the majority of deniers stated that they believe climate change to be mostly caused by non-human causes.

This research elucidated the differences in perceptions of climate change evidence between believers and deniers. The qualitative analysis of justifications for climate change beliefs, reported in Chapter 3 showed that public understanding of climate change is influenced by

exogenous factors (e.g. media communication, extreme weather events and perceptions of scientific consensus). Climate change believers are by far more likely to point to the changes in weather as a justification for belief. The credibility of evidence was used to back up their views when referring to scientific evidence and they correctly show an understanding of the scientific agreement among scientists about climate change. On the other hand, deniers are most likely to point to climate change being a natural phenomenon as a justification, thus denying not climate change, but anthropogenic climate change. They also show distrust in scientific evidence when referring to it and show little confidence in the scientific agreement among scientists about climate change. This suggests that the importance placed on these exogenous influences, along with their interpretation, differs based on one's beliefs.

The results of this study add to past research, which has found irrelevant environmental information affecting judgments (Li et al., 2011). Indeed, by far the most common justification for believing climate change is happening was weather: respondents mainly pointed to changing weather patterns occurring as a justification for climate change happening. This mirrors the association of weather with climate change, as has been found by previous research. However, given that observed weather changes can lead to systematic misunderstanding of climatic changes (Weber and Stern, 2011), this indicates that communication efforts should focus on educating people on the differences between weather and climate.

One of the key points of interest in this study was how perceptions of climate change evidence and of scientific agreement varied between believers and deniers. Indeed, a distrust of scientific evidence and doubt regarding the scientific agreement about climate change were reported by deniers, with the opposite being true for believers. Previous studies have also found this relationship (Ding et al., 2011), with those uncertain about climate change expressing perceptions of 'unreliable' evidence (Whitmarsh, 2011). This indicates that the public's perceptions of scientific agreement and trust in evidence and the scientific method play an important role in determining the public's climate change beliefs. This study showed the importance of these perceptions as, by using them as justification for belief or disbelief, it demonstrates their salience in people's minds. Thus, as belief that climate change is happening is high in the UK, communication efforts need to focus on people's misunderstanding of the scientific agreement regarding climate change. Additionally, better science education is needed to create trust and familiarity with the credibility of scientific evidence, while media education is required to highlight role of

constructed expert disagreement in climate change reporting, as was reported by Boykoff and Boykoff (2004).

The most common justification for not believing climate change is happening was that it is a natural process. This seems to indicate an association of climate change with anthropogenic climate change amongst deniers. Thus, denying that climate change is a human-caused problem was found to be the key component of denial, not denying the fact that the climate is changing. To some extent, this is understandable given that just over half of the UK public believe that experts still question whether human activity is contributing to climate change (Downing and Ballantyne, 2007).

The scientifically complex nature of climate change and the significant contribution human activity has on it may lead to people finding it difficult not to feel uncertain about human involvement in it (e.g. Weber, 2010). Stressing the importance of perceptions of scientific agreement, Ding et al. (2011) recently argued that 'people who believe that scientists disagree on global warming tend to feel less certain that global warming is occurring and show less support for climate policy' (p.462). If we are to encourage people to transition to low carbon lifestyles, it is important to design information campaigns that address these misperceptions. Indeed, in agreement with Ding et al. (2011), future campaigns should adopt a policy of repeating that 'the vast majority of climate scientists agree that human-caused global warming is happening' (p.465). Learning from public health communication, strategies that follow this repetition method of clear and simple messages have the potential to become familiar to people and ultimately perceived as true (Hornik, 2002, Ding et al., 2011).

However, it must be taken into account that health communication differs greatly from climate change communication, given that despite the scientific agreement that climate change is caused mainly by human activity, the public still demonstrates a high level of uncertainty (Zehr, 2000). Corner et al., (2012) recently carried out a study examining the effect reading materials can have on people's climate change scepticism, when these make opposing claims regarding the reality and seriousness of climate change. The results demonstrated that, as has already been established, 'individuals with opposing attitudes towards climate change assimilate novel, conflicting information about climate change in a biased way' (p.470). As a method to overcome this, Corner et al., (2012) point to Morton et al, (2010) who found that people were more likely to demonstrate stronger intentions to act in a pro-environmental way when uncertainty was used to point out that losses might

not happen if the desired action is taken. Thus, future research could examine climate change beliefs as a result of such a campaign, along with whether these behaviours are indeed carried out.

A potential limitation of the research reported in this thesis arises from the questionnaire's wording aimed at examining the levels of belief in climate change. Respondents indicated their levels of agreement about whether climate change is happening. However, this question did not specify whether this meant climate change as a natural phenomenon, climate change as an anthropogenic phenomenon, or climate change as a natural phenomenon which has increased as a result of human impact. As such, with the wording as it was, I labelled as deniers those who disagreed with the statement. However, the justifications provided for these beliefs found 'natural process' to be the most common justification why the 'deniers' did not think climate change is happening. This suggests that people may perceive the term 'climate change' as meaning 'anthropogenic climate change'. Whitmarsh (2009b) examined the variation in understanding between the terms 'climate change' and 'global warming', and found the former to be associated with natural causes and the latter associated with human causes. However, the difference in perceptions regarding human influence between believers and deniers was not examined. Therefore, future research could incorporate both terms and both meanings into their study, as 'deniers' may not necessarily be denying the existence of climate change as a natural phenomenon.

In summary, in relation to research aim 1, I have shown that the majority of the UK public believe that climate change is happening, with justifications for beliefs found to differ depending on belief. More specifically, believers based their belief on changing weather, and deniers pointed to the natural process involved. Furthermore, believers were found to report a trust in scientific evidence and confidence regarding the scientific agreement about climate change, with deniers reporting the contrary.

These main findings lead to practical aspects of communication implication. Climate change beliefs and attitudes are hypothesised to be important for the transition to a more sustainable society. Thus, understanding these profiles *could be important for policy and communication interventions, and information campaigns, as targeted information could be provided in an attempt to stress the difference between climate and weather and to clarify the widespread scientific agreement and the validity of the evidence gathered.*

7.3 RESEARCH AIM TWO: TO EXAMINE THE ENERGY SAVING BEHAVIOURS CURRENTLY CARRIED OUT AND THE DETERMINANTS OF THESE

Unsustainable behaviours at individual and global scales are leading to changes in the conditions of the Earth, one of which is climate change. And yet, *studies reveal that household and transport energy demand is rising (Oliver et al., 2013), and energy conservation behaviours are carried out by only a minority of the public (Whitmarsh, 2009a).* According to the findings of this research, people are not carrying out the most effective of the Gardner and Stern (2008) short list of behaviours, neither environmentally nor financially. Yet, the results showed that just over half of the respondents (55%) claim to take action out of concern for climate change. Overall, this suggests that, despite the effort people state they are taking to cut down on the use of gas and electricity at home (DEFRA, 2009), people are not reducing their CO_2 emissions as much as they could and they are not saving the money they potentially could. Therefore, given the potential for further end-user energy demand reduction for reducing our current CO_2 emissions, communication efforts to encourage behaviour change should emphasise the most effective behaviours. The potential savings from each could also be communicated given that this research found respondents to have *relatively little knowledge regarding the potential savings of different efficiency and curtailment behaviours.*

The analysis conducted under research aim 2 compared perceptions of financial savings and actual financial savings. The results showed that despite money being identified as the key motivation of behaviour adoption, consistent with past research (Attari et al., 2010), this research has found *that the respondents of this study exhibited relatively little knowledge regarding the potential savings of different efficiency and curtailment behaviours*. In particular, I found slight overestimations where the savings were low and gross underestimations when the potential savings were high. This relationship was the same, regardless of whether the behaviour was carried out or not, with perceived savings slightly higher when the behaviour was carried out. These findings and previous studies (Attari et al., 2010, Kempton et al., 1985) highlight the need for clarifying the actual financial savings as, considering financial savings to be the key motivation, this may encourage energy adoption. Future research could examine the effect the provision of information on potential financial savings has on behaviour adoption.

Considering the great potential for energy savings when adopting the 21 behaviours examined, communication and policy efforts should focus on encouraging people to carry

these out. Indeed, as Gardner and Stern (2008) pointed out: 'The failures of past communication campaigns for energy conservation and the failures and successes of public health communication show that it is much more effective to focus campaigns on a very small number of specific actions that can make a real difference and disseminate the message repeatedly through multiple media outlets, using sources that are credible to target audiences' (p.16). Thus, given the energy reducing potential of the Gardner and Stern (2008) *short list* of behaviours, campaigns could be targeted across multiple outlets towards promoting the adoption of these specific behaviours.

One key finding of this chapter was the revelation of the motivations and barriers to each of these behaviours. Motivations were examined for the behaviours carried out and the barriers were examined for the behaviours not carried out. More specifically, financial savings were found to be the key motivator for both efficiency and curtailment behaviours. Thus efforts could be made to promote the potential savings from behaviour adoption for both types of behaviours. On the other hand, barriers differed according to behaviour type. Not knowing whether it matters was the main barrier for curtailment behaviours. Information provision could address the immediate potential savings from the repeated adoption of curtailment behaviours. The high financial cost was the key barrier to efficiency behaviours. For example, as the majority of household energy use is for heating (Department of Energy and Climate Change, 2011), this finding supports the need for financial incentives for home efficiency behaviours since these have the potential to help reduce energy use significantly.

Overall, efficiency and curtailment behaviours differ with respect to the initial investment, the subsequent effort required and the potential savings. These differences are reflected in the corresponding perceived motivations and barriers to their behaviour adoption. Indeed, both behaviours have the potential in resulting in financial savings, albeit much higher for efficiency behaviours. Therefore, future policies to promote behaviour adoption should concentrate on alleviating the barriers to each behaviour type beginning with the most effective behaviours; removing the financial barrier for efficiency behaviours, and making people feel the adoption of curtailment behaviours is worthwhile. Additionally, given that money is the key motivation for both behaviour types and given the financial misconceptions found, these policies could also promote the potential financial savings both types of behaviours can result in.

Past studies have found that people are more likely to carry out sustainable behaviours when they believe climate change is happening (e.g. Joireman et al., 2010, Heath and Gifford, 2006). *However, these studies examined the relationship between climate change belief and intention to act, rather than actual behaviours.* In this study, this factor was not found to influence the energy saving behaviours examined. Respondents were asked if they carried out the 21 energy saving behaviours as proposed by Gardner and Stern (2008), with all respondents answering the 9 general behaviours and home owners and car owners answering additional home or car behaviour questions respectively. The 21 regression analyses carried out for each of the 21 behaviours examining the factors influencing behaviour adoption indicate that belief in climate change only had a minor influence on 2 home behaviours. These results imply that home and transport energy saving behaviours are largely carried out independently of one's beliefs in climate change. This result could be explained by the fact that the individual goal of saving money was found to be the key motivation for behaviour adoption, rather than the collective goal of helping the environment. Due to the perceived financial benefits from the adoption of energy saving behaviours, these are not perceived to be linked to saving the environment. Thus, this could explain why belief was found to play no part in behaviour adoption. Given the weak link this study found between climate change beliefs and behaviour adoption perhaps future communication campaigns could focus less on the existence of climate change when encouraging people to change their behaviours in order to ultimately reduce their energy use (Engels et al., 2013).

One of the key points of interest in this research has been the role of efficacy and outcome expectations in influencing energy saving behaviours. Previous studies identify self-efficacy (examined as part of the Theory of Planned Behaviour and labelled as perceived behavioural control) as a major influence on people's intention to perform pro-environmental behaviours (De Groot and Steg, 2007, Heath and Gifford, 2002, Kaiser et al., 2005). However, to the best of my knowledge, no studies to date have examined perceptions of the five forms of efficacy and outcome expectancy (as explained in Chapter 4) for individual energy saving behaviours in the UK. Focusing on these two psychological constructs, *which have been found to have practical applications in predicting and influencing long-term behaviour change, creates an original approach to understanding the key influences for energy saving behaviours*. The 21 regression analyses conducted here indicate that perceptions of self-efficacy are the strongest influence on both general and car behaviours (not home behaviours), across all the factors examined. This finding

suggests that communication campaigns should focus on increasing people's perceptions of confidence to carry out these behaviours.

Indeed, policy and communication efforts that increase people's perceived self-efficacy could be quite beneficial. Chapter 4 discussed the four main influences on self-efficacy (*enactive mastery experience*, *vicarious experience*, *verbal persuasion*, and *physiological state)* (Bandura, 1977), while Chapter 6 discussed the effect of interventions on increasing one's self efficacy using these four influences. *The results revealed a statistically significant increase in participants' self-efficacy and confidence in adopting each of the behaviours. This suggests that tailored information campaigns could include such a strategy when encouraging behaviour adoption.* Indeed, not limiting themselves to pointing out the behaviours to adopt, they could go through the above steps and ensure people feel self-efficacious about each of the behaviours they are encouraged to adopt. However, experimental research is needed to shed more light on the effect of these interventions on the adoption of energy saving behaviours and to examine how these could be applied on a national level.

Interestingly however, SE did not predict any of the home behaviours. This finding does lead to further questions which cannot be answered based on the data collected. Other variables that were not included in this study could help to answer this question (e.g. perceived monetary investments for home behaviours). This seems reasonable considering the large investment required, indicating that further research into people's perceptions of financial investments into energy efficiency is required to explore this further.

Moving on to personal outcome expectancy, this was found to have limited effect on energy saving behaviours. This finding is contrary to expectations and previous findings (Lubell, 2002, Heath and Gifford, 2006). This was also the case for outcome expectancy. Regarding personal outcome expectancy, this could be explained by the fact that individual behaviours, carried out independently, do not have the potential to have a noticeable impact on climate change mitigation. This provides an answer to Kerr's (1996) article titled 'Does My Contribution Really Matter?' Indeed, these results show that people perceive the low impact of their individual behaviours and as such communication efforts should aim to increase low perceptions of personal outcome expectancy, especially for curtailment behaviours where the main barrier cited was not knowing whether it matters (Lorenzoni, Nicholson-Cole, and Whitmarsh, 2007; Semenza, et al., 2008). Regarding outcome expectancy, this is an interesting finding considering almost all behaviours were

carried out for financial reasons. However, given the financial misperceptions presented in Chapter 6, people are not aware of how much money they could actually save. Further research could investigate whether perceptions of outcome expectancy increase when people are provided with accurate information of potential savings.

It is also interesting to note the relationship between the collective forms of efficacy and outcome expectancy on energy saving behaviour adoption since climate change is a collective problem. The few studies that have used these constructs have done so examining them in the context of general environmental behaviours (Bonniface and Henley, 2008, Lam, 2006) and as such their influence on individual energy saving behaviours is unknown. My regression analyses reveal that they also have a limited effect on energy saving behaviours. However, unlike personal outcome expectancy, both were found to have a negative relationship with behaviour adoption. Thus, increased beliefs of most people being able to carry out the behaviour (collective efficacy) and increased beliefs that if most people carry out the behaviour it will contribute enough environmentally to make it worth it (collective outcome expectancy) as both lead to decreased behaviour adoption.

Regarding collective efficacy and collective outcome expectancy, this negative relationship may result from the social dilemma nature of pro-environmental behaviours. As discussed in Chapter 4, *the two possible effects of individual decisions to cooperate in social dilemma situations are: (a) the 'free-rider' effect, and (b) the 'avoid being a sucker effect'* (Dawes, 1980, Koletsou and Mancy, 2011). The first involves high levels of trust in others cooperation and as such, *believe they can defect without significantly hurting others*. The second involves low trust in others and as such *believe they should also defect so as to avoid incurring costs with limited or no gain*. One study found perceptions of collective efficacy to be low amongst environmental activists and non-activists, as they did not trust others to carry out waste-minimizing behaviours due to selfishness and greed (Bonniface and Henley, 2008). Thus with trust having been found to be an important construct in cooperative behaviours for social dilemma situations (Dawes, 1980, De Cremer et al., 2001, Van Vugt, 2009), strategies could be employed to make people's energy use more public. For example electricity companies could include information about neighbours' energy use in customers' statements.

Moving onto other factors affecting behaviour adoption, consistent with other studies which found saving money as being the main motivator for behaviours carried out (e.g.

DEFRA, 2002, Whitmarsh, 2009a), perceived money saved was the second most salient predictor ranging over general, home and car behaviours. This finding reflects the importance placed on saving money and what the drivers of energy saving behaviours are. These findings suggest that home and transport energy saving behaviours could be viewed separately to climate change and as such, they are carried out with an individual goal in mind (saving money) rather than the collective one of saving the environment.

In summary, in relation to research aim 2, I have shown that the UK public does not carry out the most effective of the 21 Gardner and Stern (2008) energy saving behaviours. Additionally, despite the majority of the public stating that they believe climate change is happening and that they take action out of concern for climate change, neither of these two factors was found to be related to the adoption of the behaviours examined (Gardner and Stern, 2008). *However, despite money being found to be the key motivator for behaviour adoption, the behaviours carried out do not correspond to the ones that are the most effective for saving money, nor those perceived to be the most effective. This could be due to misunderstandings of the effectiveness of behaviours.* Furthermore, the findings indicate that self-efficacy is associated with behaviour adoption.

These main findings lead to practical aspects of communication implication. *End-user energy demand reduction is the only viable short-term strategy for reducing our current CO_2 emissions.* Therefore, a transition to a low carbon society has the potential to be achieved by communication and policy campaigns increasing self-efficacy perceptions and awareness of actual money saved.

7.4 RESEARCH AIM THREE: TO IDENTIFY THOSE WHO WOULD BENEFIT THE MOST FROM TARGETED INTERVENTIONS

This study explored whether willingness to save energy translates into saving energy. No statistically significant relationship was found in the correlation between willingness to conserve energy and the actual energy saved. This is perhaps unsurprising because, as past research has shown, there is a divergence in the recommended behaviours by policy makers and those actually carried out by the public (e.g. Whitmarsh, 2009a). Overall, this suggests that willingness to save energy does not necessarily translate into energy saving behaviours. One possible explanation for this is the lack of knowledge over the most effective behaviours at reducing one's energy use (e.g., Baird and Brier, 1981;

Gatersleben, 2000). This is supported by the underestimations of financial savings across the majority of the behaviours examined.

The regression analyses carried out indicate that we can identify target groups based on sociodemographic factors and that this warrants a varied approach to interventions. A key point regarding tailoring interventions to target groups is to identify the groups of people that may respond most positively to these interventions. These groups were initially identified by a review of the literature. This was followed by an analysis of the data collected on willingness to do more for the environment and on the adoption and non-adoption of the 21 *short list* behaviours as proposed by Gardner and Stern (2008). As the statistics presented from this study have shown, those who want to do more for the environment are more likely to be women with children, while car owners and those not from London are more likely to save the least amount of energy and make the largest error regarding overall potential energy savings. Taking these sociodemographic characteristics into consideration, interventions catering to the needs of each group were presented in Chapter 6.

In summary, in relation to research aim 3, through a literature review I have examined interventions that could be applied to the general public in order to encourage them to reduce their energy consumption. These include the use of tailored information, goals and direct feedback through the use of smart meters. Subsequently, through an examination of the potential audiences that could benefit the most from targeted interventions, I found certain sociodemographic variables able to partially identify the groups of people that may respond most positively to targeted interventions; those who want to do more for the environment, those who save the least amount of energy, and those who make the biggest error regarding the potential financial savings.

An important recommendation for future initiatives is to ensure interventions are targeted at the needs of the target audience. More specifically, interventions should address the motivation of women with children who were found to want to do more for the environment. Additionally, interventions should target car owners as they have the highest potential to save energy (Abrahamse et al., 2005). Thus, the results from this study indicate that determining the profile of the target audiences by gathering information on which needs require to be addressed may have the potential to increase the likelihood of behaviour change. Moreover, despite the high potential that the adoption of efficiency behaviours may result in, they require an initial investment, which was then found to be the

main barrier to the adoption of these behaviours. *Thus, structural strategies could also be promoted* (such as the Green Deal)*, in order to encourage the adoption of efficiency behaviours.*

7.5 LIMITATIONS OF THIS STUDY

This study has offered several contributions to this field of research through an analysis of three different aspects of climate change beliefs and behaviours. More specifically: i) it has revealed that justifications on climate change beliefs differ depending on belief, ii) it has demonstrated that there is little association between belief in climate change and the adoption of climate change mitigation behaviours, and iii) it has reviewed and presented general interventions aimed to all, and tailored interventions aimed to specific audiences in order to encourage households to reduce their energy consumption.

However, there are a number of limitations. The main limitation of this study is that it relied on self-reporting of behaviours. *Self-reporting is commonly used for the examination of household energy consumption (e.g. Whitmarsh, 2009a), while some studies have used energy readings (e.g. Poortinga et al., 2004) and others have examined this based on the possession and use of household appliances (e.g. Gatersleben et al., 2002). However, as Olsen (1981) argued, self-reported behaviours may not necessarily reflect the actual behaviours carried out, as these reflect people's perceptions of their behaviours, rather than the behaviour itself. For example, Olsen (1981) pointed to a study carried out by Milstein (1978) which found that 'the actual temperature in the homes studied was on the average about 4^{o}F higher than what the respondents gave as their thermostat setting' (p. 121). And yet, other studies have found a high correlations between estimated and actual gas and energy use (Gatersleben et al., 2002).* Future research can use more objective measures of behaviour, such as energy readings, or the monitoring of smart meters, which can allow for the examination of 100% of a household's electricity use.

One further limitation to this study was the wording of the question used to assess people's perceptions of the CO_2 saved from the adoption of each behaviour. [...]. However, my results showed that respondents did not fully understand the question as the sum of percentage reductions across most respondents' answers exceeded 100%. Future research could examine people's understandings of the CO_2 emissions saved for each behaviour,

possibly by using a pie chart or a slider, but making clearer that the maximum they can save is indeed 100% of their own emissions.

The results regarding motivations and barriers to energy saving behaviour adoption are not based on theoretical explanations. More specifically, given that self-efficacy was found to be the key predictor for behaviour adoption, future research could examine self-efficacy barriers, in order to elicit whether people don't believe it matters or would be effective for environmental protection.

Finally, one limitation of this study is that behaviour adoption and subsequent analysis relied on the *short list* of energy saving behaviours as proposed by Garner and Stern (2008). This list was published 8 years ago, and was designed for a US audience. Thus, the use of a list which catered to a UK audience could have provided different results.

7.6 CONCLUDING COMMENT

The majority of the UK public (75%) believe climate change is occurring, but many (17%) still believe it is mostly due to natural causes. Most people justify their belief based on their experience of weather and appear to confuse weather with climate. Nonetheless, belief in climate change or its anthropogenic causes have limited relationship with behaviour adoption, for which financial savings emerge as the strongest predictor. Knowledge about the relative effectiveness of different behaviours is extremely weak and the most effective behaviours are underestimated by (up to 8 times less). Those saving the least are car owners. Demographic variables explained 37% of overall energy saving, suggesting that a general strategy that communicates with the full population, while specifically addressing the barriers and concerns of households with women and children, older people, those with high incomes and car owners would be a good approach. This should focus on clear identification of financial savings associated with behaviours and raising self-efficacy through barrier elimination, perhaps through vicarious experience (such as using stories and examples of those who have already successfully adopted the behaviours).

Part E: References & Appendices

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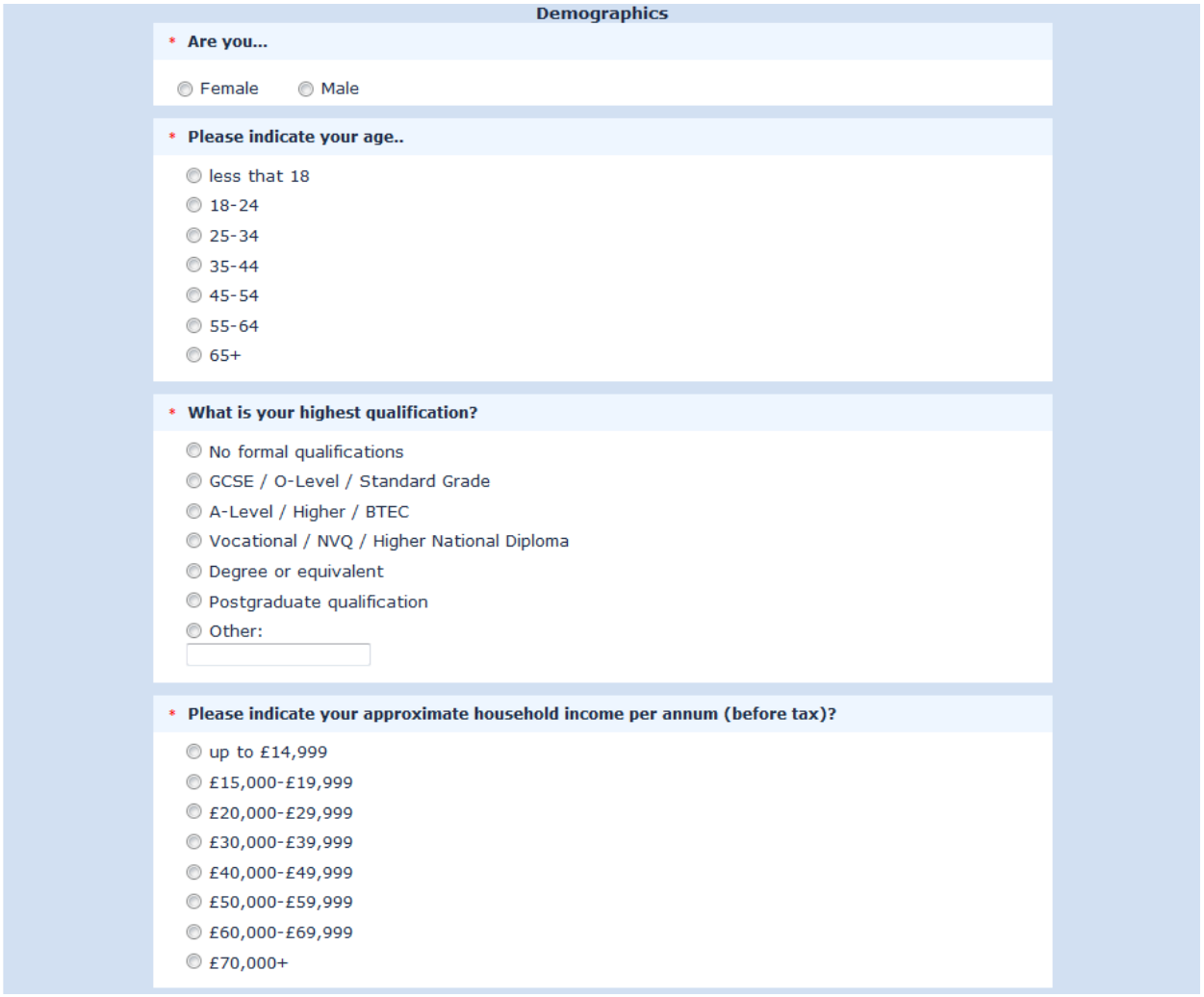
9 Appendices

9.1 APPENDIX A - Questionnaire used for study



Demographics

* **Are you...**

○ Female ○ Male

* **Please indicate your age..**

○ less that 18
○ 18-24
○ 25-34
○ 35-44
○ 45-54
○ 55-64
○ 65+

* **What is your highest qualification?**

○ No formal qualifications
○ GCSE / O-Level / Standard Grade
○ A-Level / Higher / BTEC
○ Vocational / NVQ / Higher National Diploma
○ Degree or equivalent
○ Postgraduate qualification
○ Other:

* **Please indicate your approximate household income per annum (before tax)?**

○ up to £14,999
○ £15,000-£19,999
○ £20,000-£29,999
○ £30,000-£39,999
○ £40,000-£49,999
○ £50,000-£59,999
○ £60,000-£69,999
○ £70,000+

* How many days a week do you travel to a place of...

	0	1	2	3	4	5 or more
work	○	○	○	○	○	○
study	○	○	○	○	○	○

* What is the postcode of your home and main job or course of study?

Please provide just the 1st part of the postcode followed by the number in the second part (e.g. NW11 6_ _).

If you don't have a work or study postcode type 000000

	postcodes
home	
work	
study	

* How do you usually travel to your main place of work or study (including school)? Check any that apply

- ☐ walk
- ☐ drive
- ☐ cycle
- ☐ bus
- ☐ train
- ☐ taxi
- ☐ motorcycle
- ☐ carpool

Other:

* How do you usually travel to your main place of work or study (including school)? Check any that apply

- ☐ walk
- ☐ drive
- ☐ cycle
- ☐ bus
- ☐ train
- ☐ taxi
- ☐ motorcycle
- ☐ carpool

Other:

* Which region of the UK do you live in?

Please choose...

* Do you own your main home?

- ○ Yes
- ○ No

* Do you own or take responsibility for the upkeep of one or more cars?

- ○ Yes
- ○ No

Demographics 2

* **How many people live in your household, including yourself?**

* **How many flights have you taken in the last 12 months (counting as one flight outward, return and any transfers)?**

Only numbers may be entered in these fields

within the UK

outside the UK

* **Are your home bills monthly or quarterly?**

- (•) Monthly
- ( ) Quarterly
- ( ) I do not pay the bills

* **How much do you spend monthly on ... ?**

	winter (£)	summer (£)
electricity		
gas		
transport		

Environment

* **Which of the following statements best describes your beliefs about whether climate change is occurring?**

- ( ) I am certain or almost certain it is happening
- ( ) I tend to believe it is happening
- ( ) I am unsure if it is happening
- ( ) I tend to believe it is not happening
- ( ) I am certain or almost certain it is not happening

* **Why have you selected your answer above?**

* **Position the slider to indicate whether you believe climate change is caused mostly by humans or mostly by other causes.**

All human caused — 5 — All non-human

0 10

* **Position the slider to indicate the relative contribution to climate change of industry vs. households.**

All from industry — 5 — All from households

0 10

* **Position the slider to indicate the proportion of household emissions that can be attributed to home consumption vs. transport:**

1. **Home consumption - electricity, natural gas, and heating oil that is used for the house**
2. **Transport - car, train, bus, air travel**

5

Home consumption — Transport

0 — 10

* **To what extent do you agree with the statement: "Humans are capable of finding ways to overcome the world's environmental problems"?**

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree

* **To what extent do you agree with the statement: "My lifestyle contributes to climate change"?**

- Strongly agree
- Agree
- Unsure
- Disagree
- Strongly disagree

* **Have you taken, or do you regularly take, any action out of concern for climate change?**

- Yes
- No
- Don't know

* **Which of these best describes how you feel about your current lifestyle and the environment?**

- I'd like to do **a lot more** to help the environment
- I'd like to **continue** with what I'm doing at the moment
- I'd like to do **a bit more** to help the environment
- Don't know

* **To what extent do you agree with the statements: "Climate change is a big problem for..."**

	Strongly agree	Agree	Unsure	Disagree	Strongly disagree
Planet Earth					
Humanity					

* **How likely would you be to make an effort to reduce your carbon emissions if ...?**

	Extremely likely	Very likely	Maybe, maybe not	Very unlikely	Extremely unlikely
... you thought **most people were** making an effort					
... you thought **most people weren't** making an effort					
... you thought most of **your friends were** making an effort					
... you thought most of **your friends weren't** making an effort					

* **Consider the different areas where environmental problems could have harmful consequences, and for each please rate how concerned you are about their impact.**

	Not at all concerned 1	2	3	4	5	6	Extremely concerned 7
marine life							
future generations							
your health							
plants							
people in the UK							
your future							
animals							
the human race							
your lifestyle							
birds							
people in your community							
your prosperity							

*

	Very high confidence 9 out of 10	High confidence 8 out of 10	Medium confidence 5 out of 10	Low confidence 2 out of 10	Very low confidence 1 out of 10
How confident do you think scientists are regarding climate predictions?					
How confident should we be about scientific predictions about climate change before making recommendations to the public that affect their lifestyle?					
How confident do you think scientists are about the link between carbon emissions and climate change?					

Home Behaviours

*** Have you done these?**

Loft insulation and ventilation	Please choose...
A more efficient central heating boiler (92% efficient, e.g. condensing boiler)	Please choose...
Double or triple glaze windows	Please choose...
Draught proofing of home	Please choose...
An A+ Rated Fridge Freezer, in place of a lower rated one bought between 1993 and 2000	Please choose...
An AAA rated washing machine to replace an old model	Please choose...

Please choose...
installed or upgraded
chosen property with
not done this

*** Please select the MAIN reason (or two main reasons) for your choice**

	MAIN reason	Secondary reason
Loft insulation and ventilation	Please choose...	Please choose...
Install a more efficient central heating boiler (92% efficient, e.g. condensing boiler)	Please choose...	Please choose...
Double or triple glaze windows	Please choose...	Please choose...
Draught proofing your home	Please choose...	Please choose...
An A+ Rated Fridge Freezer, in place of a lower rated one bought between 1993 and 2000	Please choose...	Please choose...
An AAA rated washing machine to replace an old model	Please choose...	Please choose...

*** Indicate how much money you believe <u>you</u> save (or would save) per year by doing these.**

	£0	£1-£5	£5-£10	£10-£20	£20-£40	£40-£80	£80-£160	£160-£320	£320-£640
Install/upgrade loft insulation and ventilation	○	○	○	○	○	○	○	○	○
Install a more efficient central heating boiler (92% efficient, e.g. condensing boiler)	○	○	○	○	○	○	○	○	○
Replace single glazing with double or triple glaze windows	○	○	○	○	○	○	○	○	○
Draught proof your home	○	○	○	○	○	○	○	○	○
Replace a Fridge Freezer unit bought between 1993 and 2000 with a new A+ Rated Fridge Freezer	○	○	○	○	○	○	○	○	○
Replace an old washing machine with an AAA rated model	○	○	○	○	○	○	○	○	○

*** Indicate how much you believe you reduce (or would reduce) <u>your</u> total CO2 emissions per year by doing these.**

	0%	1-2%	2-5%	5-10%	10-20%	20-50%	50-100%
Install/upgrade loft insulation and ventilation	○	○	○	○	○	○	○
Install a more efficient central heating boiler (92% efficient, e.g. condensing boiler)	○	○	○	○	○	○	○
Replace single glazing with double or triple glaze windows	○	○	○	○	○	○	○
Draught proof your home	○	○	○	○	○	○	○
Replace a Fridge Freezer unit bought between 1993 and 2000 with a new A+ Rated Fridge Freezer	○	○	○	○	○	○	○
Replace an old washing machine with an AAA rated model	○	○	○	○	○	○	○

Car Behaviours

* **Do you do these?**

	Yes	No
Service your car regularly	○	○
Buy tyres that lessen resistance	○	○
Maintain correct tyre pressure	○	○
Use a more efficient car (30.7 MPG* vs. 20 MPG) – *Miles Per Gallon	○	○

* **How often do you do these?**

Drive to avoid sudden acceleration and stops	Please choose...
Combine errand trips to halve current mileage / car use	Please choose...

* **Please select the MAIN reason (or two main reasons) for your choice.**

	MAIN reason	Secondary reason
Service your car regularly	Please choose...	Please choose...
Buy tyres that lessen resistance	Please choose...	Please choose...
Maintain correct tyre pressure	Please choose...	Please choose...
Use a more efficient car (30.7 MPG* vs. 20 MPG)	Please choose...	Please choose...
Drive to avoid sudden acceleration and stops	Please choose...	Please choose...
Combine errand trips to halve current mileage / car use	Please choose...	Please choose...

* **Indicate how much money you believe <u>you</u> save (or would save) per year by doing these.**

	£0	£1- £5	£5-£10	£10-£20	£20-£40	£40-£80	£80-£160	£160-£320	£320-£640
Service your car regularly, get frequent tune-ups, including air filter changes	○	○	○	○	○	○	○	○	○
Buy tyres that lessen resistance	○	○	○	○	○	○	○	○	○
Maintain correct tyre pressure	○	○	○	○	○	○	○	○	○
Use a more efficient car (30.7 MPG vs. 20 MPG)	○	○	○	○	○	○	○	○	○
Drive to avoid sudden acceleration and stops	○	○	○	○	○	○	○	○	○
Combine errand trips to halve current mileage / car use	○	○	○	○	○	○	○	○	○

* **Indicate how much you believe <u>you</u> reduce (or would reduce) your total CO2 emissions per year by doing these.**

	0%	1-2%	2-5%	5-10%	10-20%	20-50%	50-100%
Service your car regularly, get frequent tune-ups, including air filter changes	○	○	○	○	○	○	○
Buy tyres that lessen resistance	○	○	○	○	○	○	○
Maintain correct tyre pressure	○	○	○	○	○	○	○
Use a more efficient car (30.7 MPG vs. 20 MPG)	○	○	○	○	○	○	○
Drive to avoid sudden acceleration and stops	○	○	○	○	○	○	○
Combine errand trips to halve current mileage / car use	○	○	○	○	○	○	○

General Behaviours

* **Do you do these?**

	Yes	No
Use 85% bright compact fluorescent or LED bulbs instead of incandescent bulbs	○	○
Try to minimise flights **within** the UK	○	○
Try to minimise flights **outside** the UK	○	○

* **How often do you do these?**

Carpool to work with one other person	Please choose...
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	Please choose...
Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F)	Please choose...
Recycle paper, glass, and plastic	Please choose...
Reduce standby use of electricity by appliances and electronics by 90%	Please choose...
Wash clothes at 30°C instead of 40°C	Please choose...
Do not use clothes (tumble) dryer for 5 months of the year	Please choose...
Wait until there is a full load for washing	Please choose...

* **Please select the MAIN reason (or main two reasons) for your choice**

	MAIN reason	Secondary reason
Use 85% bright compact fluorescent or LED bulbs instead of incandescent bulbs	Please choose...	Please choose...
Try to minimise flights **within** the UK	Please choose...	Please choose...
Try to minimise flights **outside** the UK	Please choose...	Please choose...
Carpool to work with one other person	Please choose...	Please choose...
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	Please choose...	Please choose...
Turn down water heater thermostat from 60oC to 49oC (140°F to 120°F)	Please choose...	Please choose...
Recycle paper, glass, and plastic	Please choose...	Please choose...
Reduce standby use of electricity by appliances and electronics by 90%	Please choose...	Please choose...
Wash clothes at 30°C instead of 40°C	Please choose...	Please choose...
Do not use clothes (tumble) dryer for 5 months of the year	Please choose...	Please choose...
Wait until there is a full load for washing	Please choose...	Please choose...

* **Indicate how much money you believe you save (or would save) per year by doing these.**

	£0	£1-£5	£5-£10	£10-£20	£20-£40	£40-£80	£80-£160	£160-£320	£320-£640
Use 85% bright compact fluorescent or LED bulbs instead of incandescent bulbs	○	○	○	○	○	○	○	○	○
Carpool to work with one other person	○	○	○	○	○	○	○	○	○
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	○	○	○	○	○	○	○	○	○
Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F)	○	○	○	○	○	○	○	○	○
Recycle paper, glass, and plastic	○	○	○	○	○	○	○	○	○
Reduce standby use of electricity by appliances and electronics by 90%	○	○	○	○	○	○	○	○	○
Wash clothes at 30°C instead of 40°C	○	○	○	○	○	○	○	○	○
Do not use clothes (tumble) dryer for 5 months of the year	○	○	○	○	○	○	○	○	○
Wait until there is a full load for washing	○	○	○	○	○	○	○	○	○
Completely avoid flying within the UK	○	○	○	○	○	○	○	○	○
Completely avoid flying outside the UK	○	○	○	○	○	○	○	○	○

* **Indicate how much you believe you reduce (or would reduce) your total CO2 emissions per year by doing these.**

	0%	1-2%	2-5%	5-10%	10-20%	20-50%	50-100%
Use 85% bright compact fluorescent or LED bulbs instead of incandescent bulbs	○	○	○	○	○	○	○
Carpool to work with one other person	○	○	○	○	○	○	○
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night	○	○	○	○	○	○	○
Turn down water heater thermostat from 60°C to 49°C	○	○	○	○	○	○	○
Recycle paper, glass, and plastic	○	○	○	○	○	○	○
Reduce standby use of electricity by appliances and electronics by 90%	○	○	○	○	○	○	○
Wash clothes at 30°C instead of 40°C	○	○	○	○	○	○	○
Do not use clothes (tumble) dryer for 5 months of the year	○	○	○	○	○	○	○
Wait until there is a full load for washing	○	○	○	○	○	○	○
Completely avoid flying inside the UK	○	○	○	○	○	○	○
Completely avoid flying outside the UK	○	○	○	○	○	○	○

0% 100%

SE&CE

Please rate your degree of confidence from 0 (no confidence) to 50 (moderately confident) to 100 (high confidence).

*

	I am able to do this	Most car owners will be able to do this
Service car regularly	Please choose...	Please choose...
Buy tyres that lessen resistance	Please choose...	Please choose...
Maintain correct tyre pressure	Please choose...	Please choose...
Use a more energy efficient car	Please choose...	Please choose...
Drive to avoid sudden acceleration and stops	Please choose...	Please choose...
Combine errand trips to halve current mileage/car use	Please choose...	Please choose...

*

	I am able to do this	Most home owners will be able to do this
Install/upgrade loft insulation and ventilation	Please choose...	Please choose...
Install a more efficient central heating boiler (e.g. condensing boiler)	Please choose...	Please choose...
Replace single glazing with double or triple glaze windows	Please choose...	Please choose...
Draught proof your home	Please choose...	Please choose...
Replace a Fridge Freezer unit bought between 1993 and 2000 with a new A+ Rated Fridge Freezer	Please choose...	Please choose...
Replace an old washing machine with an AAA rated model	Please choose...	Please choose...

*

	I am able to do this	Most people will be able to do this
Use 85% bright compact fluorescent bulbs or LEDs instead of incandescent bulbs	Please choose...	Please choose...
Carpool to work with one other person	Please choose...	Please choose...
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	Please choose...	Please choose...
Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F)	Please choose...	Please choose...
Recycle paper, glass, and plastic	Please choose...	Please choose...
Reduce standby use of electricity by appliances and electronics by 90%	Please choose...	Please choose...
Wash clothes at 30°C instead of 40°C	Please choose...	Please choose...
Do not use clothes (tumble) dryer for 5 months of the year	Please choose...	Please choose...
Wait until there is a full load for washing	Please choose...	Please choose...
Minimise flying inside the UK	Please choose...	Please choose...
Minimise flying outside the UK	Please choose...	Please choose...

Resume later | Next >> | Exit and clear survey

0% 100%

OE

Please rate your degree of confidence from 0 (no confidence) to 50 (moderately confident) to 100 (high confidence).

"If I do this, it will contribute financially enough to make it worth it"

*

Service your car regularly	Please choose...
Buy tyres that lessen resistance	Please choose...
Maintain correct tyre pressure	Please choose...
Use a more energy efficient car	Please choose...
Drive to avoid sudden acceleration and stops	Please choose...
Combine errand trips to halve current mileage / car use	Please choose...

*

Install/upgrade loft insulation and ventilation	Please choose...
Install a more efficient central heating boiler (e.g. condensing boiler)	Please choose...
Replace single glazing with double or triple glaze windows	Please choose...
Draught proof your home	Please choose...
Replace a Fridge Freezer unit bought between 1993 and 2000 with a new A+ Rated Fridge Freezer	Please choose...
Replace an old washing machine with an AAA rated model	Please choose...

*

Use 85% bright compact fluorescent bulbs or LEDs instead of incandescent bulbs	Please choose...
Carpool to work with one other person	Please choose...
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	Please choose...
Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F)	Please choose...
Recycle paper, glass, and plastic	Please choose...
Reduce standby use of electricity by appliances and electronics by 90%	Please choose...
Wash clothes at 30°C instead of 40°C	Please choose...
Do not use clothes (tumble) dryer for 5 months of the year	Please choose...
Wait until there is a full load for washing	Please choose...
Minimise flying inside the UK	Please choose...
Minimise flying outside the UK	Please choose...

Resume later | Next >> | Exit and clear survey

0% 100%

POE&COE

Please rate your degree of confidence from 0 (no confidence) to 50 (moderately confident) to 100 (high confidence).

*

	If I do this, it will contribute environmentally enough to make it worth it	If most car owners do this, it will contribute environmentally enough to make it worth it
Service car regularly	Please choose...	Please choose...
Buy tyres that lessen resistance	Please choose...	Please choose...
Maintain correct tyre pressure	Please choose...	Please choose...
Use a more energy efficient car	Please choose...	Please choose...
Drive to avoid sudden acceleration and stops	Please choose...	Please choose...
Combine errand trips to halve current mileage/car use	Please choose...	Please choose...

*

	If I do this, it will contribute environmentally enough to make it worth it	If most home owners do this, it will contribute environmentally enough to make it worth it
Install/upgrade loft insulation and ventilation	Please choose...	Please choose...
Install a more efficient central heating boiler (e.g. condensing boiler)	Please choose...	Please choose...
Replace single glazing with double or triple glaze windows	Please choose...	Please choose...
Draught proof your home	Please choose...	Please choose...
Replace a Fridge Freezer unit bought between 1993 and 2000 with a new A+ Rated Fridge Freezer	Please choose...	Please choose...
Replace an old washing machine with an AAA rated model	Please choose...	Please choose...

*

	If I do this, it will contribute environmentally enough to make it worth it	If most people do this, it will contribute environmentally enough to make it worth it
Use 85% bright compact fluorescent bulbs or LEDs instead of incandescent bulbs	Please choose...	Please choose...
Carpool to work with one other person	Please choose...	Please choose...
Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	Please choose...	Please choose...
Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F)	Please choose...	Please choose...
Recycle paper, glass, and plastic	Please choose...	Please choose...
Reduce standby use of electricity by appliances and electronics by 90%	Please choose...	Please choose...
Wash clothes at 30°C instead of 40°C	Please choose...	Please choose...
Do not use clothes (tumble) dryer for 5 months of the year	Please choose...	Please choose...
Wait until there is a full load for washing	Please choose...	Please choose...
Minimise flying inside the UK	Please choose...	Please choose...
Minimise flying outside the UK	Please choose...	Please choose...

Resume later | Submit | Exit and clear survey

9.2 APPENDIX B – Sources of quota data

1. UK population

In 2010 the UK population was 62.3 million (www.ons.gov.uk)

2. Age and Gender from the Office for National Statistics

http://webcache.googleusercontent.com/search?q=cache:NFZs5jwecUgJ:www.ons.gov.uk/ons/about-ons/what-we-do/FOI/foi-requests/economy/gdp/population-figures-provided-are-mid-year-estimates-for-the-uk.xls+&cd=1&hl=en&ct=clnk&gl=uk&client=firefox-a

Age and Gender

Mid-2010 Population Estimates: UK; estimated resident population by single year of age and sex

Thousands

Age	Persons	Males	Females		Persons	Males	Females
All ages	**62,262.0**	**30,643.3**	**31,618.7**				
0-4	**3,858.4**	**1,977.3**	**1,881.2**	**45-49**	**4566.1**	**2250**	**2316.1**
0	795.2	407.4	387.8	45	948.3	469.4	478.8
1	784.7	402.3	382.4	46	935.9	461.8	474
2	788.6	404.0	384.6	47	918.5	451.2	467.3
3	756.5	388.0	368.5	48	892.8	438.8	454
4	733.5	375.6	357.9	49	870.7	428.7	441.9
5-9	**3,446.4**	**1,761.5**	**1,684.8**	**50-54**	**3,981.1**	**1,964.7**	**2,016.4**
5	718.7	367.5	351.2	50	835.0	411.2	423.8
6	709.0	363.1	345.9	51	818.1	403.7	414.4
7	684.9	351.2	333.7	52	805.9	398.5	407.5
8	666.3	339.9	326.4	53	775.2	382.8	392.3
9	667.6	339.9	327.7	54	746.9	368.5	378.4
10-14	**3,566.9**	**1,825.3**	**1,741.6**	**55-59**	**3,578.3**	**1,758.6**	**1,819.8**
10	683.3	349.8	333.5	55	726.6	358.3	368.3
11	703.1	359.8	343.3	56	727.1	357.6	369.5
12	715.5	365.5	350.1	57	713.0	350.7	362.2
13	734.8	376.3	358.5	58	704.7	345.6	359.1
14	730.2	374.0	356.2	59	707.0	346.3	360.7
15-19	**3,911.8**	**2,012.8**	**1,898.9**	**60-64**	**3,763.6**	**1,840.1**	**1,923.5**
15	736.4	378.5	357.9	60	724.8	354.7	370.1

16	757.8	389.4	368.4	61	744.3	365.0	379.3
17	773.9	398.3	375.6	62	794.6	389.1	405.5
18	807.7	415.6	392.1	63	829.7	405.3	424.4
19	836.0	431.1	404.9	64	670.2	325.9	344.3
20-24	**4,309.9**	**2,213.1**	**2,096.8**	**65-69**	**2,931.7**	**1,412.1**	**1,519.6**
20	840.0	431.1	408.9	65	650.1	315.2	334.8
21	845.5	433.4	412.0	66	632.9	306.9	326.0
22	873.6	449.3	424.3	67	603.8	290.5	313.4
23	870.9	449.6	421.3	68	541.6	259.5	282.1
24	879.9	449.6	430.3	69	503.2	240.0	263.2
25-29	**4,249.8**	**2,168.6**	**2,081.2**	**70-74**	**2,467.8**	**1,160.3**	**1,307.4**
25	886.4	453.5	432.9	70	517.6	245.7	271.8
26	861.2	442.0	419.2	71	511.8	242.3	269.5
27	837.6	430.9	406.7	72	498.6	234.9	263.7
28	823.1	415.9	407.2	73	480.0	224.3	255.7
29	841.5	426.4	415.1	74	459.7	213.0	246.7
30-34	**3,891.4**	**1,959.8**	**1,931.6**	**75-79**	**2,001.8**	**893.9**	**1,107.8**
30	832.6	420.3	412.2	75	436.9	200.9	236.0
31	795.1	401.3	393.8	76	410.1	185.5	224.6
32	756.7	380.0	376.7	77	396.7	177.1	219.6
33	743.7	374.5	369.3	78	385.7	169.8	215.9
34	763.3	383.6	379.7	79	372.4	160.7	211.8
35-39	**4,201.7**	**2,084.6**	**2,117.1**	**80-84**	**1,492.6**	**607.1**	**885.5**
35	782.3	392.4	389.9	80	348.7	147.1	201.6
36	798.0	397.4	400.6	81	321.4	133.2	188.3
37	837.4	415.6	421.8	82	292.6	118.9	173.6
38	879.7	433.2	446.5	83	275.6	109.8	165.8
39	904.4	446.0	458.4	84	254.3	98.1	156.2
40-44	**4,632.1**	**2,293.4**	**2,338.6**	**85-89**	**934.6**	**326.1**	**608.5**
40	895.5	442.5	453.0	85	228.1	85.1	143.0
41	920.6	454.8	465.8	86	204.3	73.2	131.1
42	926.5	459.8	466.8	87	181.9	62.9	119.0
43	946.4	470.1	476.3	88	167.1	55.5	111.6
44	943.0	466.2	476.8	89	153.3	49.4	103.9
				90 and over	**476.1**	**133.9**	**342.2**

Sources: Office for National Statistics, National Records of Scotland, Northern Ireland Statistics and Research Agency.

3. Education from the Office for National Statistics

www.ons.gov.uk/ons/rel/lmac/earnings-by.../chd---qualifications-2.xls

UK population, age 22-64, by highest qualification, per cent
UK, October-December 1993, 2010

	1993	2010
Degree	12	25
Higher education	8	10
A Levels	23	21
GCSE grades A*-C	17	20
Other qualifications	15	12
No qualification	25	11

4. Household income from Experian

http://cdu.mimas.ac.uk/experian/HouseholdIncome-2011.pdf

Annual income	%
< £15,000	20.03
£15,000 - £19,999	7.64
£20,000 - £29,999	21.36
£30,000 - £39,999	16.69
£40,000 - £49,999	11.70
£50,000 - £59,999	7.25
£60,000 - £69,999	4.49
£70,000 - £99,999	6.39
£100,000 - £149,999	3.45
£150,000+	1.00

5. Home ownership from the Office for National Statistics

www.ons.gov.uk/ons/rel/was/wealth-in-great-britain-wave-2/2008-2010--part-1-/index.html

	Percentage
	2008/10
of which owned outright	30.88
of which owned with mortgage	37.23
of which part owned part rent[1]	0.43

9.3 APPENDIX C – Sample of quotas reached during data collection

The shaded boxes indicate that those quotas had been reached on the 11th of June 2012.

Age

	18-24	25-34	35-44	45-54	55-64	65+
Out of 500	**60**	**82**	**88**	**88**	**75**	**107**
Out of 434	**60**	**77**	**70**	**76**	**75**	**76**

Gender

	Male	Female
Out of 500	**245**	**255**
Out of 434	**206**	**228**

Region (UK total - 62.3 million in mid-2010)

	North East	North West	Yorkshire and The Humber	East Midlands	West Midlands	East	London
Out of 500	**20**	**55**	**45**	**35**	**45**	**45**	**65**
Out of 434	**20**	**48**	**44**	**36**	**42**	**28**	**47**

	South East	South West	Wales	Scotland	Northern Ireland
Out of 500	**70**	**40**	**25**	**40**	**15**
Out of 434	**72**	**28**	**25**	**30**	**14**

Household income

	<£15,000	£15,000-£19,999	£20,000-£29,999	£30,000-£39,999	£40,000-£49,999	£50,000-£59,999	£60,000-£69,999	£70,000+
Out of 500	**100**	**38**	**107**	**84**	**59**	**36**	**22**	**54**
Out of	**100**	**38**	**93**	**79**	**50**	**35**	**22**	**17**

434								

Education

	no formal qualification	GCSE, O-Level, Standard Grade	A-level, Higher, BTEC	Vocational, NVQ, Higher National Diplomas	Degree or equivalent	Postgraduate qualification	Other..
Out of 500	**55**	**100**	**105**	**50**	**125**	**40**	
Out of 434	**25**	**100**	**105**	**50**	**104**	**41**	**9**

Car owner

	Yes
Out of 500	**367**
Out of 434	**329**

Home owner

	Yes
Out of 500	**343**
Out of 434	**267**

9.4 Appendix D - Sources of questions used in study

Gender, Age and Income	(Whitmarsh, 2009a)
How many people live in your household including yourself?	(DEFRA, 2009)
Which of the following statements best describes your beliefs about whether climate change is occurring? I am certain or almost certain it is happening I tend to believe it is happening I am unsure it is happening I tend to believe it is not happening I am certain or almost certain it is not happening	Adapted from Spence et al. (2011)
Humans are capable of finding ways to overcome the world's environmental problems	DEFRA (2007)
Have you taken, or do you take, any action out of concern for climate change? Yes No Don't know	(Whitmarsh, 2009a)
Which of these best describes how you feel about your current lifestyle and the environment? I'm happy with what I do at the moment I'd like to do a bit more to help the environment I'd like to do a lot more to help the environment Don't know	(DEFRA, 2009)
Rate how often concern about climate change influences your decisions: Very frequently Frequently Occasionally Rarely Never	Adapted from Spence et al. (2011)
Rate how often you talk to your friends and family about climate change: Very frequently Frequently Occasionally Rarely Never	Adapted from DEFRA (2009)
Consider the different areas where environmental problems could have harmful consequences, and for each please rate how concerned you are about their impact: Marine life, future generations, your health, plants, people in the UK, your future, animals, the human race, your lifestyle, birds, people in your community, your prosperity	(Schultz, 2001)

9.5 APPENDIX E - Rightslink Printable License

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9.6 APPENDIX F – NVivo coding of qualitative question

Coding used for justification of beliefs, along with description of each code and examples and identifiers for those for, unsure and against climate change				
	Codes	Description	Example And Identifier *FOR*	Example And Identifier *UNSURE or AGAINST*
Just because	Just because	General views, personal beliefs or knowledge are mentioned but are not supported by anything.	'General attitude' & 'Because it is'	
Encounter	Weather	Changes in the weather or in seasons are mentioned.	'Because the seasons are all mixed up where we are having a heat wave one minute and heavy rain the next'	-
	Some signs	Existence of signs to indicate climate change is mentioned or there is a mention of small effects, but in a vague manner.	'We see some signs but not always'	'It is a small effect, and I think that we won't know, for sure, for some years'
Evidence	Evidence general	General evidence is mentioned.	'Because all the evidence suggests this'	'Because I haven't seen much evidence yet that it's not just normal weather behaviour'
	Evidence specific	Specific evidence is mentioned.	'Ice caps melting'	-
Natural process	Natural process	The *natural* cyclical nature of climate change is mentioned explicitly or implicitly.	'Changes in climate I think is cyclical. Was it man made climate change which caused the Ice Age?' & 'Some things have happened before'	
People	Unidentified source	Information in general, or a general source of information is mentioned in a vague manner.	'Because I listen to advice'	'Too much conflicting information'
	Filters	People or institutions who may filter information or evidence are mentioned.	-	'Because I think pro climate change enthusiasts are selective over what data they publish and ignore any data that challenges their beliefs'
	Politics/ government	The government is mentioned indirectly, e.g. tax raise.	-	'Just an excuse to raise taxes'
	Media	The media is mentioned, either using the word 'media', or forms of media (e.g. tv, newspapers), or verbs associated with the accessing media (e.g. reading, watching).	'Watched programs, read articles'	'Media hype is causing this'
	Scientists	Scientists are mentioned, using the words scientists or experts.	'Because I trust scientists more than rumour or hearsay. Climate change is now proven'	'There are varying opinions among experts'
Unsure	Unsure	Answers that seem vague or where respondents mention that they don't know enough.	'I do not know enough about the subject. Only hearsay'	

Pro-Environmental Index

	General	Car	home
Curtailment **Always x1** **Often x0.75** **Sometimes x0.5** **Rarely x0.25** **Never x0**	Carpool £235/4% (A, O, S, R, N)	Alter driving £310/5% (A, O, S, R, N)	
	Turn down thermostat £47/2.2% (A, O, S, R, N)	Combine errand trips £133/2.1% (A, O, S, R, N)	
	Turn down water heater £30/2.3% (A, O, S, R, N)		
	Recycle £0/0% (A, O, S, R, N)		
	Reduce standby £35/3.1% (A, O, S, R, N)		
	Wash clothes at 30°C £9/0.3% (A, O, S, R, N)		
	Do not use tumble dryer £15/0.65% (A, O, S, R, N)		
	Wait for full load £15/0.2% (A, O, S, R, N)		
Efficiency **Yes x1** **No x0** **Installed x1** **Chose with x1** **Not done x0**	Replace 85% of bulbs £47/2.2% (Y,N)	Service your car regularly £150/2.5% (Y,N)	Install/upgrade loft insulation £175/7.2% (I,C,N)
		Buy tyres that lessen resistance £30/0.5% (Y,N)	Install a more efficient central heating boiler £188/6.45% (I,C,N)
		Maintain correct tyre pressure £15/0.25% (Y,N)	Double glaze windows £165/6.8% (I,C,N)
		Buy a more efficient car £389/6.2% (Y,N)	Draught proof your home £55/1.4% (I,C,N)
			A+Fridge Freezer £24/1.5% (I,C,N)
			AAA washing machine £9/0.44% (I,C,N)

9.8 APPENDIX H – Sources of data for CO_2 emissions and money saved by each behaviour examined

Financial savings and Environmental savings **All information was used in September 2012 and taken from the Energy Saving Trust (www.energysavingtrust.org.uk/) unless specified otherwise**		
	Financial impact (£ per annum)	**Environmental impact (CO_2 per annum)**
Service your car regularly, get frequent tune-ups, including air filter changes	150	2.5
Buy tyres that lessen resistance	30	0.5
Maintain correct tyre pressure	30	0.5
Buy a more efficient car (30.7 MPG* vs. 20 MPG) – *Miles Per Gallon	389	6.2
Install/upgrade loft insulation and ventilation	175	7.2
Install a more efficient central heating boiler (92% efficient, e.g. condensing boiler)	188	6.45
Replace single glazing with double or triple glaze windows	165	6.8
Draught proof your home	55	1.4
Replace 85% of all incandescent bulbs with equally bright compact fluorescent bulbs***	47	2.2
Replace a Fridge Freezer unit bought between 1993 and 2000 with a new A+ Rated Fridge Freezer	24	1.5
Replace an old washing machine with an AAA rated model	9	0.4
Carpool to work with one other person	235	4
Alter driving (avoid sudden acceleration and stops)	310	5
Combine errand trips to halve current mileage / car use	133	2.1

Turn down thermostat from 22°C to 20°C during the day and to 18°C during the night (72°F-68°F day and 65°F night)	47	2.2
Turn down water heater thermostat from 60°C to 49°C (140°F to 120°F)	30	2.3
Recycle paper, glass, and plastic	0	0
Reduce standby use of electricity by appliances and electronics by 90%*	35	3.1
Wash clothes at 30°C instead of 40°C**	9	0.3
Do not use clothes (tumble) dryer for 5 months of the year*	15	0.65
Wait until there is a full load for washing	15	0.65

* http://www.greenchoices.org/

** http://www.which.co.uk/

*** http://www.greenfeetuk.com/index.html

9.9 APPENDIX I – Viewing responces to climate change through different disciplinary perspectives

Whitmarsh (2011) recently commented that ‘sustainability is a complex and multi-layered problem evident at the levels of both social structures and individual actions which demands contributions from a range of perspectives’ (p.258). These perspectives differ depending on the discipline in question. Indeed, different disciplines have different strengths and weaknesses, and as such have dealt with climate change and sustainability in a range of ways (Urry 2011). The natural sciences have focused on climate change by generating ‘relatively robust and globally significant accounts of anthropogenic climate change’ (Urry 2011, p.19). Economic approaches generally involve the examination of the efficient allocation of human resources (Jager et al., 2000). Sociology tends to focus on the social and physical context within which individuals act, while psychology typically focuses on the decision making of individuals (Whitmarsh 2011; Jager et al., 2000).

Pointing out the importance of interdisciplinary research in terms of climate change mitigation, Whitmarsh (2011) suggested that ‘all social, as well as natural sciences can bring [something] to improving humanity's welfare and directing it towards a more sustainable course’ (p.260). My thesis focuses on the psychology of climate change mitigation. In an attempt to offer a more holistic view of the decision making involved in climate change mitigation behaviours, and escape the individualistic perspective of psychology, this appendix goes on to explore overlapping and competing (with psychology) understandings of behaviour change in relation to energy and climate. Special attention is given to economics and sociology.

ECONOMICS

HOMO ECONOMICUS

In order to examine the economic behaviours of individuals, traditional economics uses the standard neoclassical model of behaviour, commonly referred to as *Homo Economicus* (Gsottbauen and Van den Bergh, 2010). This model rests on two fundamental assumptions: perfect rationality and self-interest (Gsottbauen and Van den Bergh, 2010). More

specifically, Homo Economicus behaves in a calculating manner, and is guided by a particular goal, such as that of profit maximization (Faber et al., 2002; Simon 1976; Van der Bergh 2010).

HOW HOMO ECONOMICUS INFORMS POLICY AROUND BEHAVIOUR CHANGE (PRICES AND INFORMATION)

In traditional economics, this rational actor approach is used to formalise behaviour (Jager etal 2000). Using this neoclassical behavioural model, choices are assumed to be predictable, as individuals are understood to behave consistently by choosing rationally and in a way that maximizes utility regardless of the situation, at least for the majority of the time (Blumenthal-Barby etal 2012). As put by Thaler and Sunstein (2008) 'If you look at economics textbooks, you will learn that Homo Economicus can think like Albert Einstein, store as much memory as IBM's Big Blue, and exercise the willpower of Mahatma Gandhi' (p.6).

Under the Homo Economicus model, human decision making can be modelled and can be fully explained by people trying to maximise their outcomes (Jager et al., 2000). According to simple economic 'benchmark' models, behaviour changes depend importantly on income and prices, as well as many other influences. Since prices often direct economic decisions, they can be used by policy makers to influence consumers' behaviours in the desired direction (Van der Bergh 2010). Thus, in line with this, policy recommendations may use monetary incentives to influence behaviours (Gsottbauen & Van den Bergh, 2010).

LIMITATIONS AND MODIFICATIONS OF HOMO ECONOMICUS

However, in real life, people's behaviours often fail to conform to this model (Gintis 2007). Moving on from the rational economics paradigm, behavioural economics approaches have aimed to integrate the psychological foundations of human behaviour into economic analysis (Lindbeck 1997). Relying on evidence mainly from laboratory experiments, they have demonstrated how most people differ from Homo Economicus in terms of its key assumptions. As Gintis (2007) pointed out, 'people succumb to harmful temptations, behave charitably and/or vengefully, and have a concern for fairness' (p.312). The two main points in which real people were found to differ from Homo Economicus are bounded rationality and limited self-interest. Many contributions have criticized the early

Homo Economicus models as an inadequate concept for ecological economics. Indeed, as Becker (2006) pointed out, empirical studies show that people do not always act rationally (bounded rationality) or in pursuit of self-interest (limited self-interest).

Bounded rationality - People tend to not make optimal decisions. Simon (1955) first pointed out that people not only have imperfect access to information, but they also have limited computational capabilities. Simon (1955) argued that individuals behave like utility maximisers only in situations involving simple choices. When decisions are more complicated, individuals' decisions tend to diverge from perfect rationality. As Gsottbauen and Van den Bergh (2010) pointed out, in our everyday lives, decisions tend to take place with cognitive limitations and imperfect information, thus explaining why human behaviour differs from that predicted by Homo Economicus. For example, experiments have found that people make use of heuristics in order to reduce complexity in decision-making (Gsottbauen & Van den Bergh, 2010). Despite this being a useful technique when time and cognitive abilities are limited, it may also lead to systematic errors of judgment (Gsottbauen & Van den Bergh, 2010). The important role of bounded rationality in individual decisions on energy use and conservation is supported by many studies (Gsottbauen & Van den Bergh, 2010). For example, Gsottbauen and Van den Bergh (2010) pointed to the 'energy-efficiency paradox' which refers to the gap between current and optimal energy use. Furthermore, due to limited cognitive resources, many of our daily routines are automated, which may lead to people being unaware of the effect of their behaviours (Jager et al., 2000).

Limited self-interest – People's preferences have been found to have been found to depart from pure self-interest. Laboratory experiments involving experimental games (e.g. public goods games) have shown that decision making may be influenced by other preferences, such as fairness or reciprocity (Lindbeck 1997). More specifically, contrary to what the self-interest model would predict, people have been shown to behave with fairness and cooperation in many situations (Gsottbauen & Van den Bergh, 2010), whilst also engaging in satisfying behaviours (Simon, 1976).

Overall, the original Homo Economicus model has been criticised in the literature (Faber et al., 2002), including in the economics literature itself. As Jager et al., (2000) have pointed out, in real life people's decisions are shaped by their limited cognitive resources, and for this reason decisions are influenced by cognitive processes such as social comparison and repetitive behaviour. Recognising the bounded rationality and limited self-interest of

human behaviours, behavioural economics opened the way to alternative models of behaviour, which adjust or replace the rational, maximization model and its predictions (Gsottbauen & Van den Bergh, 2010). Experimental results from behavioural economics have established that: a) human choice is a social phenomenon and b) regular patterns of decision-making, such as responses to rewards and punishments, can be predicted (Gowdy 2008).

Pro-environmental behaviours

In terms of pro-environmental behaviours, people frequently engage in behaviours, such as buying products and using energy, which all have environmental impacts. As Gsottbauen and Van den Bergh (2010) pointed out, the standard neoclassical economic analysis points policy recommendations in the direction of the impact of income and prices on behaviour. Thus, steering away from the basic neoclassical behavioural assumptions means that 'less importance will be given to price-based instruments' (Van der Bergh 2010). The importance of this lies in the fact that economic incentives may encourage behavioural change, however as Adger et al., (2009) pointed out, the evidence determining how long lasting the effect of such measures are on behaviour change is yet not clear cut (Adger et al., 2009). Steering away from price-based instruments, Gsottbauen and Van den Bergh (2010) pointed to a study related to status and social norms that had a significant impact on behaviour using non-pecuniary incentives. Indeed, Milinski et al. (2006, as cited by Gsottbauen and Van den Bergh, 2010) found that people were more likely to invest in climate protection if they knew their decision would be made public. Thus, in the context of climate change mitigation, strategies could be developed whereby individuals' CO_2 emissions are published, or as Rand and Nowak (2009) proposed, stickers could be placed on polluting cars.

THALER AND SUNSTEIN'S (2008)'NUDGE'

As was discussed above, contrary to Homo Economicus, people have been found to not always act in their best interest. Behavioural economics differs from traditional economics as it takes into account predictable cognitive biases which guide our behaviours, especially in situations involving limited time or insufficient information (Whyte 2012).

Thaler and Sunstein (2008) argued that policymakers must rethink behaviour change methods in order to better align people's predictable tendencies with their true preferences. Thaler and Sunstein (2008) went on to introduce the concept of 'nudging', which they

defined as ‘any aspect of the choice architecture that alters people’s behaviour in a predictable way without forbidding any options’ (Thaler and Sunstein, 2008, p.6).

The basis for nudging is ‘choice architecture’ (Thaler and Sunstein 2008, p.81). The architecture of choice has been found to influence how people make decisions (Leonard 2008). Nudges are thus changes in the choice context that, in subtle ways, will help individuals make decisions without restricting their choices (Whyte et al., 2012). Given that in real life people’s decisions are shaped by their limited cognitive resources (Jager et al., 2000), nudges are aimed to appeal to people’s reflexive or automatic cognitive processes (Oliver 2013), and thus help decision making in situations where people may lack time and information (Whyte et al., 2012).

Whyte (2012) argues that it is necessary to neither create new incentives for people nor limit people’s choices by using expensive government policies. Instead, he claims that a better method to encourage certain behaviours is to adjust the context within which people make these decisions (Whyte 2012). This approach can be used by policymakers to serve as architects of choice, and in turn ‘steer people toward better decisions’ on a variety of topics including health related behaviours and those affecting the environment (Amir and Lobel 2008, p.2108). The important role nudging can play in guiding people’s decisions was pointed out by Amir and Lobel (2008, p.2099) who argued that: ‘By understanding the ways in which individuals are susceptible to biases and flawed decision making, law and policy can help improve individual and group behaviour’.

Nudge interventions have mainly been in the field of health care, where policymakers and researchers have begun to increasingly use principles of nudging to persuade people to change their health-related behaviours (Blumenthal-Barby et al.,2012). In their article, Blumenthal-Barby et al. (2012) identify the methods of nudging to direct people toward particular decisions. One such method is that of *priming.* According to this method, behaviours and decisions can be influenced based on the principle that our behaviours are influenced by subconscious cues, which in turn can be used as primers for the desired behaviours. Indeed, in the field of public health, Hanks et al. (2012) carried out a study examining the influence food positioning has on the consumption of health food. More specifically, Hanks et al. (2012) examined the consumption of healthy food when this is placed in more prominent positions, while placing less healthy food in less convenient locations. Their results showed that sales of healthier foods increased by 18% while the consumption of less healthy foods decreased by 28% (Hanks et al., 2012).

Nudge type interventions have impacted policy across Europe. According to Oliver (2013), governments in several European countries are implementing nudge interventions. Nudging has also impacted on policy in the UK (Hall et al., 2013). Indeed, the influence of nudging on UK policy can be seen in the MINDSPACE report (Dolan et al., 2010). This report demonstrates the political appeal of nudging and suggests that 'approaches based on 'changing contexts' - the environment within which we make decisions and respond to cues - have the potential to bring about significant changes in behaviour at relatively low cost' (Dolan et al., 2010, p. 8). Nudging is also being considered for use in terms of encouraging the reduction of energy use among households. One such example involves the provision of feedback of individuals' energy usage along with that of their neighbours (Hall et al., 2012).

Nudging is considered as a low cost strategy for encouraging energy conservation (Thaler and Sunstein 2008). However, despite this low cost and the advantages nudging appears to offer, Blumenthal-Barby et al. (2012) set out the ethical considerations regarding the use of nudge strategies. For example, they mention that: 'one should consider whether it is fairly easy for people to go their own way and to choose a different direction than the one that they are being primed toward' (p.6). Oullier et al. (2010) pointed out that nudges will help to influence the individuals' choices 'while leaving the possibility of not following the suggested direction' (p.41). However, although nudges may not forbid any options, Oliver (2013) argued that it is not clear whether these influences are indeed voluntary.

SOCIOLOGY

Sociology adopts a more holistic view to climate change mitigation, by focusing on the social and physical context within which individuals act. In support of this, Shove (2010) recently argued that climate change should not be framed as a problem of human behaviour. She supported this argument with a quote from Uzzell (2008 as cited by Shove 2010): 'Trying to persuade people to consume and waste less through behaviour change programmes will not address the larger and more significant problems concerning the ways under which people need or think they need to live and consume' (p.1277).

STRUCTURE AGENCY PROBLEM

A key issue of social theories concerns the relationships between individual and society (Ropke 2009). This relationship was pointed out by Archer (1995): 'For it is part and parcel of daily experience to feel both free and enchained, capable of shaping our own future and yet confronted with towering, seemingly impersonal constraints'. The two perspectives outlined in this example represent the 'problem of structure and agency', which as Archer (1995) pointed out, is used to indicate central dilemmas in social theory. These two perspectives involve: the (agency) individualist and the (structure) systemic or structural paradigm (Spaargaren 2011).

Agency – individualist perspective

The agency perspective involves 'reducing society to the sum of the individuals and their actions' (Ropke 2009, p.2491). Focusing on the individual, this perspective involves an emphasis on 'human action instead of social structure' (Sztompka 1994, p.30).

Pointing out the importance of the individualist paradigm and the role individuals have to play in environmental change, Spaargaren (2011) argued that:

> 'When resorting to institutional actors and measures only and when trying to exclusively organize environmental change via new technologies and infrastructures that are installed by providers, policy makers are denying or at least underrating the crucial role of human agents in processes of environmental change. In this top-down structuralist approach, citizen-consumers are hardly offered the possibilities to participate in, co-shape and democratically control processes of environmental change. As studies on failed technological innovations (Schot, 2001; Heiskanen et al., 2005) show, it turns out to be very difficult to realize the environmental benefits of eco-designed products, technologies and infrastructures when they are designed without reference to the user-practices they help constitute and are implemented without the knowledge and education of practitioners' (p.814).

Spaargaren (2011) pointed out that the individualist paradigm is mainly employed by governments when promoting policies for the encouragement of sustainable behaviours. More specifically, the individualistic paradigm involves campaigns such as the 'footprinting' of individuals by environmental NGOs, and as such place a responsibility on individuals to reduce their energy consumption to desired limits (Spaargaren 2011).

These campaigns tend to mainly involve the provision of information. However, despite this being a method used extensively to encourage energy conservation behaviours,

numerous studies have found it to not necessarily lead to behaviour changes (Abrahamse et al., 2005). Yet, Whitmarsh (2011) argued that without information, such as information regarding the emissions from energy use, 'how can policy makers or citizens hope to contribute in any capacity to societal transition towards sustainability'?

Arguing against the use of the individualistic agency perspective, Shove (2010) pointed out that strategies of intervention 'presume that environmental damage is a consequence of individual action and that given better information or more appropriate incentives damaging individuals could choose to act more responsibly and could choose to adopt `pro-environmental behaviours'' (Shove 2010). Indeed, Shove (2010) argued that this course of action 'deflects attention away from the many institutions involved in structuring possible courses of action and in making some very much more likely than others.'

Structure - Structuralist perspective

Based on the structuralist perspective 'the social system and structures exist as a given reality and determine to a large extent the actions of individuals' (Ropke 2009, p.2491). This perspective can be viewed as a consequence to the failure of the strategies employing individualist perspectives. The key difference between this and the individualistic paradigm is the shift of attention from the individual to the systems around it. This results in the policies designed with a primary focus on institutional actors, such as companies and municipalities (Spaargaren 2011).

Pointing out the importance of the structuralist paradigm, Spaargaren (2011) argued that:

> 'People do not develop ideas and ways of doing 'from within' by themselves. Their thinking and doing are shaped by fellow citizens and by the objects and situational factors which form an integral part of the contexts of their behaviours. By restricting themselves to strategies from the individualist paradigm, policy makers can be said to be sociologically naive while neglecting the profound influences of the wider chains of interaction that serve as systems of provision shaping and sometimes pre-configuring the choices and behaviours of individual citizen-consumers to a considerable extent. As a result, too much responsibility for change is put on the plate of the individual citizen-consumer' (p.814).

In agreement with Shove (2010), Whitmarsh (2011) recently pointed out that environmental policy tends to shift responsibility from institutions and governance structures to individuals. In doing so, responsibility is placed on individuals to reduce their energy consumption. However, arguing against a total shift to a strucuralist perspective,

Whitmarsh (2011) claimed that this may result in 'a situation where individuals are excluded from societal decision making and participation in enacting change'.

The 'structure-agency' problem concerns the micro-scopic focus versus the macro-scopic in sociology (Adger et al., 2009). From the previous analysis, given the limitations of both the individualistic and the stucturalist approaches, Giddens (1984) initially developed the structuration theory, as an attempt to reconcile the perspectives discussed above. This involves understanding both structures and agents as being important in the explanation of social life, where structures and agents are not two independently given sets of phenomena. Indeed, in agreements with this perspective, Ropke (2009) pointed out that there exists an interplay between actors and structures, given that 'structures can only be established through the actions of individuals, and simultaneously, these actions are formed by the prevailing structures'. Practice theory is an emerging approach which creates a middle level between agency and structure and has sought to address many of the shortcomings of the structure agency problem (Hargreaves 2011). It is described in the next section.

PRACTICE THEORY

Aiming to overcome the structure-agency problem, social practice theorists, from Giddens (1984) and Bourdieu (1977, 1990), to the more recent work by Reckwitz (2002), Shove (2010, 2003), Ropke (2009) and Warde (2005) have aimed to create a middle level between agency and structure.

The central idea of practice theory is the identification of clusters of activities within the continual flow of activities (Ropke 2009). These activities can involve everyday and routine practices such as heating, cooking and driving (Hargreaves 2011), the performance of which is seen as part of 'the routine accomplishment of what people take to be 'normal' ways of life' (Shove, 2004, p.117). Through organisation and interdependence, these clusters of activities can then be conceived as entities by practitioners (Ropke 2009). According to Shove et al., 2007), 'a practice is a relatively enduring, relatively recognizable entity' (p.71). These entities exist when the activities involved are carried out by large groups of people, where the individuals concerned act as 'carriers' of practices (Ropke 2009).

On the one hand, the central focus for the individualistic agency perspective was on the individuals who perform practices, while the central focus for the structure perspective was

the social structures that surround individuals. Due to the emphasis on practices as 'shared behavioural routines', for practice theory, attention is diverted from individual decision making (Hargreaves 2011). It is the practice itself that is the central focus, which in turn becomes the main unit of analysis (Hargreaves 2011). According to practice theory, practices are socio-technically mediated, and influenced by 'things' and their use, a background knowledge in the form of understanding, know how, states of emotion and motivational knowledge' (Reckwitz 2002, p.249). In this view, behaviours are not seen as the result of individuals' attitudes, values and beliefs constrained by various contextual 'barriers' (Hargreaves 2011). For example, Doyle and Davis (2013) used the example of heating, to point out that as a practice, it is 'considered to be nested within broader socio-technical energy regimes that comprise a cluster of elements including regulations, technologies, user practices and markets, cultural meanings, infrastructures of provision, maintenance and supply networks'.

Thus, practice theory involves the development of different methods to encourage sustainable behaviours and in turn directs research towards the analysis of actually 'doing' these every day practices, such as how various practices are carried out and changed (Hargreaves 2011). Hargreaves (2011) carried out a study examining the use of practice theory, through an ethnographic case study, for the study of pro-environmental behaviour change in a workplace. This case study involved nine months of participant observation along with the completion of 38 semi-structured interviews. After pointing out that practice theory 'de-centres individuals from analyses' and in turn directs attention towards the social and collective organisation of practices, the author argued that:

> 'practice theory provides a more holistic and grounded perspective on behaviour change processes as they occur in situ. In so doing, it offers up a wide range of mundane footholds for behavioural change, over and above individuals' attitudes or values. At the same time, it reveals the profound difficulties encountered in attempts to challenge and change practices, difficulties that extend far beyond the removal of contextual 'barriers' to change and instead implicate the organization of normal everyday life'.

It is important to point out that this study was focused only on one case study. Thus further research could help illuminate the benefits practice theory has to offer in the pursuit of more effective behaviour change campaigns that encourage the promotion of more sustainable practices, in terms of household energy saving.

CONCLUSION

Upon recognising that different disciplines have different strengths and weaknesses, Whitmarsh (2011) argued that interdisciplinary research is important to overcome the status quo and move on to effectively help contribute towards societal and environmental problems. This Appendix has examined the economic and sociological perspectives of behaviour change in relation to energy and climate, which can be considered to be overlapping and competing with psychology.

In terms of economics, the Homo Economicus model from standard economic theory was initially examined. This assumes that individuals are fully rational and act in a self-interested manner. Yet, experiments in behavioural economics have shown that people's behaviours tend to deviate from rational behaviour, and as such people the simple Homo Economicus is generally acknowledged to be a problematic simplification of reality (Gsottbauen and Van den Bergh, 2010). Nonetheless, as Becker (2006) argued, this model may be useful when attempting to answer questions relating directly to financial and monetary problems. Nudge theory was then discussed as a key idea arising from behavioural economics. Applications based on nudge theory encourage certain behaviours by adjusting the context within which people make decisions (Whyte 2012). This type of intervention has been mainly used in the field of health care, with studies demonstrating its success in steering people towards carrying out the desired behaviours (Hanks et al., 2012). The key advantage nudging has to offer is that it is a low cost intervention method and as such does not require expensive government policies (Whyte 2012). On the other hand, ethical considerations of the nudges applied must be taken into account, with Oliver (2013) pointing out that it is not clear whether influences by nudges are under voluntary control. To date, only a limited number of studies have examined the effects of nudges on behaviour change (e.g. Avineri 2012). Therefore, their effectiveness has not yet been fully determined.

From the perspective of Sociology, the structure-agency problem was initially examined. This involved the discussion of the agency/individualist and the structure/systemic or structural paradigms (Spaargaren 2011). The distinction lies in the idea that these paradigms concern decisions at micro-scopic versus macro-scopic levels in sociology (Adger et al., 2009), and as such, depending on which paradigm is of concern, the appropriate course of action is designed. The agency perspective focuses on the individual, with one key issue of its use being the deflection of attention from institutions that are able

to make possible courses of actions more likely than others (Shove 2010). The structural perspective shifts attention from the individual to the systems around it, with one key concern here being that individuals are excluded from societal decision making (Whitmarsh 2011). Practice theory was then discussed as a possible middle ground between agency and structure perspectives (Hargreaves 2011). This diverts attention from individuals and directs it to practice itself (Hargreaves 2011). By grouping behaviours into clusters and entities, practice theory provides a more holistic and grounded perspective on behaviour change. This theory requires news ways of thinking of behaviour change campaigns (Hargreaves 2011), by providing a more holistic approach and thus addressing the complex relations between meanings and skills and not focusing on psychology's narrow examination of individual decision making.

This thesis follows a psychological perspective. This narrow focus could be criticised by a sociologist by arguing that climate change mitigation is a systemic problem, and as such responsibility for tackling climate change should not be placed on individuals. Indeed, in agreement with Shove (2010), I also think that current behaviour change policies tend to be rather narrow, by focusing on the individual, rather than institutions and governance structures. However, despite this narrow focus, psychology is able to play a key role in understanding and responding to climate change. By providing 'a theoretically and empirically based understanding of human behaviour at the individual level', Swim et al (2010, p.20) argued that psychology is able to help us to understand, among other things, people's understandings of climate change, their response to it along with their willingness to act, and whether they choose to support public policies. This is important because:

> 'The effectiveness of various policies (e.g., cap and trade) requires the involvement and support of people. Psychologists can help by providing links between environmental policies and individuals by attending to the ways that individuals and communities may or may not be receptive to or even react against environmental policies developed by government officials including whether their reaction to policies are function of the policies themselves or other factors such as their relationship to government and their preferences for nongovernmental solutions (Swim et al., 2010, p.20).

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