SOCIAL AND PERSONAL PSYCHOLOGICAL INFLUENCES ON INDIVIDUAL ENGAGEMENT WITH GLOBAL CLIMATE CHANGE

Charles Adedayo Ogunbode

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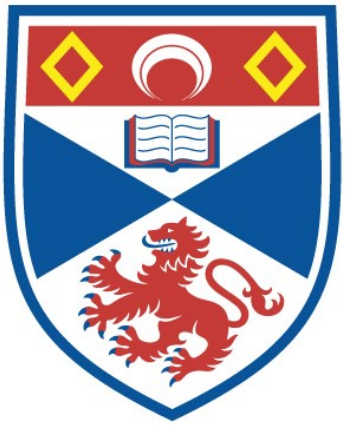

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Abstract

The aim of this thesis was to examine the way individual responses to global climate change are determined by intrapersonal, social and experiential factors through three streams of research. The first stream employs cross-sectional and experimental methods to demonstrate that the influence of climate change information on behavioural intentions among two African populations is largely conveyed indirectly through perceived threat and concern. My findings support a view that a failure to account for the indirect effects of knowledge may have resulted in a systematic underestimation of its importance as a basis for environmental action.

In the second stream, I sought to resolve previous inconsistencies in the evidence for a link between flooding experiences and climate change engagement. Using secondary data analysis, I found that political affiliation modulates the link between flooding experience and preparedness to engage in climate change mitigation behaviour in the UK, such that the indirect links between flooding experience and preparedness to reduce energy use, and willingness to pay higher prices for energy efficient products, was stronger among left-leaning voters. These results were followed up with four experimental studies in which flooding experience was operationalised with a mental simulation technique. The experiments were designed to examine how values and attribution may moderate the effects of flooding experiences on climate change attitudes, but they did not yield any conclusive findings.

Finally, I examined the interplay between descriptive and injunctive social norms as influences of behavioural engagement with climate change using cross-sectional and experimental data. I found that social norms may influence behavioural engagement with climate change indirectly through their effects on individuals' perceptions of, and emotional responses to, the problem. However, the nature of this influence may also be dependent on the convergence of the two norm types and the level of individuals' intrinsic prioritization of pro-environmental outcomes.

Contents

Chapter 1

General introduction

Human activities are changing the natural environment at an unprecedented scale (Vitousek, Mooney, Lubchenco, & Melillo, 1997). Uncontrolled population growth, intensive agriculture, deforestation, hazardous and toxic waste management practices, natural resources extraction, and fossil fuel consumption (to name a few) have given rise to rapid and profound modifications of ecological systems (Oskamp, 2000). These changes have produced a variety of negative consequences including climate change, biodiversity loss, and air, soil and water contamination. Addressing these consequences necessitates tackling the human behaviours that drive detrimental environmental change, reorienting environmental attitudes and reforming humanity's relationship with nature (Nickerson, 2003; Stern, 1992).

Despite being primarily concerned with the study of the human mind and behaviour; psychology's potential has been underutilized in the development of solutions to environmental change (Gifford, 2008; Nolan, Kenefick, & Schultz, 2011; Spence & Pidgeon, 2009). A wealth of knowledge already exists in psychology that can be effectively harnessed to promote pro-environmental attitude and behaviour change in society (Gifford, Kormos, & McIntyre, 2011; Swim et al., 2009). However, some this knowledge still requires thoughtful interpretation and adaptation, and further complementing investigation of the more challenging aspects of the behavioural dimensions of environmental change, to be truly useful for informing environmental policies (Spence & Pidgeon, 2009).

Psychologists have been studying the behavioural dimensions of environmental problems for over four decades. Early research on this topic mainly focused on the effects of environmental conditions on human functioning and less on the environmental consequences of human behaviour. More recently, research addressing the latter has burgeoned in response to the rising prominence of overarching environmental challenges such as global climate change (Nickerson, 2003). To date, remarkable progress has been made in identifying various psychological factors that operate as key facilitators of, and barriers to, public engagement with adverse environmental change.

The primary purpose of this thesis is to build upon, and extend, current understanding of the psychological influences that underpin the way individuals engage with global manifestations of detrimental environmental change. This purpose will be pursued with a focus on the way

attitudinal and behavioural responses to global climate change are determined by intrapersonal factors and influences arising from the social and physical environment. Climate change currently ranks as one of the world's most pressing anthropogenic environmental problems. It poses a threat to the ecological systems that support life on earth, and has dire implications for human socioeconomic security, prosperity, and wellbeing (Bellard, Bertelsmeier, Leadley, Thuiller, & Courchamp, 2012; McMichael, Woodruff, & Hales, 2006; Stern, 2007). There is a consensus among scholars that human behaviour is not only integral to causing climate change, but also to mitigating and adapting to it (Clayton et al., 2015; Gifford et al., 2011).

In subsequent sections of this chapter, I discuss the characterization of climate change as a psychological problem. In this respect, I outline the ways in which psychological processes are implicated in the causal antecedence of climate change, how climate change impacts psychological wellbeing and social relations, and how research in psychology can aid the development of effective adaptation and mitigation strategies. Subsequently, I address the conceptualization of environmental behaviour and present a concise review of psychological theorizing of the antecedence of environmental actions. Next, I discuss how key intrapersonal and external factors identified in this review, can be organized within an integrative framework to obtain a functional and parsimonious model for understanding the antecedence of climate change-related behaviour. Finally, I present an outline of the research comprising the different chapters in this thesis.

Understanding climate change as a psychological problem

The causal role of human behaviour

There have been fluctuations in global temperatures and climate in the course of the earth's history, but the magnitude of changes in global climate has increased exponentially in the last century (Pachauri & Reisinger, 2007). Research shows that the recent changes in global climate are a result of human activities; particularly the emission of greenhouse gases such as carbon dioxide, methane and nitrous oxide from fossil fuel use, agriculture and deforestation (Cotton & Pielke, 2007; Dale, 1997; Schneider, 1989; Solomon, Plattner, Knutti, & Friedlingstein, 2009; Wuebbles & Jain, 2001). It is important to note that, although the terms 'global warming' and 'climate change' are often used interchangeably, climate change involves more than just temperature change. The human activities that drive temperature change have also triggered a series of associated phenomena including sea level rise, loss of polar ice, ocean acidification, melting of continental glaciers and more (Pachauri & Reisinger, 2007; Swim et al., 2011).

Scholars have described climate change as a common[1] goods dilemma as it involves collective action driven by individuals' short-term interests that degrades a long-term common good (Dietz, Ostrom, & Stern, 2003; Gifford, 2008; Swim et al., 2011). Human behaviour contributes to climate change through the consumption of goods and services that directly and indirectly involve fossil fuel consumption, greenhouse gas emission and the other biophysical processes that alter the climate (Gifford et al., 2011; Swim et al., 2011). A great deal of evidence supports the view that current levels of human consumption, combined with population growth, are contributing to climate change and are having a negative impact on the natural environment (Dietz & Rosa, 1994; Dietz, Rosa, & York, 2007; Ehrlich & Holdren, 2017; Vlek & Steg, 2007). Continuing the current rate of greenhouse gas emission is expected to yield a variety of adverse consequences (IPCC, 2007b; Pachauri & Reisinger, 2007). If per capita emissions were held constant, the population increase expected in the next fifty years would produce a 50% increase in the global emissions rate (Swim et al., 2009).

Research in the US suggests that individuals and households account for nearly 40% of national carbon emissions through home energy use and transport; a greater proportion than the entire US industrial sector (see Gardner & Stern, 2008). This illustrates the centrality of individual decisions and actions to the problem of climate change. It also highlights an avenue for psychology to play a role in developing climate change solutions by improving understanding of how climate-relevant decisions and actions are influenced by personal, social, economic, institutional and social-structural factors, and using that understanding to help devise effective interventions (Stern, 2011).

Climate change impacts psychological wellbeing and intergroup relations

The threat and unfolding impacts of current climate change encompass direct, indirect and mediated experiences with global climatic patterns, region-specific weather conditions and physical environmental impacts (Reser & Swim, 2011). These experiences are likely to have significant effects on mental health and wellbeing, particularly among the most vulnerable populations (Berry, Bowen, & Kjellstrom, 2010; Mudaliar & Rishi, 2012; Trombley, Chalupka, & Anderko, 2017). Localized consequences of extreme weather events and degraded landscapes, such as injury or stress, can be viewed as direct personal climate change impacts (Doherty & Clayton, 2011).

[1] Commons is defined as any desirable, divisible entity to which multiple individuals or groups have access (Gifford & Hine, 1997).

By some estimates, 25% to 50% of people will suffer negative mental health outcomes following experiences of extreme weather events (Shukla, 2013). Psychological responses are typically heightened in the first year after the disaster occurs (Goldmann & Galea, 2014), and factors such as the magnitude of the traumatic event, exposure to the injury or death of a loved one, lower socioeconomic status, lower education, inadequate social support, and being young and female all contribute to the risk of developing a mental illness in the aftermath of such disasters (Neria & Shultz, 2012; Trombley et al., 2017). Common initial responses to experiencing a climate change-related disaster may include anxiety, hypervigilance, social withdrawal, anger, flashbacks, guilt and avoidance (Forbes et al., 2015; Halpern & Tramontin, 2007).

Flooding is expected be one of the main impacts of climate change on UK communities (DoH, 2001). Following widespread flooding across England in 2007, Paranjothy et al. (2011) found that the prevalence of psychological distress, anxiety, depression and probable post-traumatic disorder (PTSD) was two- to five-fold greater among people who had been affected by floodwater in their home. Agrarian communities are particularly vulnerable to the impacts of climate change. The incidence of droughts and crop failure are projected to increase considerably due to global climate change (Challinor, Simelton, Fraser, Hemming, & Collins, 2010; Dai, 2012). In parts of the world, these events have been linked to farmer suicide (Guiney, 2012; Hanigan, Butler, Kokic, & Hutchinson, 2012) and higher levels of distress and helplessness induced by economic hardship (Dean & Stain, 2010; Vins, Bell, Saha, & Hess, 2015).

Other psychological impacts of climate change may be gradual, cumulative and experienced indirectly through social communication and the media (Reser & Swim, 2011; Weber & Stern, 2011). Disasters often receive more attention than gradual climate change impacts of climate change, but the latter can also have negative implications for human health (Trombley et al., 2017). The severity of climate change impacts is not solely due to extreme weather and other natural events, but also to the way human systems interact with these events (Doherty & Clayton, 2011). In this regard, the psychological impacts of climate change are likely to be moderated by vulnerability to environmental changes (Cutter, Boruff, & Shirley, 2003), and mediated by media representations and information technologies (Nerlich & Jaspal, 2014; Ripberger, Jenkins-Smith, Silva, Carlson, & Henderson, 2014).

For example, pre-existing psychiatric illness are closely associated with death during a heatwave (Bouchama et al., 2007). Research in Israel shows that admission to psychiatric hospitals for bipolar depression and exacerbation of acute psychosis is associated with periods of increased heat (Shapira et al., 2004; Shiloh et al., 2005). Increased suicide rates, particularly among men and the elderly, have also been associated with increasing temperatures in Korea (Y. Kim, Kim, & Kim, 2011) and the UK (Page, Hajat, & Kovats, 2007). The indirect, vicarious impacts of climate change include emotional and affective responses associated with viewing images of environmental degradation or human suffering in the media (Doherty & Clayton, 2011). Although not every individual experiences strong reactions to climate change, those who perceive this information as the manifestation of a 'global ecological crisis' may suffer feelings of uncertainty and emotional distress (Searle & Gow, 2010; Stokols, Misra, Runnerstrom, & Hipp, 2009).

Both climate-related disasters and gradual climate change effects can have severe impacts on communities (Trombley et al., 2017). In the aftermath of Hurricane Floyd, research shows a significant increase in the rate of inflicted and non-inflicted traumatic brain injuries among children aged two years or younger in the affected areas (Keenan, Marshall, Nocera, & Runyan, 2004). Temperature rise has also been linked to an increase in acts of aggression and violence (Anderson, 2001). Increased competition for natural resources, jobs and land due to climate change can set the stage for intergroup conflict. For example, an unusually long, severe, and plausibly climate change-induced, drought that destroyed large areas of arable land in Syria has been shown to have had a direct impact on the country's economic condition and played a role in the outbreak of civil war (Gleick, 2014; Kelley, Mohtadi, Cane, Seager, & Kushnir, 2015).

The issues discussed in this section are by no means an exhaustive reflection of the wide-ranging psychological implications of climate change, but they serve to illustrate how climate change can be understood as a challenge for psychologists in the dimensions of mental health and social relations. Doherty and Clayton (2011) argue that: "psychologists are well positioned to provide guidance on what constitutes healthy coping with the psychological impacts of climate change and to intervene in situations of mental health injury or disordered adjustment" (pg. 271). Optimal coping responses to climate change impacts will require accurate risk recognition, effective management of emotions, a focus on pro-social outcomes, and

engagement in mitigation and adaptation actions that are likely to be effective (Doherty & Clayton, 2011; Swim et al., 2011; Weber & Stern, 2011).

Effective solutions require psychological engagement with climate change

Human interactions with global climate occur at multiple levels of social organization including individuals, households, governments and entire societies (Clayton et al., 2015). To date, research has largely focused on institutional actors (e.g., government and industries) and the demographic, economic and technological trends that drive climate change, with minimal attention directed at the factors that influence decisions and actions at the individual level (Clayton et al., 2015; National Research Council, 2011). Despite being central to the cause of climate change, human behaviour remains the least understood dimension of the problem (Gifford et al., 2011; Pachauri & Reisinger, 2007). Public policy discourse on climate change often emphasizes technocratic solutions while the role of psychology is virtually unacknowledged (Gifford, 2008; Klöckner, 2011).

Some scholars have suggested that the imprint of human activities on the global environment has grown so large that we can consider the current period a unique geological era in the Earth's history - termed the *Anthropocene* (Steffen, Grinevald, Crutzen, & McNeill, 2011). The human activities that drive global climate change primarily refer to behaviours that involve the release of carbon dioxide (e.g., burning fossil fuels for energy or heat production), methane (e.g., agriculture) and nitrous oxide (e.g., through industrial processes). Because climate change is rooted in human behaviour, the contribution of a psychological perspective is indispensable (Swim et al., 2009).

Through support for policies and the adoption of technologies, individual behaviour drives societal change (Clayton et al., 2015). Considering research in the UK and US shows that changes in individual behaviours and lifestyle could reduce national carbon emissions by as much as twenty to thirty percent (Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Dietz, Stern, & Weber, 2013; Gardner & Stern, 2008; Skea et al., 2009), the lack of consideration of psychological perspectives on individual behaviour is puzzling (van der Linden, 2014b). While the potential of behaviour change in addressing climate change is clear, research in the UK and US suggests that the majority of the public still view climate change as a temporally and spatially distant threat (Bord, Fisher, & Connor, 1998; Lorenzoni & Pidgeon, 2006; Spence, Poortinga, & Pidgeon, 2012) with relatively low personal relevance compared with other economic and social issues (Poortinga & Pidgeon, 2003). According to Clayton et al. (2015),

effective societal responses to climate change cannot be achieved in the absence of an understanding of how people perceive climate change, the factors that influence mitigation and adaptation behaviours, and how climate change will affect human wellbeing.

Individuals play a key role in responding to climate change; they are the actors who initiate, inspire, guide and enact the cuts in greenhouse gas emissions needed to mitigate climate change, and they develop and implement adaptive responses to minimize its impacts (Wolf & Moser, 2011). Given this understanding, involving individuals with climate change must be considered an imperative. Involving or engaging individuals with climate change means creating a sense of personal connection with the issue. From a psychological perspective, climate change engagement encompasses cognitive (knowledge, beliefs), affective (concern, worry) and behavioural (action motivation, behaviour) dimensions (Lorenzoni, Nicholson-Cole, & Whitmarsh, 2007). In other words, engagement involves what people think, feel and do about climate change (Whitmarsh, O'Neill, & Lorenzoni, 2013).

By implication, the different dimensions of climate change engagement are potential avenues for intervention. While there are still significant gaps in our understanding of how to increase, balance and maintain engagement on these various levels, there is a consensus among many psychologists that unilateral communication (e.g., providing scientific information regarding climate change) generally fails to foster cognitive engagement or produce sustained behavioural engagement (Whitmarsh, O'Neill, & Lorenzoni, 2011). Affective engagement is even more difficult to achieve, not to mention sustain or control, through unilateral communication (Moser, 2007). Research suggests that dialogic processes, culturally-relevant narratives (e.g., stories), and the constructing of meaning in social interaction may have greater potential to touch people deeply, motivate interest and sustain engagement with climate change (Brulle, 2010; Kearney, 1994; Wolf & Moser, 2011).

A lot of policy is based on oversimplifications and inaccurate assumptions about the processes that guide individual engagement with climate change (Clayton et al., 2015). For example, while economic incentives – a popular policy instrument, can be a significant motivation to make pro-environmental choices and decisions, research in psychology has shown that they also crowd out people's intrinsic pro-environmental motivations (e.g., Evans et al., 2012), and only tend to be effective while the incentive is maintained. In other words, external incentives are not an effective long-term motivation for pro-environmental behaviour (Steg, Bolderdijk, Keizer, & Perlaviciute, 2014; van der Linden, 2014b). Yet, the determinants of sustained pro-

environmental conduct have been a key area of research for environmental and social psychologists (Clayton et al., 2015; Gifford, 2008). In a subsequent section of this introduction, I briefly review some of the psychological perspectives on the antecedence of pro-environmental behaviour that are most relevant to the focus of this thesis. However, before proceeding to this review, I will present an overview of the concept of environmental behaviour and its operationalization in the context of climate change.

Conceptualizing environmental and climate change-related behaviour

Impact-oriented definitions of environmental behaviour

Environmental behaviour has been conceptualized in two ways relating to impact on the environment (Stern, 2000). In this respect, impact is understood as the extent to which behaviour results in changes in the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself (Stern, 1997, 2000). The rationale for an impact-focused conceptualization of environmental behaviour lies in the need to identify and target actions that have large effects on the environment and environmental issues (Heiskanen & Pantzar, 1997; Stern, 2000). The first concept of environmental behaviour concerns behaviours that have a direct impact on the environment such as clear-felling of forested areas for commercial monocultures, waste disposal processes, burning fossil fuels for energy etc. A second concept of environmental behaviour addresses actions that have an indirect impact on the environment by shaping the context in which choices are made that directly cause environmental change (Stern, 2000). Examples of such behaviours include consumption of unsustainably-sourced products and policymaking that facilitates economic growth at the expense of natural resource conservation.

Defining environmental behaviour from actors' perspective

Environmental behaviour can be defined from the actor's perspective based on whether they intend their action to have an impact on the environment. Historically, environmental impact has largely been a by-product of human desires for comfort, mobility, power, security and status, and the technologies and organisations humanity has created to achieve these desires (Stern, 2000). However, with growing awareness of anthropogenic environmental change, environmental protection has become a significant consideration in decision-making. Therefore, from the actor's standpoint, environmental behaviour can also be understood as any actions taken with the intent to have a [beneficial] impact on the environment. According to Stern (2000), the intent-oriented definition differs from an impact-oriented definition insofar

that the former highlights intent as an independent cause of behaviour and highlights the possibility that environmental intent may not result in environmental impact. In the context of climate change, actions defined by experts as having the most impact (e.g., energy conservation) may not overlap with those taken by the public with the intention of mitigating climate change (e.g., recycling). For example, in a survey of UK residents, 96% of respondents reported engagement in actions objectively determined to have an impact on climate change (e.g., domestic energy conservation) while only 31% reported that they engaged in pro-environmental behaviour out of concern about climate change (Whitmarsh, 2009).

Nonetheless, both definitions are important for research. An impact-oriented focus is necessary for targeting behaviours that cause large changes in the environment and is critical for making research useful, while an intent-oriented definition focuses on people's beliefs and motives and is necessary for understanding and changing the target behaviours (Stern, 2000; Stern & Gardner, 1981).

Typologies of environmental behaviour

There are number of different types of environmental behaviour and each may be determined by a different set of causal factors. In broad terms, pro-environmental actions may be categorized as public- or private-sphere behaviours (Stern, 2000). Public-sphere behaviours include active involvement in environmental groups and political activities (environmental activism), launching and signing petitions on environmental issues (environmental citizenship), and endorsement of environmental regulations (support for environmental policies). Whereas, private-sphere behaviours include 'green' consumerism (e.g., purchasing sustainably-sourced products or products made from recycled materials), domestic energy and water conservation practices, and adoption of low-carbon transport options (Stern, 2000).

Clayton and Myers (2009) also offer a tripartite typology of environmental behaviours. The first category in their typology is termed *curtailment* behaviours. This refers to behaviours aimed at reducing the exploitation of natural resources and they include voluntary adoption of frugal lifestyles, reducing energy use, and reducing the size of families. The second category of behaviour, they term *behavioural choices*. This refers not to *what* action is taken but *how* it is done. Examples of such behaviours include choosing to reuse or recycle items rather than throwing them away, choosing to use public transport instead of driving or choosing to consume only locally-sourced produce. The final category of behaviours involves *technological choices*. These include decisions made concerning the adoption of pro-

environmental technologies such as electric vehicles, renewable energy in the home or energy-efficient appliances.

Some authors have suggested that psychologists should focus primarily on high impact behaviours given the limits on attention, time and resources (e.g., Gardner & Stern, 2002). However, all behaviours are worthy of examination, irrespective of their impact. Due to the effects of self-perception, commitment, conformity and a desire to appear consistent, people who take a small step for an environmental cause may go on to take bigger steps (Burger, 1999; Clayton & Myers, 2009).

Behaviour in the context of climate change: Adaptation vs. mitigation

Behavioural engagement with climate change involves *mitigation* and *adaptation* (van der Linden, 2014b). According to the IPCC (2001), mitigation refers to actions that minimize the release, or enhances the sinks, of greenhouse gases. On the other hand, adaptation refers to adjustments in human or natural systems in response to present or anticipated climate change to moderate harm and take advantage of beneficial opportunities. In other words, adaptation addresses the effects and mitigation addresses the cause of climate change. The two categories of action are complementary aspects of any potentially effective societal response to climate change.

The impacts of climate change are already apparent across the globe (Collier, Conway, & Venables, 2008; Parmesan & Yohe, 2003; Wheeler & von Braun, 2013). Therefore, adaptation measures are a necessity (IPCC, 2007a; Parry, Arnell, Hulme, Nicholls, & Livermore, 1998). However, relying on adaptation alone could lead to a scale of climate change to which adaptation can only be achieved at high social and economic costs. Consequently, mitigation is also essential for reducing the risks of climate change (Klein, Schipper, & Dessai, 2005).

The research comprising this thesis focuses mainly on environmental behaviours relevant to climate change mitigation. According to van der Linden (2014), mitigation actions are an interesting subject for psychology because of the spatial and temporal scales on which they are effective, and the relative distribution of the associated benefits and costs. While the need for adaptation is clearly illustrated by perceptible and imaginable local risks (e.g., flooding), mitigation entails acting in ways that involve significant immediate and personal costs in order to obtain potentially large but uncertain, and globally distributed, future benefits (Klein et al., 2005; van der Linden, 2014b). Further, the benefits of adaptation to the public are self-evident,

while the benefits of voluntary mitigation actions are based on a belief that climate change is caused by human activities - a notion that may be contested by some groups (Leiserowitz, Maibach, Roser-Renouf, Smith, & Dawson, 2013; Poortinga, Spence, Whitmarsh, Capstick, & Pidgeon, 2011). As a result, the motivations that underlie adaptation actions tend to be less psychologically challenging than those that drive mitigation actions (van der Linden, 2014b).

Psychological perspectives on the antecedence of pro-environmental behaviour

Pro-environmental behaviours and their underlying motivations have been linked to a distinct set of cognitions, emotions and values (Stern & Dietz, 1994; Stern, Dietz, & Kalof, 1993), a recognition of the inextricable link between human survival and a fragile natural environment (Dunlap, Van Liere, Mertig, & Jones, 2000), and a variety of psychological dispositions including empathy with non-human life and an affinity toward nature (Gosling & Williams, 2010; Schultz, 2000). The cognitive, affective and behavioural dimensions of engagement with environmental issues have complex interrelationships, and numerous theoretical models have been advanced with the aim of representing these interrelationships in ways that help psychologists understand, and make predictions about, how individuals respond to environmental issues. No single theoretical model is solely sufficient to account for the complexity of pro-environmental behaviour, but some models are more widely used than others (Gifford et al., 2011). Below, I present a brief overview of a number of key theories of environmental behaviour with an emphasis on those most pertinent to the focus of this thesis.

Theories of environmental behaviour

The knowledge-deficit model

Also known as the linear awareness model, the knowledge-deficit model proposes a linear causal relationship between knowledge of environmental problems, environmental concern and pro-environmental behaviour. This model of pro-environmental behaviour emerged in the 1970s and was based on a fundamental notion that educating the public about environmental issues would naturally promote engagement in pro-environmental behaviour (Kollmuss & Agyeman, 2002). The knowledge-deficit model lies at the heart of a multitude of environmental education and public communication programs that have been launched across the world in response to various problems including water conservation, littering and the energy crisis (Akerlof, 2017; F. Campbell, 2007; Syme, Nancarrow, & Seligman, 2000). Over the last forty years, interest in public awareness as a precursor of to the adoption of environmental policies and behaviour has grown in tandem with government enthusiasm for low-cost ‘soft’ policy

approaches to achieving sustainability goals. In support of the knowledge-deficit model, several studies have shown that knowledge and awareness are positively linked to pro-environmental attitudes and actions (Gamba & Oskamp, 1994; Masud, Akhtar, Afroz, Al-Amin, & Kari, 2015), and that informational campaigns can significantly promote pro-environmental attitudes and behaviours (Bidwell, 2016; Staats, van Leeuwen, & Wit, 2000; van der Ploeg, Cauilan-Cureg, van Weerd, & De Groot, 2011). However, the popular adoption of the knowledge-deficit model as an orienting framework for communicating scientific issues, including those relating to the environment, has been widely criticized on empirical and theoretical grounds.

From an empirical perspective, scholars have repeatedly highlighted the fact that the relationship between public knowledge and attitudes is often weak (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Diekmann & Preisendörfer, 1998). Further, while individuals with relatively high levels of knowledge have been shown to have more consistent attitudes toward general domains of scientific (or environmental) issues, the predictive power of knowledge decreases with the increasing specificity with which the focal issue is defined (G. Evans & Durant, 1995). In other words, the strength of the link between knowledge and attitudes varies considerably, depending on the nature and specificity of the attitude domain. The effect of information provision and knowledge on behaviour is also highly subject to the moderating influence of situational factors. For instance, attitudes and behaviour may remain unchanged, irrespective of heightened awareness of environmental problems, if prevailing social norms and customs promote negative environmental practices (Kollmuss & Agyeman, 2002). Similarly, information provision may be ineffective in changing behaviour if the desired behaviour is associated with high costs or difficulty (Kaiser & Fuhrer, 2003).

From a theoretical perspective, scholars have criticized the knowledge-deficit model on the basis of its underlying assumptions that ignorance lies at the root of negative attitudes and that shortfalls in the public's knowledge can be remedied via unilateral communication of factual information from experts to lay citizens (Ahteensuu, 2012; Brunk, 2006; Bulkeley, 2000a). Research suggests that scientists often have inaccurate perceptions of public knowledge and attitudes regarding scientific issues (Carr, Grand, & Sullivan, 2017). Further, communication strategies that focus solely on knowledge of 'scientific facts' as the yardstick of public understanding of environmental and technological risks are often insensitive to the diversity of individuals' values regarding the acceptability of risks, as well as the differences between

experts and lay people in their responses to different dimensions of risk (e.g. certainty, catastrophic potential, controllability, equity and risk to future generations) (for a review of these issues, see Hansen, Holm, Frewer, Robinson, & Sandøe, 2003). In contrast to expert perspectives, the lay public understanding of environmental issues typically reflect a combination of scientific information, values and local experience (Bulkeley, 2000a). This understanding develops through day-to-day social practices that occur within discursively constructed and institutionally embedded relations of trust, dependency and agency between individuals, communities, science and governments (Bulkeley, 2000a; Wynne, 1996). Consequently, the public may hold views that diverge from scientific facts for reasons other than a lack of understanding of the issue in question.

Nonetheless, research shows that familiarity with the causes and consequences of environmental problems generally has significant indirect links with behavioural engagement (Bamberg & Möser, 2007), and knowledge can help build competence leading to pro-environmental action (Jensen, 2002). Thus, a widely shared view among psychologists is that factual knowledge of environmental issues alone is an insufficient motivation, but a necessary precondition, for pro-environmental behaviour (Bolderdijk, Gorsira, Keizer, Steg, & Ouellette, 2013; Jensen, 2002; Steg & Vlek, 2009).

Protection motivation theory

Protection motivation theory was originally proposed as a framework for understanding the appraisal processes that underlie individuals' responses to perceived risks in the health domain (Rogers, 1975). According to this theory, individuals' responses to perceived risks are determined by the outcome of two processes, termed threat appraisal and coping appraisal. Threat appraisal entails assessment of the severity of a risk/hazard and the likelihood of being subjected to its effects. On the other hand, coping appraisal entails assessments of the effectiveness of potential response options, the effectiveness of the individual to perform the response options and the costs of responding.

From the protection motivation theory perspective, people are more likely to engage in adaptive responses when they perceive a risk to be severe and likely to affect them, and when they perceive themselves to be capable of executing responses with a perceived high likelihood of effectiveness (Maddux & Rogers, 1983; Rogers, 1975). According to Rogers (1983), these processes of deliberation may not be within conscious awareness. A number of studies have demonstrated that the protection motivation theory can help explain a variety of environmental

behaviours including those relating to climate change (Bockarjova & Steg, 2014; Kim, Jeong, & Hwang, 2013; Rainear & Christensen, 2017). However, while this theory has been most widely used in relation to health communications involving fear appeals, it does not explicitly address the role of emotions as a motivation for responses to perceived threats.

The theory of planned behaviour

The theory of planned behaviour (Ajzen, 1991) is an extension of the theory of reasoned action (Fishbein & Ajzen, 1975), and is one of the most widely applied models in environmental psychology. According to the theory of planned behaviour, intentions are the most proximal determinant of behaviour and intentions are causally determined by attitudes toward the behaviour, perceived control over the behaviour, and perceived social expectations to engage in the behaviour. This model has been successfully applied to explain various environmental behaviours including recycling (Boldero, 1995; Nigbur, Lyons, & Uzzell, 2010; Tonglet, Phillips, & Read, 2004) and choice of transport mode (Bamberg, Ajzen, & Schmidt, 2003). A major strength of the theory of planned behaviour is its parsimony (Heath & Gifford, 2002). However, it is entirely situated in a view of people as rational actors and fails to account for the influence of key motivations such as emotions and values. Several studies have shown that the explanatory power of the model can be increased by incorporating factors such as value-driven environmental concerns (de Groot & Steg, 2007a), anticipated emotions (Perugini & Bagozzi, 2001), and personal norms (Harland, Staats, & Wilke, 1999).

The norm activation model

Following a meta-analysis of studies addressing the predictors of pro-environmental behaviour, Bamberg and Möser (2007) found that moral norms and emotions such as anticipated guilt explain a considerable amount of variance in behaviour. On this basis, they argued that the causal antecedence of pro-environmental behaviour is best conceptualized as reflecting a combination of self-interested and pro-social motives. Considering that pro-environmental behaviours typically produce benefits for individuals other than those performing the behaviours, several authors have suggested that they should be categorized as a form of pro-social or altruistic behaviour (Dietz, Fitzgerald, & Shwom, 2005; Steg & de Groot, 2010).

In line with this, theories of altruistic behaviour such as Schwartz' (1977) norm activation model (NAM) have been employed in explaining pro-environmental behaviour. According to the NAM, altruistic behaviours arise from an activation of internalized personal moral norms (otherwise known as personal norms), which in turn emerge from a knowledge that not acting

altruistically will have negative consequences for valued others and an acceptance of personal responsibility for averting these negative consequences (Steg & de Groot, 2010). In the environmental domain, the NAM's awareness of consequences component is generally conceptualized as knowledge of the adverse consequences of environmental issues. This form of knowledge has been empirically shown to predict acceptance of responsibility, which in turn predicts personal norms regarding pro-environmental actions (de Groot & Steg, 2009). In combination, these factors have been used to explain public engagement in a variety of behaviours including recycling, green purchasing and pro-environmental driving behaviour (de Groot, Steg, & Dicke, 2007; Joireman, Lasane, Bennett, Richards, & Solaimani, 2001; Onwezen, Antonides, & Bartels, 2013). Like the theory of planned behaviour, the NAM has been widely used in environmental behaviour research because of its parsimony. However, its explanatory power is limited by its explicit account for the roles of value-based and affective influences (Onwezen, Antonides, & Bartels, 2013; Stern & Dietz, 1999). For this reason, several attempts have been made to extent the model by incorporating additional predictors.

Value orientations theory and the value-belief-norm model

One of the most popular extensions of the NAM is the value-belief-norm (VBN) model developed by Stern et al. (1999). The VBN model links the NAM to a value orientations theory previously proposed by Stern, Dietz, and Kalof (1993). According to Stern et al. (1993), environmental concern and individuals' motivation to act pro-environmentally are determined in part by value orientations. Values are desirable goals and stable beliefs, linked inextricably to affect, that transcend actions and situations (Schwartz, 2006). They motivate action and are used by individuals as a standard for evaluating attitudes and behaviours (Rokeach, 1968; Schwartz, 1992). Schwartz (1992) identified ten core values (self-direction, stimulation, hedonism, achievement, security, power, tradition, conformity, benevolence and universalism) that occur across cultures. Value orientations are defined as clusters of compatible value types, and Stern et al. (1993) proposed that environmental concern generally arises from one of three value orientations which they termed *egoistic*, *social-altruistic* and *biospheric* value orientations.

Egoistic value orientations comprise values that prioritize the pursuit of personal advancement and security, while *social-altruistic* value orientations are strongly aligned with concern for the welfare of other individuals, and *biospheric* value orientations involve concern for the welfare of non-human life and environmental protection (Stern, Dietz, & Kalof, 1993). Egoistic value

orientations are a strong motivation for most human behaviour, and they induce pro-environmental behaviours particularly when such action serves the personal interests of the actor. However, social-altruistic and biospheric value orientations have more consistent links with environmental concern and pro-environmental behaviour. These inspire pro-environmental behaviour when people perceive a threat to other individuals or nature as a consequence of adverse environmental conditions (Nordlund & Garvill, 2002; Steg, Dreijerink, & Abrahamse, 2005; Stern, Kalof, Dietz, & Guagnano, 1995).

According to Stern et al. (1993), egoistic, social-altruistic and biospheric value orientations toward the environment are not incompatible, and individuals' environmental attitudes often reflect a combination of these orientations. The relative strength of each value orientation determines individuals' sensitivity to information about outcomes for value objects such as personal welfare, community welfare, or the integrity of the biosphere. Drawing on Schwartz' NAM, Stern et al. (1993) argue that people who are aware that adverse environmental conditions have negative consequences for things they value will be motivated to take meliorating action, and the significance of this can be understood in terms of their value orientation. They illustrate this argument with the following regression equation:

$$M = V_{ego}AC_{ego} + V_{soc}AC_{soc} + V_{bio}AC_{bio} + e$$

Where (M) represents individuals' motivation to engage in pro-environmental behaviour, the subscripts ego, soc and bio represent egoistic, social-altruistic and biospheric value weights (V) or consequences (AC). They propose that motivation to act pro-environmentally can be calculated by summing the product of knowledge of consequences for valued objects (AC) and the importance of the value orientation toward the object (V) across the three value orientations. Using this model Stern et al. (1993) found that value orientations explained 46% of the variance in intentions to engage in pro-environmental political actions, 12% variance in willingness to pay higher income taxes, and 8% variance in willingness to pay higher taxes on petrol in a sample of American university students. They also found that egoistic value orientations were the strongest predictors of pro-environmental intentions, and none of the intentions measures had an exclusive (or independent) value base. In a subsequent study, de Groot et al. (2007) also found that value orientations had a significant effect on individuals' intentions to reduce their car use and willingness to accept increases in vehicular tax in five European countries. However, they found that the relationships between value orientations and pro-environmental

behaviours were significantly mediated by personal moral norms and acceptance of responsibility.

Stern et al. (1999) proposed the value-belief-norm (VBN) model as an amalgamation of the value orientations theory and NAM. The VBN represents pro-environmental behaviour as being most proximally determined by personal norms, which are in turn determined by acceptance of responsibility, awareness of consequences, environmental worldviews[2] and value orientations (Figure 1).

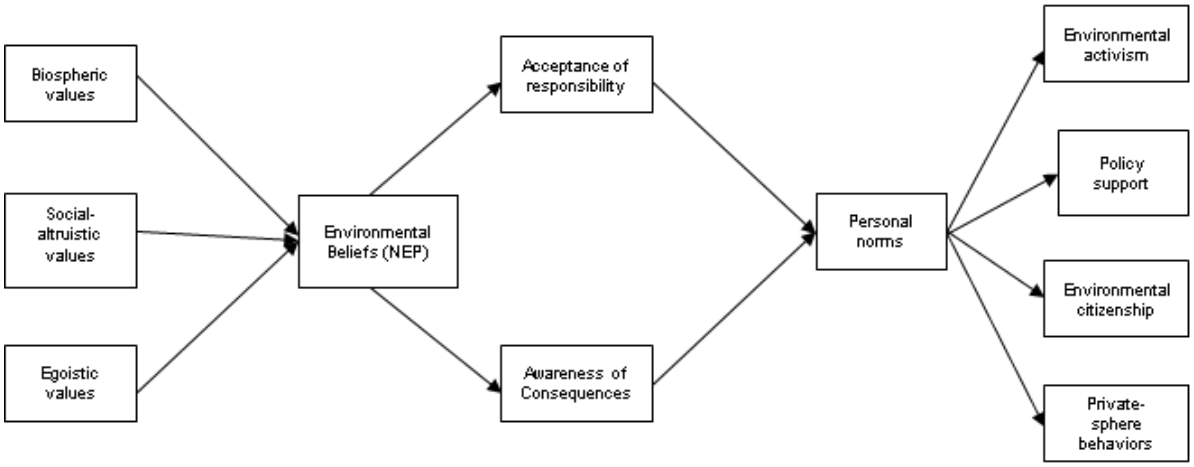

Figure 1. The Value-Belief-Norm Model (adapted from Stern et al. 1999)

One of the most significant features of the VBN is its attempt to link the value-based and cognitive antecedents of moral motivations for pro-environmental behaviour. It explains a considerable amount of variance in behaviours relating to environmental citizenship, support for environmental policies and willingness to undertake pro-environmental lifestyle changes (de Groot & Steg, 2009; Nordlund & Garvill, 2003; Steg et al., 2005). However, like its predecessors, the VBN overlooks the crucial role of emotions as components of pro-environmentalism[3]. Further, research indicates that the VBN is a poor predictor of environmental behaviours that entail significant behavioural costs and strong external constraints such as recycling, certain conservation behaviours and car use (Raymond, Brown, & Robinson, 2011). Intrapersonal processes are indisputably only a fraction of the antecedence of pro-environmental behaviour (Turaga, Howarth, & Borsuk, 2010). Consequently, some

[2] Environmental worldviews are typically operationalized in the VBN using the New Ecological Paradigm (NEP) scale developed by Dunlap and Van Liere (1978) (see also Dunlap, Van Liere, Mertig, & Jones, 2000).
[3] Pro-environmentalism refers to a propensity to take act with an intent to achieve positive environmental outcomes. In other words, a drive to engage in behaviours intended to achieve outcomes that support the maintenance of a healthy and balanced environment (Stern, 2000).

authors have argued that pro-environmental behaviour may be better explained by models that account for interactions between its attitudinal (or personal) and social-contextual determinants (Guagnano, Stern, & Dietz, 1995).

Social identity and social influence perspectives on environmental behaviour

Some authors have argued that environmental behaviours are a function of group processes and as such should be analysed from a perspective of social groups (e.g., Duke, 2010). As discussed previously in this chapter, climate change, and other prominent global environmental challenges, can be understood as common goods dilemmas where individual gains can lead to collective losses (Hardin, 1968). When individuals act in ways that harm the environment to obtain personal benefits, they externalize the costs to others. If too many people act in a self-serving way, the collective losses may accumulate to outweigh the individual gains. Therefore, cooperation among individuals is necessary to achieve a mutually beneficial outcome (Duke, 2010). The larger point being made here is that global environmental problems are shared problems requiring a collective response, and theorizing on how people appraise and respond to these problems should take account of collective processes and collective thinking (Fritsche, Barth, Jugert, Masson, & Reese, in press).

The processes that underlie the human capacity to think and act in line with collectives are described in the social identity perspective (Tajfel & Turner, 1986; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987a). According to this view, people define themselves in terms of their unique person or as interchangeable members of a group as a function of situationally salient comparative contexts and the cognitive accessibility of relevant social categories. The collectively interchangeable state of 'social identity' makes people susceptible to internalizing collective beliefs, goals and action tendencies, and explains how individual actors are psychologically transformed into collective actors (Fritsche, Barth, Jugert, Masson, & Reese, in press).

People are particularly susceptible to the influence of collective or normative beliefs and actions regarding environmental issues because environmental problems are often ambiguous (Duke, 2010). Social norms play a key role in guiding human behaviour by providing information about how to act (Bicchieri, 2006). In a number of experiments, Cialdini et al. (1990, 1991) found that focusing people on information regarding socially approved or disapproved behaviour had a significant effect on their subsequent littering behaviour. Similarly Bolsen (2013; see also Bolsen, Leeper, & Shapiro, 2014) found that incorporating

information regarding social norms into persuasive appeals increased people's motivation to perform actions addressing climate change and energy conservation. A considerable amount of empirical evidence also suggests that social norms have indirect effects on pro-environmental behaviour through their influence on the way people perceived the consequences of environmental problems, attribute responsibility for mitigating responses and perceive their efficacy, and that of others around them, in addressing environmental threats (Klöckner, 2013; Steg & Vlek, 2009).

Researchers have delineated a number of different types of social norm with corresponding differences in the mechanisms via which they exert an influence on pro-environmental behaviour. I present an in-depth discussion of the different modes of social influence in Chapter 5 with a focus on how two specific types of social norm: descriptive and injunctive, contribute to individuals' motivation to engage in climate change-related pro-environmental actions. In the next section, I discuss the interrelationships between different key factors identified in the preceding review and subsequently integrate them into a framework of social and intrapersonal influences on pro-environmental behaviour that serves as a blueprint for the studies reported further on in this thesis.

Conceptualizing relationships among key determinants of individual responses to environmental threats

The fundamental role of threat perception as a motivation for pro-environmental action

My organization of the influences that underlie climate change engagement into an integrated framework is oriented around the importance of threat perception as a basis for action. As evidenced in the summary of environmental behaviour theories presented above, many models of pro-environmental behaviour share an assumption that motivations to address environmental problems arise primarily from an understanding (or awareness) that environmental issues pose an active or potential threat, and that this threat entails negative consequences to valued entities such oneself, important social referents or the natural environment. This understanding has been operationalised in various forms including problem awareness (e.g., Nordlund & Garvill, 2002), environmental awareness (e.g., Grob, 1995), environmental concern (Fransson & Garling, 1999) and perceived threat (Baldassare & Katz, 1992). The importance of threat perception as an underlying driver of pro-environmentalism is validated by a great deal of empirical support and I consequently adopted it as a rallying point in the development of my framework.

The diversity of operationalisations of the perceived negative consequences of environmental change may have served to obscure the predictive value of the concept. Ogunbode and Arnold (2014) indicate that researchers typically measure individuals' knowledge of the *factually accurate* implications of environmental problems that lay individuals may not necessarily possess. Lay evaluations of environmental problems tend not be constituted entirely by a technical knowledge of the properties, causes and effects of environmental phenomena (Dunlap, 1998; Henry, 2000). Rather, they generally reflect a combination of influences including 'local knowledge', personal values and scientific information (Bulkeley, 2000b). Consequently, it seems more likely that people are motivated to act pro-environmentally by their *subjective construal* of the implications of environmental problems. Further, where the perceived implications of environmental problems relate to potential impacts on valued entities and objects, the degree of motivation to act is more likely to be a function of the perceived *magnitude* (or severity) and *likelihood*, than a factual cognizance, of these impacts.

Threat perception and concern: linking the cognitive and affective motivations for pro-environmental action

Research suggests that behavioural responses to perceived threats follow an ordered process wherein threat recognition creates an emotional drive, or a state of heightened anxiety, that focuses individuals on information about potential response options and motivates behaviour and/or attitude change (Hovland, Janis, & Kelley, 1953; Zeelenberg, Nelissen, Breugelmans, & Pieters, 2008). Other perspectives on the relationship between perceived threat and emotions also suggest that emotions act as information to guide the evaluation of perceived threats, and can help people act morally, even when such actions are in conflict with their short term interests (Böhm & Pfister, 2000; Finucane, 2012; Slovic, Finucane, Peters, & MacGregor, 2002). In the environmental domain, van der Linden (2014a) found that the perceived threat and affective responses to climate change influence each other in a stable feedback system. On this basis, he advocates that the relationship between threat perception and affect should be understood as having a dual nature in which affect operates as a post-cognitive process as well as an information processing heuristic that guides the evaluation of environmental threats.

The significance of these perspectives for environmental behaviour research is that they address the links between cognitive and affective engagement with environmental change; a relationship which is often poorly conceptualised in models of pro-environmental behaviour. Previously, concern about environmental change has been operationalised as an attitudinal

component of pro-environmentalism and researchers have largely focused on measuring its cognitive indicators (Fransson & Garling, 1999; Schultz, 2001). Moser (2007) argues that emotional responses are a vital dimension of pro-environmentalism and their role as determinants of pro-environmental action should not be neglected. Modelling pro-environmental behaviour as a response to the perceived severity and likelihood of negative impacts due to environmental change offers an opportunity to coherently link the cognitive and affective dimensions of pro-environmentalism because it encompasses the interactions between cognitive evaluations of the significance of environmental threats, the emotional responses that drive and are produced by these cognitions, and the combined influence of both psychological processes on exerted behaviour.

Perceived efficacy and behavioural responses to environmental threats

Efficacy beliefs operate as an important set of proximal determinants of human motivation, affect and action (Bandura, 1982, 1997). Further, their influence pervades all dimensions of human psychological functioning including our thoughts, aspirations, goals, expectations, and appraisals of opportunities and impediments in the external environmental (Bandura, 2000). Efficacy beliefs are a common feature in models of pro-environmental behaviour. For example, the perceived behavioural control component of the theory of planned behaviour (Ajzen, 1991) is a form of efficacy appraisal, insofar that it represents individuals' evaluation of their capability of performing a specific behaviour.

The degree of individuals' belief in their own efficacy to perform potential behavioural responses, and the efficacy of these responses to mitigate an identified threatening situation, is directly related to their likelihood of responding adaptively to a perceived threat (Bandura, 1982, 2000). This view has been supported by empirical evidence from several studies showing that threat perception is most likely to elicit adaptive responses under conditions of high perceived efficacy (Maddux & Rogers, 1983; Rimal, 2001; Rippetoe & Rogers, 1987; Rogers, 1975). Although the majority of studies in the environmental domain have only focused on the independent effects of threat perception and efficacy beliefs on pro-environmental behaviours and intentions (Bockarjova & Steg, 2014; S. Kim et al., 2013; Rainear & Christensen, 2017), one study suggests that threat perceptions and efficacy beliefs may have a paradoxical relationship in the context of climate change (Hornsey et al., 2015).

Climate change poses severe negative implications for the planet and this is a widely recognized fact among scientists and many members of the broader population (Cook et al.,

2013; Lorenzoni & Pidgeon, 2006; Reynolds, Bostrom, Read, & Morgan, 2010). However, there are a number of reasons for uncertainty about the prospect that these implications can be mitigated (Gifford et al., 2009). Firstly, the effects of carbon emissions may have already reached a tipping point, which means that it may be too late to avoid the negative consequences of climate change even if carbon emissions were drastically reduced (Mora et al., 2013; Pachauri & Reisinger, 2007). Secondly, resolving climate change requires the coordinated efforts of major corporations, governments and billions of individuals. Finally, there is limited evidence of political will to coordinate a global response (Coss, 2000; Rogelj et al., 2010). Individuals may wonder how much their own personal efforts can influence climate outcomes in the face of these complicated interdependencies (Hornsey et al., 2015).

Yet, several studies show a moderately large positive association between perceived efficacy and self-reported concern about climate change (Heath & Gifford, 2006; Kellstedt, Zahran, & Vedlitz, 2008; Milfont, 2012). Further, mean scores on various indices of perceived efficacy regarding climate change tend to settle above the midpoint (e.g., Heath & Gifford, 2006; Reser, Bradley, Glendon, Ellul, & Callaghan, 2012). These trends are in conflict with a considerable amount of evidence in psychology suggesting that efficacy beliefs tend to serve as a buffer against perceived threat (Bandura, 1997; Lazarus & Folkman, 1984; Rogers, 1983). However, Hornsey et al. (2015) argue that they can be understood as an indication that perceptions of efficacy emerge from feelings of threat regarding climate change, such that compensatory and protective perceptions of efficacy increase in line with increase in perceived threat. Their argument is based in a view of efficacy beliefs as motivated cognitions that are designed to manage helplessness in the face of threat, and was supported by evidence from two studies involving samples of Australian and US residents.

From this brief review, one can conclude that efficacy beliefs have a complex interrelationship with perceived threat, and they play a key role in determining the way people respond to threatening issues including environmental change.

The role of values in environmental threat perception and response

People judge the outcomes of their deliberative choices against their values, but cognitive limitations demand that they only focus on a few values out of all possible ones (Dietz & Stern, 1995). Typically, values can be integrated into a few general categories of which the most robust relate to individuals' welfare and to collective welfare. This understanding is consistent with the notion of value orientations discussed previously in this chapter. Attitudes are

constructed on the basis of expectations about how the attitude object (e.g., environmental problem) is likely to affect specific people or things we value, and beliefs (e.g., perceived negative consequences/threat) about the nature and likelihood of these effects mediate between values and attitudinal responses (e.g., intentions and action motivation) (Stern & Dietz, 1994). In other words, values determine our responses to threatening situations or issues through its influence on our beliefs about the way the focal situation or issue is likely to affect things that are important to us.

One of the ways values can shape our beliefs is by acting as an amplifier for social information (Kasperson et al., 1988). For example, having a strong biospheric value orientation may lead an individual to selectively seek or attend to information about the implications of environmental problems and consequently develop beliefs about those implications that guide their behaviour (Stern & Dietz, 1994). Values may also influence beliefs by leading people to accept information selectively on account of the congruence between the information and their values (Kahan, 2013; Stern & Dietz, 1994). Through such processes, values exert a strong influence on our inclination to recognize and attend to environmental threats.

Contextual influences on environmental threat perception and response

Contact and experiences with the natural environment shape our sense of connectedness with nature, our environmental attitudes, and our behavioural proclivities (Byrka, Hartig, & Kaiser, 2010; Collado & Corraliza, 2015; Kil, 2016). First-hand and vicarious exposure to the evidence of environmental change and degradation can also have a powerful effect on our understanding of the immediacy and gravity of environmental problems, and through this process engender a motivation for pro-environmental action (Borick & Rabe, 2010; Hine & Gifford, 1991; Schultz, 2000). However, not all environmental threats may be directly perceptible to lay members of the public. For example, the evidence of global climate change is largely represented by technical meteorological, ecological and hydrological data, systematically gathered and curated by scientific experts, that is then transmitted to the public through purposive communication efforts. In this respect, awareness-raising programs and other such informational campaigns constitute a part of the context in which individuals identify and proceed to make sense of salient environmental threats. Further, the uncertainty and ambiguity of global climate change also increases the likelihood that individuals will look to the reactions of other around them for social cues on how the threat of climate change is collectively construed and what constitutes an appropriate response (Duke, 2010). Even

though contextual factors such as directly observable changes in the environment, information delivered via awareness campaigns and social norms may be relatively distal influences on behavioural responses to environmental threats, it is important to consider their connection with personal beliefs, affective responses and intentions as intrapersonal psychological processes do not operate independently of the social and physical context within which the agentic individual is situated.

Meta-theoretical framework of the thesis: an integrative psychological model of social and personal influences on pro-environmental behaviour in the context of climate change

According to Bandura (1986), behaviour, internal cognition and affect, and the external environment operate as interacting determinants in what he termed a cycle of *triadic reciprocal determinism* (Figure 2). Bandura (1986, 1989a) argues that internal cognitions and affect are developed and modified by contextual influences that provide information and stimulate emotional responses through modelling, instruction and social persuasion. He further argues that people's beliefs, feelings, goals and intentions give shape and direction to their behaviour and that the extrinsic effects of their actions in turn partly determine their thoughts and emotional reactions.

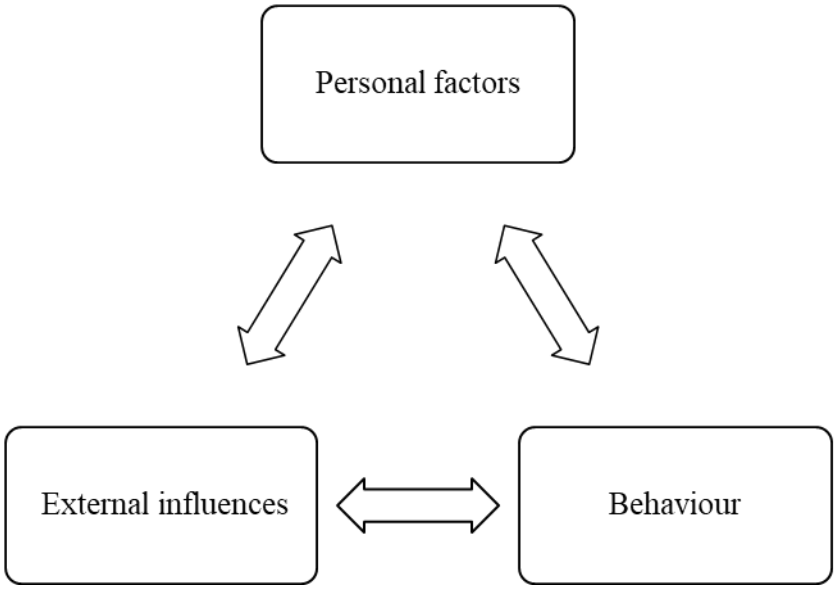

Figure 2. A causal model of triadic reciprocal determinism (Bandura, 1986, 1989b).

To facilitate the development and testing of hypotheses regarding linear relationships among the key determinants of pro-environmental action discussed above, I outlined a unidirectional framework loosely based on Bandura's model of triadic reciprocal determinism to serve as a rough blueprint for the studies comprising this thesis (Figure 3). Drawing from Bandura (1989b), I envisaged that influences originating from our external and social environment, specifically targeted communication campaigns, experiences with the impacts of climate change, and social norms, shape behavioural engagement with climate change through their effects on, and interactions with, values, perceived threat, concern and perceived efficacy.

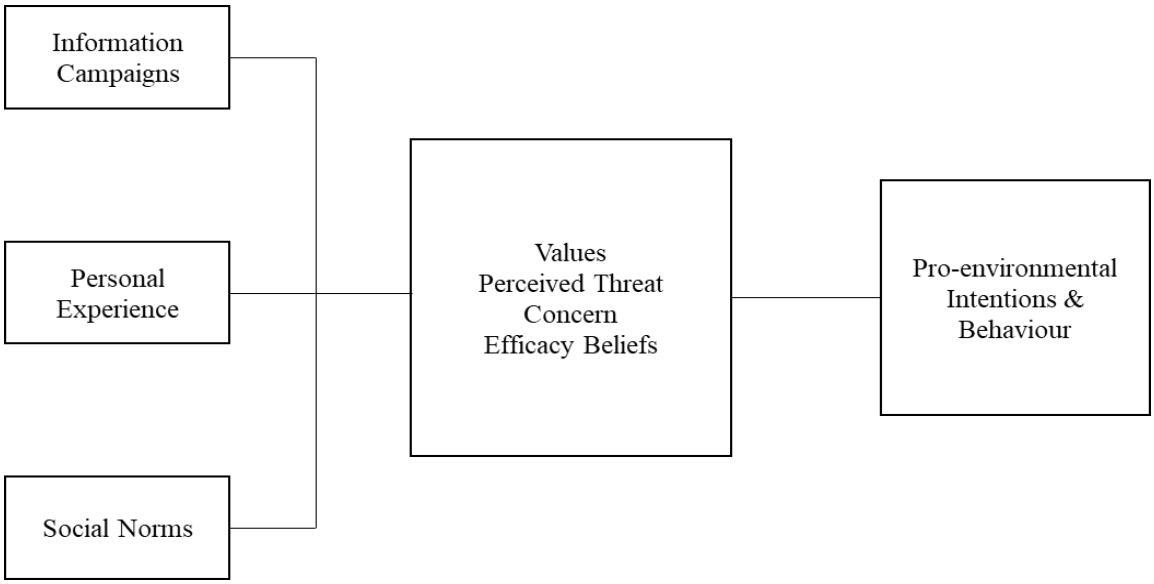

Figure 3. A conceptual framework of social and personal influences on pro-environmental action

Bandura (2000) highlights the fact that individuals are not mere conduits for external influences on behaviour. Pre-existing values determine the way we interpret our experiences of the physical world and how we integrate externally generated information into our beliefs and worldviews. While information campaigns may draw our attention to climate change and furnish us with knowledge of the causes and consequences of the problem, we may not be motivated to act unless our emotions are engaged and we perceive climate change to be a threat to entities we value. Similarly, although the ambiguity of problems like climate change may make us more predisposed to look to the behaviour and expectations of others around us for guidance on what constitutes an appropriate response, such social information may only have an influence on own beliefs and behaviour if we feel a sense of connection or identity with other actors in our environment. In the next section, I present an outline of how the different

elements of my integrative model are examined in the chapters comprising the rest of this thesis.

Thesis outline

The remainder of this thesis is organised around four chapters that examine the relationships between distal external factors – information campaigns, extreme weather events and social norms, and more proximal personal influences – perceived threat, concern, perceived efficacy, and biospheric values, as predictors of climate change-related pro-environmental behaviour and intentions (Table 1.1). In Chapter 2, I examine the indirect influence of exposure to climate change information on willingness to engage in civic actions aimed at addressing climate change through perceived threat and concern. The studies reported in that chapter were conducted in two sub-Saharan countries: Nigeria and South Africa. While, individual responses to climate change (and other environmental problems) are self-apparently global phenomena, research on the behavioural dimensions of climate change has been markedly characterised by a focus on Western, Educated, Industrialized, Rich and Democratic (WEIRD: Henrich, Heine, & Norenzayan, 2010) societies. Compared with WEIRD societies with near universal awareness of climate change, research suggests that climate change awareness is still very low in many parts of Africa (T. M. Lee, Markowitz, Howe, Ko, & Leiserowitz, 2015). Further, although research in WEIRD societies suggests that the link between knowledge and environmental behaviour may be weak or inconsistent, and this often presented as a universal truism, there is no evidence showing that it is the case in Africa. The purpose of the research presented in Chapter 2 was, in part, to address this issue.

In Chapter 3, I address the link between personal experience of flooding and climate change engagement. Using secondary data, I explore the role of political affiliation as a moderator of the relationship between flood experience, climate change perceptions and preparedness to engage in climate change mitigation behaviours in a nationally-representative sample of UK residents. Chapter 4 builds on the focus of Chapter 3 by exploring the moderating influence of biospheric values and attribution in the link between flood experience and climate change perceptions, and pro-environmental behaviour and intentions. In Chapter 4, flood experience is operationalized in four experiments using a mentally simulated personal experience of flooding. In Chapter 5, I present an overview of theoretical and empirical perspectives on the influence of social norms on behaviour and how the interaction between descriptive norms affect intentions to perform socially desirable behaviours including environmental actions.

This is followed by two studies in which I examine the indirect independent and interactive influence of descriptive norms on climate change-related behaviours and intentions conveyed via perceived efficacy, perceived threat and concern. The main findings in the thesis are summarised and discussed in Chapter 6.

Table 1.1. Outline of chapters and PhD thesis

Outline of chapter	Key research aims	Method
1. Introduction		
2. The indirect effects of exposure to information on willingness to act pro-environmentally in response to climate change	Examine indirect links between exposure to information and climate change attitudes in previously underexplored cultural contexts	Cross-sectional survey and Experiment
3. The moderating role of political affiliation in the link between flood experience and individual engagement with climate change in the UK	Examine the equivalence of the link between flood experience, climate change perceptions and preparedness to engage in mitigation behaviour across groups of individuals at different ends of the political spectrum	Quantitative secondary analysis
4. The effects of a mentally simulated flood experience on climate change engagement	Explore the moderating effects of values and attribution on the link between flood experience and climate change attitudes using a mentally simulated experience of flooding	Experiment
5. The interactive influence of descriptive and injunctive norms on climate change perceptions and pro-environmental behaviour	Examine interactions between descriptive and injunctive norms with a focus on how the interactive influence of the two types of norm on climate change-related behaviour and intentions are conveyed via perceived efficacy, perceived threat and concern	Cross-sectional survey and Experiment
6. General discussion and conclusion		

Chapter 2

The indirect effects of exposure to information on willingness to act pro-environmentally in response to climate change: Evidence from Nigeria and South Africa

Introduction

As discussed in Chapter 1, it is commonly assumed that providing people with information about environmental problems increases their likelihood of acting pro-environmentally (Akerlof, 2017; Hungerford & Volk, 1990). Information campaigns typically seek to elicit behaviour change through various channels including: appealing to the alignment between altruistic personal values and environmental goals (value-based campaigns); informing people about the perceptions, attitudes and behaviour of salient actors and role models (social norm marketing campaigns); and targeting attitude change via increasing factual knowledge of environmental problems (awareness campaigns) (Steg & Vlek, 2009). The research presented in this chapter focuses on awareness campaigns and the underlying assumption that exposure to information affects environmental attitudes and behaviour.

Revisiting the contested link between knowledge and environmental behaviour: empirical and methodological considerations

Even though awareness campaigns remain a popular strategy among organizations seeking to promote pro-environmental changes in social practices, research suggests that knowledge is only weakly linked to environmental attitudes and behaviour (Abrahamse et al., 2005; Mckenzie-Mohr, 2000). Compared with direct experiences, such as witnessing dead fish floating across the surface of a polluted lake, providing people with information about environmental problems has a weaker effect on attitudes, and is less likely to produce changes in behaviour (Kollmuss & Agyeman, 2002). The effect of information on environmental behaviour may be even further reduced when performance of the behaviour is associated with severe situational costs or constraints (Kaiser & Fuhrer, 2003; Steg & Vlek, 2009).

Yet, individuals need to know what needs to be done and what they can do before actions can take place. Hence, some researchers have maintained that knowledge is an important precursor to pro-environmental actions (Jensen, 2002; Kaiser & Fuhrer, 2003), and this view is supported by evidence that awareness campaigns are effective in promoting pro-environmental attitudes and behaviours (Bidwell, 2016; Staats et al., 2000; van der Ploeg et al., 2011). Knowledge

delivered through awareness campaigns can be particularly crucial for triggering concern and facilitating appropriate behavioural responses in situations where the evidence for an environmental problem is not readily accessible, as with long-term weather patterns and anthropogenic climate change (Osbaldiston & Schott, 2012; Rasool & Ogunbode, 2015).

According to Kaiser and Fuhrer (2003), the influence of knowledge on environmental behaviour is systematically underestimated due to a number of reasons. Firstly, it is not simply the amount of knowledge available that determines behaviour. Rather, environmental behaviour arises from the convergent influence of different forms of knowledge including *declarative* or *system* knowledge (understanding of how environmental systems work), *procedural* knowledge (understanding of actions required to achieve environmental or conservation goals), *effectiveness* knowledge (understanding of the ecological consequences of different actions) and *social* knowledge (understanding of the relevant motivations and intentions of others). Most studies focus on one or two forms of knowledge and their absolute effects on environmental behaviour; thereby neglecting the ways in which the different forms of knowledge interact in convergent and divergent ways. Secondly, knowledge is not a sufficient condition for environmental action and must be understood as a distal predictor of behaviour that is conveyed by more proximal mediators (Carmi, Arnon, & Orion, 2015; Kaiser & Fuhrer, 2003). The mediated influence of knowledge on behaviour is underestimated by commonly used statistical methods that are sensitive to absolute direct influences but do not account for measurement error attenuation (Kaiser & Fuhrer, 2003).

In this chapter, I address the mediated influence of knowledge by examining the indirect links between exposure to information and climate change-related attitudes in two African populations. The purpose of this research is to clarify the extent to which information provision and knowledge determine individual responses to environmental issues in African societies.

Why is it necessary to examine the link between knowledge and environmental attitudes in Africa?

According to researchers at the BBC World Service Trust (Deane, 2009), people in Africa are at ‘humanity’s climate change frontline’. The reality of climate change is evidenced across the continent by rising temperatures, growing pressure from pests and disease, declining agricultural productivity, and the increasing frequency of extreme weather events (Toulmin, 2009). Yet, due to shortfalls in funding and communication infrastructure, climate change awareness is generally low in Africa (Godfrey, Le Roux-Rutledge, Cooke, & Burton, 2010;

Pugliese & Ray, 2009). A recent study revealed that more than two-thirds of adults in several African countries including Egypt, Ghana, Morocco, Nigeria and Zambia have no awareness of climate change (T. M. Lee et al., 2015). Scholars argue that the information needs of African citizens should be accorded greater priority as the capacity for effective responses to climate change is contingent on the availability and accessibility of relevant information (Cooke, Mohammed, Pauker, & Godfrey, 2010; Gandure, Walker, & Botha, 2013).

While knowledge may not presently be a focal determinant of public engagement with environmental issues in affluent post-industrial societies with generally greater information provision and environmental awareness levels, its role in African countries has yet to be empirically established. Among populations with a high level of awareness of environmental problems, the motivation to engage in pro-environmental actions is arguably more likely to be subject to the influence of factors with greater variability such as the value attached to pro-environmental outcomes and the perceived personal and social benefits of achieving such outcomes. In other words, the influence of knowledge in such contexts may be masked by a ceiling effect. Whereas, the variability in knowledge levels may have a more pronounced effect on environmental attitudes and behaviour among populations with a generally lower level of environmental awareness. On this basis, I present findings from three studies examining the link between exposure to information and climate change-related attitudes in two sub-Saharan African countries. Below, I outline a theoretical model that connects exposure to information with climate change attitudes and provide a brief overview of public engagement with climate change in the context of my research populations.

Theoretical framework and hypotheses: Linking exposure to information with motivation to address climate change

Previous studies addressing the effect of information on individual responses to climate change in Africa have primarily focused on rural and agrarian settings. These studies show that access to information has a significant influence on farmers' perception of climate change (Habtemariam, Gandorfer, Kassa, & Heissenhuber, 2016; Regassa & Stoecker, 2014) and choice of adaptation strategies (Deressa, Hassan, Ringler, Alemu, & Yesuf, 2009). However, beyond examining direct effects, no attempt has yet been made to empirically investigate *if* and *how* exposure to information indirectly affects climate change attitudes through its influence on knowledge. In the current research, I sought to obtain a more holistic understanding by assessing the indirect effects of exposure to information on climate change attitudes. My

inquiry was guided by a theoretical model rooted in an amalgam of knowledge-deficit theory and appraisal theories of risk/threat mitigation.

The knowledge-deficit theory is one of the oldest models of environmental behaviour. It proposes that pro-environmental behaviour arises from environmental awareness and concern in a linear sequential process (see Burgess, Harrison, & Filius, 1998). In this perspective, awareness is conceptualized as a factual knowledge of environmental problems (i.e. their nature, causes and consequences), while concern represents an environmental attitude index resulting from knowledge. Environmental attitudes are typically understood as encompassing the beliefs, emotions and behavioural intentions that people hold regarding environmental issues (Schultz, Shriver, Tabanico, & Khazian, 2004). Thus, taken at face value, the concern construct in the knowledge-deficit model appears to tap primarily into the affective component of environmental attitudes. Extrapolating from this theory, knowledge can be understood as a mediator in the link between exposure to information and environmental attitude and behaviour (Figure 4). However, the knowledge-deficit model does not unpack the process by which knowledge gives rise to attitude change, nor does it explicitly describe the relationship between knowledge and other attitude dimensions such as beliefs and behavioural intentions. The lack of account for behavioural intentions is particularly significant as these are understood to be the most proximate predictors of behaviour (Ajzen, 1991). Therefore, it is necessary to look to other theories for a more elaborate framework of the relationship between knowledge and environmental attitudes.

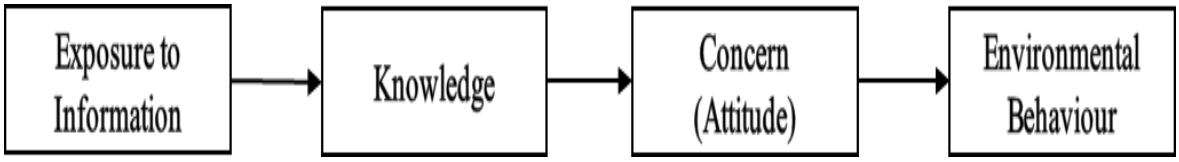

Figure 4. The knowledge-deficit model (adapted from Kollmuss & Agyeman, 2002).

According to Akerlof (2017), environmental awareness can be understood as comprising knowledge that human actions cause environmental problems, and cognizance of the threat posed to value objects including humans, other life-forms and the environment by these problems (see also de Groot & Steg, 2009). This concept of environmental awareness overlaps significantly with the concept of *risk perception* – a term that broadly encapsulates 'lay' evaluations of situations or events that could have negative consequences for value objects (Breakwell, 2007). Risk perception comprises two components: knowledge of risk gained from

direct or vicarious experience, and a judgment of the severity and likelihood of negative consequences (Akerlof, 2017). This conceptual overlap between environmental awareness and risk perception led me to co-opt perspectives from risk and coping appraisal research in developing a theoretical framework that links knowledge with environmental attitudes.

Appraisal theorists propose that encounters in the external environment (e.g. exposure to information about a risk or hazard) trigger appraisal processes in which individuals evaluate if, and how, the encountered stimulus is relevant to their wellbeing (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). The most fundamental of these appraisal processes – termed *primary appraisal*, entails evaluations of what is at stake in the encounter; such as the potential for harm or benefit to the individual and/or things they value. The choice, and *motivation* to follow the course, of a given response to any perceived risk or hazard are determined in part by the outcomes of primary appraisal (Floyd, Prentice-Dunn, & Rogers, 2000)[4].

Research shows that knowledge predicts climate change concern and perceived threat (Mumpower, Liu, & Vedlitz, 2016; Shi, Visschers, Siegrist, & Arvai, 2016). Concern (or worry) and perceived threat/risk have also been consistently shown to predict support for climate policies and engagement in mitigation and adaptation actions (Grothmann & Patt, 2005; Rainear & Christensen, 2017; Zahran, Brody, Grover, & Vedlitz, 2006). Therefore, the relationship between knowledge and individuals' responses to climate change can be evaluated within a framework of primary appraisal. I consider perceived threat to be a cognitive dimension of primary appraisal insofar that it encompasses judgments of the severity and likelihood of adverse impacts on the individual (and valued others such as family, community, nature) resulting from climate change. Likewise, concern and worry represent the affective dimension of primary appraisal as they reflect anticipatory feelings elicited by expected negative consequences (Loewenstein, Weber, Hsee, & Welch, 2001).

[4] Appraisal theories also detail a secondary appraisal process that complements primary appraisal (Floyd, Prentice-Dunn & Rogers, 2000). Secondary appraisal involves evaluation of the efficacy of response options (*i.e.* behavioural/coping responses), and the individual's ability to execute the relevant behavioural responses (*i.e.* personal or self-efficacy).

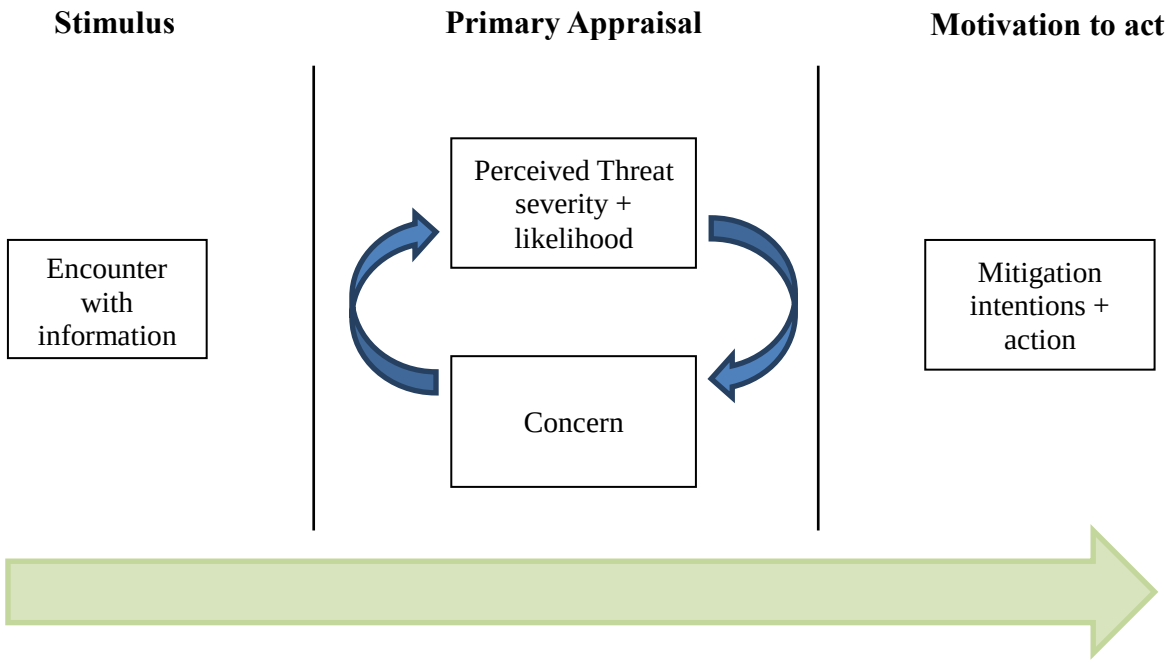

Figure 5. A conceptual model of the link between information exposure and threat mitigation responses through the primary appraisal process.

Although some popular models of threat appraisal and coping such as the *protection motivation theory* (Rogers, 1975) do not explicitly address the relationship between perceived threat and affective responses such as worry and concern, research in the environmental domain suggests that environment-related threat perception and affective responses can be conceptualized as reciprocal influences in a stable feedback system (van der Linden, 2014a). In this regard, concern operates both as an information processing heuristic that guides the evaluation of perceived threats as well as a product of the cognitive threat appraisal process (Figure 5). Further, based on an understanding of environmental attitudes as encompassing beliefs, emotions and behavioural intentions, the outcomes of primary appraisal (perceived threat and concern) and the consequent action intentions/motivation can be interpreted as reflecting a common latent environmental attitude; of which perceived threat and concern are more proximally determined by exposure to information.

Based on these considerations, I propose that exposure to climate change information has a significant positive influence on intentions to address climate change that is serially mediated by knowledge and perceived threat (H1: exposure → knowledge → perceived threat → behavioural intentions), and knowledge and concern (H2: exposure → knowledge → concern → behavioural intentions). Following Frick, Kaiser and Wilson's (2004) concept of 'system

knowledge', I operationalized knowledge as cognizance of the causes and consequences of climate change. This hypothesis was tested with data gathered in Nigeria and South Africa.

A brief overview of public engagement with climate change in Nigeria and South Africa

Nigeria and South Africa are responsible for much of Africa's greenhouse gas (GHG) emissions. Gas flaring in Nigeria's petroleum industry alone accounts for roughly 25% of Africa's total annual GHG emissions (Ukala, 2010). Similarly, due its heavy dependence on coal for energy, South Africa contributes three times more to global carbon-dioxide emissions than it contributes to global GDP and is ranked the 13th highest carbon-dioxide emitter in the world (Seymore, Inglesi-Lotz, & Blignaut, 2014). In the last few decades, the Nigerian and South African governments have introduced various policies and legislation aimed at reducing GHG emissions and promoting sustainable economic growth (Nachmany et al., 2015). Further, both governments have identified climate change awareness raising as a key priority for facilitating behaviour change and informed public participation in efforts to build climate change resilience (Environmental Affairs Department – Republic of South Africa, 2011; Federal Ministry of Environment, 2009). Therefore, research addressing the influence of information provision on individuals' engagement with climate change is highly pertinent in these countries.

Although no study involving nationally-representative population samples of either country has been conducted, research suggests that public understanding of climate change is patchy in Nigeria and South Africa (Godfrey et al., 2010). Research respondents in Nigeria purportedly conflate climate change with Ozone layer depletion, and a majority see climate change as a natural phenomenon (Abegunde, 2016) or the 'will of God' (Cooke et al., 2010). Findings from a qualitative study commissioned by the BBC World Service Trust indicate that South Africans have a comparatively better understanding of the causal role of human activities in climate change but consider climate change impacts a remote threat to their country and the wider African continent (Neville, 2010). Citizens in both countries commonly express feelings of powerlessness to respond to climate change and generally attribute the responsibility for action to the government (Godfrey et al., 2010).

Yet, through civic actions such as pushing for policy changes at varying levels of government and enacting behaviour changes in line with adaptation and mitigation strategies individuals can play key roles in tackling climate change (Moser, 2009; Whitmarsh et al., 2013). Thus, in the current research, I examined the influence of information exposure in relation to willingness

to engage in behaviours with direct implications for the political, social and economic circumstances within which Africans engage with climate change. These types of behaviours are typically overlooked in African climate change research in favour of agricultural adaptation behaviours. Below, I report findings from tests of my hypotheses across three studies. In Study 1, I demonstrate that, as hypothesized, knowledge, perceived threat and concern mediate the link between exposure to information and willingness to act on climate change in a Nigerian sample. Similarly, the hypothesized mediation was supported by cross-sectional data from a South African sample in Study 2. In Study 3, I distinguish between the effects of knowledge of climate change causes and consequences and show that exposure to information is indirectly linked to willingness to act pro-environmentally through knowledge of climate change consequences and perceived threat. However, knowledge of climate change causes did not significantly mediate the indirect effects of exposure to information. Details of my methods and findings from the studies are presented in the following sections.

Study 1

Method

Participants and procedure

Data were gathered in two southern Nigerian states, Abia and Imo, from an opportunity sample of 217 respondents attending a teachers' seminar series organised by the education department. 81% of respondents were school teachers, while others were employed in various educational support roles. Further, the majority of respondents were female (82.5%), urban residents (55.8%) and the mean age was 50.2 years (SD = 8.97). The questionnaires used to gather the data were delivered to a member of the secretarial staff within the education department, who in turn distributed them to attendees at the seminar series. Respondents were briefly informed about the purpose of the study before being asked to provide their consent to participate.

Measures

Exposure to climate change information was assessed with a single item: 'How often do you come across information about climate change (or global warming)? Responses to this item were recorded on a 5-point scale (1 = Never, 2 = Rarely, 3 = Regularly, but less than 4 times each month, 4 = Weekly, 5 = Daily). The modal rate of encounter with climate change information among the sample was 'Rarely', although 20.3% of respondents indicated that they encountered climate change information 'Daily'.

Knowledge of climate change causes and consequences was assessed with eight items adapted from Ogunbode and Arnold (2014). Three of the items were factual statements about climate change (e.g. 'climate change is caused by increased carbon-dioxide concentration in the atmosphere'), three others were reverse-worded statements (e.g., 'climate change has nothing to with the rise in sea levels') and two were common misconceptions reported in prior research (e.g., climate change is caused by Ozone layer depletion). Responses to the items were initially recorded using a 5-point scale (1 = Strongly Disagree, 3 = Unsure, 5 = Strongly Agree). Subsequently, the responses were recoded into a dichotomy of wrong and right answers ('1', '2', '3', = 0; '4', '5' = 1) and a composite knowledge measure was derived from the sum of right answers provided by each participant ($\alpha = .60$). The knowledge measure is presented in full in Appendix 1.

Using a measured adopted from Ogunbode and Arnold (2014), *perceived threat* was assessed by asking participants to rate the extent to which they consider climate change a threat in six domains (lifestyle, health, livelihood, family, community, country). Responses to these items were recorded using a 5-point scale (1 = Strongly Disagree, 5 = Strongly Agree). Principal axis factor analysis showed that the items load on to a single factor explaining 47.3% of the variance in responses (Eigenvalue = 2.84, $\alpha = .77$).

Concern was measured with two items. The first was a rating of respondents' level of concern about the effects of climate change in the world, and the second a rating of concern about the effects of climate change in their country. Responses to both items were recorded using a 5-point scale (1 = Not Concerned, 5 = Extremely Concerned). These items were moderately correlated ($r = .45$, $p<.001$) and principal axis factor analysis showed that they load on a single factor which explains 72.4% of the variance in responses (Eigenvalue = 1.45; $\alpha = .61$).

The behavioural outcome in this research was operationalised as *willingness to engage in climate change-related behaviour*. As an indicator of willingness to act on climate change, participants were asked to rate their level of agreement with the statement: "I am willing to pay special taxes aimed at reducing the impacts of climate change". Further, based on research suggesting that the government's response to climate change is commonly perceived as inadequate in Nigeria and South Africa (Cooke et al., 2010; Neville, 2010), participants were asked to rate their agreement with the statement: "I would participate in protests or rallies against government inaction on climate change". Responses to both questions were recorded with a 5-point scale (1 = Strongly Disagree, 5 = Strongly Agree). These two items were only

modestly correlated (r = .22, p = .001) and willingness to pay taxes for addressing climate change was significantly lower than willingness to participate in protests or rallies among the sample (M_{diff} = -.254, $t_{(216)}$ = -2.44, p = .015). The two items were consequently analysed as separate measures.

This choice of outcome measures is justified by prior research showing a moderate positive association between intentions and behaviour measures in the environmental domain (e.g., Bamberg & Möser, 2007). Additionally, the construct and criterion validity of hypothetical measures of willingness to pay for addressing environmental problems and willingness to engage in climate change-related political activism have been demonstrated in other studies (e.g., Clements, McCright, Dietz, & Marquart-Pyatt, 2015; O'Garra & Mourato, 2016; Roser-Renouf, Maibach, Leiserowitz, & Zhao, 2014).

Results

Preliminary analyses

I found that exposure to climate change information was significantly correlated with knowledge and concern, but not perceived threat and willingness to protest or pay taxes to address climate change (Table 2.1). Willingness to pay taxes to reduce climate change and willingness to participate in protests and rallies were regressed on exposure to climate change information, knowledge, perceived threat and concern using the Maximum Likelihood Estimation (MLE) method in AMOS 20. Based on previous research indicating that gender and age affect environmental attitudes and access to information in Nigeria (Ogunbode & Arnold, 2012), both factors were included in the analysis as control variables. This analysis revealed that exposure to information, knowledge, concern and perceived threat explained 12% and 15% of the variance in willingness to pay taxes to address climate change and willingness to protest government inaction respectively (Figure 6).

Test of hypotheses

I tested my mediation hypotheses using the PROCESS macro for regression-based estimation of mediation, moderation and conditional effects in SPSS (Hayes, 2013). Exposure to information had significant indirect effects serially mediated by knowledge and perceived threat on willingness to protest government inaction (B = .02, SE = .01, 95%CI: [.01, .04], N = 215) and willingness to pay taxes to reduce climate change (B = .01, SE = .01, 95%CI: [.00, .04], N = 215), which supports my hypothesis (H1). Similarly, knowledge and concern serially mediated the indirect effects of exposure to information on willingness to protest government

inaction (B = .00, SE = .00, 95%CI: [.00, .02], *N* = 215) and willingness to pay taxes to reduce climate change impacts (B = .00, SE = .00, 95% CI: [.00, .01], *N* = 215), which supports my second hypothesis (H2)[5].

Table 2.1. Zero-order correlations for the measured constructs in Study 1

	M(SD)	**2**	**3**	**4**	**5**	**6**
1. Exposure to information	3.03(1.27)	.18**	.20**	-.00	.02	.03
2. Knowledge	5.29(1.90)		.13*	.38***	.03	.16*
3. Concern	3.43(0.80)			.19**	.24***	.13†
4. Perceived threat	3.66(0.75)				.28***	.29***
5. Willingness to protest	3.30(1.19)					.22**
6. Willingness to pay climate tax	3.05(1.27)					

[a]Pearsons correlation coefficient, †p<.10, *p<.05, **p<0.01, ***p<.001. N = 217. Scale range for knowledge measure is Min = 0 and Max = 8, while others have a range of Min = 1 and Max = 5.

Discussion

The findings from Study 1 support the hypothesized roles of knowledge, concern and perceived vulnerability as serial mediators of the link between exposure to information and willingness to act on climate change. They also elucidate the process by which exposure to information plausibly triggers behavioural responses to climate change among the sample. While exposure to climate change information had a significant direct relationship with knowledge, it was not directly linked with perceived threat (see Figure 6). This suggests that, among this sample of individuals, the indirect effects of exposure to information on behavioural outcomes conveyed by knowledge and perceived threat plausibly occur in the serial process implied by the theoretical model.

Overall, these findings support previous indications by Ogunbode and Arnold (2014) that concern and the perceived threat of climate change are important determinants of climate change-related behaviour in Nigeria. Therefore, I sought to replicate these findings among another African sample in Study 2.

[5] Alternative configurations to the hypothesized mediation: [perceived threat → knowledge] and [concern → knowledge] were not supported by the data.

Study 2

Method

Participants and procedure

Using the same questionnaire employed in Study 1, I gathered data from 198 respondents in four urban (Bloemfontein, Cape Town, Johannesburg, Port Elizabeth) and five rural locations (Coffee Bay, Giyani, Hoedspruit, Humansdorp, Jeffreys Bay) across South Africa. This was achieved using a combination of opportunistic and snowball sampling methods. Respondents were approached and recruited at random in public areas (shopping malls in urban areas and food markets in rural areas). The sample comprised 2.5% unemployed individuals, 18.2% full-time students and 73.7% individuals employed in part-time or full-time blue and white-collar roles across a variety of sectors. The gender distribution of respondents was closely matched (Females = 49%), but the majority were urban residents (59.1%), and the mean age was 35.2 years (SD = 11.57).

Results

Preliminary analyses

11.6% of respondents indicated that they encounter climate change information 'Daily', but the modal rate of encounter with information was 'Rarely' (34.8%). Using the same approach as in Study 1, a composite measure was derived from the sum of correct responses to the eight *knowledge* items but the measure had low reliability ($\alpha = .54$) among the South African sample. Consequently, two items with low item-total correlations estimates were dropped to increase the reliability of the scale ($\alpha = .63$). Factor analysis showed that the items constituting the *perceived threat* measure loaded on a single factor explaining 71.73% of variance in responses (Eigenvalue = 4.30, $\alpha = .92$) and a similar result was observed with the concern items (Eigenvalue = 1.77, Variance explained = 88.44%, $\alpha = .87$). Respondents reported slightly greater willingness to protest government inaction than willingness to pay taxes to reduce climate change. However, the difference between mean scores on both measures was not statistically significant ($M_{diff} = -.193$, $t_{(196)} = -1.72$, $p = .087$).

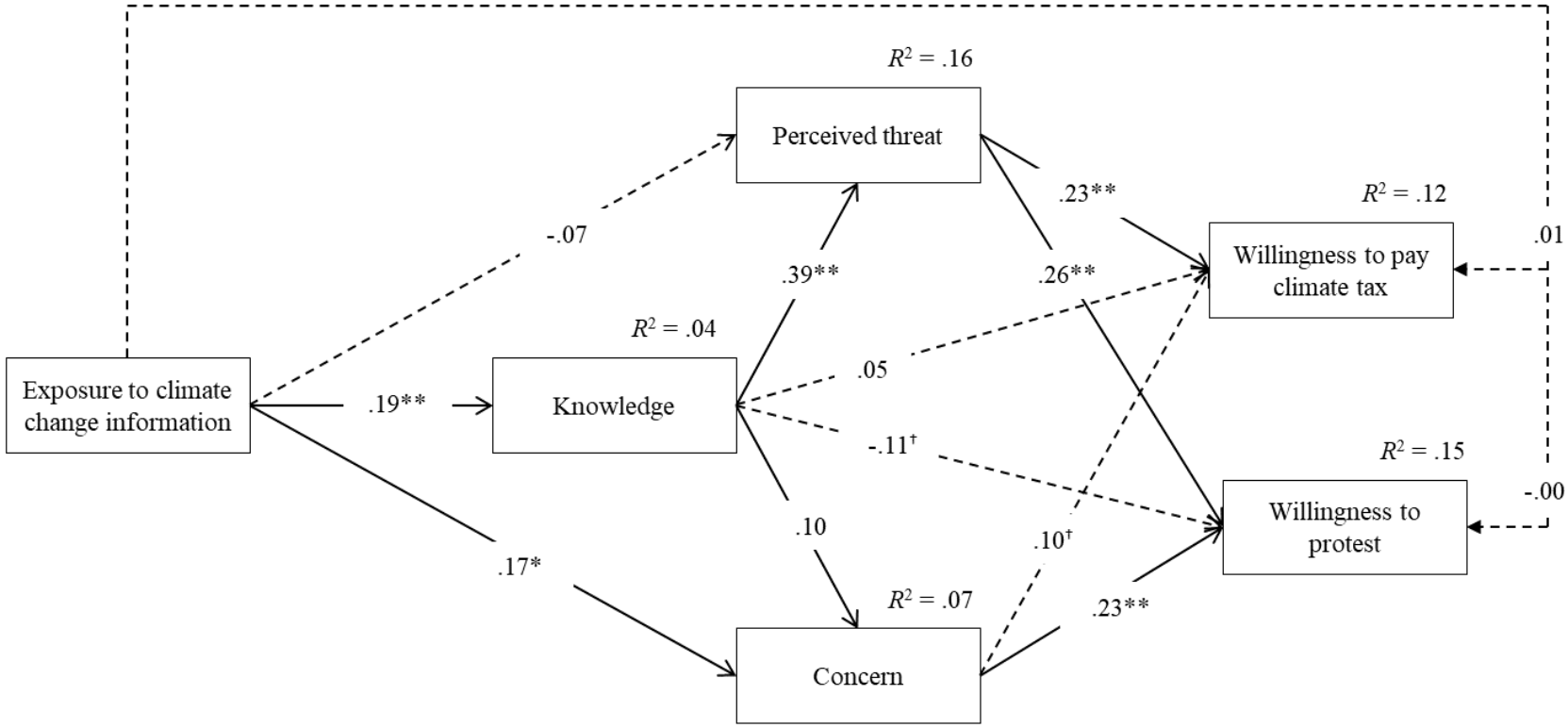

Figure 6. Multiple regression of willingness to engage in climate change-related behaviour on exposure to information, knowledge, perceived threat and concern in Study 1 (Nigeria) N = 217).

Table 2.2. Zero-order correlations and factor loadings for the measured constructs in Study 2

	M(SD)	2	3	4	5	6
1. Exposure to information	2.93(1.11)	.17*	.35***	.11	.16*	.04
2. Knowledge	4.82(1.36)		.23**	.23**	.17*	-.04
3. Concern	3.56(1.00)			.43***	.32***	.28***
4. Perceived threat	3.93(0.86)				.42***	.28***
5. Willingness to protest	3.13(1.31)					.25***
6. Willingness to pay climate tax	2.93(1.26)					

[a]Pearsons correlation coefficient, †p<.1, *p<.05, **p<0.01, ***p<.001. N = 197. Scale range for knowledge measure is Min = 0 and Max = 6, while others have a range of Min = 1 and Max = 5.

Exposure to climate change information was correlated with knowledge, concern and willingness to protest, but not perceived threat and willingness to pay taxes to address climate change (Table 2.2). Regression analysis using the MLE method in AMOS 20 revealed that exposure to information, knowledge, concern and perceived threat explained 13% and 23% of the variance in willingness to pay taxes to reduce climate change and willingness to protest government inaction respectively (Figure 7).

Tests of hypotheses

My mediation hypotheses were tested using the PROCESS macro (Hayes, 2013). The first hypothesis (H1) was supported as exposure to information had significant indirect effects serially mediated by knowledge and perceived threat on willingness to participate in protests against government inaction (B = .01, SE = .01, 95%CI: [.00, .04], N = 197) and willingness to pay taxes to reduce climate change (B = .01, SE = .01, 95%CI: [.00, .03], N = 197). Similarly, I found support for my hypothesis (H2) as exposure to information had significant positive indirect effects serially mediated by knowledge and concern on willingness to protest against government inaction (B = .01, SE = .01, 95%CI: [.00, .02], N = 197) and willingness to pay taxes to reduce climate change (B = .01, SE = .01, 95%CI: [.00, .03], N = 197).

Exposure to information was more strongly related to concern than knowledge among the sample (see Table 2.2. and Figure 7), and this led me to explore alternatives to the hypothesized relationships between these factors. Interestingly, exposure to information also had a significant negative effect serially mediated by concern and knowledge on willingness to pay taxes to reduce climate change (B = -.01, SE = .01, 95% CI: [-.03, -.00], N = 197) but not on willingness to protest (B = .00, SE = .01, 95%CI: [-.00, .03], N = 197). There was no significant

effect mediated by perceived threat and knowledge on either willingness to protest (B = .00, SE = .00, 95%CI: [-.00, .01], N = 197) or willingness to pay taxes to reduce climate change (B = -.00, SE = .00, 95%CI: [-.01, .00], N = 197).

Discussion

The hypothesized mediating role of knowledge, perceived threat and concern in the link between exposure to information and willingness to act on climate change were supported in Study 2. However, the data also supported an alternative configuration in which concern precedes knowledge and together both factors mediate a negative indirect link between exposure to information and willingness to pay taxes to address climate change. The valence of this indirect link appeared to rest mainly on a negative relationship between knowledge and willingness to pay taxes to address climate change. Research in other contexts has shown that factors such as political orientation and trust in scientists can play a role in moderating the effect of knowledge on climate change attitudes, whereby people with conservative political leanings or lack of trust in the scientific consensus on climate change may report lower levels of concern and willingness to act with increasing knowledge (Malka, Krosnick, & Langer, 2009; McCright, 2011). In this study, knowledge was only negatively linked with willingness to pay taxes (Figure 7) which suggests that a third factor, such as a lack of trust in government or confidence in the efficacy of taxation to reduce climate change, may be involved in the link between both factors (see Bakaki & Bernauer, 2017).

To further clarify the role of knowledge in the South African context, I conducted a follow-up experiment using established measures of climate change knowledge and willingness to act pro-environmentally in response to climate change. The purpose of Study 3 was to address some of the limitations of the first two studies including a lack of control for the quality and content of climate change information encountered by participants and the relatively low internal consistency of the knowledge measures.

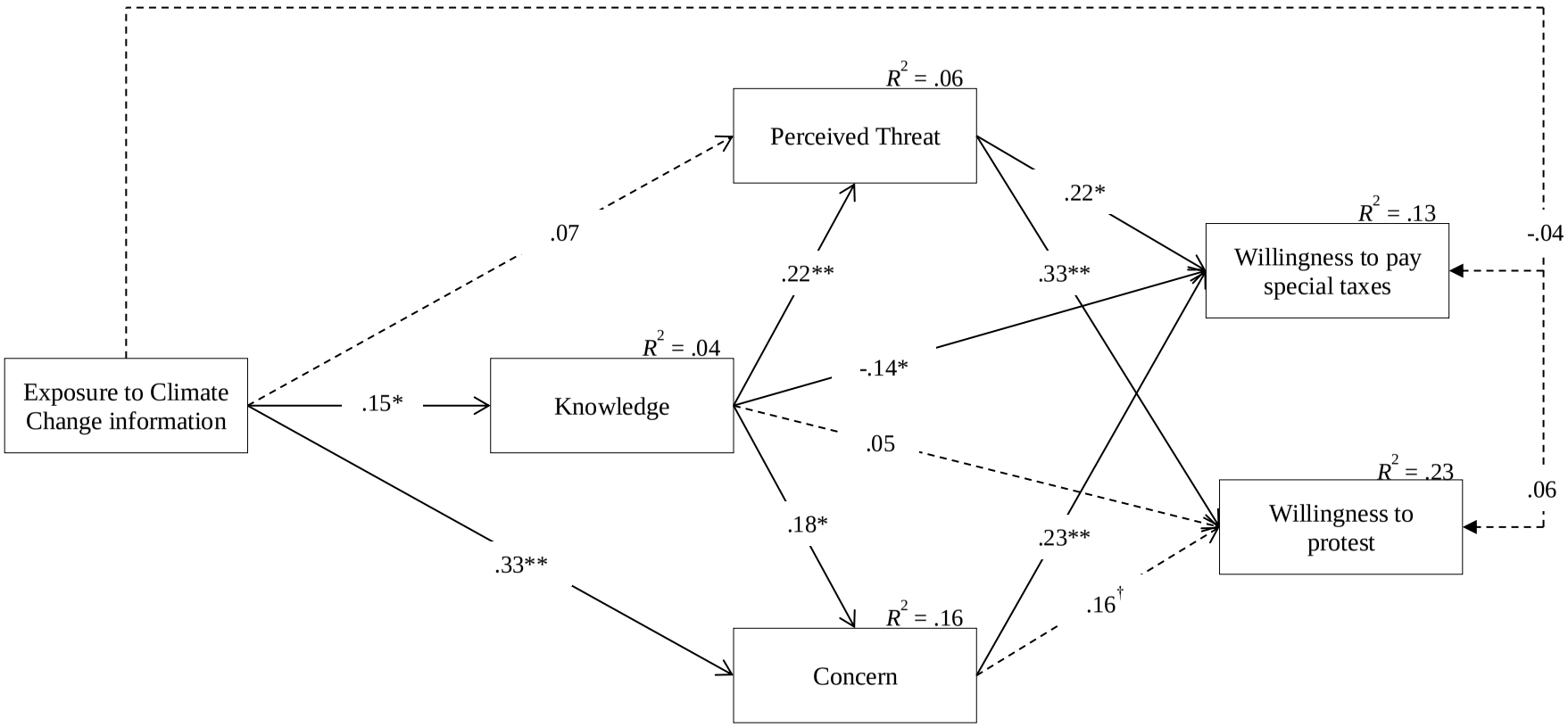

Figure 7. Multiple regression of willingness to engage in climate change-related behaviour on exposure to information, knowledge, perceived threat and concern in Study 2 (South Africa) N = 197.

Study 3

Method

Participants and procedure

I recruited 105 South African residents to participate in an online survey experiment through advertisements on social media. Entry into a raffle for a 500 Rand reward was offered as an incentive for participation. In studies 1 and 2, I operationalized exposure to climate change information as rate of encounter with climate change information. Although this measure captures the volume of information participants are likely to have been exposed to, it does not reflect the quality or content of the information. Therefore, in the present experiment, I employed experimental stimuli with an explicit focus on information pertaining to the causes and consequences of climate change. Further, I adopted a measure of climate change knowledge that allows distinction between the two dimensions of knowledge and explicit examination of their roles in the link between exposure to information and climate change attitudes.

Participants were randomly assigned to one of two conditions: (1) a *control condition* in which they were only presented with a scientific definition of climate change; and (2) an *information condition* in which they were presented with the climate change definition and some information about the causes and impacts of climate change. The experimental stimuli are presented in Appendix 2. The experiment was framed as a memory exercise and participants were instructed to bear the information they had read in mind as they subsequently completed measures of climate change knowledge, perceived threat, concern and intentions to act on climate change.[6] Participants were fully debriefed at the end of the study.

Twenty-two participants were excluded from the analyses due to incomplete responses (>50% missing values), and an additional 47 cases had missing values across the items measuring climate change concern due to a malfunction of the hosting platform used to administer the study. We imputed the concern values for the 47 cases using the Expectation Maximization (EM) algorithm as Little's MCAR test showed that they were missing at random ($\chi^2_{(6)} = 6.73$,

[6] Those who opted in to the raffle for a reward were also asked to indicate if they would be willing to donate part of their remuneration to a climate change advocacy group in the event that they were selected to receive the reward. This was intended to be analysed as a measure of actual behaviour but it was omitted from the analysis due to over half of the sample (57%) electing not to participate in the raffle.

p = .346). The final sample obtained with complete responses (N = 83) comprised 61.4% females and 36.1% males with a mean age of 32.18 years (SD = 9.93).

Measures (Dependent Variables)

Knowledge of the causes of climate change was measured using 12 items presented to participants in random order. Participants were asked to rate the extent to which each item (e.g., Deforestation) contributes to climate change (minor contribution / no contribution / major contribution). Five of these were correct statements while seven were incorrect. Responses were scored (0 = wrong, 1 = right) and indexed (0-12) based on the number of correct responses (α = .66). I also measured *knowledge of climate change impacts (consequences)* with 11 items using a similar approach (α = .61). The items constituting both scales are presented in Appendix 3 and the scoring method has been validated in previous research (see van der Linden, 2014; van der Linden, 2015).

Perceived threat was measured by asking participants to rate the extent to which they consider climate change a threat in 6 domains (lifestyle, health, livelihood, family, community; α = .90). I also measured climate change *concern* by asking participants to rate their level of concern about the effects of climate change across the world, in South Africa and on their wellbeing (α = .89). Lastly, I assessed participants' *willingness to act* in 4 actions aimed at addressing climate change (donate money to an environmental group engaged with climate change, sign a petition calling on the South African government to make stronger commitments to reducing emissions, participate in protests or rallies against inadequate government action on climate change, pay higher prices – i.e. pay a climate change tax on goods and services consumed; α = .72).

Table 2.3. Zero-order intercorrelations among the variables addressed in Study 3

	2	3	4	5	6
1. Information Condition	.03	.24*	.01	.03	.14
2. Knowledge (Cause)		.52***	.23*	.26*	.16
3. Knowledge (Consequences)			.30**	.30**	.29**
4. Perceived Threat				.83***	.50***
5. Concern					.41***
6. Willingness to act					-

*p<.05, **p<.01, ***p<.001, N = 83.

Results

Preliminary analyses

There was no significant difference in the distribution of participants' gender ($X^2_{(1)} = .79$, $p = .375$, $N = 81$) and age ($M_{Control} = 31.36$, $SD_{Control} = 10.02$; $M_{Information} = 33.16$, $SD_{Information} = 9.87$; $t_{(81)} = -.82$, $p = .413$) between the experimental conditions; and neither factor was significantly related to the dependent variables (see Appendix 4). Hence, gender and age were not included as predictors in the analyses. Zero-order correlations among the independent and dependent variables are presented in Table 2.3. Participants in the information condition had significantly higher mean scores on the knowledge of climate change consequences measure than those in the control condition but there was no significant difference in mean scores on the knowledge of climate change causes measure between the two groups (Table 2.4). Regression analysis using the MLE method in AMOS 20 revealed that the experimental manipulation and mediating variables explained 29% of the variance in willingness to act on climate change (Figure 8).

Table 2.4. Descriptive and comparative statistics for the dependent variables across the experimental conditions

	Condition			
	Control	Information		
DV	M (SD)		*t*	*p*
Knowledge (Cause)	5.89 (1.90)	6.03 (2.25)	-.30	.763
Knowledge (Consequences)	7.38 (1.66)	8.13 (1.46)	-2.18	.032
Concern	5.88 (.88)	5.93 (.93)	-.27	.788
Perceived threat	5.80 (.92)	5.83 (.98)	-.12	.907
Willingness to act	3.64 (.90)	3.88 (.83)	-1.25	.215

Listwise valid $N = 83$ (Control = 45, Information = 38). DV = Dependent Variable.

Tests of hypotheses

Using the PROCESS macro (Hayes, 2013), I found that exposure to information did not have a significant indirect effect on willingness to engage in climate change-related behaviour serially through knowledge of climate change causes and perceived threat (H1: B = .01, SE = .03, 95% CI: [-.03, .09, $N = 83$) or knowledge of climate change causes and concern (H2: B = -.00, SE = .01, 95% CI: [-.05, .01], $N = 83$), which contradicts my hypotheses. However, in support of my hypothesis (H1), exposure to information had a significant indirect effect on willingness to act serially through knowledge of climate change consequences and perceived threat (B = .07, SE = .05, 95% CI: [.01, .25, $N = 83$). Exposure to information did not have a

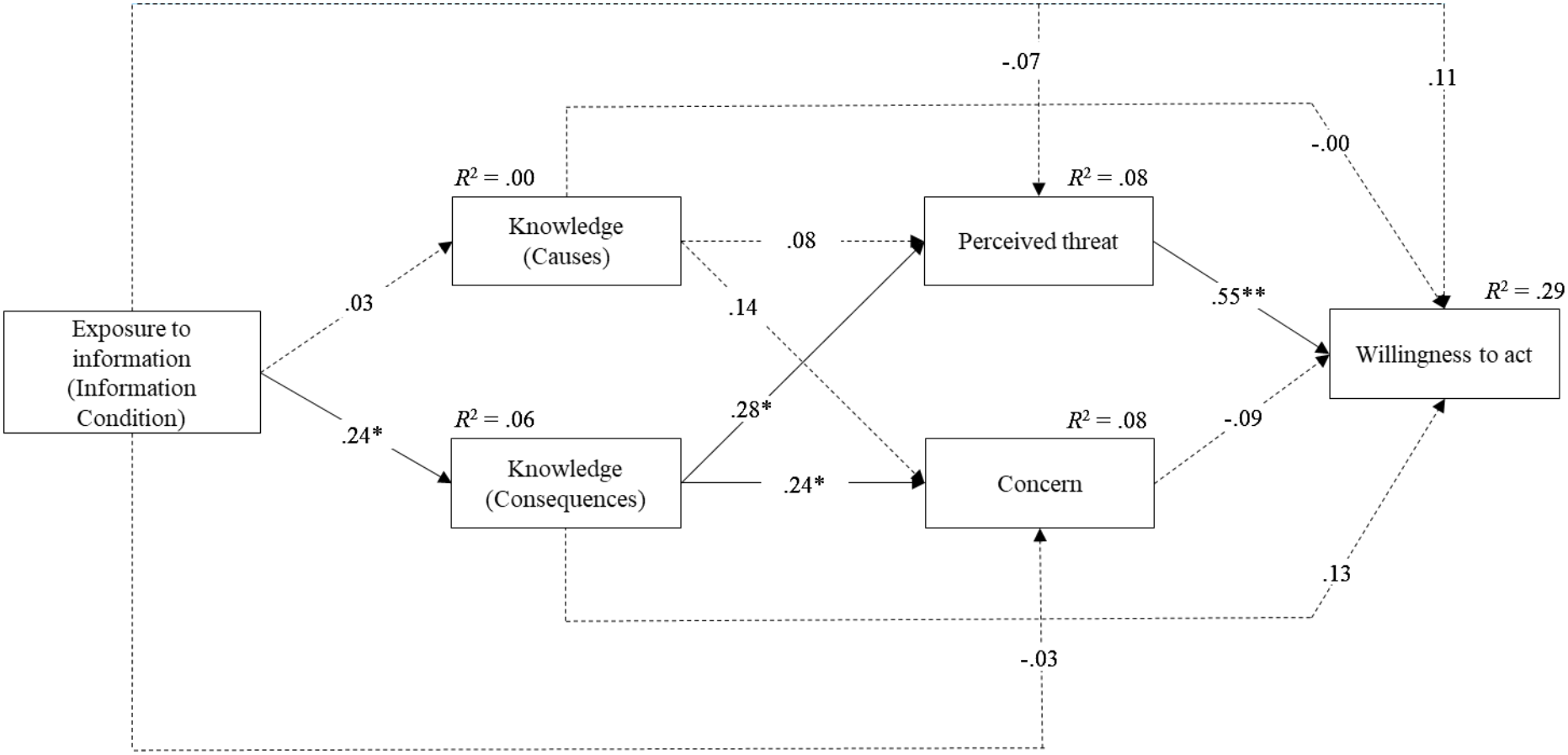

Figure 8. Willingness to act, perceived threat, concern and climate change knowledge regressed on the experimental manipulation (N = 83).

significant indirect effect on willingness to engage in climate change-related behaviour serially through knowledge of climate change consequences and concern (H2: B = -.01, SE = .02, 95% CI: [-.10, .02], *N* = 83).

Discussion

The results of Study 3 provide further evidence of the serial mediating role of knowledge (specifically of climate change consequences) and perceived threat in the link between exposure to information and behavioural responses to climate change. Although climate change knowledge is commonly operationalised as a unitary construct, my findings suggest that climate change cause and consequences knowledge have different implications for motivation to address climate change. This study shows that information may be more likely to motivate pro-active engagement with climate change when it enables people understand climate change as a personally relevant threat.

However, the hypothesized serial mediation of the link between exposure to information and willingness to act on climate change by knowledge and concern (H1) was not supported by the experimental data. My findings may be reflective of Loewenstein et al.'s (2001) argument that the affective and cognitive outcomes of risk evaluations can have divergent effects on subsequent behaviour. On the other hand, considering the proportion of responses to the concern items that was missing due to the error in the administration of the study, no definitive statements on the role of concern can be made based on the data obtained in this study.

General Discussion

The purpose of this research was to assess the indirect effects of exposure to information on responses to climate change behaviour in the African context. Climate change awareness is generally low across Africa and increasing access to relevant information as a means to enable effective public engagement with climate change has been strongly advocated (Godfrey et al., 2010; Pugliese & Ray, 2009). Yet the effectiveness of awareness campaigns with regard to Africans' responses to climate change seemed dubious in light of prior indications that such strategies typically have little tangible impact on environmental behaviour (e.g., Kollmuss & Agyeman, 2002; Mckenzie-Mohr, 2000; Owens, 2000). Further, it appears that the value of awareness

campaigns may be systematically underestimated due to a common practice of neglecting to estimate the indirect effects of knowledge mediated by other more proximate determinants of behaviour such as beliefs and emotions (Carmi et al., 2015; Kaiser & Fuhrer, 2003). Consequently, I investigated the indirect links between exposure to information and willingness to engage in climate change-related behaviour in three studies involving population samples from Nigeria and South Africa. I hypothesized that exposure to information is significantly linked with willingness to engage in climate change-related behaviour in a serial sequence mediated by knowledge, concern and perceived threat.

I found support for the prediction that knowledge and perceived threat serially mediate the link between information exposure and willingness to engage in climate change-related behaviour in all three studies. I also found some support for the predicted serial mediation by knowledge and concern of the relationship between information exposure and willingness to engage in climate change-related behaviour in Study 1 (Nigeria) and Study 2 (South Africa). These findings are consistent with the notion that awareness campaigns can promote positive engagement with climate change through their influence on peoples' understanding and perceptions of the problem.

The results of this research have important implications for our understanding of awareness campaigns as a means of promoting positive engagement with environmental issues in Africa. As opposed to narrowly focusing on the direct effects of informational strategies on behaviour, identifying the mediators that link exposure to information with behavioural responses to environmental problems provides a more accurate reflection of the significance of knowledge in the web of influences that underlie environmental behaviours. This research shows that exposure to information can contribute positively to climate change-related behaviour to the extent that it generates knowledge that enables people in African societies recognize the threat posed by climate change impacts.

Research suggests that the traditional mass media (television, radio, print) are the primary source of climate change information for people in Africa (e.g., Abegunde, 2016; Cherotich, Saidu, & Bebe, 2012; Godfrey et al., 2010). Media coverage of climate change in Nigeria and South Africa tends to focus disproportionately on international events such as climate change summits and major disasters, while local climate change-

related issues receive less publicity (Tagbo, 2010). Such information is unlikely to motivate citizens to act in response to climate change because it frames climate change as a global, rather than local, problem and fosters a view of climate change as a distant threat (C. Jones, Hine, & Marks, 2017; Scannell & Gifford, 2013).

Across the three studies, exposure to information, knowledge, concern and perceived threat together explained a modest amount of variance (12 – 29%) in the indices of willingness to engage in climate change-related behaviour. This plausibly reflects the involvement of other predictors that were beyond the scope of this research. For example, while I only focused on primary appraisal in this chapter, appraisal theories also propose a secondary appraisal process – termed *coping appraisal* that may be involved in the link between encounter with information and environmental behaviour (see Rainear & Christensen, 2017).

Coping appraisal encompasses individuals' evaluation of available response options for coping with perceived risks in three dimensions: (1) *response efficacy* – which refers to the perceived efficacy of a given behavioural response to mitigate the risk/threat; (2) individuals' *self-efficacy* or beliefs about their ability to perform the behavioural response; (3) and the *response costs* or barriers associated with the behaviour. Meta-analytic studies have shown that coping appraisal may be more closely related to behaviour than primary appraisal (e.g., Floyd et al., 2000). Incorporating measures of African citizens' perceptions of the efficacy and costs of individual mitigation and adaptation behaviours would likely increase the explanatory power of my theoretical framework. For example research in the United States suggests that exposure to climate change information is negatively related to perceived personal efficacy to address climate change, but personal efficacy is positively linked to climate change concern (Kellstedt et al., 2008). The negative link between exposure to information and perceived efficacy in the United States has been attributed to media portrayals of the polarization of public opinion and ignorance of the scientific consensus on climate change (ibid.). However, in African contexts, clarifying how information about the causes and consequences of climate change influences such perceptions remains a question for further research.

The social and normative context in which climate change information is encountered and processed is an additional factor that is likely to have important implications for

the link between encounter with information and willingness to engage in climate change-related behaviour. Against a backdrop of widespread ignorance of the relevance and immediacy of adverse climate change impacts, and externalization of the responsibility for mitigation action, unfavourable social norms may limit the effectiveness of awareness campaigns to motivate engagement in pro-environmental action. Further, the perceived corruption of public institutions and legacies of government suppression of political activism in African countries may be significant barriers to citizens' willingness to engage in the behaviours that were represented in our studies. Therefore, to better assess the effects of information provision and knowledge, it is important to consider the modulating influence of such contextual factors on Africans' perceptions of climate change and their willingness to engage in adaptation and mitigation behaviour.

Limitations

This research has a number of limitations that must be considered in the interpretation of my findings. Firstly, the effects of exposure to information were only tested using self-reported willingness to engage in climate change-related behaviour. Further studies involving experimental methods, longitudinal designs and measures of actual behaviour are needed to substantiate the current findings. Secondly, the measures of climate change knowledge showed poor to modest reliability (as determined by $\alpha < .70$) across the three studies. Reliable psychometric measurement of factual knowledge is a long-standing challenge for research following the knowledge-deficit paradigm (Bauer, Allum, & Miller, 2007). Formulating short unambiguous statements for which an authoritative answer can be determined is an empirical problem for many fields of science (ibid.). In this research, this problem is arguably exacerbated by poor conceptual understanding of climate change among the target population. For example, given the repeatedly documented conflation of climate change with ozone layer depletion and the greenhouse effect with hot steamy weather among African citizens (Cooke et al., 2010; Deane, 2009; Godfrey et al., 2010), one cannot be absolutely certain that participants respond to questions about climate change causes and impacts in relation to an accurate concept of climate change rather than an altogether different environmental issue[7]. The ubiquity of such misconceptions makes it difficult to achieve

[7] 31.3% and 40.6% of respondents answered affirmatively or were unsure about the statement: "Climate change is caused by Ozone layer depletion" in Study 1 and Study 2 respectively.

a high level of internal consistency even when using previously validated measures as demonstrated in Study 3. Nonetheless, this highlights the need for more basic research addressing public understanding of climate change in African contexts with a view to developing standardized and validated measures that can be used to accurately map the distribution of climate change knowledge in African societies and test models of the origins and effects of such knowledge.

Conclusion

The studies presented in this chapter show that exposure to information can help promote engagement in climate-change related pro-environmental behaviour by influencing the way people in Africa understand climate change and the level of threat posed to them. This result may seem fundamental and time-worn in an environmental research context dominated by WEIRD interests and priorities. Yet, it is of high pertinence in such areas as Africa; where awareness of climate change is still low and a large degree of change in attitudes and behaviour is required to achieve long-term resilience to climate change impacts.

Chapter 3

Flood experience, political affiliation and individual engagement with climate change in the United Kingdom[8]

Introduction

Research suggests that 'proximizing' climate change (i.e. framing the issue as more immediate, relevant and real) can help mobilize public support for mitigation and adaptation policies and promote pro-environmental behaviour (Lorenzoni et al., 2007; McDonald, Chai, & Newell, 2015; Spence et al., 2012). Proximizing climate change has the potential to motivate individuals to act pro-environmentally by (1) making climate change consequences more personally relevant and easier to visualize, (2) creating feelings of personal vulnerability and concern, and (3) decreasing the psychological distance of climate change among individuals with a responsibility or capacity for action (see Weber 2006; Brügger et al. 2015; Jones et al. 2017). Based on this premise, researchers have suggested that highlighting the links between local weather events and global climate change may be an effective strategy to proximize climate change and galvanize public action (Spence, Poortinga, Butler, & Pidgeon, 2011; A. Taylor, de Bruin, & Dessai, 2014).

Although it is practically impossible to detect the evidence of climate change through casual weather observations, personal experience of extreme weather events associated with climate change (such as flooding or heatwaves) has been linked to climate change belief, concern and willingness to act pro-environmentally (Akerlof, Maibach, Fitzgerald, Cedeno, & Neuman, 2013; Demski, Capstick, Pidgeon, Sposato, & Spence, 2017; Konisky, Hughes, & Kaylor, 2015; Myers, Maibach, Roser-Renouf, Akerlof, & Leiserowitz, 2013). However, there are also indications that many people see extreme weather and climate change as separate issues. Perceived vulnerability to extreme weather events may readily change in accordance with local experiences, but such change in perceptions does not invariably culminate in a shift in attitudes regarding

[8] Parts of this chapter have been published in an article entitled: "The moderating role of political affiliation in the link between flooding experience and preparedness to reduce energy use", by **Ogunbode, C.A.**, Liu, Y. & Tausch, N. *Climatic Change* (2017). https://doi.org/10.1007/s10584-017-2089-7

climate change (Bruine de Bruin, Wong-Parodi, & Morgan, 2014; Dessai & Sims, 2010; Whitmarsh, 2008).

The evidence for the psychological effects of extreme weather experiences is seemingly beset by contradictions. This is due in part to flawed operationalisations of the concept in previous research (see also Demski et al. 2017) and a common neglect to account for key intervening variables, such as values and identities, that modulate the way people interpret their experiences with extreme weather (Fielding & Hornsey, 2016). In this chapter, I present a re-analysis of data from a prior study purporting a link between flood experience and preparedness to engage in climate change mitigation behaviour in the United Kingdom. I address the plausible moderating role of political affiliation in the relationship between extreme weather experience and climate change perceptions, and critically discuss the implications for efforts to harness personal experiences in promoting climate change engagement. Here, I use the term 'climate change engagement' to describe the collective cognitive, affective and conative dimensions of engagement including awareness, concern and motivation to act (Lorenzoni et al., 2007). The empirical and conceptual considerations that guided my analysis are briefly discussed in the following sections.

Disentangling 'extreme weather experience' from 'climate change experience'

The purported association between extreme weather experiences and climate change attitudes appears more consistent when extreme weather experience is operationalised as 'perceived personal experience of climate change or global warming' (e.g., asking survey respondents if they have experienced "any extreme weather conditions that they interpret as caused by long-term, global climate change": see Blennow, Persson, Tomé, & Hanewinkel, 2012) compared with unattributed measures of extreme weather experience (e.g. simply asking if respondents have experienced flooding: see Bruine de Bruin et al., 2014; Whitmarsh, 2008). Considering the challenges inherent in scientifically attributing any single weather event to global climate change (Hulme, 2014), perceptions of a causal relationship between extreme weather and climate change among lay individuals reflects the involvement of subjective appraisal and attribution processes that likely exert unique influences on attitudes, over and above that of mere experience with extreme weather. In other words, 'extreme weather experience' is a step removed from 'perceived personal experience of climate change'.

Conflating the links between either of these two constructs and climate change engagement is misleading because it spuriously inflates the inherent value of extreme weather experiences and subsumes the intervening roles of other factors that modulate how extreme weather events are interpreted and integrated into individuals' beliefs, feelings and motivations.

The social construction of extreme weather as indicative of climate change

According to Reser et al. (2014), the interconnection between extreme weather patterns, the intensity and frequency of natural disasters, and the unfolding meteorological and geophysical impacts of climate change have imbued extreme weather events with a powerful 'climate change signal' in the context of human risk perception, experience and understanding. Extreme weather experiences can heighten climate change engagement by confirming pre-existing beliefs, increasing the salience of climate change, and enabling personal realization of the immediacy and reality of the problem among people who perceive this 'signal', (Akerlof et al., 2013; Myers et al., 2013; Reser et al., 2014). Extreme weather events can also create opportunities to teach people about climate change as individuals may become more attentive and receptive to education efforts following adverse personal experiences with extreme weather (Howe, Boudet, Leiserowitz, & Maibach, 2014; C. Lang & Ryder, 2016; Rudman, McLean, & Bunzl, 2013). However, extreme weather experiences may fail to produce changes in climate change engagement when the event(s) experienced are not explicitly attributed to climate change (Reser et al., 2012); especially when engagement pertains to mitigation actions and policies (e.g., McCright et al. 2014; van der Linden 2014).

Research shows that people situated in the same, or proximate, locations can have remarkably different perceptions of their experiences with the same extreme weather event(s) (Cutler, 2015; Shao, 2016). As academic debate on the psychological mechanisms that underlie the effects and constitution of extreme weather experiences continues to unfold with new evidence and perspectives, different streams of research have converged on the socially constructed nature of perceived 'extreme weather' with regard to societal interpretation of climatic trends and events (Goebbert, Jenkins-Smith, Klockow, Nowlin, & Silva, 2012; Hulme, Dessai, Lorenzoni, & Nelson, 2009). There is growing evidence that pre-existing values, beliefs and worldviews have a significant moderating influence on whether or not people perceive salient weather events to be

'extreme' or 'unusual' (Goebbert et al., 2012; Shao, 2016), or perceive their experiences with unusual weather to be consistent with trends expected from climate change (Capstick & Pidgeon, 2014). Indeed, the influence of political values and identification may eclipse that of objective climate extremes on climate change perceptions in some instances (Marquart-Pyatt, McCright, Dietz, & Dunlap, 2014). Nonetheless, irrespective of the moderating influence of social and personal psychological attributes, people tend to ascribe undue weight to perceived weather abnormalities; with the result that perceived experiences of abnormal weather, by and large, appear to give rise to greater climate change belief and concern (Zaval, Keenan, Johnson, & Weber, 2014).

Objective weather has a weaker influence on climate change engagement than perceived weather (Shao, 2016). It seems evident that the impact of extreme weather experiences as triggers of climate change proximization and engagement is inextricably linked to the motivations that underlie variability in individuals' predisposition to attribute extreme weather events to climate change. Therefore, it is necessary to identify the attributes that influence the likelihood that individuals will make causal attributions of extreme weather events to climate change, and assess if and how these attributes moderate the relationship between extreme weather experiences and climate change engagement. With these considerations in mind, I revisited previous research by Spence et al. (2011) in which a positive link was found between reported flood experience and preparedness to reduce energy use in a UK national sample.

Prior research on perceptions of flooding and climate change in the United Kingdom

Flooding is expected to be one of the main threats to UK communities resulting from climate change (DoH, 2001; Schaller et al., 2016). In a study by Spence et al. (2011), people with experience of local flooding reported greater perceived ability to address climate change (perceived instrumentality), higher levels of climate change concern, less uncertainty that climate change is occurring, and stronger perceptions of local vulnerability to climate change impacts compared to those without (Figure 9). Additionally, Spence et al. (2011) found that perceived instrumentality, concern and perceived local vulnerability positively mediated a link between flood experience and preparedness to reduce energy use. These findings were interpreted within the

framework of goal-setting theory. Goal-setting theory proposes that setting concrete, specific goals can boost individuals' belief that their actions will lead to outcomes (perceived instrumentality) and increase their likelihood of taking subsequent action (Locke & Latham, 2002). On this basis, Spence et al. (2011) argued that experiences of extreme events such as flooding which can be attributed to climate change may help individuals better relate to climate change impacts and confer them with an increased sense of instrumentality, which in turn translates into greater preparedness to engage in actions that help tackle the issue. Although Spence et al. (2011) did not directly address the question of attribution, they proffered a statement that: "[the] relationships observed [….] may have developed in people's understandings through the interaction between a series of major flooding events in the UK and the salience accorded to climate change in public life and discourse in recent years" (pg. 48).

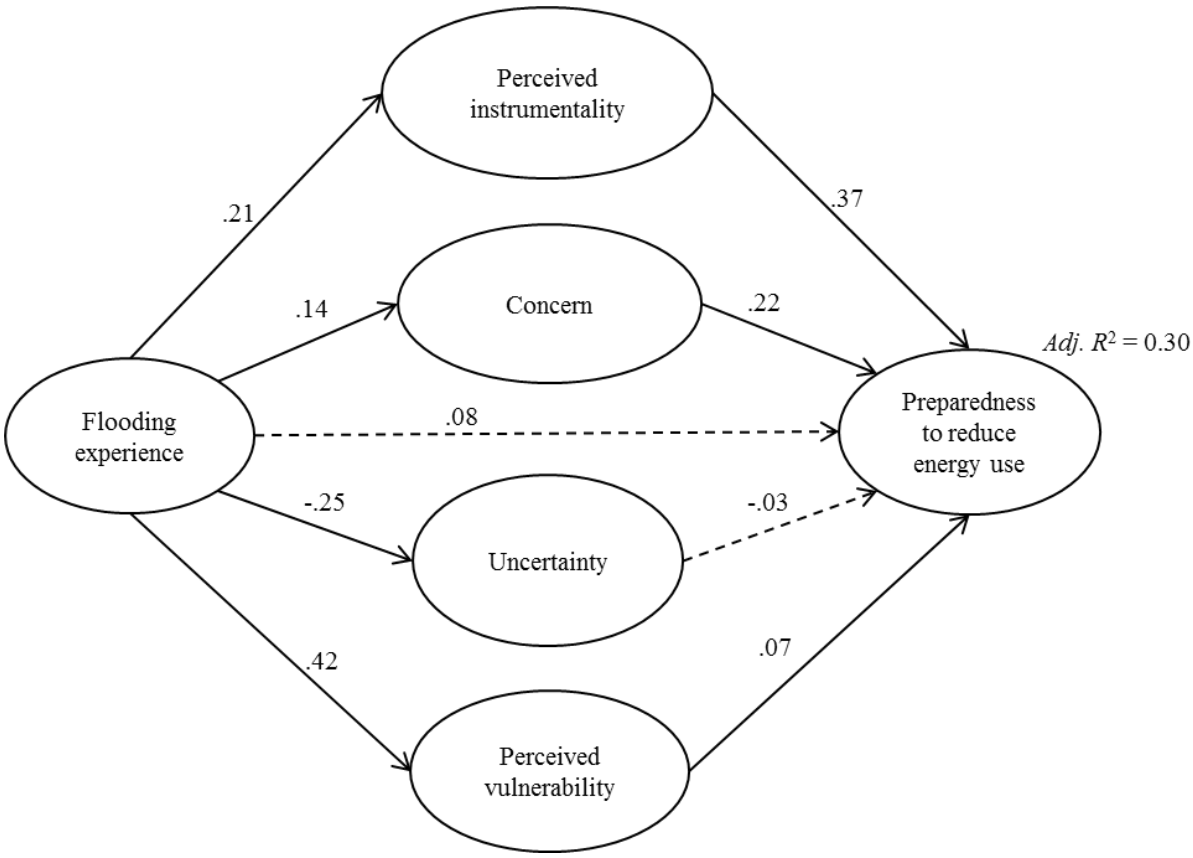

Figure 9. Effect of flood experience on preparedness to reduce energy use mediated by perceived instrumentality, concern, uncertainty and perceived vulnerability. Age, gender and socio-economic grade were included as covariates in the analysis and observed effects are net of their impact. Values are unstandardized regression estimates with solid lines indicating paths significant at $p < 0.05$ (Adapted from Spence et al. 2011).

Following a run of exceptionally severe storms and flooding across the UK in December 2013 and January 2014, Capstick et al. (2015) also conducted a survey of public perceptions of the climate change using a nationally representative sample. Like Spence et al. (2011), they found that people with direct experience of the floods were more likely to see their local area as vulnerable to climate change impacts and were more likely to view climate change as a serious threat to themselves and their family. Most respondents (64%) in Capstick et al.'s (2015) survey agreed that the floods had been caused in part by climate change, and a greater majority (72%) agreed that the floods demonstrated what could be expected from climate change in the future. Interestingly, 45% of respondents in the study agreed with the notion that 'it is impossible to link a single weather event with climate change', compared with 33% who disagreed. Capstick et al.'s (2015) findings show that a considerable proportion of UK residents are not naïve to the difficulty inherent in scientifically establishing a causal link between extreme weather and climate change, yet many perceive climate change to be implicated in their experience of unusually severe flooding.

Similarly, Demski et al. (2017) found that UK residents with direct experience of flooding as a consequence of the 2013/2014 winter storms reported greater levels of negative emotional responses to flooding, perceived risk from climate change and personal salience of the issue. Interestingly, they also found that some of these changes in perceptions and emotions not only mediated a link between flood experience and behavioural responses to climate change, but also a link between flood experience and adaptation intentions regarding heatwaves - a different weather event potentially linked with climate change. These findings were speculatively interpreted as evidence that flood experiences increase the cognitive availability of climate change (i.e. they make climate change more tangible); and in so doing prompt support for climate change policies and intentions to personally engage in mitigation and adaptation behaviours.

However, other research in the UK (Hamilton-Webb, Manning, Naylor, & Conway, 2016; Whitmarsh, 2008) addressing the link between flood experience and climate change engagement has produced some contrasting findings. Prior to Spence et al.'s (2011) study, Whitmarsh (2008) found no significant differences in perceived vulnerability to climate change or actions taken to address the issue between flood and non-flood victims in the south of England. More recently, Hamilton-Webb et al. (2016)

found that while flood experience was significantly associated with climate change concern and behavioural responses in a sample of UK farmers, mitigation actions such as reducing energy use and increasing use of minimum tillage were largely being undertaken as part of normal practice rather than with the intention of addressing climate change. In both studies, climate change was the least cited perceived cause of flooding, compared with other locally observable factors such as lack of watercourse maintenance. Though, Hamilton-Webb et al. (2016) observed that farmers who were reducing their energy use were also more likely to believe that climate change is a major cause of flooding in the UK. The authors of these two studies concluded that personal values appeared to be more important than experience in determining the way people engage with flooding in the context of climate change.

The current research: conceptual framework and hypotheses

The notion of climate change is a statistical abstraction. Research suggests that people typically prefer to constitute their attitudes from information gained through experiences of directly observable trends and events than expend the additional amount of cognitive effort required to process abstract climate change information (Myers et al., 2013; Weber, 2006). Inferring the evidence of climate change from experience is not only less cognitively demanding than analytical processing of abstract statistical information, it also occurs more rapidly and has a stronger influence on attitudes and perceptions (Myers et al., 2013). However, experiential processing of climate change-related evidence is often guided by values (Hornsey, Harris, Bain, & Fielding, 2016; Kahan, 2013). More specifically, social identity – as a function of membership in social groups with shared fundamental values (e.g. political and ideological groups), operates as a filter in climate change information processing and assimilation (Fielding & Hornsey, 2016; Kahan, Jenkins-Smith, & Braman, 2011).

According to social identity and self-categorization theories, individuals internalize the values and norms of the groups they belong to by incorporating their social identity, as group members, into their self-concept (Tajfel & Turner, 1986; Turner et al., 1987a). Through this process, political and ideological group membership provide a template of beliefs and norms that prescribe and describe prototypical in-group views on key issues (Fielding & Hornsey, 2016). Consequently, when people perceive themselves in terms of membership in such groups, they assimilate to the group prototype – i.e., their

attitudes and beliefs become regulated by the norms and standards associated with the salient social identity (Rabinovich, Morton, Postmes, & Verplanken, 2012). Political and ideological group identity can be expected to modulate perceptions of climate change to the extent that they influence whether or not individuals perceive relevant events as unnatural or a reason to act (Hahnel & Brosch, 2016). Indeed, research shows that political affiliation and ideological orientation are significantly linked to the way people perceive flooding and other extreme weather events (Cutler, 2015; L. C. Hamilton, Wake, Hartter, Safford, & Puchlopek, 2016), as well as their climate change beliefs and willingness to act pro-environmentally (Gromet, Kunreuther, & Larrick, 2013; L. C. Hamilton & Stampone, 2013; McCright & Dunlap, 2011; McCright, Dunlap, & Marquart-Pyatt, 2016; Whitmarsh, 2011).

Research in the United States has consistently revealed a strong effect of political orientation on climate change views, whereby Democrats and liberals express greater concern about climate change and report beliefs about climate change that are more consistent with mainstream science than Republicans and conservatives (e.g., Marquart-Pyatt et al., 2014; McCright & Dunlap, 2011). Similarly, Conservative voters and individuals with a right-leaning ideological views have been shown to exhibit greater levels of scepticism about climate change on average than their liberal or politically left-leaning counterparts in the UK (B. Clements, 2012; Poortinga et al., 2011; Whitmarsh, 2011). These findings suggest that variations in climate change belief and concern may be normatively associated with partisan and ideological identification. Therefore, I hypothesized that political affiliation significantly modulates the likelihood that people see a link between flooding and climate change, as well as the relationship between flood experience and climate change attitudes. Specifically, I hypothesized that supporters of the Conservative party and other right-leaning parties are less likely to see flooding as linked to climate change than supporters of Labour, Liberal Democrats or other left-leaning parties (H1). Further, I hypothesized that the relationship between flooding experience and climate change attitudes will be weaker among supporters of the Conservatives and other right-leaning parties, due to the normative association of such political identities with scepticism about climate change (H2). I tested these hypotheses by comparing reported flood experience and climate change attitudes among sub-populations of left- and right-leaning voters in Spence et al.'s (2011) dataset.

Method

Data

A detailed summary of the sampling, survey instruments development, and data collection procedures is provided in Spence et al.'s (2011) report. The data used in my analysis were supplied by the first author of the report on request. According to Spence et al. (2011), the survey instrument was developed by a team of four academic researchers. It was further refined with input from a partner social research company and an expert advisory panel comprising academic researchers, members of relevant government departments and members of third-sector groups. Data collection was conducted by the social research company using computer-assisted personal interviews between 5 January and 2 March 2010, with each interview taking approximately 30 minutes to complete. A nationally representative quota sample (N = 1,822) of the population of Great Britain (i.e., England, Scotland and Wales) was obtained.

Data analysis

Using respondents' reported voting intentions, I categorised those who indicated "Labour", "Liberal Democrat" or "Green" as left leaning voters (N = 532), and those who indicated "British National Party (BNP)", "Conservative" or "UK Independent Party (UKIP)" as right leaning voters (N = 416). The placement of the parties on the left-right political spectrum was based on data from public polls conducted by YouGov – a major internet-based market research company – over a period of 12 years preceding that in which Spence et al.'s (2011) survey was conducted (Dahlgreen, 2014). Respondents in YouGov's polls were asked to place each political party and themselves on a left-right scale ranging from "very left-wing" (-100) to "very right-wing" (100).

I compared reported flood experience, perceived personal experience with climate change, and mean levels of climate change attitudes across both groups of voters with chi-square and *t* tests. I also assessed the equivalence of Spence et al.'s (2011) multiple-mediation model (Figure 1) − which links flood experience with preparedness to reduce energy use through perceived instrumentality, concern, uncertainty about climate change and perceived vulnerability − across the two groups with multi-group path analysis. Extending Spence et al.'s (2011) analysis, I further examined their model using an alternative outcome variable, willingness to pay higher prices for energy

efficient products, and examined the equivalence of the multiple mediation for the two groups of voters using this measure.

I specified the multiple-mediation model in AMOS 22 following the procedure detailed by Spence et al. (2011); all mediator residuals were allowed to co-vary freely and the demographic factors (age, gender and social grade) were included as covariates in the model. I tested the equivalence of the model for right and left-leaning voters by comparing a model in which all structural paths were constrained to be equal for both groups with one in which they were allowed to vary freely, using chi-square difference tests. Subsequently, I assessed the equivalence of each path in the model by comparing the fully constrained model with a constrained model in which only one path was allowed to vary freely at a time. I estimated the specific indirect effects of flood experience conveyed through the mediators using the PROCESS macro for regression-based tests of mediation, moderation and conditional processes (Hayes, 2013) as was done by Spence et al. (2011). Items used in this analysis and descriptive statistics for each group are presented in Table 3.1.

Missing data

There was a small proportion of missing data (<5%) on some of the variables and list-wise deletion was used in the chi-square and *t*-tests. However, I estimated the multiple mediation model in AMOS 22 using two versions of the dataset; one in which list-wise deletion was applied and another in which the missing values were replaced with the regression imputation method (Arbuckle, 2013). There were no substantive differences in the results obtained using either dataset. Hence, here I report the results obtained using the imputed data for the multigroup comparisons.

Table 3.1. Experience and climate change attitude measures with descriptive and comparative statistics for left and right-leaning voters

		Political Affiliation		Total (*N*)
		Left-Leaning	**Right-Leaning**	
Have you personally experienced flooding in your local area recently or not?	Yes	113	98	211
	No	413	316	729
Total (*N*)	Pearson $X^2_{(1)} = 0.64$, $p = 0.425$	526	414	940
Have you personally noticed any signs of climate change during your lifetime?	Yes	339	219	558
	No	173	186	359
	Don't Know	20	11	31
Total (*N*)	Pearson $X^2_{(2)} = 14.92$, $p = 0.001$	532	416	948
Cited sign of climate change	No sign witnessed	193	197	390
	Other event cited	284	183	467
	Flooding cited	55	36	91
Total (*N*)	Pearson $X^2_{(2)} = 11.84$, $p = 0.003$	532	416	948

Construct	*Items*$^{\beta}$	M(SD)$^{\beta}$		*t(df)*
Perceived instrumentality ($\alpha = 0.76$)	'I can personally help to reduce climate change by changing my behaviour, 'I personally feel that I can make a difference with regard to climate change'	3.54 (1.05)	3.17 (1.07)	$5.24_{(879.58)}$***
Concern about climate change	'How concerned if at all are you about climate change, sometimes referred to as global warming?'	3.03 (0.90)	2.74 (0.96)	$4.65_{(846.40)}$***
Uncertainty over climate change	'I am uncertain that climate change is really happening'	2.35 (1.23)	2.67 (1.25)	$-3.93_{(936)}$***
Perceived local vulnerability	'My local area is likely to be affected by climate change'	3.32 (1.17)	3.17 (1.21)	$1.90_{(919)}$ †
Preparedness to reduce energy use	'I am prepared to greatly reduce my energy use to help tackle climate change'	3.70 (1.03)	3.42 (1.09)	$3.96_{(841.88)}$***
Preparedness to pay for energy efficiency	'I am prepared to pay significantly more for energy efficient products'	3.20 (1.22)	2.94 (1.15)	$3.34_{(935)}$**

$^{\beta}$ Responses to perceived instrumentality, uncertainty, perceived local vulnerability and preparedness to reduce energy use items were recorded using a 5-point scale (1 = strongly disagree, 5 = strongly agree); concern about climate change was recorded with a 4-point scale (1 = not at all concerned, 4 = very concerned), †$p<0.10$, *$p<0.05$, **$p<0.01$, ***$p<0.001$

Results

Left-leaning voters were no more likely to report having had a personal experience of local flooding than right-leaning voters ($\chi^2_{(1, 940)} = 0.64$, $p = 0.425$). However, the former were more likely to report having noticed signs of climate change in their lifetime ($\chi^2_{(1, 917)} = 13.98$, $p < 0.001$). In line with my hypothesis (H1), they were also more likely to cite flooding when prompted to state what signs they had witnessed ($\chi^2_{(2, 948)} = 11.84$, $p = 0.003$). While this does not directly address the question of whether respondents attributed their recent experience of local flooding to climate change, it provides some indication that the likelihood of seeing a link between flooding and climate change covaries with political affiliation. There were also significant differences in climate change attitudes between the two categories of voters; with left-leaning voters reporting greater perceived instrumentality, concern, willingness to reduce energy use, preparedness to pay more for energy efficient products and less uncertainty about climate change (Table 3.1).

As expected (H2), I found that Spence et al.'s (2011) mediation model (Figure 10) of the relationship between flood experience, climate change perceptions and preparedness to reduce energy use was not equivalent for left and right-leaning voters ($\Delta\chi^2_{(24, 934)} = 46.05$, $p = 0.004$). The total indirect effect of flood experience on preparedness to reduce energy use via climate change perceptions was significant among left-leaning ($B = 0.07$, SE = 0.03, 95% CI (0.02, 0.13), $N = 491$), but not right-leaning voters ($B = 0.07$, SE = 0.04, 95% CI (-0.01, 0.15), $N = 371$). Perceived instrumentality ($B = 0.04$, SE = 0.02, 95% CI (0.00, 0.08)) and uncertainty about climate change ($B = 0.01$, SE = 0.01, 95% CI (0.00, 0 .03)) significantly mediated the relationship between flood experience and preparedness to reduce energy use only among left-leaning voters. I also found that only the path linking uncertainty about climate change and preparedness to reduce energy use in Spence et al.'s (2011) model differed significantly for left and right-leaning voters ($\Delta\chi^2_{(1, 934)} = 6.58$, $p = 0.010$).

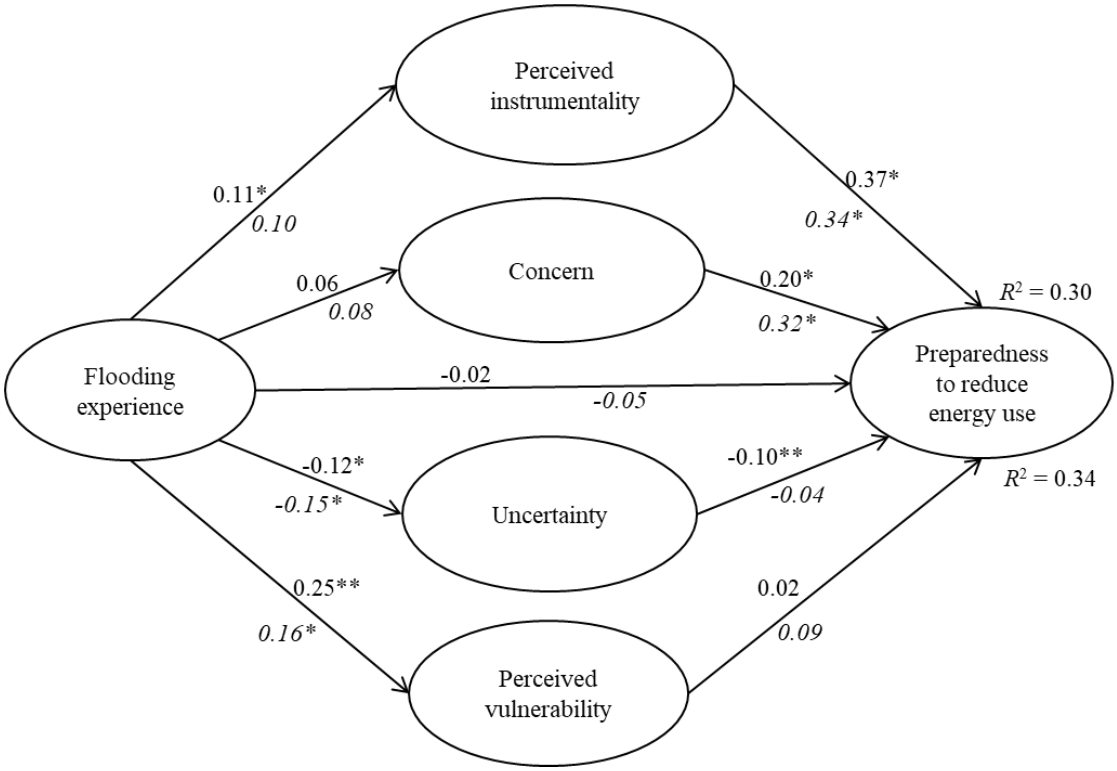

Figure 10. Effect of flooding experience on preparedness to reduce energy mediated by perceived instrumentality, concern, uncertainty and perceived vulnerability. Italicized values below the paths are unstandardized regression estimates for right-leaning voters (Conservative, BNP, UKIP; N = 400), and values above paths are unstandardized regression estimates for left-leaning voters (Labour, Liberal Democrat, Green; N = 532). Estimates are based on bias-corrected 95% confidence intervals using 1,000 bootstrap resamples. "*" denotes paths significant at $p<0.05$.

Similarly, a multiple mediation model linking flood experience, climate change perceptions and willingness to pay higher prices for energy efficient products (Figure 11) was not equivalent for left and right-leaning voters ($\Delta\chi^2_{(24, 934)} = 46.89$, $p = 0.003$). However, the total indirect effect of flood experience on willingness to pay higher prices for energy efficient products was significant among both left-leaning (B = 0.07, SE = 0.03, 95% CI (0.02, 0.13), $N = 534$) and right-leaning voters (B = 0.04, SE = 0.02, 95%CI (0.00, 0.09), $N = 400$). Among left-leaning voters, only perceived instrumentality significantly mediated the link between flood experience and willingness to pay higher prices for energy efficient products (B = 0.04, SE = 0.02, 95% CI (0.00, 0.08)), while perceived local vulnerability to climate change mediated the link between flood experience and willingness to pay higher prices for energy efficient

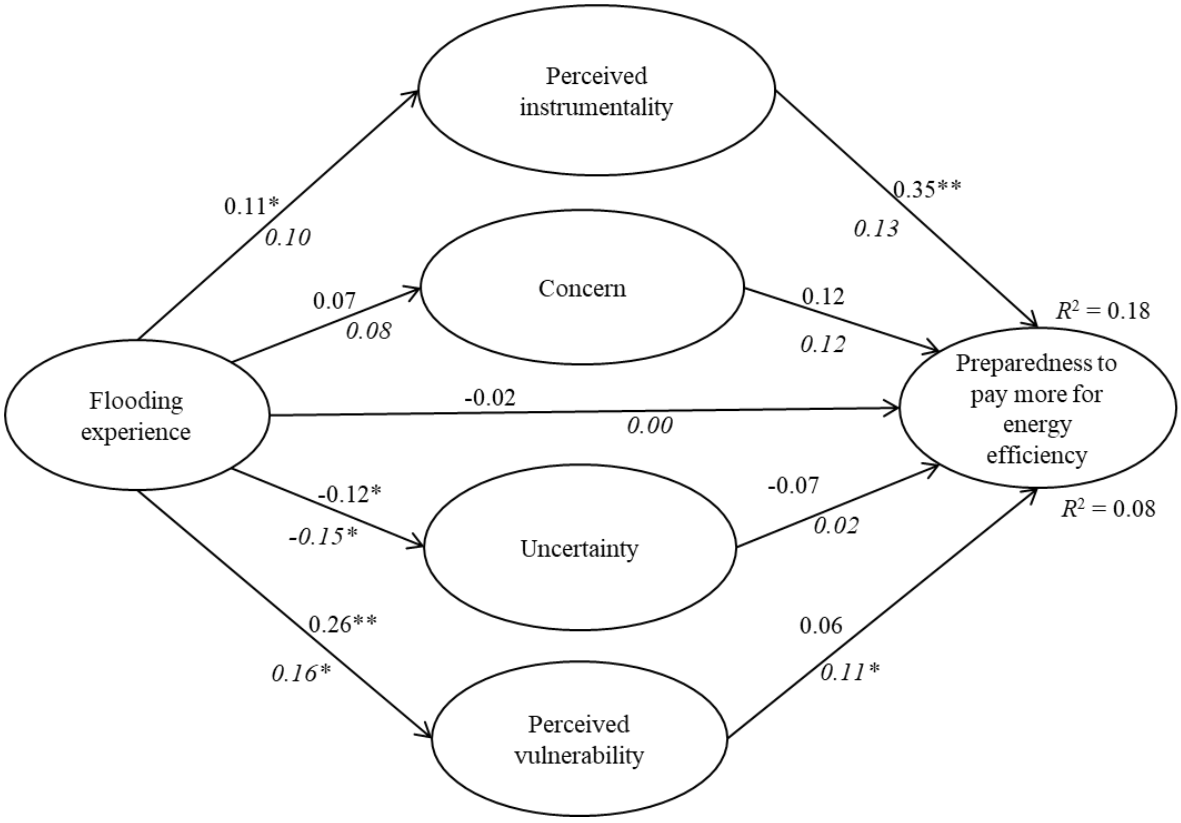

Figure 11. Effect of flooding experience on preparedness to pay for energy efficient products mediated by perceived instrumentality, concern, uncertainty and perceived vulnerability. Italicized values below the paths are unstandardized regression estimates for right-leaning voters (Conservative, BNP, UKIP; N = 400), and values above paths are unstandardized regression estimates for left-leaning voters (Labour, Liberal Democrat, Green; N = 532). Estimates are based on bias-corrected 95% confidence intervals using 1,000 bootstrap resamples. "*" denotes paths significant at $p<0.05$.

products among right-leaning voters (B = 0.02, SE = 0.01, 95%CI (0.00, 0.05)). Interestingly, there was a significant difference between both groups of voters in the path linking perceived instrumentality with preparedness to pay more for energy efficient products ($\Delta\chi^2_{(1, 934)} = 10.86$, $p = 0.001$), as well as the path linking uncertainty about climate change with preparedness to pay more for energy efficient products ($\Delta\chi^2_{(1, 934)} = 4.61$, $p = 0.032$). Detailed results of the multi-group path comparisons are presented in Appendix 5. Overall, these findings indicate that the way flood experience affects people's climate change perceptions and action intentions varies systematically depending on their political affiliation; and plausibly in line with their pre-existing views and ideologies.

Discussion

The political and ideological polarization of public views on climate change is well documented in the United States (Bliuc et al., 2015; McCright & Dunlap, 2011), and to a lesser extent in Europe (McCright et al., 2016). Individuals have a tendency to interpret and assimilate climate change-related information in ways that correspond with their pre-existing values and political loyalties (Hornsey et al., 2016; Kahan, 2013). This tendency – which is broadly termed *motivated cognition*, is underpinned by the appropriation of normative views and attitudes associated with salient social identities and group memberships as a lens through which information is processed and incorporated into personal beliefs (Fielding & Hornsey, 2016; Hahnel & Brosch, 2016). Motivated cognition is also linked to individuals' desire to maintain congruence between their beliefs and the values they share with significant others (Kahan, 2013). Based on this, the objective of this study was to examine the modulating role of political affiliation, a commonly salient form of social identity with regard to environmental issues, in the link between flood experience and climate change attitudes. To an extent, my findings reflect a systematic pattern of differences in the way individuals with politically left- and right-wing affiliations are influenced by their experiences with flooding.

In line with the *cultural cognition* thesis (Kahan, 2013; Kahan et al., 2011), it appears that people 'learn' from their experiences with flooding in ways that produce climate change attitudes that are consistent with their shared values. Where experience of local flooding appeared to contribute indirectly to increasing preparedness to reduce energy use by reducing uncertainty about climate change and increasing perceived instrumentality among left-leaning voters, this effect was not obtained among right-leaning voters. Therefore, it seems plausible that the influence of flood experience on climate change engagement – as reflected in preparedness to reduce energy use, is weaker among right-leaning voters, since this demographic has been shown to have greater levels of climate change scepticism in the UK (Whitmarsh, 2011).

Although my analyses showed that left-leaning voters were more likely to report having witnessed signs of climate change and cite flooding as a sign of climate change, it is not clear that the significant indirect relationship between flooding experience and willingness to reduce energy use among this group is simply due to the way they

attribute their experience of flooding. In both groups of voters, local flooding experience was positively linked with perceived local vulnerability to climate change, negatively linked with uncertainty that climate change is happening, and indirectly linked with preparedness to pay more for energy efficient products, which suggests that flood experiences have a significant impact on climate change attitudes irrespective of political affiliation (or the underlying values and identities they reflect). Therefore, I will further explore the unique influence of attribution on the link between flood experience and climate change attitudes using experimental methods in Chapter 4.

In contrast to Spence et al.'s (2011) findings, flooding experience had no significant link with perceived instrumentality, and the positive link with uncertainty about climate change did not translate to greater willingness to reduce energy use, among right-leaning voters in my analysis. On the other hand, flood experience was indirectly linked to preparedness to pay more for energy efficient products among both left and right-leaning voters. This link was mediated by perceived instrumentality for left-leaning voters and perceived vulnerability for right-leaning voters. This may be indicative of biases in respondents' processing of flood experience by their beliefs about the causes of climate change. While left-leaning voters are more likely to believe that climate change is driven by human activities, right-leaning voters tend to see climate change as a natural process (e.g., McCright & Dunlap, 2011; Weber & Stern, 2011)[9]. Therefore, even though local flood experiences may generally promote perceptions of climate change as a certain and proximate threat, support for mitigation strategies such as reducing energy use may be less likely to result via perceived instrumentality among right-leaning voters with greater levels of pre-existing scepticism about the anthropogenic nature of climate change. Whereas, the mediating role of perceived vulnerability in the link between flood experience and willingness to pay more for energy efficient products among left leaning voters may be attenuated by arguably greater pre-existing levels of perceived vulnerability to climate change.

Given an understanding that values and identity function as filters in information processing (Fielding & Hornsey, 2016; Kahan et al., 2011), simply highlighting the links between extreme weather and climate change is unlikely to be a broadly effective

[9] Right-leaning voters (28.61%) were more likely to indicate that climate change is not happening/not anthropogenic than left-leaning voters (19.73%) in the current sample ($\chi^2_{(1)} = 9.92$, $p = 0.002$).

strategy for promoting climate change engagement. Information which supports climate change knowledge and understanding is unlikely to be politically neutral (Gavin, Leonard-Milsom, & Montgomery, 2011), and political affiliation can have a considerable influence on how individuals interpret their experience with extreme weather in relation to climate change (Givens, 2014; Hahnel & Brosch, 2016). Further, identification with a political group makes individuals susceptible to align their judgments and actions to the standards of their affiliated political group; to the extent that political affiliation may have a greater influence on climate change-related judgments than the combination of personal experience, values and ideology (Cohen, 2003; Hahnel & Brosch, 2016). Therefore, while Spence et al.'s (2011) argument that flood experience confers a sense of personal efficacy and greater preparedness to reduce energy use may hold true for left-leaning voters - whose politics normatively endorse belief in anthropogenic climate change and engagement in mitigation actions, my findings suggest that these outcomes may not be achieved to the same extent, or may be achieved via different psychological routes, among right-leaning voters.

Nevertheless, drawing on local weather events as a means of proximizing climate change remains a promising strategy. My analysis showed that flood experience was significantly linked with lower uncertainty about climate change and greater perceived vulnerability to climate change impacts among both left- and right-leaning voters. Educational interventions that link local extreme weather events with global climate change may successfully build on such experiences to help people better understand the causes and consequences of climate change (e.g., Zhao et al. 2013). Additionally, the fluid and context-dependent nature of social identities provides opportunities to circumvent the challenge posed by antagonistic political affiliations by exploiting such resources as in-group messengers, and communication strategies that promote pro-environmental in-group norms and link social identity with pro-environmental outcomes (Fielding & Hornsey, 2016). For example, reframing mitigation activities as improving technological and economic advancement, rather than averting climate change risks, has been shown to significantly increase motivation to act pro-environmentally among political groups that typically exhibit high levels of climate change scepticism (Bain et al. 2012). Similarly, messages that appeal to the 'conservative' value of reducing waste and patriotic support for low carbon technologies as "Great British Energy" were found to reduce scepticism and elicit broad

support, while social justice framing – a narrative commonly employed in current climate change communication, produced political polarization among audiences in the UK (Whitmarsh & Corner, 2017).

It should be noted that the current research has some limitations. Firstly, due to the cross-sectional nature of the data, it is impossible to establish causal interrelationships between flood experience, climate change perceptions and willingness to reduce energy use among the sample. Although the results are consistent with my proposition that the link between extreme weather experiences and climate change perceptions and action motivations vary systematically depending on political affiliation, longitudinal studies are needed to further substantiate the current findings. Secondly, the possibility that prior experiences with flooding (or other extreme weather events) may have influenced participants' reported voting intentions and climate change attitudes in the survey cannot be ruled out. However, considering that there was no significant difference between left- and right-leaning voters in their reported experiences of local flooding, and left-leaning voters were more likely to cite flooding as a sign of climate change, it seems more likely that political affiliation moderates the interpretation of flood experiences and their consequent effects on attitudes.

The significant differences (in multigroup path analysis) between left and right-leaning voters in my re-analysis of Spence et al.'s (2011) model were the paths linking scepticism with willingness to reduce energy use and preparedness to pay more for energy efficient products; and the path linking perceived instrumentality with preparedness to pay more for energy efficient products. Scepticism about the reality and drivers of climate change is plausibly the most politically divisive aspect of climate change perceptions (with consequent implications for individuals' willingness to engage in mitigation actions) in the UK, rather than the attribution of flooding with regard to climate change (c.f. Marquart-Pyatt et al. 2014). Subsequent research exploring whether similar patterns are observed in relation to other mitigation actions could yield some broader insights into determining how individuals' political affiliation relates to their preparedness to act pro-environmentally. It would also be informative to determine if experiences with other extreme weather events such, as heatwaves, in the UK affect climate change risk perceptions and uncertainty across different political groupings as was observed with flooding in this study.

Conclusion

My results support previous indications that integrating interactions between political affiliation and extreme weather experience into predictive models of mitigation and adaptation intentions can lend valuable nuance and greater accuracy to assessments of the effects of such experiences on climate change engagement in the UK (Capstick, Whitmarsh, Poortinga, Pidgeon, & Upham, 2015; Demski et al., 2017). Irrespective of the modulating influence of politics, it is unlikely that a strategy of proximizing climate change through experiences with extreme weather alone will be sufficient to build and sustain positive climate change engagement since a focus on climate change risks can lead to maladaptive responses including desensitization, denial and defensiveness (Brügger et al., 2015). Therefore, more research is needed to determine how extreme weather experiences can be combined with other climate change communication strategies to maximize and broaden their positive influence on individuals' attitudes and motivations.

Chapter 4

Exploring the effects of a mentally simulated experience of flooding on climate change engagement

Introduction

Flooding is expected to be one of the main impacts on UK communities to result from climate change (DoH, 2001). As discussed in Chapter 3, personal experiences with local flooding can promote engagement with climate change (Spence, Poortinga, Butler, & Pidgeon, 2011; Taylor, de Bruin, & Dessai, 2014), particularly among people with values and ideological leanings that are normatively congruent with belief in anthropogenic climate change and pursuing the goal of climate change mitigation. To better understand the conditions in which flood experiences can be marshalled to boost public concern and willingness to act on climate change, it is necessary to further probe the influence of values, and determine how they guide the way individuals integrate experiential information into their personal attitudes and beliefs. Drawing on previous research showing that imagined situations can have similar effects as real-life situations on cognition, affective responses and behaviour (e.g., Crisp & Turner, 2009; Greenwood, 1989), I operationalized flood experiences in this chapter using a mentally simulated personal experience of flooding. This was used as a means to test more specific hypotheses regarding how flood experience interacts with pre-existing values and beliefs in determining individuals' responses to climate change.

In the absence of direct familiarity with risks, people often draw on indirect or vicarious experiences (Marx et al., 2007). One of the ways in which people vicariously experience extreme weather and climate change is through exposure to cinematic material such as films and documentaries (Sakellari, 2015). This form of visual media has immediacy and allows people empathically process climate change information like they were with the characters acting/speaking (Howell, 2014). Like direct experiences, visual media can promote the psychological availability of climate change information and elicit powerful affective responses with important implications for subsequent actions and decision-making (Leiserowitz, 2004). However, the effectiveness of cinematic productions in changing attitudes toward climate change may be limited by a common practice of framing climate change in apocalyptic terms, as well as audience perceptions of the credibility of films as sources of scientific information. To avoid

these pitfalls, I utilized a method of visualising extreme weather in a manner that affords people the perspective of an actor in the event, rather than that of a vicarious observer.

In subsequent sections of this introduction, I briefly review prior research on the psychological effects of cinematic portrayals of climate change. I discuss how the use of fear arousal and catastrophe narratives, and public (dis)trust in the scientific credibility of film producers, may limit the effectiveness of films as instruments for encouraging climate change engagement. Next, I discuss the role of personal experiences as a source of mental imagery and the importance of mental imagery as an element of public climate change discourse. This is followed by an exposition on the concept of mental imagery and applications of mental imagery and mental simulation across various fields of psychology. Lastly, I outline the considerations and predictions that guided my studies.

Experiencing extreme weather and climate change vicariously through cinematic visual media: effects and limitations

Research shows that vicarious experiences with natural disasters and extreme weather through cinematographic depictions can increase climate change awareness, concern and motivation to act in the short term (Howell, 2011; Jacobsen, 2011; Lowe, 2006; Lowe et al., 2006). Prominent climate change films like *The Day After Tomorrow* (2004), *An Inconvenient Truth* (2006) and *The Age of Stupid* (2009) use dramatic images and fictional or true stories to engage audiences with climate change mitigation (Manzo, 2017; Weik von Mossner, 2013). Imagery plays a key role in cognitive and affective information processing (Leiserowitz, 2006; Marx et al., 2007), and visual media have been described as having the power to instantaneously convey motivating messages by condensing complex information, contributing to people's memory and awareness, and providing a basis for personal thoughts and conversations (Nicholson-Cole, 2005).

Cinematic representations of climate change are recognizably grounded in the knowledge-deficit model; insofar that they reflect an assumption that public ignorance is a primary reason for the lack of engagement with climate change, and that this can be resolved by bolstering public knowledge (Nolan, 2010; Sakellari, 2015). Further, climate change films affectively engage their audience through evocations of personal loss (Hammond & Breton, 2014), and seek to draw on the motivational influence of

fear by representing the consequences of climate change with apocalyptic and catastrophe narratives (Morrison & Hatfield-Dodds, 2011; Sakellari, 2015).

However, the fear of catastrophe has limited effectiveness when dealing with future-located threats, such as climate change, because the severity of predicted dangers does not correlate with everyday knowledge and direct experience of present circumstances (Hammond & Breton, 2014). While catastrophe frames may successfully engage audiences who already have a level of awareness and concern about climate change (Howell, 2011), fear-inducing communication can also undermine perceptions of personal efficacy, decrease trust in the information source (O'Neill & Nicholson-Cole, 2009), and cause less engaged individuals to become more apathetic toward climate change (Morrison & Hatfield-Dodds, 2011).

Additionally, climate change communication is as much a 'knowledge deficit' problem as it is one of 'trust deficit' (Sakellari, 2015). Public distrust in government, industrial agencies and science has long posed a challenge to environmental risk communication (Slovic, 1993; Trettin & Musham, 2000). Regardless of the volume or veracity of facts provided, the persuasiveness of climate change communication depends largely on the extent to which the audience perceive the information and information source to be trustworthy (Hmielowski, Feldman, Myers, Leiserowitz, & Maibach, 2014; Malka et al., 2009). Because science on screen is often inaccurate (Perkowitz, 2013), many people may not perceive climate change films to be a credible source of information. Consequently, the effectiveness of climate change films in promoting and reinforcing pro-environmental attitudes may be limited to highly engaged individuals who already accept the mainstream scientific consensus on climate change (Howell, 2011; Morrison & Hatfield-Dodds, 2011).

Irrespective of the limitations of climate change films, visual media are an appropriate, and often optimal, way to present information when taking into account human cognitive capabilities (Boomsma, Pahl, & Andrade, 2016; Tufte, 1990). Images help transform abstract issues into something that can be visualised and responded to; thereby playing a key role in the way people perceive complex real-world issues (O'Neill & Smith, 2014). Further, climate change attitudes and perceptions appear to be linked to individuals' mental imagery of the problem (Boomsma et al., 2016), and research in the United States suggests that affective mental imagery is a strong predictor

of climate change risk perceptions and policy preferences (Leiserowitz, 2006; Smith & Leiserowitz, 2012). In the next section, I briefly discuss the relationship between personal experience and mental imagery in the context of societal responses to climate change. I use this discussion as a background to subsequently introduce the potential value of mental simulation as a vehicle to tap into the experiential processing system without succumbing to some of the limitations associated with cinematic media.

Personal experience, mental imagery and engagement with climate change

Although both direct and vicarious personal experiences can influence subsequent behaviour through experiential processes such as affect and availability heuristics (Marx et al., 2007)[10], people tend to ascribe more weight to direct experiences when forming beliefs about environmental risks (Viscusi & Zeckhauser, 2015; Weber, 2006). Therefore, individuals with a direct experience of flooding and other extreme weather events that can be linked to climate change are less likely to discount the risk of negative climate change impacts than those who vicariously obtain such experiences (Viscusi & Zeckhauser, 2015). Nonetheless, direct and vicarious personal experiences contribute strongly to people's conception and mental visualization of climate change. Highly imageable phenomena such as unusual weather events are typically salient aspects of climate change, and public climate change discourse draws heavily on local experiences of such events; plausibly due to a need to identify abstract climate change with familiar and concrete examples (Nicholson-Cole, 2005). Personal experiences also overlap with people's imaginative representations of climate change and the mental imagery conjured by both of these influences plays a significant role in determining climate change perceptions and behavioural choices (Nicholson-Cole, 2005).

Harnessing mental imagery: A brief review of theoretical and applied perspectives

Mental imagery refers to perceptual experience in the absence of sensory input, and is commonly described as 'seeing with the mind's eye' or 'hearing with the mind's ear' etc. (Ji, Heyes, MacLeod, & Holmes, 2016; Kosslyn, Ganis, & Thompson, 2001). Mental images do not only result from the recall of previously perceived objects and

[10]The affect heuristic (also known as "risk as feelings") refers to a reliance on the positive or negative feelings associated with a stimulus when making judgments about, or acting in response to, the stimulus (Loewenstein et al., 2001). The availability heuristic is a rule of thumb that allows people to solve problems based on what they remember and how easily the memory is retrieved, i.e. how readily available the memory is (Marx et al., 2007).

events, they can also be created by combining and modifying stored perceptual information in novel ways (Kosslyn et al., 2001). Mental imagery is considered a core component of the 'prospective brain', which enables the simulation of hypothetical or future events based on prior knowledge and experience (Ji et al., 2016; Moulton & Kosslyn, 2009; Schacter, Addis, & Buckner, 2008). According to Moulton and Kosslyn (2009), mental imagery is best understood in terms of mental simulation. In this respect, it can be understood as the episodic construction of a hypothetical scenario that mimics perception and evokes cognitive and affective associations, consequently allowing us to answer 'what if' questions by making the likely consequences of performing a specific action or being in a specific situation explicit and accessible (Ji et al., 2016; Moulton & Kosslyn, 2009).

Mental imagery derives motivational power, in part, from being linked to emotions, and this link arises from the ability of mental imagery to simulate reality. According to Lang (1977, 1979), a mental imagery representation of an emotionally charged stimulus (e.g. a snake) activates an associative network of stored information that overlaps with that activated during actual experience of the stimulus (i.e., encountering a snake). This associative network consists of perceptual information about the stimulus (colour, shape and size of the snake), semantic information about what it means (danger, venomous bite), somatovisceral response information about what it feels like to encounter the stimulus (fear, racing heart), and preparatory motor responses evoked by the encounter (e.g., muscles tensing to flee from the snake) (P. J. Lang, 1987). Based on this overlap in perceptual information between imagined and real stimuli, Lang (1977, 1979) further postulated that imagined interaction with stimuli can be used as a template for conditioning emotional and behavioural responses to real-life interactions with the same stimuli. This proposal is supported by a considerable amount of empirical evidence. For example, distressing mental imagery has been shown to be symptomatic of a range of anxiety and mood disorders (Burnett Heyes, Lau, & Holmes, 2013; Holmes & Mathews, 2010), and research shows that mental imagery cues can used to elicit positive emotions (Holmes, Mathews, Dalgleish, & Mackintosh, 2006) and manage the manifestations of conditions such as post-traumatic stress disorder (Long et al., 2011; Lu, Wagner, Van Male, Whitehead, & Boehnlein, 2009).

Mental imagery and simulation also play a key role in social cognition. When perceiving other individuals' behaviour, common motor representations are activated

such that there is a match between perceived and represented behaviour. This capacity allows us to simulate the mental states of others including their intentions, feelings and beliefs (Goldman & Sripada, 2005; Preston & de Waal, 2001). In addition to predicting the mental states of others, mental simulation is implicated in the inferences we make about our own attitudes and behaviours. In this regard, mental simulation has been identified as a heuristic that helps fulfil fundamental epistemic and self-evaluative needs relevant to basic functioning (Kahneman, 1982). The role of simulation in satisfying these needs lies in our ability to consider alternative possibilities for past behaviour – otherwise known as 'counterfactual' thinking (Galinsky & Moskowitz, 2000). The ability to imagine better alternatives than reality serves as an incentive for future behaviour (Markus & Nurius, 1986), and a motivation for self-improvement (Gaglio, 2004). On this basis, mental simulation has been described as a mechanism of self-regulation that facilitates our pursuit of goals, ambitions and aspirations (Crisp & Turner, 2012).

Researchers have documented the use of mental simulation as a self-regulatory technique across various domains including academic achievement, clinical psychology, health, sports performance, advertising and intergroup relations (Miles & Crisp, 2013; Oettingen & Mayer, 2002; Smith, Wright, Allsopp, & Westhead, 2007; Taylor et al., 1998). This literature indicates that mental simulations can be instrumental for eliciting behavioural and attitudinal change. For example, imagining contracting a disease has been shown to increase the perceived likelihood of actually contracting the disease by increasing the psychological availability of the events imagined (Sherman, Cialdini, Schwartzman, & Reynolds, 1985). As discussed in Chapter 2, the perceived likelihood of being affected by a hazard or threat is a fundamental determinant of behavioural/coping responses. Therefore, this finding was interpreted as having important ramifications for preventive health programmes (Sherman et al., 1985). Similarly, Morewedge, Huh, and Vosgerau, (2010) demonstrated that people who repeatedly imagined eating a particular food (e.g., chocolate) many times subsequently consumed less of the imagined food than people who imagined eating that food fewer times, imagined eating a different food (e.g., cheese), or did not imagine eating any food. Their study suggests that repeatedly simulating an action can trigger its behavioural consequents; in this case, people became habituated to a stimulus solely due to mental simulation. According to Oettingen (2012) interventions involving

mental simulation can be used autonomously by people to regulate their own goal pursuits and long-term development.

Recent research in environmental psychology has also linked mental imagery to pro-environmental thoughts and the formation of pro-environmental goal intentions. Drawing on prior evidence in cognitive psychology, Boomsma et al. (2016) proposed that affectively charged external images of environmental change can be internalized to bolster the motivational power of new or pre-existing pro-environmental goals and serve as triggers for pro-environmental behaviour change. These proposals were backed up in three experimental studies where, following exposure to a video depicting marine plastic pollution (experiment 1), thermal images depicting heat loss in homes (experiment 2), and slideshows of positive and negative future climate scenarios (experiment 3), participants who reported having more vivid mental visualization of environmental change as a consequence of encountering these stimuli also reported having more pro-environmental thoughts and significant pro-environmental behaviour change. Further, vivid mental imagery of the future climate scenarios was found to strengthen the link between goal intentions and self-reported pro-environmental behaviour change (experiment 3).

Beyond these examples, applications of mental imagery and simulation have been explored in other areas of psychology including affective regulation (Gilbert & Wilson, 2007), creativity (Clement, 2008), goal pursuit (Blankert & Hamstra, 2017), inter-group relations (Crisp & Turner, 2009), and interpersonal communication (Honeycutt & Ford, 2001). The different streams of psychological research that address mental imagery converge on an understanding of mental simulation as a core mechanism that that is critical for basic motor control, action initiation, affective regulation, social inference and motivation to effect change across a variety of behavioural domains (see Crisp, Birtel, & Meleady, 2011).

Considering the theoretical significance of mental imagery and a strong precedent of incorporating mental simulation techniques into interventions aimed at achieving attitudinal and behavioural change, it seems plausible that mental simulation may also be an effective tool for influencing attitudes toward climate change. According to Crisp et al. (2011), mental simulation is a fundamental aspect of the human experience and, as such, should be considered a correspondingly critical component of behavioural

change strategies. Based on these perspectives, I explored the potential effects of mentally simulated experiences of flooding as an instrument for further investigating the effects of actual flood experience on climate change attitudes.

The current research: mentally simulated flood experience and climate change attitudes

The objective of this research was to explore the possibility that individuals' attitudes toward climate change may be significantly influenced through a mentally simulated experience of flooding. To my knowledge, this is the first attempt in environmental psychology to manipulate the effects of extreme weather experiences on climate change attitudes using this strategy. Given the practical constraints inherent in manipulating real-world flood experiences, the development of a technique that can be used to functionally mimic the effects of flood experience in a 'laboratory' setting could enable researchers to engage more effectively with questions about the role of extreme weather experiences in climate change engagement that have hitherto been unanswerable with cross-sectional data.

Based on the preceding review, I expected that mentally simulating a personal experience of flooding (i.e., imagining oneself as a victim of a flooding event) will trigger similar perceptual and attitudinal responses as are commonly observed with actual flood experience. In other words, I anticipated that mentally simulated flood experience will, at the very least, significantly increase perceived vulnerability to (or the perceived threat of) climate change impacts (cf. Spence et al., 2011; Taylor et al., 2014). Further, considering repeated indications in prior research that the motivational influence of mental imagery is closely linked with emotions and affect (Holmes & Mathews, 2005, 2010; Leiserowitz, 2006), I anticipated that a mentally simulated experience of flooding would also produce an increase in climate change concern. Boomsma et al. (2016) showed that mental imagery is linked with the formation of pro-environmental goals, and the vividness of mental imagery strengthens the link between environmental goal intentions and self-reported pro-environmental behaviour change. In a similar vein, Spence et al. (2011) argued, based on goal-setting theory, that experiences of events such as flooding may help individuals to better relate to climate change impacts and thus confer them with an increased sense of instrumentality in addressing the issue. Therefore, I predicted that mentally simulating an experience of

flooding will have a significant effect on individuals' perceived efficacy in addressing climate change.

As demonstrated in Chapter 3, some effects of flooding experience such as increased perceived instrumentality (efficacy), perceived vulnerability (threat) and preparedness to engage in mitigation behaviour do not generalize in an equivalent fashion across groups of individuals with differing political affiliation. However, the results of that study do not provide direct insights into why this the case. Consequently, here I examined the potential moderating influence of two variables that may help explain these differences: values and attribution, on the link between imagined flood experience and climate change attitudes.

Values are known to have a moderating influence on how people process climate change information (Kahan et al., 2011), and people have been shown to exhibit significant differences in their endorsement of environmental values depending on their political affiliation (Whitmarsh, 2011). People who place a priority on environmental protection or have strong biospheric values can be more responsive to information highlighting the adverse environmental consequences of human activities (e.g, Bolderdijk, Gorsira, Keizer, Steg, & Ouellette, 2013). The reason for this is that information about environmental problems is not a sufficient condition for attitudinal and behaviour change on its own if individuals are not motivated to act on their knowledge of the situation (Bolderdijk et al., 2013; Schultz, 2010). Therefore, I predicted that the extent to which mentally simulated flood experience affects climate change perceptions and attitudes will be contingent on the strength of individuals' biospheric values.

In Chapter 3 (section 1.2), I discussed research suggesting that one of the routes via which pre-existing values and beliefs influence the link between extreme weather experiences and climate change attitudes pertains to individuals' inclination to see salient weather events as 'unusual' (Goebbert et al., 2012) or see their experiences with extreme weather as consistent with trends expected from climate change (Capstick & Pidgeon, 2014). Coupled with the fact that objective weather has been found to have a weaker effect on climate change engagement than perceived weather (Shao, 2016), this suggests that the way weather events are attributed or interpreted in the context of climate change plays a key role in determining the effects of extreme weather

experiences on climate change perceptions and attitudes. On this basis, I expected that the effect of a mentally simulated experience of flooding on climate change attitudes will be modulated by the extent to which people consider the visualized event to be linked to climate change.

I explored these predictions in four experimental studies examining the effect of an imagined experience of flooding on climate change perceptions, behavioural intentions and pro-environmental behaviour. In these experiments, I also addressed the moderating influence of biospheric values (Study 4, Study 5), and attribution (Study 5, Study 6 and Study 7).

Study 4

Aims and hypotheses

The aim of Study 4 was to test the effect of a mentally simulated experience of flooding on climate change perceptions and behavioural intentions. I hypothesized that individuals subjected to a mentally simulated experience of flooding will report higher perceived threat from climate change (H1), higher concern (H2), and higher perceived efficacy to personally address climate change (H3). I also hypothesized that perceived threat (H4), concern (H5) and perceived efficacy (H6) will significantly mediate the effect of a mentally simulated flood experience on intentions to engage in mitigation actions. Lastly, I hypothesized that the strength of individuals' biospheric values will modulate the effect of the mentally simulated flood experience on climate change perceptions; whereby the the indirect effects of the imagined experience manipulation on behavioural intentions mediated by perceived threat (H7), concern (H8) and perceived efficacy (H9) will be greater among people with stronger biospheric values.

According to Husnu & Crisp (2010), prior experience has a significant influence on the availability of information used when constructing an imagined scenario. In other words, people who have previously experienced flooding directly in reality are expected to be able to envisage more vivid mental simulations of flood experience and consequently experience a more pronounced effect of the simulation on perceptions and behavioural intentions. Therefore, I controlled for the influence of past flooding experience in my analyses.

Method

Participants

87 students at the University of St Andrews, 20 males and 67 females, aged between 18 and 30 (M = 20.8, SD = 2.66), were randomly assigned to one of two conditions: control (N = 46) versus imagined flood experience (N = 41). Participants were recruited from the research subject pool with advertisements placed within the School of Psychology and Neuroscience, and with notices circulated in the weekly student memos. Each subject received £3 for taking part in the research. Prior to the start of the experiment, participants were provided brief information about the nature of the study including the fact that they would be required to answer questions pertaining to their attitudes toward extreme weather and climate change.

Procedure

At the start of the experiment, participants were directed to complete a questionnaire measuring their demographic profile (gender, age, ethnicity and course of study). They were then asked to complete one of two tasks depending on the condition to which they had been assigned. Participants in the control condition were given the following instruction: "We would like you to spend the next two minutes imagining an outdoor scene. Try to imagine aspects of the scene around you (e.g., is it a beach, a forest, are there trees, hills, what's on the horizon?). In the space below, please list the different things you saw in the scene you just imagined". This set of instructions was adopted from Stathi and Crisp (2008).

Participants in the imagined flood experience condition were presented with three images depicting scenes of severe flooding in southern England captured earlier in the same year (see Appendix 6). The images were captioned with the following message:

"In February 2014, the UK Met Office confirmed that England and Wales had experienced the wettest winter since records began in 1766. Downpours totalling 435mm of rain broke the 250-year old England and Wales precipitation records. Heavy rainfall from late 2013 into early 2014 resulted in severe flooding around the UK, affecting thousands of homes, cutting off critical transport routes and causing social and economic disruption in many parts of the country. According to the Met Office, climate change will lead to an increase in extreme weather in the coming years".

After reading this caption, participants were presented with the following instruction:

"Please take two minutes to imagine yourself as a victim of the flood described above. Imagine watching your home and property being extensively damaged by floodwater, and being unable to get access to nearby shops for food and groceries, or get to work and school as most roads in the vicinity are now submerged. In the space provided below, please describe as many aspects of the scenario you just imagined as possible".

Subsequently, participants were also asked to indicate how easy it was for them to imagine being in the flooding situation (response: 1 = very difficult, 7 = very easy), how vivid their mental imagery of being in the situation was (response: 1 = not vivid, 7 = very vivid), and if they thought it was likely that the flooding that occurred across the UK in 2014 is a result of climate change (response: 0 = No/Don't Know, 1 = Yes).

After completing the tasks in either condition, participants were asked to complete the dependent measures before being thanked and debriefed. All items and responses were administered in a testing room at the University of St Andrews via a standard desktop computer using the Qualtrics platform.

Measures

Past flood experience. This was measured with a single item: "Have you had a personal experience of unusually intense rainfall and flooding in the last 5 years?". This item was adopted from van der Linden (2014). Responses were recorded with a yes/no format. Approximately half of the total sample of participants indicated that they had previous experience of unusually intense rainfall and flooding (50.6%).

Biospheric value orientation (α = .88, M = 5.76, SD = 1.04). I measured biospheric values by asking participants to rate the importance of four values (respecting the earth, protecting the environment, unity with nature and preventing pollution) as guiding principle in their lives. Response to these items were recorded using a 9-point format (-1 = opposed to my values, 0 = not important, 7 = extremely important). This measure has previously been validated cross-culturally (de Groot & Steg, 2007b, 2008) and has been widely used in both experimental (e.g., Bolderdijk et al., 2013) and cross-sectional studies (van der Werff, Steg, & Keizer, 2013).

Perceived threat (α = .87, *M* = 5.10, SD = 0.93). This was measured with six items addressing the perceived severity and likelihood of being affected by the threat posed by climate change. Participants were asked to rate the seriousness of the threat posed by climate change to: the environment, people in the UK and themselves as individuals. Next, they were asked to rate the likelihood that the threat posed by climate change would affect their health and wellbeing, the wellbeing of society as a whole and, wildlife and natural landscapes. Responses to this measure were recorded using a 7-point format (1 = very low, 7 = very high).

Concern (*M* = 5.33, SD = 1.36). This was measured with a single item: "how strongly do you feel the following emotion when you think about climate change? – concern". Responses were recorded as 1 = not at all, 7 = very strongly.

Perceived efficacy (*M* = 5.34, SD = 1.16) was measured with a single item: "I can personally help reduce climate change by changing my behaviour". Responses were recorded using a 7-point scale (1 = Strongly disagree, 7 Strongly agree).

Behavioural intentions (α = .79, *M* = 5.00, SD = 1.19). I measured this by asking participants how likely they were to engage in the following behaviours in the near future: (1) Sign a petition calling on the government to make stronger commitments to addressing climate change; (2) donate to an environmental group that focuses on climate change; (3) volunteer in or join an environmental group that is engaged with climate change issues; (4) try to limit your energy consumption for the sake of the environment. Responses were recorded with a 7-point format (1 = not likely, 7 = very likely). Principal axis factor analysis showed that all four items loaded onto a single factor explaining 61.1% of the variance (Eigenvalue = 2.44).

There were other variables measured in the questionnaire that are not considered here. These include measures of objective climate change knowledge, self-rated climate change knowledge, perceived climate change salience, acceptance of responsibility for addressing climate change, and emotional responses to climate change: anger, fear, worry and outrage (see Appendix 6).

Results and discussion

Preliminary analyses

Qualitative analyses of participants' description of the various aspects of the scenario they imagined showed that the most common themes of the mental imagery generated by the imagined flood experience task pertained to personal losses incurred due to the flood (e.g., "*I can see my house sinking under the heavy rain, all my belongings going away with the water waves*"; "*my home is submerged in water, I can't use any of my things anymore; it is difficult to get around*", "*I might have limited access to the internet, maybe I wouldn't be able to communicate with friends*"), emotional responses to the effects of the flood (e.g., "*I would be worried about the financial consequences flooding will cause*", "*I am worried about my relatives and family, thinking when this flood is going to end*", "*I feel very helpless and trapped*") and the physical dynamics of the flood event (e.g., "*water rushing down the street*", "*woke up in the morning, seeing flood water outside"*).

Contrary to Husnu and Crisp (2010), prior real-world flooding experience had no significant relationship with the vividness of participants' mental imagery of being in the imagined flood scenario (r (41) = .17, p = .296). Similarly, the vividness of the mental imagery was not related to biospheric value (r (41) = -.19, p = .242), perceived threat (r (41) = .21, p = .193), concern (r (41) = -.09, p = .565), perceived efficacy (r (41) = -.07, p = .687) or behavioural intentions (r (41) = .22, p = .160). There was also no significant link between biospheric value and whether participants indicated that they thought the 2014 UK flooding is likely to have been linked to climate change (r (41) = .25, p = .123). However, there was a significant link between participants' perception that the 2014 UK flooding may have been linked to climate change and their level of perceived threat (r (41) = .43, p = .005) and behavioural intentions (r (41) = .40, p = .011), but not concern (r (41) = .25, p = .123) or perceived efficacy (r (41) = .16, p = .317). Zero-order correlations among the measured variables are presented in Table 4.1.

Table 4.1. Zero-order intercorrelations between the variables addressed in Study 1.

	2	3	4	5	6	7
1. Imagined Experience	-.08	-.07	.13	.13	-.16	-.07
2. Past flood Experience		.00	-.04	.11	-.06	.08
3. Biospheric Value			.41***	.20†	.11	.33**
4. Perceived Threat				.36**	.13	.54***
5. Concern					.13	.49***
6. Perceived Efficacy						.31**
7. Behavioural Intentions						-

†p<.10, **p<.01, ***p<.001, N = 87.

Tests of hypotheses

Contrary to my expectations, there was no significant difference in perceived threat (H1), concern (H2), perceived efficacy (H3) or behavioural intentions between participants in the control condition and those in the imagined flood experience condition (Table 4.2). I further assessed the effect of the imagined flood experience manipulation on perceived threat, concern and perceived efficacy, taking into account the effects of biospheric values, past flood experience, gender and age. This analysis was conducted with the PROCESS macro for regression-based estimation of mediation, moderation and conditional effects in SPSS (Hayes, 2013).

Table 4.2. Descriptive and comparative statistics for Study 4

DV	Condition		
	Control (N = 46)	Imagined Experience (N = 41)	
	M(SD)		t(85)
Perceived Threat	4.99(1.03)	5.22(0.80)	-1.92
Concern	5.17(1.57)	5.51(1.08)	-1.16
Perceived Efficacy	5.52(0.91)	5.15(1.37)	-1.52
Behavioural Intentions	5.07(1.26)	4.92(1.11)	0.61

The regression analysis revealed that the imagined experience manipulation had a significant effect on perceived threat (H1) when biospheric value, past flood

experience, gender and age are controlled (Table 4.3). However, the effects of the manipulation on concern and perceived efficacy remained non-significant (Table 4.3). As expected, biospheric value was positively linked with perceived threat, but more interestingly there was also a significant interaction between biospheric value and imagined flood experience in their effect on perceived threat. Closer examination of this interaction effect revealed that the imagined flood experience manipulation had a significant effect on perceived threat at low levels of biospheric value (B = .89, SE = .27, *p* = .001, 95% CI: [.36, 1.41], *N* = 86) but not at high levels (B = -.10, SE = .25, p = .690, 95% CI: [-.60, .40}, N = 86]). This means that, relative to the control group, participants with a weaker endorsement of biospheric values reported a higher level of perceived threat following the imagined flood experience task than those with a stronger endorsement of biospheric values (Figure 12). Further, biospheric value significantly moderated the indirect effect of imagined flood experience on behavioural intentions mediated by perceived threat in an opposite pattern to my hypothesis (H7). In this respect, the imagined flood experience manipulation had significant indirect effects on behavioural intentions through perceived threat (H4) when biospheric value was significant at the mean level or a standard deviation below the mean level of biospheric value, whereas there was no significant indirect effect of the imagined flood experience manipulation on behavioural intentions through perceived threat when biospheric value was at a standard deviation above the mean (Table 4.3).

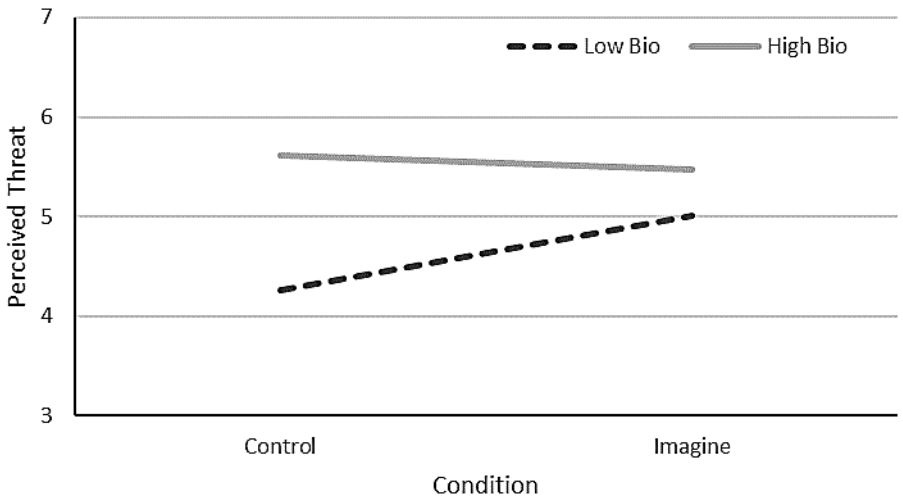

Figure 12. Effect of imagined flood experience and biospheric value on perceived threat from climate change.

Table 4.3. Multiple regression of imagined flood experience, biospheric value and the control variables on climate change perceptions and behavioural intentions

Mediator Variable Model			
IV	Perceived Threat	Concern	Perceived Efficacy
	B(SE)	B(SE)	B(SE)
Imagined Experience	.39(.18)*	.52(.29) †	-.40(.26)
Biospheric value	.45(.09)***	.30(.15)*	.14(.13)
Imagined Experience*Biospheric value	-.47(.18)*	-.13(.30)	-.21(.26)
Past flood experience	.10(.18)	.35(.30)	-.15(.27)
Gender	.39(.21)†	.71(.35)*	-.06(.31)
Age	.04(.03)	.00(.06)	.00(.05)
F	5.58***	1.90†	0.75
R^2	.30	.13	.05
N		86	

Dependent Variable Model	
	Behavioural Intentions
Perceived Threat	.53(.11)***
Concern	.24(.08)**
Perceived Efficacy	.21(.08)*
Imagined Experience	-.22(.20)
Past flood experience	.08(.19)
Gender	.69(.23)**
Age	-.04(.04)
F	12.09***
R^2	.52
N	86

Conditional Indirect Effects of Imagined flood experience on behavioural intentions at Biospheric value = Mean and ± 1SD			
Mediator	Biospheric value	Effect	95% CI
Perceived Threat	- 1SD	.47	[.18, .90]
	M	.21	[.04, .43]
	+ 1SD	-.05	[-.29, .20]
Index of moderated mediation		-.25	[-.55, -.09]
Concern	- 1SD	.16	[-.01, .45]
	M	.13	[-.00, .38]
	+ 1SD	.09	[-.08, .40]
Index of moderated mediation		-.03	[-.19, .09]
Perceived Efficacy	- 1SD	-.04	[-.21, .07]
	M	-.08	[-.24, .00]

	+ 1SD	-.13	[-.36, .01]
Index of moderated mediation		-.04	[-.21, .02]

Cell entries are unstandardized regression estimates with standard errors in parentheses. *p<.05, **p<.01, ***p<.001. Effect = Bootstrap estimate of effect. Confidence intervals are bias-corrected and based on 1,000 resamples (Preacher & Hayes, 2008).

These results suggest that the participants with high biospheric values do not report a significant change in their attitudes following the imagined experience task; plausibly because they already have a high level of intrinsic value-driven motivation to address climate change. Whereas, for participants with low biospheric values, consciousness of climate change consequences may also be relatively low and among this group. Thus, the imagined experience manipulation was able to significantly increase perceptions of the threat posed by climate change and through this process also increase intentions to engage in mitigation behaviour.

However, the imagined flood experience manipulation did not have a significant effect on concern or perceived efficacy even after controlling for biospheric values, past flood experience, gender and age. Further, the imagined experience manipulation did not have significant indirect effects on behavioural intentions through concern (H5) or perceived efficacy (H6), there was no significant interaction between biospheric value and concern (H8) not between biospheric value and perceived efficacy (H9) in their effects on behavioural intentions (Table 4.3).

This study demonstrated that a mentally simulated experience of flooding may effectively increase perceived threat of climate change, especially among individuals with a weak endorsement of biospheric values who might only have a low consciousness of climate change. However, the manipulation did not have significant effects on concern and perceived efficacy. There were two key limitations in this study that may have influenced the effectiveness of the manipulation. Firstly, participants in the imagined flood experience condition were provided with images of scenes of people affected by the 2014 UK floods. Research suggests that more vivid mental images may be formed when people are given an opportunity to construct their own images. For example, when asked to form mental images based on a verbal report describing the aftermath of a road accident, Krans et al. (2010) found that the emotional effect of forming one's own images was stronger than that reported by participants who viewed video footage on which the verbal report was based. Participants in this study may have

found the supplied images less relatable than that which they may have generated on their own, thereby reducing the effect of the imagined flood experience.

A second limitation of the study pertains to the fact that a link between climate change and the flooding was implied in the textual description provided to participants in the imagined flood experience condition. Although attribution was found to be significantly correlated with perceived threat and behavioural intentions, further exploration of these results revealed that the mean levels of perceived threat between the group of participants who thought the flooding might be due to climate change (M = 5.49, SD = 0.70, N = 25), those who did not think the flooding was linked to climate change (M = 4.86, SD = 0.77, N = 15), and those in the control condition (M = 4.99, SD = 1.03, N = 46) was not statistically different (F (2, 79) = 3.10, p = .051). Similarly, the mean behavioural intentions scores across the groups of participants who thought the flooding might be linked to climate change (M = 5.26, SD = 0.82, N = 25), those who did not think the flooding may be linked to climate change (M = 4.32, SD = 1.33, N = 15) and those in the control condition (M = 5.07, SD = 1.26, N = 46) was not significantly different (F (2, 79) = 1.90, p = .157). Nonetheless, this flaw in the experimental design makes it difficult to definitively isolate the effects of merely imagining a flood from the interpretive context of climate change as a probable cause. These limitations were addressed in a subsequent experiment.

Study 5

Aims and hypotheses

The aim of Study 5 of was to test the effect of a mentally simulated experience of flooding on climate change perceptions and behavioural intentions and address some of the limitations of Study 4. Specifically, the imagined flood experience task only involved a textual description with no reference to climate change. I also employed a multi-item measure of perceived efficacy and a measure of actual pro-environmental behaviour.

I tested the same hypotheses in Study 4 as were tested in Study 5: participants with an imagined flood experience were expected to report increased perceived threat (H1), concern (H2) and perceived efficacy (H3). Further, the imagined flood experience was expected to have an indirect effect on pro-environmental behaviour through perceived threat (H4), concern (H5) and perceived efficacy(H6). Lastly, biospheric value was

expected to modulate the effect of imagined flood experience on the climate change perceptions such that the indirect effects on pro-environmental behaviour mediated by perceived threat (H7), concern (H8) and perceived efficacy (H9) will be significantly moderated by biospheric value.

Method

Participants and procedure

255 undergraduate students (40 males, 214 females; M_{age} = 19.59, SD_{age} = 2.74) at the University of Leicester were randomly assigned to one of two conditions: a control (N = 130) or imagined experience condition (N = 125). Participants were recruited with advertisements placed within the School of Psychology. They were informed about the nature of the study, including the fact that they would be required to answer questions regarding their attitudes toward extreme weather and climate change, prior to the start of the experiment. Each subject received course credit and was entered into a raffle for a £50 shopping voucher for taking part in the study.

As in Study 1, participants in the control condition were asked to imagine an outdoor scene and make a list of the different things they saw in the scenario they imagined. However, the imagined flood experience task was modified in two ways. Firstly, only a description of the 2013/2014 floods was provided, with no accompanying images. This was done so that participants could generate their own mental imagery of the flood scene. Secondly, to separate the effect of the imagined flood experience from the effect of attributing the event to climate change, no reference was made to climate change in the descriptive text. The message presented was as follows:

"In February 2014, the UK Met Office confirmed that England and Wales had experienced the wettest winter since records began in 1766. Downpours totalling 435mm of rain broke the 250-year old England and Wales precipitation records. Heavy rainfall from late 2013 into early 2014 resulted in severe flooding around the UK, affecting thousands of homes and farms, cutting off critical transport routes, and disrupting social and economic activities across large parts of the country".

After reading this message, participants were presented the following instruction:

"For the next two minutes, please imagine yourself as a victim of the flooding described above. Imagine watching your home and property being extensively damaged by

floodwater, and being unable to get access to nearby shops for food and groceries, or get to work/school as most roads in the vicinity are now submerged. In the space provided below, please describe as many aspects of the scenario you just imagined as possible".

Participants were also asked to indicate how easy it was for them to imagine being in the flooding situation (response: 1 = very difficult, 7 = very easy), how vivid their mental imagery of being in the situation was (response: 1 = not vivid, 7 = very vivid), and how likely they thought it was that the flooding that occurred across the UK in 2014 is linked to climate change (response: 1 = not likely, 7 = very likely). After completing the tasks, participants in either condition were directed to complete the dependent measures before being thanked and debriefed. The experiment was administered using an online survey platform and participants were free to complete the study at any time and place of their choosing.

Measures

Past flood experience was measured using the same measure employed in Study 4. Approximately a third of the total sample of participants indicated that they had previously experienced unusually intense rainfall and flooding (32.1%).

Biospheric value orientation (α = .87, *M* = 5.38, SD = 1.07). This was also measured using the same measure used in Study 1 (adopted from de Groot & Steg, 2008).

Perceived threat (α = .86, *M* = 4.75, SD = 1.00). This was measured with seven items addressing the perceived severity and likelihood of being affect by the threat posed by climate change. Participants were asked to rate the seriousness of the rate posed by climate change to: them personally, people around the world, the natural environment and the area they currently live in. Responses to this half of the measure were recorded with a 7-point scale (1 = not serious at all, 7 = very serious). Next, they were asked to rate the likelihood that climate change will have harmful long-term effects on society, the likelihood that they would personally experience threats to their health and wellbeing as a consequence of climate change, and the likelihood that the natural environment will be severely affected by climate change impacts. Responses to the latter half of the measure were also recorded with a 7-point format (1 = very unlikely, 7 = very likely). Although perceived threat severity (Eigenvalue = 3.80, variance explained = 54.3%, α = .79) and threat likelihood (Eigenvalue = 1.20, variance

explained = 17.1%, α = .70) emerged as separate factors in factor analysis, the scale was retained as a unitary measure due to the strong correlation of the two factors (*r* (255) = .74, *p*<.001).

Concern (*M* = 4.67, SD = 1.56). This was measured with a single item: "Thinking about the seriousness of climate change right now, and its potential impacts, how strongly do you feel the following emotions? – concern". Responses were recorded as 1 = not at all, 7 = very strongly.

Perceived efficacy (α = .87, *M* = 3.73, SD = 1.36). I measured this by asking participants how confident they were that the following can make a difference in addressing climate change: "personally changing your behaviour and lifestyle (*e.g.*, purchasing practices and energy use)" and "efforts made by you as an individual to address climate change". Responses to these items were recorded with a 7-point format (1 = not confident, 7 = very confident).

Pro-environmental behaviour. I measured this by asking participants if they would like to donate a fraction of their remuneration to an environmental group if they were selected to receive the £50 shopping voucher. They were given an option to donate up to 50% of the value of the voucher. Responses were recorded using a yes/no format. Overall, 122 participants (47.8%) elected to donate part of their reward to an environmental group.

There were other measures in the questionnaire that are not considered in this chapter. These include measures of pro-environmental self-identity, perceived social norms, acceptance of responsibility for addressing climate change, objective and self-rated climate change knowledge, and emotional responses to climate change: anger, fear, guilt and worry (see Appendix 7).

Results and discussion

Preliminary analyses

Qualitative analyses of participants' description of their mental visualization of the flood experience revealed similar key themes as those observed in Study 1: physical dynamics of the flooding (e.g., "*flood water coming [in] under the door*", "*there is water everywhere, swashing (sic) around my feet*", "*flood water coming down my sloped drive*"), personal losses incurred due to the flooding (e.g., "*devastation of my*

home, loss of my grounding memories (i.e. photo albums, my books, family heirlooms)", "*my house slowly deteriorating due to the excess amounts of water*", "*belongings ruined, home ruined, insurance providers refusing to pay out so a lot of debt*") and emotional responses to the effects of the flood ("*I feel vulnerable and lost*", "*feeling helpless and not being able to do anything to save my home*", "*shock, distress, unsure of the future and how to resolve the issue of not having a home and losing my possessions*").

Similar to Study 4, previous flood experience had no significant relationship with the vividness of participants' mental imagery of experiencing the imagined flood (r (250) = -.07, p = .430). Interestingly, biospheric value was significantly related to the vividness of participants' mental imagery of experiencing the flood (r (250) = .26, p = .004), and their perception of a possible link between the 2013/2014 UK flooding and climate change (r (250) = .36, p<.001). However, the vividness of their mental imagery was not significantly related to perceived likelihood of a link between the 2013/2014 UK flooding and climate change (r (250) = .16, p = .071). Zero-order correlations among the measured variables are presented in Table 4.4.

Table 4.4. Zero-order intercorrelations among the variables addressed in Study 2

	2	3	4	5	6	7
1. Imagined Experience	-.08	-.00	-.03	.08	.01	-.09
2. Past Flood Experience		.01	.04	.03	-.01	.05
3. Biospheric Value			.48***	.35***	.42***	.21**
4. Perceived Threat				.54***	.48***	.22***
5. Concern					.36***	.16*
6. Perceived Efficacy						.07
7. Donation						-

*p<.05, **p<.01, ***p<.001, N = 255 (except correlations with Past flood Experience N = 250).

Tests of hypotheses

I found no support for my hypotheses as participants in the imagined flood condition did not report significantly greater perceived threat (H1), concern (H2), perceived efficacy (H3) than those in the control condition (Table 4.5).

Table 4.5. Participants' mean scores on the dependent variables across the experimental conditions

DV	Condition		
	Control (N = 130)	Imagined Experience (N = 125)	
	M(SD)		*t*
Perceived Threat	4.78(1.03)	4.73(1.06)	.45
Concern	4.55(1.50)	4.79(1.63)	-1.22
Perceived Efficacy	3.71(1.24)	3.75(1.47)	-.21
Would you like to donate a part of your remuneration to [environmental group]?	52.31% yes	43.2% yes	χ^2 (1) = 2.12, *p* = .146

I further assessed the effect of the imagined experience manipulation using multiple regression with the PROCESS macro (Hayes, 2013). This analysis showed that neither perceived threat (H4: B = -.01, SE = .03, 95% CI: [-.10, .04], N = 245), concern (H5: B = .02, SE = .04, 95% CI: [-.02, .14], N = 245), nor perceived efficacy (H6: B = -.00, SE = .03, 95% CI: [-.09, .03], N = 245) significantly mediated the effect of the imagined flood experience on willingness to donate to an environmental group. Contrary to expectation, biospheric value did not moderate any indirect effects of the imagined flood experience mediated by perceived threat (H7), concern (H8) or perceived efficacy (H9) (Table 4.6).

Table 4.6. Test of moderated mediation hypotheses

	Mediator Variable Model		
IV	Perceived Threat	Concern	Perceived Efficacy
	B(SE)	B(SE)	B(SE)
Imagined Experience	-.46(.58)	-1.08(.96)	-.24(.82)
Biospheric value	.43(.08)***	.41(.13)**	.52(.11)***
Imagined Experience*Biospheric value	.08(.11)	.25(.18)	.05(.15)

Past flood experience	.04(.06)	.07(.10)	.01(.09)
Gender	.00(.01)	-.02(.02)	.01(.01)
Age	-.03(.02)	-.06(.03)	-.06(.03)
F	13.91***	8.03***	9.62***
R^2	.26	.17	.19
N		250	

Dependent Variable Model

	Donation behaviour
Perceived Threat	.39(.17)*
Concern	.12(.11)
Perceived Efficacy	-.02(.11)
Imagined Experience	-.36(.27)
Past flood experience	.10(.15)
Gender	-1.10(.40)
Age	.02(.05)
Model χ^2	19.40**
R^2	.08 (Cox & Snell), .10 (Nagelkerke)
N	250

Conditional Indirect Effects of Imagined flood experience on donation behaviour at Biospheric value = Mean and ± 1SD

Mediator	Biospheric value	Effect	95% CI
Perceived Threat	- 1SD	-.05	[-.26, .08]
	M	-.01	[-.14, .07]
	+ 1SD	.02	[-.11, .17]
Index of moderated mediation		.03	[-.06, .16]
Concern	- 1SD	.00	[-.09, .11]
	M	.03	[-.02, .16]
	+ 1SD	.07	[-.04, .25]
Index of moderated mediation		.03	[-.02, .16]
Perceived Efficacy	- 1SD	.00	[-.01, .07]
	M	-.00	[-.06, .03]

	+ 1SD	-.00	[-.10, .05]
Index of moderated mediation		-.00	[-.05, .03]

Cell entries are unstandardized regression estimates with standard errors in parentheses. *p<.05, **p<.01, ***p<.001. Effect = Bootstrap estimate of effect. Confidence intervals are bias-corrected and based on 1,000 resamples (Preacher & Hayes, 2008).

Considering the fact that the imagined flood experience manipulation had a significant effect on perceived threat when the descriptive text linked the 2013/2014 UK flooding to climate change in Study 4, I explored the data in Study 5 for evidence of a moderating role of attribution. I found that the perceived likelihood of the flooding being linked to climate change was positively correlated with perceived threat (r = .40, p<.001, N = 125), and concern (r = .32, p<.001, N = 125). However, perceived likelihood of the flooding being linked to climate change was not significantly related to perceived efficacy (r = .15, p =.107, N = 125).

These correlations could only be computed for the participants in the imagined flood experience condition as those in the control did not receive any information about the flooding. To assess the moderating effect of attribution on the imagined flood experience manipulation, I used a median-split to categorize participants in the imagined flood experience condition into weak/no attribution and strong attribution groups; meaning groups of those who rated a link between the flood and climate change as being unlikely or of very low likelihood and those who rated it as being very likely respectively.

I found that participants in the weak/no attribution group reported significantly lower levels of perceived threat (p = .011) than those in the control condition (Table 4.7). On the other hand, participants in the strong attribution group reported higher levels of perceived threat (p = .011) and concern (p<.001) than those in the control condition (Table 4.7). However, the imagined experience manipulation did not have a significant effect on perceived efficacy or willingness to donate to an environmental group among both the weak/no attribution and strong attribution groups (Table 4.7).

Table 4.7. Participants mean scores on the dependent variables across experimental groups categorized by attribution level in Study 2

DV	Condition			
	Imagined experience – Weak/No Attribution (N = 75)	Control (N = 130)	Imagined experience – Strong Attribution (N = 50)	
	M(SD)			*F*
Perceived threat	4.38(1.04)	4.78(1.03)	5.25(0.88)	12.69***
Concern	4.33(1.80)	4.55(1.50)	5.48(1.04)	9.40***
Perceived efficacy	3.59(1.38)	3.71(1.24)	3.99(1.58)	1.35
Would you like to donate a part of your remuneration to [environmental group]?	40% yes	52.31% yes	48% yes	χ^2 (2) = 2.89, p = .236

***p<.001

Interestingly, the imagined experience manipulation did not have a significant indirect effect on willingness to donate to an environmental group through perceived threat (B = .06, SE = .08, 95% CI: [-.06, .25], N = 245), concern (B = .08, SE = .10, 95% CI: [-.07, .29], N = 245), or perceived efficacy (B = -.00, SE = .04, 95% CI: [-.12, .06], N = 245) among participants who strongly attributed the flooding to climate change. Similarly, perceived threat (B = -.05, SE = .07, 95% CI: [-.22, .05], N = 245), concern (B = .01, SE = .04, 95% CI: [-.13, .04], N = 245), and perceived efficacy (B = -.00, SE = .03, 95% CI: [-.09, .04], N = 245), did not mediate any indirect effects of the imagined flood experience manipulation on willingness to donate to an environmental group among participants who weakly attributed or did not see a link between climate change and the flooding. Further, there was no significant interaction between biospheric value and the imagined flood experience (at the different levels of attribution) in their effect on perceived threat (F (2, 241) = 0.17, p = .842), concern (F (2, 241) = 2.05, p = .131), or perceived efficacy (F (2, 241) = 1.43, p = .242).

Although, the findings of Study 4 were not replicated in Study 5, the findings from Study 5 indicate that mentally simulating an experience of flooding can produce increased perceived threat and concern about climate change if individuals attribute the flooding to climate change. Interestingly, although biospheric value was positively correlated with vividness of participants mental imagery and the extent to which they perceived the imagined flood to be linked to climate change, it did no significantly moderate the effect of the imagined experience manipulation on perceived threat or concern. A key limitation of this study pertains to the fact that the participants in the control condition did not receive any information about the flooding nor were they asked about how they might have attributed the event so it was impossible to account for their varying levels of attribution. Further, as discussed in Chapter 3, pre-existing levels of climate scepticism may reduce the effect of extreme weather experiences on climate change attitudes particularly with regard to willingness to engage in climate change mitigation behaviour. Therefore, in a subsequent experiment, I explicitly addressed the role of attribution in the link between the imagined flood experience and climate change attitudes while accounting for pre-existing levels of scepticism.

Study 6

Aims and hypotheses

The aim of Study 6 was to examine the interaction between attribution and a mentally simulated experience of flooding in predicting climate change perceptions and behavioural intentions. This study was designed to improve on some of the limitations of the previous studies and more accurately determine the effect of the imagined flood experience manipulation by accounting for pre-existing levels of climate change scepticism. In Chapter 3, I argued that high-levels of pre-existing climate change scepticism among right-leaning voters may explain the reduced effect of flood experience on climate change attitudes observed among that demographic. Consequently, in this study, I shifted my focus from biospheric values and on to scepticism, as a potential factor in understanding the effectiveness of the imagined flood experience task.

Additionally, I measured the attribution of the flooding event used in the manipulation across both the control and imagined flood experience conditions. I hypothesized that individuals subjected to a mentally simulated experience of flooding will report higher

perceived threat (H1), concern (H2), and perceived efficacy (H3). I also hypothesized that individuals' attribution of the flooding event will significantly moderate the effect of a mentally simulated experience of flooding on perceived threat (H4), concern (H5), and perceived efficacy (H6). Lastly, I hypothesized that attribution will significantly mediate any indirect effects of the imagined flood experience on behavioural intentions mediated by perceived threat (H7), concern (H8) and perceived efficacy (H9).

Method

Participants

I recruited 250 members of the general British public, through an online survey panel provider, to participate in an internet based experiment. The data provided by 5 participants who failed an attention check embedded in the questionnaire were omitted from analysis, leaving a final sample (N = 245) comprising 44.1% males and 55.9% females with a mean age of 49.9 years (SD = 13.07). The participants were informed that they would be required to answer questions regarding their attitudes toward extreme weather and climate change prior to the start of the experiment.

Procedure

At the start of the experiment, participants were presented with a set questions measuring their demographic profile (gender, age, political affiliation) and the control variables (pre-test scepticism and past flooding experience). Subsequently, they were randomly assigned to either a control or imagined flood experience condition.

Participants in the imagined flood experience condition were presented with the following message: "Beginning on Saturday, 4th December 2015, Storm Desmond brought exceptionally heavy rainfall to large parts of northern England, southern Scotland and north Wales. The rainfall resulted in record-breaking flooding in Cumbria, Northumberland and the Scottish Borders. In the course of the following three days, 45,700 homes across the UK were left without power, over a thousand people were evacuated from their homes, and three people lost their lives due to the severity of the wind and rainstorms. Further, the storm also caused extensive disruption to critical road, rail and air transport services across the country. According to Met Office Chief Scientist, Professor Dame Julia Slingo, the "extraordinary amounts of water" dumped by the storm broke precipitation records going back to the 1800s."

After reading this message, they were then presented the following instruction:

"For the next two minutes, please imagine yourself as a victim of the floods described above. Imagine watching your home and property being extensively damaged by floodwater, being unable to get access to nearby shops for food and groceries, and being unable to go to work as most roads in the vicinity are now submerged. In the space provided below, please describe as many aspects of the scenario you just imagined as possible".

Following the same procedure as Study 1 and Study 2, participants were also asked to indicate how easy it was for them to imagine being in the flooding situation (response: 1 = very difficult, 7 = very easy), how vivid their mental imagery of being in the situation was (response: 1 = not vivid, 7 = very vivid), and how likely they thought it was that Storm Desmond and the extreme flooding it caused are linked to climate change (response: 1 = not likely, 7 = very likely). After completing the task, participants were directed to complete the dependent measures.

Participants in the control condition were directed to complete the dependent measures right after the initial questionnaire measuring their demographic information and the control variables. After completing the dependent measures, they were presented with the description of Storm Desmond outlined above and simply asked to rate the likelihood that Storm Desmond and the extreme flooding it caused are linked to climate change (response: 1 = not at all likely, 7 = very likely). The experiment was administered using an online survey platform and participants were free to complete the study at any time or place of their choosing.

Measures

Pre-test scepticism (M = 3.28, SD = 1.16). This was measured with six items adopted from a measure developed by Whitmarsh (2011). These include: "I do not believe climate change is a real problem", "the evidence for climate change is unreliable", "recent floods and heatwaves in this country are due to climate change", "floods and heatwaves are not increasing, there's just more reporting of it in the media these days", "it is impossible to link a single event such as a flood to climate change", "claims that human activities are changing the climate are exaggerated" (response: 1 = strongly disagree, 7 = strongly agree; α = .81).

Attribution (*M* = 4.62, SD = 1.41) was measured with a single item: "how likely do you think it is that Storm Desmond and the flooding it caused are linked to climate change?" (1 = not at all likely, 7 = very likely).

Perceived threat (*M* = 4.65, SD = 1.26, α = .94). Perceived threat was measured with eight items reflecting the perceived seriousness and likelihood of adverse climate change impacts. Perceived seriousness was measured with four items: "how serious of a threat do you believe climate change is to you personally?", "how serious of a threat do you think climate change impacts are for the area you currently live in?", "how serious do you estimate the impacts of climate change are for the natural environment?", "how serious of a threat do you think the impacts of climate change are across the world?" (response: 1 = not serious at all, 7 = very serious). Perceived likelihood was also measured with four items: "in your judgment, how likely do you think it is that climate change will have harmful effects on your local area?", "how likely do you think it is that you will experience serious threats to your health or overall well-being, sometime during your lifetime, as a result of climate change?", "how likely do you think it is that the natural environment (including wildlife and biodiversity) will be affected adversely by climate change?", "how likely do you think it is that British society as a whole will experience adverse long-term consequences from climate change?" (response: 1 = not likely, 7 = very likely).

Concern (*M* = 4.74, SD = 1.68) and *perceived efficacy* (*M* = 3.80, SD = 1.43, α = .80) were measured with the same items used in Study 5.

Behavioural intentions (M = 4.12, SD = 1.22, α = .78) was measured with six items. I asked participants how likely they were to engage in the following behaviours in the next four weeks: Mostly walk, cycle or use public transport when commuting; launch or sign a petition calling on the government to make stronger commitments to lowering carbon emissions and investing in renewable energy; join or volunteer in an organization involved with climate change; donate to or raise funds for an environmental group involved with climate change; purchase and consume only locally sourced produce; conserve energy by switching off lights in unoccupied rooms and turning off unused appliances at home/work. Factor analysis revealed that the last item: switching off lights in unoccupied rooms, emerged as a separate factor (Eigenvalue = 1.11, variance explained = 18.53%) while the others loaded on one factor (Eigenvalue

= 3.00, variance explained = 50%, α = .78). Nonetheless, the scale was used as unitary measure since the 'switching off lights' item had an acceptable item-total correlation in the combined scale (r = .32).

There were other measures included in the questionnaire that are not considered in this chapter. These include measures of education, a six-item version of the New Ecological Paradigm (NEP) scale, acceptance of responsibility, self-rated and objective climate change knowledge, perceived social norms and emotional responses to climate change: anger, fear and worry (see Appendix 8).

Results and discussion

Preliminary analyses

Participants' description of their mental visualization of the imagined flood experience produced similar themes as those observed in the previous studies. Most descriptions were related to emotional responses to the consequences of the flood (e.g., "*pretty scared many valuables lost, will insurance cover all aspects?*", "*worry, concern for family, friends, animals*", "*feeling fear, despair, panic*") and visualization of damage caused by the flood ("*a scene of utter devastation – everything under water and people clambering to be rescued*", "*stone buildings being washed away, cars submerged in water, damage to businesses, children unable to attend school*").

There was no significant correlation between previous flood experience and the vividness of participants' mental imagery of experiencing the imagined flood (r (117) = .08, p = .407) or their likelihood of seeing a link between the flooding caused by Storm Desmond and climate change (r (241) = .01, p = .907). However, the vividness of participants' mental imagery of experiencing the imagined flood was positively correlated with their likelihood of seeing a link between climate change and the flooding caused by Storm Desmond (r (121) = .28, p =.002), and negatively correlated with pre-existing climate change scepticism (r (121) = -.19, p =.035). Zero order correlations among the measured variables are presented in Table 4.8.

Table 4.8. Zero-order intercorrelations among the variables addressed in Study 3

	2	3	4	5	6	7	8
1. Imagined Experience	-.06	.02	.09	.08	.12†	-.03	.03
2. Past flood Experience		-.06	.01	.10	.08	.05	.11†
3. Pre-test Scepticism			-.71***	-.72***	-.68***	-.53***	-.51***
4. Attribution				.70***	.64***	.50***	.48***
5. Perceived Threat					.80***	.62***	.59***
6. Concern						.56***	.57***
7. Perceived Efficacy							.58***
8. Behavioural Intentions							-

†p<.10, ***p<.001, *N* = 245 (except correlations with Past Flood Experience, *N* = 241).

Tests of hypotheses

I found no support for my hypotheses as participants in the imagined flood condition did not report significantly higher levels of perceived threat (H1), concern (H2) or perceived efficacy (H3) (Table 4.9).

I tested the mediation and moderated mediation hypotheses using the PROCESS macro for SPSS (Hayes, 2013), with prior flood experience, pre-test scepticism, gender, and age controlled. Contrary to expectation, there was no significant interaction between attribution and the imagined flood experience manipulation in their effect on perceived threat (H4: B = -.05, SE = .07, 95% CI: [-.19, .10]), concern (H5: B = .03, SE = .11, 95% CI: [-.18, .25]), and perceived efficacy (H6: B = -.04, SE = .12, 95% CI: [-.27, .21]). The imagined flood experience manipulation had a significant indirect effect on behavioural intentions through concern (B = .05, SE = .03, 95% CI: [.00, .14]) but not perceived threat (B = .03, SE = .03, 95% CI: [-.01, .10]), or perceived efficacy (B = -.05, SE = .04, 95% CI: [-.14, .03]).

Table 4.9. participant mean scores on the dependent variables across the experimental conditions

DV	Condition		
	Control (N = 124)	Imagined experience (N = 121)	
	M(SD)		*t*
Perceived Threat	4.55(1.23)	4.75(1.28)	-1.26
Concern	4.55(1.68)	4.93(1.66)	-1.81†
Perceived Efficacy	3.85(1.34)	3.76(1.51)	.52
Behavioural Intentions	4.09(1.21)	4.15(1.23)	-.39

†$p<.10$

However, attribution did not significantly moderate any indirect effects of the imagined flood experience mediated by perceived threat (H7: IMM[11] – B = -.01, SE = .02, 95% CI: [-.06, .01]), concern (H8: IMM – B = -.01, SE = .02, 95% CI: [-.05, .02]) or perceived efficacy (H9: IMM – B = .01, SE = .03, 95% CI: [-.06, .06]).

The results of this experiment failed to replicate the previously observed effects of the imagined flood experience manipulation on perceived threat or concern. Contrary to expectation, there was also no significant interaction between the imagined flood experience and attribution in their effects on perceived threat, concern or perceived efficacy. It is not clear why the manipulation had no effect on the dependent variables in this experiment. The level of perceived threat and concern may have been already so high among the participants that exposure to the imagined flood experience could not raise it further. The effects of the manipulation are unlikely to have been suppressed by pre-existing scepticism[12] as this was controlled for. Nonetheless, given that attribution significantly predicted perceived threat, concern and perceived efficacy, I conducted a subsequent experiment examining the extent to which a direct manipulation of participants' attribution of the imagined flood event would impact the effect of the imagined flood experience manipulation on climate change attitudes.

[11] IMM refers to the index of moderated mediation. This value represents the slope of the line relating an indirect effect to values of a moderator (see Hayes, 2015).

[12] I also explored potential interactions between pre-test scepticism and the imagined experience manipulation, as well as three-way interactions between pre-test scepticism, attribution and the imagined experience manipulation. Neither of these had any significant effects on the perceived threat, concern, perceived efficacy or behavioural intentions.

Study 7

Aims and hypotheses

The aim of Study 7 was to assess how a direct manipulation of the attribution of an imagined flood would interact with the imagined flood experience in influencing climate change perceptions and behavioural intentions. The manipulation of the attribution of the imagined flood experience was to be achieved by citing scientific statements suggesting that the flood was/was not linked to climate change. Therefore, I also explored the extent to which trust in scientists as a source of information on climate change moderated the effectiveness of the manipulation on climate change attitudes. Additionally, to address possible ceiling effects created by high levels of pre-existing concern about climate change in Study 6, I controlled for the effects of pre-test concern.

Public distrust of authorities and experts is a major barrier to climate change mitigation and adaptation (Gifford, 2011). When people lose trust in science or scientists as a source of climate change information, they become more sceptical and less likely to engage in actions that help address climate change (Gifford, 2011; Gifford et al., 2011; Matthews, 2015). Visual information is often used in the popular media, and in communication by NGOs, to illustrate reports of scientific research concerning climate change (see O'Neill & Smith, 2014). Research in the US shows that people who actively choose to watch climate change films generally have a higher level of trust in scientists and environmental groups than those who don't (Leiserowitz, 2004), suggesting that trust may play a role in the way people engage with external climate change imagery. Consequently, it seems likely that the effects of mental imagery on climate change perceptions may be modulated by trust in scientists; especially when the events simulated are framed in the context of scientific perspectives on the link between extreme weather and climate change.

I hypothesized that individuals who attribute their mentally simulated flood experience to climate change will be more likely to report increased perceived threat (H1), concern (H2), and perceived efficacy (H3) compared with individuals who have not had a mentally simulated flood experience. Further, I hypothesized that trust in scientists would have a significant interaction with the manipulation whereby the effect of attributing or not attributing a mentally simulated flood experience on perceived threat

(H4), concern (H5), efficacy (H6) will be significantly stronger among individuals with higher levels of trust in scientists than those with lower levels of trust. Lastly, I hypothesized that trust in scientists as a source of climate change information will moderate the indirect effects of the imagined experience manipulation on behavioural intentions mediated by perceived threat (H7), concern (H8) and perceived efficacy (H9), whereby the indirect effects of attributing or not attributing the imagined flood experience to climate change will be strongest at the lowest and highest levels of trust in scientists as a source of information on climate change.

Method

Participants and procedure

I recruited 230 UK residents to participate in an online experiment through adverts placed on social media (Facebook, Reddit) and circulated through a national psychology postgraduate student mailing list. The sample comprised 62 males (27%) and 158 females (68.7%)[13] with a mean age of 29.73 years (SD = 12.27). Entry in a raffle for two £25 shopping vouchers was offered as an incentive for participation. In the information sheet provided to participants prior to the start of the experiment, they were informed that they would be required to answer questions pertaining to their attitudes toward extreme weather and climate change.

Procedure

At the start of the experiment, participants were asked to complete a questionnaire measuring their demographic profile (gender, age, and political affiliation) and the control and independent variables (pre-test scepticism, past flood experience and trust in scientists). Subsequently, participants were randomly allocated to one of three conditions: an *attributed* imagined flood condition (N = 77), a *dis-attributed* imagined flood condition (N = 71) or the control condition (N = 82).

Participants in the attributed imagined flood condition were presented with the following message:

"Beginning on Saturday, 4th December 2015, 'Storm Desmond' brought exceptionally heavy rainfall to large parts of northern England, southern Scotland and north Wales. The rainfall resulted in record-breaking flooding in Cumbria, Northumberland and the

[13] 10 participants (4.3%) declined to report their gender or reported their gender as 'other'

Scottish Borders. In the course of the following three days, 45,700 homes across the UK were left without power, over a thousand people were evacuated from their homes, and three people died as a result of the severity of the wind and rainstorms. The storm also caused extensive disruption to critical road, rail and air transport services across the country. According to Met Office Chief Scientist, Professor Dame Julia Slingo, the "extraordinary amounts of water" dumped by the storm broke precipitation records going back to the 1800s". *Scientists at the Center for Atmospheric Sciences also added that "the characteristics of Storm Desmond appear to be consistent with the pattern of extreme weather events that are expected to become more likely as a consequence of global climate change.*" (Sources: BBC News; Met Office).

After reading this message, they were instructed to imagine being a victim of the flooding using the same prompt employed in the previous experiments, and asked to describe as many aspects of their imagined scenario as possible.

Participants in the dis-attributed imagined flood were presented with the following message:

"Beginning on Saturday, 4th December 2015, Storm Desmond brought exceptionally heavy rainfall to large parts of northern England, southern Scotland and north Wales. The rainfall resulted in record-breaking flooding in Cumbria, Northumberland and the Scottish Borders. In the course of the following three days, 45,700 homes across the UK were left without power, over a thousand people were evacuated from their homes, and three people lost their lives due to the severity of the wind and rainstorms. The storm also caused extensive disruption to critical road, rail and air transport services across the country. According to Met Office Chief Scientist, Professor Dame Julia Slingo, the "extraordinary amounts of water" dumped by the storm broke precipitation records going back to the 1800s. However, *scientists at the Center for Atmospheric Sciences also added that "the characteristics of Storm Desmond do not appear to be consistent with the pattern of extreme weather events that are expected to result from global climate change"*.

After reading this message, they were prompted to imagine themselves as victims of the flooding using the same prompt employed in the previous experiments and asked to describe as many aspects their imagined scenario as possible.

Following the same procedure as the preceding studies, participants in the attributed and dis-attributed imagined flood conditions were also asked to indicate how easy it was for them to imagine being in the flooding situation (response: 1 = very difficult, 7 = very easy), how vivid their mental imagery of being in the situation was (response: 1 = not vivid, 7 = very vivid), and how likely they thought it was that Storm Desmond and the extreme flooding it caused are linked to climate change (response: 1 = not at all likely, 7 = very likely). After completing the task, participants were directed to complete the dependent variable measures.

Participants in the control condition were presented only with a description of Storm Desmond and its impacts, excluding the statement regarding its link to climate change. This description was presented after participants in this condition had already completed the dependent variable measures. They were then asked to indicate how likely they thought it was that the storm and consequent flooding are linked to climate change (response: 1 = not at all likely, 7 = very likely). The experiment was administered using an online survey platform and participants were allowed to complete the study at any time or place of their choosing.

Measures

Trust in scientists (M = 4.31, SD = 0.62, α = .61) was measured with two items. I asked participants to indicate how much trust they have in the following to provide the public with information on climate change: "Scientists" and "Meteorologists". Responses were recorded with a 5-point scale (1 = no trust, 5 = a lot of trust).

Pre-test climate change concern (*M* = 3.27, SD = 0.71) was measured with a single item: "how concerned are you about global climate change?" (response: 1 = not concerned, 5 = very concerned).

Pre-test scepticism (M = 1.77, SD = 0.71, α = .84), *perceived threat* (M = 5.20, SD = 1.07, α = .90), *concern* (M = 5.66, SD = 1.31) and *perceived efficacy* (M = 4.08, SD = 1.53, α = .80) were measured using the same scales employed in Study 6.

Behavioural intentions (M = 4.46, SD = 1.15, α = .71) were measured with six items. I asked participants how likely they were to engage in the following behaviours in the future (within next four weeks): "mostly walk, cycle or use public transport when commuting", "launch or sign a petition calling on the government to make stronger

commitments to lowering carbon emissions and investing in renewable energy", "donate to, or raise funds for, an environmental group involved with climate change", "purchase and consume only locally sourced produce", "conserve energy by switching off lights in unoccupied rooms and turning off unused appliances". Responses were recorded with a 7-point scale (1 = very unlikely, 7 = very likely). Principal axis factor analysis with oblimin rotation revealed that that two of the items ('mostly walk, cycle or use public transport when commuting" and "switch off lights in unoccupied rooms and turn off unused appliances") load on one factor (Eigenvalue = 1.28, variance explained = 21.36%, $\alpha = .41$), while the remaining items load on another (Eigenvalue = 2.55, variance explained = 42.51%, $\alpha = .65$). However, considering that the two items did not constitute a reliable scale, the combined measure was retained in the analysis.

Other measures were included in the questionnaire that are not considered in this chapter. These include belief in anthropogenic climate change, perceived social norms regarding engagement in pro-environmental behaviour, acceptance of responsibility for acting on climate change, and emotional responses to climate change: anger, fear, worry (see Appendix 9).

Results and discussion

Preliminary analyses

Participants' descriptions of their mental visualizations of the flood yielded similar themes as the previous studies: the physical dynamics of the flood (e.g., "*floods of dirty water inundating every part of the ground floor of my house*", "*water running under the doors, up through the toilets and sinks*"), personal loss incurred due to the floods (e.g., "*floodwater has done extensive damage to my home and property*", "*I have lost all my worldly possessions*") and emotional reactions to the effects of the flood (e.g., "*I feel a mixture of emotions, from terror to depression and shock to see my local area so damaged*", "*feeling helpless, stressed, trapped*"). However, there was also a handful of responses (<20%) suggesting that some participants were unable to engage with the task (e.g., "*?*", "*sorry but I'm terrible at creative writing, I'm a maths student*" "*this is quite a strange exercise I think*", "*fairly rubbish*").

Nonetheless, I determined the effectiveness of the manipulation by comparing the extent to which participants attributed Strom Desmond and the flooding it caused to climate change (Table 4.10). In this regard there was significant difference in levels of

attribution across the conditions ($F_{(2, 229)} = 7.22$, $p = .001$), with participants in the dis-attributed imagined flood experience condition (Table 10) significantly rating the likelihood that Storm Desmond and the consequent flooding are linked to climate change lower than those in the control ($p = .042$) and attributed imagined flood experience ($p = .001$) conditions. However, the difference between the control and the attributed imagined flood experience condition was not significant ($p = .399$). The lack of a significant difference in levels of attribution between participants in the control condition and those in the attributed imagined flood experience condition may be due to the fact that people are more likely to attribute flooding to climate change spontaneously (see Capstick et al., 2015), thereby making it difficult to improve on this default position.

Similar to the previous studies, there was no significant relationship between previous flood experience and vividness of participants' mental imagery of experiencing the imagined flood (r (147) = .08, $p = .321$). There was also no significant relationship between vividness of participants' mental imagery and attribution (r (147) = .154, p = .063), perceived threat (r (147) = .08, p = .328), concern (r (147) = .10, p =. 247) or perceived efficacy (r (147) = .09, p = .277). Zero-order correlations among the measured variables are presented in Table 4.11.

Table 4.10. Participants mean scores on the dependent variables across experimental conditions

DV	Experimental Condition			
	Imagined experience dis-attributed (N = 71)	Control (N = 82)	Imagined experience attributed (N = 77)	
		M(SD)		*F*
Attribution	5.11(1.41)	5.63(1.20)	5.87(1.09)	7.22**
Perceived Efficacy	4.26(1.42)	4.44(1.40)	4.40(1.44)	.59
Concern	5.68(1.26)	5.62(1.26)	5.67(1.42)	.04
Perceived Threat	5.09(1.04)	5.20(1.10)	5.28(1.07)	.45
Behavioural Intentions	4.47(1.01)	4.41(1.24)	4.51(1.19)	.16

**p<.01

Table 4.11. Zero-order intercorrelations among the variables addressed in Study 4.

		2	3	4	5	6	7	8	9	10
1.	Imagined Experience (Dis-attributed)	**-.47**	-.01	.00	.04	-.05	-.07	.01	-.06	.00
2.	Imagined Experience (Attributed)		-.06	.04	-.07	-.03	.06	.01	.02	.03
3.	Trust			**-.27**	**.26**	.06	**.14**	**.21**	**.15**	.08
4.	Pre-test Scepticism				**-.55**	-.09	**-.34**	**-.17**	-.08	**-.17**
5.	Pre-test Concern					.08	**.37**	**.40**	**.19**	**.37**
6.	Past flood Experience						.06	.09	-.03	.03
7.	Perceived Threat							**.58**	**.36**	**.46**
8.	Concern								**.28**	**.49**
9.	Perceived Efficacy									**.43**
10.	Behavioural Intentions									-

Cell entries in boldface are significant at $\alpha = .05$. $N = 229$.

Tests of hypotheses

I found no support for my hypotheses as participants in the control condition did not report significantly different mean levels of perceived threat (H1), concern (H2), or perceived efficacy (H3) than those in either of the attributed or dis-attributed imagined experience conditions (Table 4.10). However, there was a significant interaction between experimental condition and trust in scientists as a source of climate change information as predictors of perceived threat (H4) (Table 4.12), whereby the attributed imagined flood experience condition produced significantly increased levels of perceived threat (B = .39, SE = .14, 95% CI: [.12, .66], N = 229) and the dis-attributed imagined flood experience condition produced significantly reduced perceived threat (B = -.44, SE = .14, 95% CI: [-.71, -.17], N = 229) among participants with a high level of trust in scientists[14]. Among participants with a low level of trust in scientists as a source of climate change information, there was no significant effect of either the

[14] These estimates were derived using the control condition as the reference category.

attributed (B = -.10, SE = .13, 95% CI: [-.35, .16], N = 229) nor the dis-attributed (B = .22, SE = .14, 95% CI: [-.05, .49], N = 229) imagined flood experience on perceived threat (Figure 13).

Table 4.12. Test of moderated mediation hypotheses for Study 7.[15]

Mediator Model			
	Threat	Concern	Efficacy
Imagined experience (Dis-attributed)	-.11(.10)	.01(.12)	-.12(.14)
Imagined experience (Attributed)	.15(.09)	.08(.12)	.13(.14)
Trust	.05(.11)	.26(.14)†	.25(.17)
Imagined experience (Dis-attributed) x Trust	-.53(.16)**	-.63(.19)**	-.80(.23)**
Imagined experience (Attributed) x Trust	.40(.15)*	.42(.19)*	.35(.23)
Pre-test Scepticism	-.25(.12)*	.24(.14)†	.17(.18)
Pre-test Concern	.44(.12)***	.87(.15)***	.53(.18)**
Past flood experience	.07(.10)	.16(.12)	-.01(.14)
Gender	-.13(.15)	.09(.18)	.20(.22)
Age	.00(.11)	-.00(.01)	-.01(.01)
R^2	.22	.23	.12
F	5.73***	6.17***	2.71**
N		229	
Dependent Variable Model			
	Behavioural Intentions		
Perceived Threat	.13(.08)		
Concern	.23(.06)***		
Perceived Efficacy	.23(.05)***		
Imagined experience (Dis-attributed)	.12(.16)		
Imagined experience (Attributed)	.11(.15)		
Pre-test Scepticism	.02(.11)		

[15] 29% of cases were ineligible to vote in the UK, would not vote or preferred not to say. Only 7.4% of cases identified with right-leaning parties (e.g., Conservatives, UKIP). Consequently, political affiliation was not included as a control variable in the analyses to preserve the sample size.

Pre-test Concern	.24(.12)*
Past flood experience	.01(.09)
Gender	-.18(.14)
Age	.01(.01)
R^2	.38
F	12.37***
N	217

Conditional indirect effects of Imagined experience (Attributed) on Behavioural Intentions at Trust = Mean and Mean ± 1SD

Mediator	Trust	Effect	95% CI
Perceived Threat	-1SD	-.02	[-.15, .03]
	Mean	.02	[-.01, .11]
	+1SD	.07	[-.01, .21]
Index of moderated mediation		.07	[-.01, .26]
Concern	-1SD	-.05	[-.23, .05]
	Mean	.03	[-.04, .13]
	+1SD	.12	[.02, .28]
Index of moderated mediation		.14	[.02, .35]
Perceived Efficacy	-1SD	.07	[-.21, .07]
	Mean	.06	[-.08, .14]
	+1SD	.09	[-.06, .28]
Index of moderated mediation		.11	[-.04, .34]

Conditional indirect effects of Imagined experience (Dis-attributed) on Behavioural Intentions at Trust = Mean and Mean ± 1SD

Perceived Threat	-1SD	.06	[-.00, .21]
	Mean	-.00	[-.07, .05]
	+1SD	-.06	[-.22, .00]
Index of moderated mediation		-.10	[-.30, -.00]
Concern	-1SD	.16	[.03, .33]
	Mean	.03	[-.07, .05]
	+1SD	-.10	[-.31, .01]
Index of moderated mediation		-.21	[-.46, -.06]
Perceived Efficacy	-1SD	.14	[.02, .35]
	Mean	-.02	[-.13, .09]
	+1SD	-.19	[-.39, -.04]
Index of moderated mediation		-.27	[-.53, -.09]

*p<.05, **p<.01, ***p<.001. Confidence intervals are bias-corrected and based on 1,000 resamples

There was also a significant interaction between trust and experimental condition in predicting concern (H5). Here, I found that the attributed imagined flood experience had a significant positive effect (B = .34, SE =.17, 95% CI: [.01, .67], N = 229) and the dis-attributed imagined flood experience had a negative effect (B = -.38, SE = .17, 95% CI: [-.71, -.05], N= 229) on concern among individuals with a high level of trust in scientists as a source of climate change information (Figure 14). Interestingly, among individuals with a low level of trust in scientists, the dis-attributed imagined flood experience condition had a significant positive effect on concern (B = .39, SE = .17, 95% CI: [.07, .72], N = 229) but the attributed imagined flood experience had no significant effect (B = -.18, SE = .16, 95% CI: -.49, .14], N = 229).

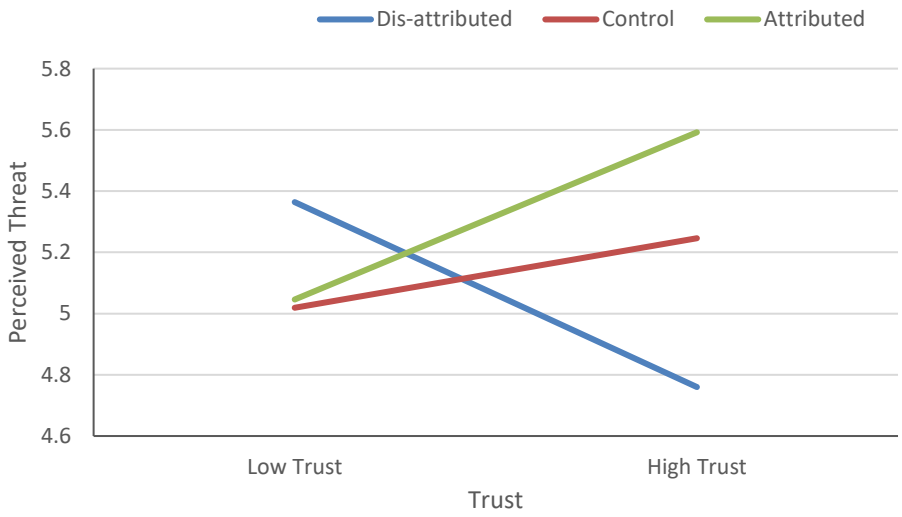

Figure 13. Effect of experimental condition on perceived threat at varying levels of trust in scientists as a source of climate change information.

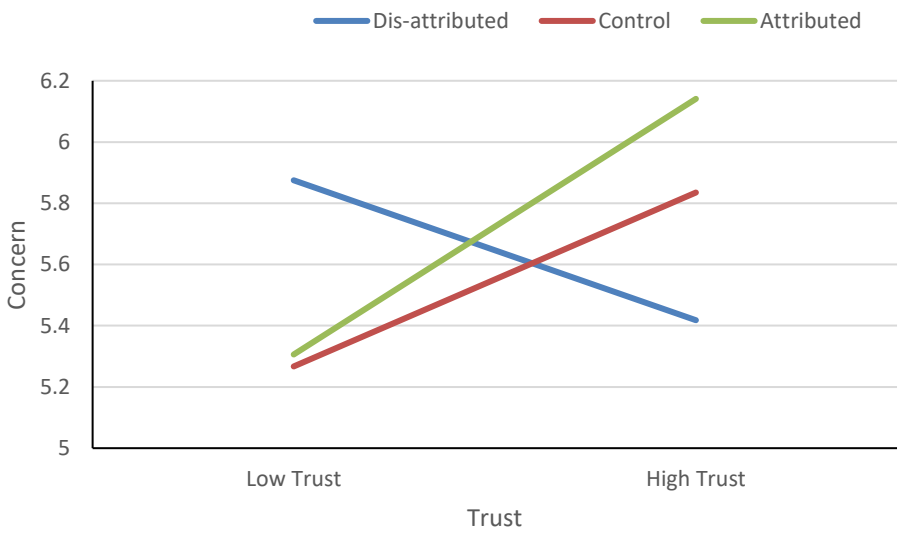

Figure 14. Effect of experimental condition on concern at varying levels of trust in scientists as a source of climate change information.

Lastly, there was also a significant interaction effect of trust and experimental condition on perceived efficacy (H6). Among participants with a high level of trust in scientists as a source of climate change information, the dis-attributed imagined flood experience condition had a significant negative effect on perceived efficacy (B = -.62, SE = .21, 95% CI: [-1.02, -.21], N = 229) but the attributed imagined flood experience condition had no significant effect (B = .35, SE = .21, 95% CI: [-.06, .75], N = 229) on perceived efficacy (Figure 15). There was no significant effect of either the attributed (B = .38, SE = .20, 95% CI: [-.03, .78], N = 229) nor the dis-attributed imagined flood condition (B = -.08, SE = .20, 95% CI: [-.47, .30], N = 229) on perceived efficacy among individuals with a low level of trust in scientists as a source of information about climate change.

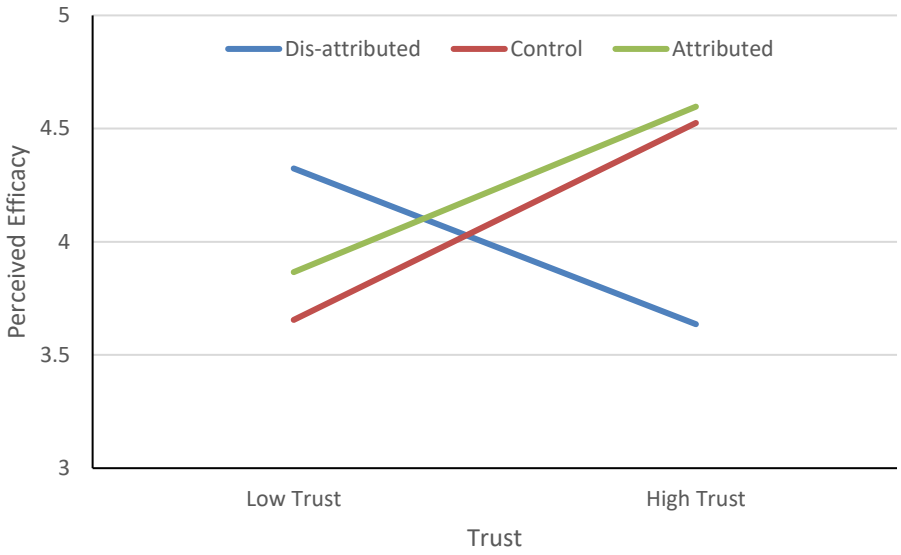

Figure 15. Effects of experimental condition on perceived efficacy at varying levels of trust in scientists as a source of climate change information.

With regard to my hypotheses regarding the moderating influence of trust in scientists on the indirect influence of the imagined experience manipulation on behavioural intentions (Table 4.12), I found that trust in scientists did not significantly moderate the indirect influence of either the attributed or dis-attributed imagined experience manipulation on behavioural intentions mediated by perceived threat (H7). However, in partial support of my prediction (H8), the attributed imagined experience manipulation had a significant positive indirect effect on behavioural intentions mediated by concern at high levels of trust. Similarly, the dis-attributed imagined experience manipulation had a significant positive indirect influence on behavioural intentions mediated by concern at low levels of trust in scientists. I also found partial support for hypothesis (H9) as the dis-attributed imagined experience manipulation had significant positive indirect effects on behavioural intentions mediated by perceived efficacy at low levels of trust and significant negative indirect effects on behavioural intentions mediated by perceived efficacy at high levels of trust. On the other hand, the attributed imagined experience manipulation did not have significant indirect effects on behavioural intentions mediated by perceived efficacy at any level of trust in scientists (Table 4.12).

Overall, the results of this experiment shed light on the role of trust as a moderator of the relationship between attribution, imagined experience of flooding and climate

change perceptions. Previous research has suggested that experiences with extreme weather are most likely to have an effect on climate change engagement when the events are attributed to climate change (Reser et al., 2012). Building on this, the findings in this study suggest that the extent and nature of the effect of attribution on climate change perceptions, when the imagined flood event is framed in the context of scientific statements regarding the involvement of climate change, is dependent on the extent to which individuals see scientists as a trustworthy source of information. When individuals have a high level of trust in scientists, the effect of attribution (or lack of) may be significantly more pronounced than when trust in scientists is low. The positive indirect effects of the dis-attributed imagined flood condition on behavioural intentions mediated by concern and perceived efficacy at low levels of trust in scientists is also an interesting observation. This suggests that the mentally simulated experience of flooding may boost concern and perceived efficacy, and lead to the formation of pro-environmental behaviour intentions, plausibly as a consequence of individuals' intrinsic inclination to act on climate change, irrespective of a lack of trust in scientists or an established link being drawn between the flooding event and climate change. This intrinsic inclination may be rooted in individuals' knowledge or general pre-existing attitude toward climate change (Ortega-Egea, García-de-Frutos, & Antolín-López, 2014).

General discussion

Researchers have repeatedly argued that public perception of climate change as a psychologically distant phenomenon – i.e., temporally, spatially and socially removed from our everyday experiences, is a key barrier to substantive climate change engagement (Brügger et al., 2015; Lorenzoni et al., 2007; McDonald et al., 2015; Spence et al., 2012). Extreme weather events such as flooding which may be linked to climate change can serve to provide concrete indications of plausible climate change impacts and thus highlight the reality and immediacy of the threat posed. On this basis, highlighting the link between local weather events and global climate change has been advocated as a potentially effective strategy to galvanize public action on climate change (Spence et al., 2011; Taylor et al., 2014). The aim of this research was to explore the effects of intervening factors – values and attribution, that modulate the effects of flood experiences on climate change attitudes using a mentally simulated experience of flooding.

As discussed in the introduction to this chapter, both direct and vicarious experiences contribute to the imageability of plausible climate change impacts and the mental imagery derived from personal experience significantly overlaps with individuals' imaginative representation of climate change (Nicholson-Cole, 2005). Further, mental imagery and simulation mimic perception and evoke cognitive and affective associations, making the likely consequences of being in a specific situation or performing a specific action more accessible and explicit (Ji et al., 2016). On this basis, it seems plausible that mentally simulating an experience of flooding could trigger similar cognitive and affective responses as actual flood experiences. The experiments presented in this chapter provide some evidence that support the notion that a mentally simulated experience of flooding can significantly influence factors such as perceived threat, concern and efficacy, which have previously been shown to be subject to the influence of actual experiences with flooding.

In Study 4, I found that people who were instructed to imagine themselves as victims of a severe flood reported significantly higher levels of perceived threat from climate change than those who were instructed to imagine a neutral outdoor scene. Additionally, the direct effect of the imagined flood experience task on perceived threat and indirect effect on behavioural intentions was only significant among individuals with a weak or average endorsement of biospheric values (i.e., those who place relatively lower priority on environmental protection and pro-environmental outcomes). Presuming that individuals with strong biospheric values typically possess a high level of awareness of adverse environmental trends (Hansla, 2011; Pereira & Forster, 2015), this finding suggests that individuals with weak biospheric values and possibly lower levels of intrinsic pro-environmental motivation are more likely to benefit from an imagined experience of a plausible consequence of climate change. In other words, the imagined flood experience can be interpreted as mimicking the capacity of actual [flood] experiences to serve as a 'teachable moment' (Kerr, 2013) and increase risk perceptions (Demski et al., 2017).

However, in Study 5 the main effect of the imagined flood experience task was not replicated; plausibly because the description of the flooding did not explicitly link the event to climate change. When I took account of whether participants perceived the flood to be linked to climate change, I found that those who attributed the flooding to climate change reported significantly greater perceived threat and concern than

participants in the control condition. On the other hand, participants who did not think the flooding was likely to be linked to climate change reported lower levels of perceived threat than those in the control condition.

Understandably, people have to see a link between extreme weather and climate change for their experiences of extreme weather to have any bearing on their attitudes toward climate change (Reser et al., 2014). While the observation that those who attributed the imagined flood to climate change also reported more positive engagement with climate change is in line with prior observations that extreme weather experiences can promote concern by entrenching pre-existing beliefs or providing new experiential information about the immediacy of the problem (Myers et al., 2013), the observation that those who did not think the flooding was linked to climate change reported lower threat perception is interesting and deserving of further investigation.

On one hand, one could argue that pre-existing levels of scepticism caused a fraction of participants to reject the attribution of the flooding to climate change and that the lower level of perceived threat reported is merely a reflection of this pre-existing scepticism. Indeed, I did not control for prior levels of scepticism in Study 5, so it is impossible to completely discount this explanation. However, I accounted for the strength of individuals' biospheric values in the analysis and this should address some of the variation in scepticism to an extent. This therefore raises the a more problematic possibility that providing a narrative for the mental simulation of a flood experience in the absence of an explicit attribution of the flood event may have caused some individuals to rationalize the imagined experience in a way that reduced their sense of perceived threat. Such outcomes have been addressed in prior research on the use of extreme weather experiences as an avenue for proximizing climate change, and scholars have counselled that caution be exercised in the use of this strategy due to the potential for 'backfire' effects such as denial and apathy (Brügger et al., 2015).

The importance of attribution, especially the negative effects of not attributing the flood experience to climate change, is further reiterated in Study 7 where I found that participants who did not see a link between the imagined flood and climate change reported lower perceived threat, concern and perceived efficacy than those in the control group if they had a high level of trust in scientists as a source of climate change information. The findings in Study 7 are more robust because I controlled for pre-

existing levels of climate change concern and scepticism. The results of Study 7 also speak to the need to build and maintain a high level of public confidence in the role of scientists as climate change 'experts' and purveyors of trustworthy information. Additionally, the dissemination of information about extreme weather events and climatic incidents as part of climate change discourse must be firmly married with the scientific consensus that all of contemporary global weather and climate is subject to the influence of anthropogenic climate change (Trenberth, 2012), and that concerted mitigation action is necessary to avert future negative impacts.

Overall, the results of Study 4, Study 5 and Study 7 suggest that the imagined flood experience task has some potential as a means of promoting perceived threat and concern about climate change depending on people's values, and whether they perceive the flood to be linked with climate change, and whether they have trust in scientists as a source of climate change information. However, the manipulation did not have a significant main effect on perceived threat or perceived efficacy in Study 6. Although, there was a significant indirect effect of the manipulation on behavioural intentions mediated by concern. There was also no significant interaction between the imagined flood experience manipulation and attribution in their effects on the dependent variables.

There are a number of reasons why the imagined flood manipulation may fail to produce a significant effect. Firstly, prior applications of mental simulation techniques in other fields indicate that mental simulation may not be powerful enough to independently change strong or intractable attitudes (e.g., Dermody, Jones, & Cumming, 2013). It is possible that the perceptions of climate change among the sample involved in Study 6 was so strong as to be impervious to the imagined flood experience task regardless of whether the subjects attributed the flooding to climate change. Secondly, looking at the mean differences between the participants in the control condition and the imagined flood experience condition, those in the imagined flood experience condition reported greater concern and perceived threat as expected but perhaps the sample size was insufficient to detect the effect of the imagined experience manipulation. Lastly, the influence of the imagined flood experience on perceived threat, concern, and perceived efficacy may have been masked by a ceiling effect. All the subjects across the four experiments volunteered freely to participate in the research. It is possible that a large proportion of individuals with relatively strong interest or

attitudes regarding climate change self-selected into the studies. Therefore, if this means that they also already have high levels of climate change consciousness and concern then there would be little room to significantly change their attitudes for the better regardless of the strength of the manipulation.

Nonetheless, there are important questions regarding the use of the imagined flood experience as an instrument for influencing attitudes and perceptions that can be explored in further research. For example, the description of the flood event and instructions for the imagined scenario only focused on adverse impacts of the flood on victims. Other applications of mental simulation techniques such as in imagined contact research have emphasized the role of mental simulation as a source of a behavioural script to guide future action (Crisp, Stathi, Turner, & Husnu, 2009). On this basis, it might be worthwhile to include a script prompting individuals to imagine themselves engaging in mitigation actions as part of their response to the imagined flood and see if this affects their perceived instrumentality in addressing climate change as well as their inclination to perform these actions in real-life. As suggested by Spence et al. (2011), extreme weather experiences influence perceived efficacy and instrumentality by providing a concrete representation of the likely consequences of individual actions. Additionally, further research could investigate whether the spatial proximity of the flooding event used in the manipulation has an impact on imageability and the consequent effects of the imagined experience manipulation. The scenarios employed in my four studies were high profile, widely publicised events that most participants would either have directly experienced or seen in the news. It would be informative to determine if the effectiveness of the manipulation depends on the accessibility of the actual event detailed in the research material or whether individuals draw on their own previous direct and indirect experiences with flooding in constructing their mental imagery of the imagined flood.

It is also possible that the imagined experience manipulation had limited effectiveness in motivating action because the flood event was quite removed from the behavioural outcomes measured, in the sense that there are intervening steps that need to take place between the experience and the consequent action (this consideration also applies to actual flood experience). First, participants needed to link the experience of the flooding to climate change. Then they had to evaluate the seriousness of the threat posed and their own capability to address the threat. Lastly, they had to be aware that the

behaviours specified would be effective in addressing climate change before they could decide to engage in the behaviours or at least form intentions to do so. Therefore, the direct impact of the manipulation may be largely limited to more proximate beliefs and affective responses such as perceived threat and concern.

I primarily focused on the effects of the manipulation in my experiments. The process through which the imagined flood experience manipulation might affect climate change perceptions was assumed based on prior arguments that mental imagery of climate change impacts and other salient environmental problems can significantly affect attitudes and behaviour by increasing the availability of climate change information (Leiserowitz, 2004, 2006) and acting as a trigger for engagement in pro-environmental behaviour (Boomsma et al., 2016). However, in subsequent research, it would be worthwhile to establish through experimental methods that these processes are also engaged by imagined experiences of flooding or other extreme weather events.

Chapter 5

The interplay between descriptive and injunctive social norms as influences on climate change perceptions and pro-environmental behaviour

Introduction

In the last two chapters, I have addressed the influence of real and imagined experiences of the physical world on individuals' responses to climate change. Here, I focus on how individuals' attitudes and behaviour are shaped by their experience of their social environment. An extensive body of evidence suggests that people care greatly about what others do and think, and social norm dynamics can be instrumental in achieving societal outcomes (Farrow, Grolleau, & Ibanez, 2017; Miller & Prentice, 2016; Nyborg et al., 2016). A prominent contemporary example of the efficacy of social norms as motivation for behaviour change is the dramatic reduction in tobacco use due to changing social attitudes toward smoking in many parts of the world (Alamar & Glantz, 2006; Stuber, Galea, & Link, 2008). Such examples are a basis for optimism that social norms-based strategies also hold promise for curbing environmentally unsustainable social practices.

In subsequent sections of this chapter, I discuss how the actions and expectations of other individuals in our environment inform our beliefs, trigger our emotions, and guide our actions through processes of social influence. Building on conceptualizations of social norms, and theorizing about social influence, from different social psychological traditions, I develop hypotheses concerning the way interactions between unwritten social rules about *what is done* and *what ought to be done* in specific situations affect individuals' behavioural responses to climate change. These hypotheses were tested in two studies using correlational and experimental methods. The purpose of this research is to tackle unresolved questions in our current understanding of how environmental behaviour is shaped by influences deriving from our social context, particularly how individuals are affected by congruence and incongruence in the actions and expectations of important social referents.

Explicating social norms

Social life is characterized by social norms i.e. shared patterns of thought, feeling and behaviour among people (Hogg & Reid, 2006; Hogg & Vaughan, 2008), or 'normative social similarities and differences between people' (Turner, 1991). An alternative conception of social norms is that they are rules and standards that are understood by members of a group or society,

and that guide or constrain behaviour without the force of laws (Cialdini & Trost, 1998). Social norms emerge from interpersonal interactions, and can include general societal expectations for our behaviour (injunctive norms), the expectations of valued others for our behaviour (subjective norms), our own expectations for our behaviour (personal norms) and the standards that develop from our observations of others' behaviour (descriptive norms) (Cialdini & Trost, 1998). Through processes of social influence[16], norms modulate individuals' perceptions, attitudes and behaviour by eliciting compliance or conformity (Cialdini & Goldstein, 2004; Hogg & Vaughan, 2008). In other words, people may align their attitudes and behaviour with prevailing social norms because they yield to (or *comply* with) direct or indirect pressure from an individual or group, or they may choose to *conform* with prevailing social norms because they are genuinely persuaded that the norms are appropriate and socially desirable.

A key prerequisite of compliance is that the source of social influence is perceived by the target of social influence to have power (Moscovici, 1976). Such power might be related to the target's belief that the influencer has more information than themselves (informational power), is authorized by a recognised power structure to command and make decisions (legitimate power), or has greater expertise than themselves (expert power). The target may also comply due to identification with, attraction to, or respect for the source of influence (referent power), or because they believe the source of influence has the ability to offer rewards for compliance (reward power) or give or threaten punishment (coercive power) (Hogg & Vaughan, 2008; Raven, 1965). However, because compliance does not reflect internal change, it typically persists only when behaviour is under surveillance.

On the other hand, the subjective validity of social norms plays a greater role than power in eliciting conformity. People often look to the behaviours of others (descriptive norms) for evidence of what is likely to be an effective or adaptive action in a given circumstance (Cialdini, 1988). The greater the number of people who respond to the situation in a given way, the more correct the behaviour is perceived to be (Cialdini & Trost, 1998; Thibaut & Kelley, 1959). The 'social proof' provided by the popularity of the behavioural response serves a decision-making heuristic that helps save cognitive effort and time while providing an outcome with a high probability of being effective (Cialdini, 2001; Cialdini & Trost, 1998). This mode of acquiescence to social norms arises from a desire to make correct decisions (Cialdini &

[16] Raven (1965) defines social influence as a change in an individual's cognition, attitude or behaviour that has its origin in another person or group.

Trost, 1998); it leads to conformity through 'an influence to accept information from other individuals as evidence of reality'(Deutsch & Gerard, 1955), otherwise known as *informational* social influence.

Conformity may also arise from a desire to build and maintain satisfactory social relationships with others. According to Cialdini and Trost (1998), social norms have power to influence because they help clarify the behaviours expected of us by others in our social world. Social expectations about *what ought to be done* in a given situation (injunctive norms) characterize the perception of what most people approve or disapprove of; they also prescribe the 'moral code' of the group (Cialdini et al., 1991). Through a process of *normative* social influence, the need to gain social acceptance and maintain a sense of belonging in one's social group (or in society) drives people to conform with the positive expectations of others and avoid acting in ways that will be met with disapproval (Cialdini & Trost, 1998; Deutsch & Gerard, 1955).

The effects of both informational and normative social influence are contingent on the similarity of the source of reference (Festinger, 1954). People do not indiscriminately imitate other individuals in their environment (Allison, 1992). Rather, they are more likely to look to similar individuals (such as in-group members), who show visible signs of success (e.g., status, power or wealth), for evidence of the most effective course of action. Likewise, considering that social approval is one of the goals that underlies conformity with injunctive norms, similar individuals are more likely to have a marked effect on our felt obligation to act in line with social expectations than dissimilar individuals (Cialdini & Trost, 1998). For example, college students are more likely to consider the norms of their fellow students than the norms of their parents when deciding whether, and how much, to drink (Perkins, 2002).

From a social identity perspective, the motivation to conform may also be contingent on the extent to which the social normative referent is seen to be prototypical of a social group with which the target of social influence strongly identifies (Glynn, 1997; Hogg & Reid, 2006; Rimal & Real, 2005). People cognitively represent social categories as prototypes that capture similarities between people within the same group and differences between groups. Prototypes maximise the ratio of intergroup differences to intragroup differences and serve to enhance the perceived entitativity[17] of a group (D. L. Hamilton & Sherman, 1996; Hogg & Reid, 2006). In

[17] Entitativity refers to the property of a group that makes it appear to be a coherent and distinct entity that is homogenous, well structured, has clear boundaries and whose members have a common fate (D. T. Campbell, 1958; D. L. Hamilton & Sherman, 1996; Hogg & Reid, 2006)

the process of categorizing people, we perceive them through the lens of the relevant group prototype and represent them in terms of how well they embody the prototype. Since group prototypes specify how people, feel, think and behave, social categorization generates stereotypical expectations and encourages stereotype-consistent interpretation of ambiguous behaviours (Hogg & Reid, 2006). Additionally, social categorization generally involves the self or is typically in reference to oneself; thus, we also categorize ourselves in the same way we categorise others (Turner, Hogg, Oakes, Reicher, & Wetherell, 1987b). Through this process, social categorization transforms self-conception, generates group identification, and governs how we feel and behave to conform to the group prototype. The individual's representation of group norms is described by the group prototype and the prescriptive force of the prototype is dependent on the centrality of the in-group identity to the individual's self-concept (in other words the extent to which they identify with the group) (Abrams & Hogg, 1990). On this basis, prototypical group members are likely to be a strong source of social influence[18] because they embody the group prototype and are consequently liked by fellow group members; they are the focus of conformity and attention for information about the group norm; they tend to act in group-serving ways due to their strong identity with the group; and they elicit trust from other group members because their behaviour benefits the group as a whole (Hogg & Reid, 2006; van Knippenberg, van Knippenberg, De Cremer, & Hogg, 2004).

The importance of social norms in shaping behaviour is widely emphasized across the social and natural sciences (Bicchieri, 2006; Ehrlich & Levin, 2005; Ostrom, 2000; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). However, as reflected in the preceding discussion, there are several different theoretical perspectives on the mechanisms through which social influence operates. In the next section, I proceed to discuss the focus of this research: the interaction between descriptive and injunctive norms. Specifically, I present a brief review of empirical evidence regarding how individuals' behaviour and perceptions are affected by the interplay between the two types of norms.

[18] Note that the social identity perspective on social influence diverges from norm focus theory in viewing adherence to normative behaviour and conformity to in-group prototypes as arising from the process of depersonalization based on self-categorization (i.e., the extent to which individuals define themselves in terms of group membership) rather than simple reference to other group members as sources of appropriate/adaptive behaviour or fear of social sanctions for norm violation (Abrams & Hogg, 1990; Hogg & Reid, 2006).

The interaction between descriptive and injunctive social norms

Conforming to social norms is often the best course of action because collective wisdom tends to serve the individual and the group well, and people are most likely to look to others for guidance on how to behave in situations that are novel, uncertain or ambiguous (Cialdini, 2001; Lapinski & Rimal, 2005). People may look to others to know what they are doing (informational dependence) or they may be concerned about others' evaluation of their behaviours (effect dependence) (E. E. Jones & Gerard, 1967). Social norms serve to help people define a certain situation, and this definition enables them to understand specific events within that situation (Fazio, 1990). People might look to their referents to determine the prevailing norms regarding a specific behaviour, but if they believe that their behaviours will not be known to others, they may choose to defy the norms. On the other hand, if informational dependence is coupled with a credible threat of social sanctions for violating the norm, conformity may be driven by injunctive norms, or a combination of descriptive and injunctive norms (Lapinski & Rimal, 2005).

Until recently, the relationship between descriptive and injunctive norms was not clearly addressed in the literature (see Lapinski & Rimal, 2005; Smith & Louis, 2008, for comments on this issue). One could presume that when people observe many others engaging in a behaviour, they likely conclude that the behaviour is socially acceptable and few or no social sanctions will be evoked by engaging in the behaviour. Yet, the perceived similarity between oneself and the actors, and observations about whether the actions are subsequently sanctioned or rewarded for their behaviours, can also determine whether specific behaviours are perceived as being socially acceptable or deviant in nature (Bandura, 1973). Given that descriptive and injunctive norms can exercise different influences on behaviour, and may be communicated through different mechanisms, it is necessary to address the interaction between the two types of norms in any attempt to model the motivational effects of social influence (Lapinski & Rimal, 2005; J. R. Smith et al., 2012).

Some authors have argued that norms are meaningless unless their violation invokes some form of sanction (Bendor & Swistak, 2001). On this basis, Rimal and Real (2003) proposed that injunctive norms moderate the effects of descriptive norms, such that the influence of descriptive norms on behaviours is amplified when injunctive norms are also strong and reduced when injunctive norms are weak. In other words, when people perceive a certain

behaviour to be widespread among their peers, they are more likely to conform if they also believe that social sanctions will be incurred for violating the norm.

However, Rimal and Real (2003, 2005) failed to find support for this hypothesis in two studies addressing the link between social norms and drinking behaviour on US college campuses. In one study, they found that the perceived social approval of alcohol consumption did not significantly interact with the perceived prevalence of drinking on campus in predicting students' intentions to drink (Rimal & Real, 2005). In another study, they found the opposite of their hypothesis to be true – college students who perceived that society disapproves of alcohol consumption, and concurrently believed that most of their peers drink, were most likely to drink (Rimal & Real, 2003). The results of the second study were interpreted as an indication that societal disapproval of students' drinking is not a meaningful deterrent to alcohol consumption on college campuses[19]. Drawing on psychological reactance theory (Brehm, 1966), they argued that students may perceive societal disapproval as a threat to their freedom to drink alcohol and consequently cling tightly to that freedom, with the result that alcohol consumption is construed in an even more positive light (Rimal & Real, 2003).

Another plausible reason for Rimal and Real's (2003) failure to find support for their hypothesis may be the social distance of 'society' as a referent for norms regarding drinking among college students. As discussed in the previous section, individuals are less likely to be influenced by the actions and expectations of socially distal or non-group-prototypical referents (Cialdini & Trost, 1998; Festinger, 1954; van Knippenberg et al., 2004). It follows that the social expectations of dissimilar others are also less likely to have an impact on whether we choose to conform with the actions of more proximate social referents[20] (e.g., Jetten, Spears, & Manstead, 1996). When both descriptive and injunctive norms were derived from more proximate social referents (close friends), the relationship between perceived descriptive norms and personal alcohol consumption was stronger among students who also perceived their friends as approving of drinking (C. M. Lee, Geisner, Lewis, Neighbors, & Larimer, 2007).

[19] An interpretation of this from a social identity perspective is that being a 'student' is a more relevant social category than being 'a member of society' in the context of drinking among college students. Therefore, the social norms of the latter category are less likely to have an influence on students' behaviour in this context.
[20] In relation to college drinking, Halim, Hasking and Allen (2012) found that social motives are also implicated in the interaction between descriptive norms and distal injunctive norms, whereby people with strong social motives for drinking are more likely to increase drinking in response to perceived prevalence among their peers and disapproval by distal social referents. People with other motives for drinking were not affected by distal injunctive norms; they only increased their drinking in line with descriptive norms. The two-way interaction between descriptive and proximal injunctive norms was not significant.

Smith and Louis (2008) found a significant interaction between descriptive and injunctive norms in the context of students' attitudes toward the introduction of full-fee places for Australian undergraduate students. Places for undergraduate students have been historically funded through a combination of government funding and student contribution, but at the time of the study, the Australian government had introduced changes that would allow universities to offer full-fee places to students who did not meet the criteria to get government-supported places; this was seen by many as a betrayal of the country's meritocratic values (J. R. Smith & Louis, 2008). In this study, descriptive norms had no significant independent effect on students' attitudes toward signing a petition on this issue or willingness to sign a petition. However, supportive injunctive norms were predictive of more positive attitudes toward the target behaviour and greater willingness to engage in the behaviour. Further, attitudes and willingness to engage in the behaviour remained high among students who perceived a supportive injunctive norm even when the descriptive norm was non-supportive. These results were interpreted as indicating that injunctive norms exert a stronger motivational influence than descriptive norms.

In the environmental domain, Göckeritz et al. (2010) found that high injunctive normative beliefs strengthened the link between descriptive normative belief and engagement in conservation behaviour among a sample of California residents. Although engagement in conservation behaviour was highest when both descriptive and injunctive normative beliefs were high, descriptive normative beliefs still had a significant positive link with conservation behaviour when injunctive normative beliefs were low. Descriptive and injunctive normative beliefs about conservation behaviour were only modestly correlated, and Göckeritz et al. (2010) highlighted the fact that while there was a level of covariance between the prevalence and approval of a given behaviour there was also a considerable degree of misalignment. They concluded that inconsistency in normative beliefs reduce the pressure to conform.

This conclusion was subsequently backed up by Smith et al. (2012) in two experimental studies showing that conflicting descriptive and injunctive norms produced weaker intentions to act pro-environmentally, even after controlling attitudes and perceptions of control. This effect was replicated in Australia, China and the UK. In line with Rimal and Real's (2003) hypothesis, they found that supportive descriptive norms had no effect on intentions to conserve energy among the British sample when injunctive norms were unsupportive but supportive descriptive norms were associated with stronger intentions to conserve energy when injunctive norms were

also supportive. Similarly, among the Chinese sample, they found that supportive descriptive norms were linked to stronger intentions to conserve energy when injunctive norms were also supportive but descriptive norms had no effect on intentions when injunctive norms were unsupportive. Interestingly, the reverse was also the case among the Chinese sample: supportive injunctive norms were only associated with increased intentions to conserve energy when descriptive norms were supportive. Across both experiments, intentions to conserve energy were at their highest when supportive descriptive and injunctive norms were aligned. Intentions to conserve energy reduced significantly when the norms were misaligned, and were at their lowest when unsupportive descriptive and injunctive norms were aligned.

However, McDonald, Fielding, and Louis (2013) have challenged the notion that norm-conflict can only result in lowered intentions to act. They argue, from a social identity perceptive, that given individuals hold multiple group memberships and are often exposed to conflicting in-group norms, if norm-conflict only reduced the perceived effectiveness of a given behaviour, then, we would be paralyzed by the diversity of our social environment (pg. 59). They proposed that some group members (presumably high-identifiers) may be motivated to perform a behaviour by information that not everyone is acting, because such information is interpreted as an indication of the need for them to personally act. Further, they suggested that individuals' attitude toward the issue in question is key to determining whether they are energized or de-motivated by norm-conflict. These arguments were supported by findings from three studies. In one correlational and one experimental study, they found that norm-conflict was positively related to the perceived effectiveness of a range of pro-environmental behaviours among individuals with strong pro-environmental attitudes and negatively related to perceived effectiveness among individuals with weak pro-environmental attitudes. Additionally, perceived effectiveness significantly mediated an indirect effect of norm conflict on behavioural intentions. In a second experimental study, they found that perceived effectiveness also moderates the effect of norm conflict on behavioural intentions, such that norm conflict only influences intentions when perceived effectiveness is high.

Based on the studies reviewed here, it seems clear that the nature of the interaction between descriptive and injunctive norms is yet to be clarified by empirical evidence. The popular notion that injunctive norms have a stronger influence on behaviour than descriptive norms (Cialdini et al., 1991; Kallgren, Reno, & Cialdini, 2000), and that the effectiveness of descriptive norms depends on prospective social sanctions invoked by supporting injunctive

norms (Bendor & Swistak, 2001; Rimal & Real, 2003), has received inconsistent empirical support. Misalignment between descriptive and injunctive norms may, or may not, reduce motivation to perform behaviours depending on individual characteristics. Therefore, one can conclude that the interactive influence of descriptive and injunctive norms on behaviour is still very much a question demanding further research.

The current research: revisiting the interplay between descriptive and injunctive social norms in the context of climate change-related behaviour

As discussed in Chapter 1, there is a considerable amount of evidence that individuals derive motivation to engage in pro-environmental behaviours from the actions and expectations of relevant social referents. Focusing people on descriptive and injunctive norms has been shown to have significant effects on a variety of behaviours and behavioural intentions including those relating to composting, littering, electricity use, sustainable holiday choices, energy conservation in hotels and public bathrooms, recycling etc. (Andersson & von Borgstede, 2010; Bergquist & Nilsson, 2016; Cialdini et al., 1991, 1990; Goldstein, Cialdini, & Griskevicius, 2008; Hardeman, Font, & Nawijn, 2017; Schultz et al., 2007; White & Simpson, 2013). Overall, the literature suggests that social norms can elicit pro-environmental behaviour directly (Farrow et al., 2017), and also indirectly through their effects on attitudes, awareness of the negative consequences of environmental problems, responsibility attribution, perceived efficacy and behavioural intentions (Klöckner, 2013; McDonald et al., 2013). The purpose of the current research is to build on this body of work by examining the interactive effect of descriptive and injunctive norms on climate change-related intentions and behaviour, and assessing how the independent and interactive influence of the two types of norms are conveyed via perceived efficacy, perceived threat and concern.

One of the reasons people look to the behaviours of others for guidance in a given situation is to determine what is likely to be the most effective course of action (Cialdini & Trost, 1998). If a certain behaviour is seen to be popular among one's peers, then it is reasonable to conclude that it must be effective. Additionally, seeing that other similar individuals successfully perform the behaviour and achieve the desired outcome is likely to contribute to our own sense of efficacy to achieve the same outcome by performing the behaviour. This argument is supported by evidence that perceived efficacy mediates the influence of social norms on environmental and health behaviours (Stok, Verkooijen, de Ridder, de Wit, & de Vet, 2014; Thøgersen, 2014). With regard to global environmental problems like climate change,

McKenzie-Mohr and Smith (1999) indicate that a sense of community impacts significantly on individuals' sense of control. In other words, a belief that one is acting in concert with others increases perceived personal efficacy and reduces individuals' propensity to resort to denial and other forms of maladaptive coping (Frantz & Mayer, 2009). Based on this rationale, we can hypothesize that perceived efficacy mediates the effect of descriptive and injunctive norms on behavioural responses to climate change (H1).

However, norm-conflict can have significant negative effects on the perceived effectiveness of specific behaviours (e.g., McDonald et al., 2013), and this may also impact individuals' perceived efficacy in achieving the desired outcome by performing the behaviour. If a behaviour appears to be commonplace among fellow group members or similarly important social referents, but there is no indication that any social sanctions will be incurred for failing to conform with this norm, this may suggest that the behaviour or the outcomes associated with performing the behaviour are not important to the group. After all, from some perspectives, one of the functions of social norms is to maintain a balance between self-oriented personal desires and collective outcomes (e.g., Sunstein, 1996; Triandis, 1994). On the other hand, if fellow group members approve of a specific behaviour but only a minority are seen to perform the behaviour, this may signal that the behaviour is not an effective means to achieve the desired outcome, or that group attitudes[21] toward the issue/outcome is weak, or that group members lack effectiveness to perform the behaviour. The latter process, in particular, can plausibly lead to reduced motivation to engage in normative behaviour (c.f. Smith et al., 2012) by reducing perceived personal efficacy. These considerations naturally lead to a hypothesis that the interactive effect of descriptive and injunctive norms on behaviour are significantly mediated by perceived personal efficacy; whereby descriptive norms significantly moderate the indirect effects of injunctive norms on behaviour (and behavioural intentions) that is mediated by perceived efficacy (H2).

The previously established link between social norms and awareness of consequences (Klöckner, 2013), and social norms and climate change risk perceptions (van der Linden, 2015), suggests that the effects of social influence extends to the processes through which individuals evaluate the significance of environmental threats. Given that environmental problems typically pose a general/collective threat, rather than target specific individuals, it

[21] The conceptualization of attitude by Kaiser, Byrka and Hartig (2010) as a measure of the amount of difficulty or costs that individuals are willing to accept in order to achieve an outcome or attitudinal goal is particularly relevant in this case.

makes sense to look to the behaviours of others for what is an appropriate response. If most group members or important social referents are performing a behaviour in response to a salient issue (e.g., global climate change), and approve of fellow group members performing this behaviour, this should indicate that the issue in focus has significant implications for an outcome that is important to the group. In this way, social norms provide information, not only about the behaviour that is being executed, but also the issue to which the behaviour is performed in response to. Taking a problem like climate change for example, if other group members are seen to be taking mitigation action and express approval for such behaviour, this suggests that climate change is an issue that has important implications for the group and that mitigation behaviours are an effective way to address the issue.

Some authors have suggested that perceptions of climate change as a social/collective threat, rather than a personal threat, is reflective of a conscious 'psychological distancing' of the problem, and thus may be associated with lower motivations to act pro-environmentally (e..g, Bord, Fisher, & Connor, 1998). However, an experimental study conducted by Spence and Pidgeon (2010) revealed that people expressed more positive attitudes toward climate change mitigation when it was framed as a social, as opposed to a personal, benefit. They suggest that this may be explained by the fact that although personal engagement with climate change may entail little intrinsic benefit to individuals, the societal benefits also encompasses benefits to individuals who are, themselves, a part of society. A subsequent study by Bolsen, Druckman, and Cook (2014) also found that messages that emphasize collective environmental benefits have significant positive effects in motivating people to act pro-environmentally in the energy conservation domain.

A cynical interpretation of the influence of descriptive and injunctive norms on individual responses to collective threats such as climate change is that individuals need not necessarily see the issue as a threat to themselves (or even accept the implied significance for the group), but if descriptive and injunctive norms are aligned on the issue, they are likely to conform with the actions of the majority in order to gain the personal benefit of social approval (or avoid social disapproval). From this perspective, they will be acting in a way that serves the interests of the group purely out of a motivation to serve their personal interests.

A less cynical interpretation is that people are motivated to achieve shared social/collective benefits and take personal action to mitigate collective threats because they internalize collective (group) goals and interests; thus, eliminating the distinction between personal and

collective benefits or threats. Based on the social identity perspective on social influence, we understand that people conform to group norms through a process of depersonalization (Abrams & Hogg, 1990) i.e. they define themselves in terms of a salient group membership and the group norms become internalized. A key argument of the social identity theory of influence is that conformity and normative behaviour represent internal cognitive change in a specific context rather than superficial compliance (Hogg & Reid, 2006; Turner, 1991). In other words, individuals will be motivated to act in ways that favour the group, not just because other group members act that way or expect them to act that way, but because group interests become internalised and are consequently represented cognitively as personal interests. By extension, this also means that if the behavioural norms regarding an issue indicate that the issue represents a threat to the group, then group members should also cognitively represent the issue as a personal threat and act accordingly. From this interpretation we can hypothesize that the influence of descriptive and injunctive on behavioural responses to problems like climate change are significantly mediated by perceived threat (H3).

The link between perceived threat and perceived social approval of acting in a way that mitigates a collective threat may be strengthened by a belief that most group members are also acting to mitigate the threat. In this regard, the descriptive norm may become more strongly associated with individuals' representation of prototypical group attitudes and behaviour, consequently heightening their perception of the threat posed by the focal issue and the likelihood that they will act in line with social expectations. On this basis, we can hypothesize that the interaction effect of descriptive and injunctive norms on behavioural responses to climate change are mediated by perceived threat; whereby unsupportive descriptive norms reduce the effect of supportive injunctive norms on perceived threat, and consequently reduce the indirect effect of injunctive norm on behaviour mediated by perceived threat (H4).

According to Böhm (2003), collective environmental threats like climate change have a high potential to elicit feelings of individual responsibility because they engender both ethical and consequence-based evaluations. Ethical-based evaluations are linked to shared values and consequence-based evaluations reflect perceived threats to the self and other social group members (Böhm, 2003). Both evaluative paths are associated with strong emotional responses including concern, worry and anger (e.g., Sundblad, Biel, & Gärling, 2007); and depending on other intervening factors such as causal representations of the perceived threat, they may also give rise to a range of responses including punishment, rehabilitation and remedying (Böhm &

Pfister, 2000). These perspectives suggest that collective threat do not only motivate individuals to act, but they also elicit strong emotional responses, which may serve to further strengthen the motivation to act in ways that serve group interests.

Research in the social identity perspective shows that a variety of emotions including sadness, anger, worry and happiness may spread among groups of individuals through processes of emotional contagion such as mimicry, perspective-taking, conditioning and social appraisal (see van Kleef & Fischer, 2016 for a review). The emotions and affective dispositions of salient prototypical group members, such as group leaders, can also have a significant influence on the feelings of other group members (e.g., Barsade, 2002). When prototypical group members act in ways that signal a perceptible affective response to a given issue (such as signalling concern about climate change by choosing to cycle instead of drive, even when this involves considerable personal costs, or directly communicating their concern to fellow group members), other group members may use this information in their evaluation of the collective significance of the issue and regulate their emotional reactions accordingly.

The dynamics of shared emotions are particularly interesting because, on one hand individuals' level of group identification and commitment determines the extent to which their emotions converge with that of other group members (e.g., Mackie, Devos, & Smith, 2000; Tanghe, Wisse, & van der Flier, 2010). On the other hand, the similarity of emotional responses to shared issues and events can also enhance self-categorization as a group member and motivate individuals to seek out further interactions with emotionally similar others (e.g., Livingstone, Shepherd, Spears, & Manstead, 2016). Research suggests that emotions play a functional role in groups. They help in the negotiation of members' roles and responsibilities, aid in the resolution of problems relating to defection and deviance, facilitate the coordination of collective efforts to achieve shared goals and, most importantly in the current context, signal the degree to which certain behaviours are approved or disapproved in light of prevailing norms or group goals (Keltner & Haidt, 1999; Spoor & Kelly, 2004; van Kleef & Fischer, 2016). Given the significance of emotions for group functioning, it is reasonable to expect that effective group functioning is at least partly contingent on the extent to which group members are able to regulate their emotions in the service of group goals (Côté, 2007; Elfenbein, 2006). In support of this idea, several studies have linked successful team performance with group member emotional intelligence (e.g., Chang, Sy, & Choi, 2012; Jordan & Troth, 2004).

From the foregoing discussion, we can rationally expect that the actions and expectations of salient social referents will have an influence on the affective reactions that individuals express in response to a collective threat like climate change. Further, based on evidence linking individual concern to both private and collective climate change mitigation intentions and actions (e.g., Semenza et al., 2008; Spence, Poortinga, Butler, & Pidgeon, 2011), we can also hypothesize that concern significantly mediates the relationship between climate change-related behaviour and descriptive and injunctive social norms (H5). There are no clear indications in the literature of how the interaction between descriptive and injunctive norms might influence climate change concern. However, drawing on the same rationale that supportive descriptive norms regarding climate change mitigation may bolster the effect of injunctive norms on perceived threat and consequent behaviour, I hypothesized that the interactive influence of descriptive norm and injunctive norm on climate change-related behaviour is mediated by concern. In this regard, I expect that unsupportive descriptive norms reduce the indirect influence of supportive injunctive norm on behaviour mediated by concern (H6).

I tested my hypotheses in two studies (one correlational and one experimental). In Study 8, I examined the mediated influence of descriptive and injunctive norms on climate change-related self-reported behaviour and behavioural intentions through perceived efficacy, perceived threat and concern. I also examined the moderating influence of descriptive norms on the indirect influence of injunctive norms on behaviour and behavioural intentions through perceived efficacy, perceived threat and concern. Study 9 was designed to address some of the limitations of Study 8. In this regard, I took account of the effects of individuals' identification with the normative referent and the strength of their biospheric values as potential intervening factors in the link between social norms and climate change-related behavioural intentions.

Study 8

Method

Participants and procedure

I gathered data from respondents in seven countries (Brazil, Colombia, Indonesia, Nigeria, Pakistan, United Kingdom and United States)[22] using a self-administered questionnaire

[22] The rationale for gathering data from multiple countries was to enable cross-cultural comparative analysis. However, due to the small size of samples obtained from the majority of countries represented, the data was pooled and treated as a single sample.

(Appendix 10). In Brazil and Colombia, the questionnaire was translated and back translated to Brazilian Portuguese and Spanish respectively with help from native speakers of the languages. Further, due to technological constraints, the questionnaire was administered to respondents in Colombia and Nigeria in paper and pencil format while it was administered to participants in the other countries through an internet-based platform.

Participants in Brazil were recruited from the human subject pool at the Federal University of Paraíba (UFPB). In Colombia, the questionnaire was administered to a class of undergraduates at the Universidad de los Andes (Uniandes), Bogotá. Participants in Indonesia were university students recruited through a snowball sampling strategy. In Nigeria, participants were students recruited to complete the questionnaire on the main campus of the University of Ibadan. In Pakistan, participants were recruited to complete the questionnaire through adverts circulated at the University of Karachi. Participants in the United Kingdom were recruited from the human subject pool at the University of St Andrews and participants in the United States were recruited from the human subject pool at the California State University, San Marcos (CSUSM). The criteria for participation in the study were age (≥ 18 years) and voluntary consent. A summary of sample size information and demographic details for participants in each country is presented in Table 5.1. Across all locations, participants were informed that they would be required to answer questions pertaining to their attitudes toward climate change prior to being asked to provide consent to participate in the study.

Table 5.1. Demographic profiles of respondent samples obtained

Country	Gender (%)		Age	*N*
	Male	Female	*M*(SD)	
Brazil	29 (31.5)	63 (68.5)	30.8 (9.92)	92
Colombia	47 (49.0)	49 (51.0)	22.1 (2.03)	96
Indonesia	79 (52.3)	72 (47.7)	23.2 (4.40)	151
Nigeria	55 (51.9)	51 (48.1)	24.2 (4.14)	106
Pakistan	52 (32.1)	109 (67.3)	25.2 (2.88)	162
UK	63 (24.7)	192 (75.3)	24.2 (6.67)	255
USA	83 (35.8)	148 (63.8)	33.2 (14.68)	232
Total	408 (37.3)	684 (62.5)	26.6 (9.36)	1094

Measures

Descriptive norm was measured with five items: “your friends/relatives think climate change is a serious threat”, “most people you know are already trying to do something about climate

change", "some people you know are trying to reduce the negative impact of their lifestyle", "some people close to you have volunteered in, or contributed money to, environmental groups", and "some people you know are members of environmental groups". Responses to these items were recorded using a 7-point response format (1 = strongly disagree, 7 = strongly agree).

Injunctive norm was measured with two items: "your close friends and relatives think you ought to personally do something to address climate change" and "your friends and family expect you to be concerned about climate change". Responses to these items were recorded using a 7-point response format (1 = strongly disagree, 7 = strongly agree).

Perceived threat was measured with six items. I asked participants to rate the extent to which they agreed that climate change poses a threat to their: "lifestyle", "health", "livelihood", "family", "community" and "society in general". Ratings were recorded using a 7-point response format (1 = strongly disagree, 7 = strongly agree).

Concern was measured with a single item: "when you think about the threat posed by climate change, how strongly do you experience the following emotion – Concern?". Responses were provided with a 7-point format (1 = not at all, 7 = very strongly).

Perceived efficacy was measured with two items: "your personal efforts can significantly help reduce the threat of climate change in your country" and "you can make lifestyle changes that will significantly help reduce the threat of climate change in your area". Participants rated their confidence that each of these statements was accurate using a 7-point format (1 = not at all confident, 7 = very confident).

Lastly, I measured *self-reported pro-environmental behaviour* and *behavioural intentions* by asking participants to indicate if they had engaged in, or if they intended to engage in the following behaviours in the future: "talk to friends/relatives about climate change", "attend a seminar or public lecture about climate change", "try to learn about climate change from books, websites and television programs", "boycott products that have a negative impact on the environment", "try to do more things that minimize your environmental impact", "join an environmental group", "volunteer in or donate money to an environmental group", "participate in a climate change-related public sensitization campaign" and "take up a climate-friendly lifestyle". Responses to these items were provided using a yes/no format and the respective variables were constituted by summing the number of yes responses. provided by each

participant. Country-specific reliability estimates and descriptive statistics for each measure used in the study are provided in Table 5.2.

There were other measures included in the questionnaire which are not considered in this chapter. These include measures of acceptance of responsibility for acting on climate change, awareness of the consequences of climate change and fatalistic attitudes toward climate change (see Appendix 10).

Results

I tested the indirect effects of descriptive and injunctive norms on past behaviour and behavioural intentions using the PROCESS macro for testing mediation, moderation and conditional process (Hayes, 2013). Country, gender and age were included in the analyses as control variables. Being a polychotomous nominal variable, six dummy categories were created to represent each country in the regression analyses (*k*-1) with the USA representing the reference category. Partial correlations between the measured variables was calculated with participants' country controlled (Table 5.3). This showed moderate inter-correlations among the variables.

Tests of hypotheses

H1: *Perceived efficacy significantly mediates the effect of descriptive and injunctive norms on behavioural responses to climate change*. Both descriptive (B = .10, SE = .05, p = .037) and injunctive norms (B = .27, SE = .04, p<.001) were significantly related with perceived efficacy. As expected, descriptive (B = .01, SE = .01, 95% CI: [.00, .03]) and injunctive norms (B = .03, SE = .01, 95% CI: [.01, .06]) also had significant indirect links with self-reported behaviour mediated by perceived efficacy. Similarly, descriptive (B = .01, SE = .01, 95% CI: [.00, .04]) and injunctive norms (B = .04, SE = .02, 95% CI: [.01, .08]) had significant indirect links with behavioural intentions mediated by perceived efficacy.

Table 5.2. Reliability estimates and descriptive statistics for the measured variables

Measure	Brazil		Colombia		Indonesia		Nigeria		Pakistan		UK		USA		Overall	
	M(SD)	α	M(SD)	α	M(SD)	α	M(SD)	α	M(SD)	α	M(SD)	α	M(SD)	α	M(SD)	α
Descriptive Norm	3.69 (1.24)	.77	3.99 (1.20)	.79	4.77 (0.98)	.78	3.98 (1.24)	.76	3.07 (1.25)	.84	4.26 (1.13)	.76	4.48 (1.42)	.89	4.11 (1.32)	.84
Injunctive Norm	3.52 (1.57)	.83	4.25 (1.40)	.72	4.63 (1.15)	.68	3.34 (1.46)	.80	2.96 (1.36)	.84	3.89 (1.48)	.83	3.39 (1.60)	.86	3.82 (1.53)	.83
Perceived Threat	5.57 (1.03)	.88	5.08 (1.22)	.92	5.08 (1.04)	.83	4.46 (1.49)	.92	4.79 (1.25)	.88	4.48 (1.32)	.92	5.00 (1.50)	.95	4.86 (1.34)	.91
Concern	4.57 (1.59)	-	4.45 (1.54)	-	5.07 (1.40)	-	4.24 (1.61)	-	4.67 (1.45)	-	5.03 (1.55)	-	4.92 (1.80)	-	4.79 (1.60)	-
Perceived Efficacy	4.29 (1.23)	.72	4.53 (1.38)	.79	4.47 (1.16)	.60	3.97 (1.47)	.76	3.78 (1.43)	.76	3.59 (1.43)	.83	3.84 (1.60)	.84	3.97 (1.45)	.79
Past Behaviour	3.63 (1.80)	.67	3.68 (1.80)	.58	4.89 (2.35)	.75	3.50 (2.35)	.73	3.22 (2.32)	.75	4.16 (2.10)	.71	4.35 (2.82)	.86	4.01 (2.37)	.76
Intentions	5.79 (1.97)	.72	5.65 (1.88)	.67	7.27 (1.92)	.75	5.82 (2.69)	.83	4.94 (2.79)	.84	5.20 (2.37)	.79	5.25 (2.90)	.87	5.61 (2.57)	.82
Valid *N* (listwise)	92		96		150		96		156		255		231		1070	

α = Cronbach's alpha coefficient.

Table 5.3. Partial correlations among the measured variables controlling for country

	2	3	4	5	6	7
1. Descriptive Norm	.66***	.25***	.28***	.33***	.44***	.41***
2. Injunctive Norm		.33***	.28***	.36***	.33***	.33***
3. Perceived Efficacy			.36***	.34***	.25***	.27***
4. Perceived Threat				.52***	.31***	.35***
5. Concern					.41***	.38***
6. Self-reported Behaviour						.65***
7. Behavioural Intentions						-

N = 1056, ****p*<.001

H2: *Descriptive norms significantly moderate the indirect effects of injunctive norms on behaviour mediated by perceived efficacy.* This hypothesis was not supported by the data (Table 5.4). The interaction between descriptive norm and injunctive norm had no significant effect on perceived efficacy, and the indirect relationship between injunctive norm and self-reported behaviour, and behavioural intentions, was significant at both high and low levels of descriptive norm.

H3: *Perceived threat significantly mediates the effects of descriptive and injunctive norm on behavioural responses to climate change.* Both descriptive (B = .19, SE = .04, *p*<.001) and injunctive norm (B = .15, SE = .04, *p*<.001) were significantly related to perceived threat. In support of my hypothesis, descriptive (B = .03, SE = .01, 95% CI: [.01, .07]) and injunctive norms (B = .03, SE = .01, 95% CI: [.01, .06]) had significant indirect links with self-reported behaviour mediated by perceived threat. Perceived threat also significantly mediated an indirect link between behavioural intentions and both descriptive (B = .05, SE = .02, 95% CI: [.02, .09]) and injunctive norm (B = .05, SE = .01, 95% CI: [.02, .08]).

H4: *Descriptive norms significantly moderate the indirect effects of injunctive norms on behaviour mediated by perceived threat.* The interaction between descriptive norm and injunctive norm had no significant effect on perceived threat. Further descriptive norm did not significantly moderate the indirect link between self-reported behaviour or behavioural intentions mediated by perceived threat (Table 5.4). Therefore, this hypothesis was not supported.

H5: *Concern significantly mediates the effect of descriptive and injunctive norms on behavioural responses to climate change*. Descriptive (B = .21, SE = .05, *p*<.001) and injunctive norm (B = .27, SE = .04, *p*<.001) were positively related with concern. Both

descriptive (B = .06, SE = .02, 95% CI: [.03, .12]) and injunctive norms (B = .09, SE = .02, 95% CI: [.06, .13]) had an indirect link with self-reported behaviour mediated by concern. Further, concern significantly mediated an indirect link between behavioural intentions and both descriptive (B = .06, SE = .02, 95% CI: [.02, .10]) and injunctive norm (B = .08, SE = .02, 95% CI: [.05, .12]).

H6: *Descriptive norms significantly moderate the indirect effects of injunctive norms on behaviour mediated by concern.* This hypothesis was not supported by the data. The interaction between descriptive and injunctive norm had no significant relationship with concern. Additionally, descriptive norm did not moderate the indirect link between either self-reported behaviour or behavioural intentions mediated by concern (Table 5.4).

Table 5.4. Regression results for conditional indirect effects of injunctive norm on self-reported behaviour and behavioural intentions at different levels of descriptive norm

IV	Mediator Variable Model		
	Perceived Efficacy	Perceived Threat	Concern
	B(SE)	B(SE)	B(SE)
Injunctive Norm	.28(.04)***	.15(.04)***	.27(.04)***
Descriptive Norm	.10(.05)*	.19(.04)***	.21(.05)***
Injunctive*Descriptive	.01(.02)	.02(.02)	.01(.02)
F	19.34***	18.81***	20.85***
R^2	.17	.17	.18
N		974	
	Dependent Variable Model		
	Past Behaviour	Behavioural Intentions	
Injunctive Norm	-.03(.03)	.04(.06)	
Descriptive Norm	.59(.07)***	.50(.07)***	
Injunctive*Descriptive	.03(.03)	-.06(.03)†	
Perceived Threat	.15(.06)**	.27(.06)***	
Concern	.32(.05)***	.26(.05)***	
Perceived Efficacy	.12(.05)*	.15(.05)**	
F	37.55***	36.19***	
R^2	.34	.33	

N	974	968

Conditional indirect effects of injunctive norm on self-reported behaviour at Descriptive Norm = Mean ± 1SD

Mediator	Descriptive Norm	Effect	95% CI
Perceived Efficacy	- 1SD	.03	[.01, .06]
	+ 1SD	.03	[.01, .07]
Index of moderated mediation		.00	[-.00, .01]
Perceived Threat	- 1SD	.02	[.00, .05]
	+ 1SD	.03	[.01, .06]
Index of moderated mediation		.00	[-.00, .01]
Concern	- 1SD	.08	[.05, .13]
	+ 1SD	.09	[.05, .14]
Index of moderated mediation		.00	[-.01, .02]

Conditional indirect effects of injunctive norm on behavioural intentions at Descriptive Norm = Mean and ± 1SD

Mediator	Descriptive Norm	Effect	95% CI
Perceived Efficacy	- 1SD	.04	[.01, .08]
	+ 1SD	.04	[.02, .08]
Index of moderated mediation		.00	[-.01, .01]
Perceived Threat	- 1SD	.04	[.01, .07]
	+ 1SD	.05	[.02, .09]
Index of moderated mediation		.01	[-.01, .02]
Concern	- 1SD	.07	[.03, .11]
	+ 1SD	.08	[.04, .12]
Index of moderated mediation		.00	[-.01, .02]

*p<.05, **p<.01, ***p<.001, Effect = Bootstrap estimate of indirect effect. Confidence intervals are bias-corrected and based on 1,000 bootstrap resamples (Preacher & Hayes, 2008). Country of residence, gender and age were controlled.

Discussion

The results of this study provide support for the notion that the actions and expectations of relevant social referents such as friends and family *independently* inform individuals' beliefs regarding climate change and their emotional and behavioural responses. Contrary to my hypotheses (H2, H4 and H6), perceived injunctive norms had significant positive links with perceived efficacy, threat and concern; and also had significant indirect links with self-reported

behaviour and behavioural intentions, regardless of the level of descriptive norm. This suggests, in line with previous research by Smith and Louis (2008), that people may engage in normative behaviour regarding collectively important issues even when other group members are not seen to be engaging in the relevant behaviour.

Alternatively, the absence of a significant interaction between descriptive and injunctive norms in this study may be indicative of the methodological difficulty of disentangling the two types of norms (see Thøgersen, 2008). Descriptive and injunctive norms regarding environmental issues are usually significantly and positively correlated (Cialdini, 2003; Thøgersen, 2006). Intuitively, this is because what most people approve is usually what most people do (Bicchieri, 2006). The two types of norm may converge at the individual-level because the behaviours of others serve as a cue for what is expected of the individual or because individuals expect that most others conform to the injunctive norm (Bicchieri, 2006; Rimal & Real, 2003; Thøgersen, 2008). Therefore, experimental designs that directly manipulate norms may be better suited for testing hypotheses regarding their interaction.

Additionally, a key factor that may influence the effects of social norms was not considered in this study. The internalization of group norms to the extent that group interests are cognitively represented as personal interests depend on the extent to which individuals identify with the group. A number of studies have shown that the level of identification with the referent group has a significant influence on the extent to which people are motivated to conform with the group norms (e.g., Christensen, Rothgerber, Wood, & Matz, 2004; Rinker & Neighbors, 2014). The strength of identification with the referents used in this study may modulate the effects of social influence, such that strong identifiers may be more strongly affected by the injunctive and descriptive norms and the interaction between the two. Whereas, low identifiers may be less affected by inconsistencies between the descriptive and injunctive norms.

Lastly, the strength of people's attitudes towards the issue also play a role in determining how they are affected by social norms (McDonald et al., 2013). People with strong environmental attitudes may not only respond positively to supportive injunctive and descriptive norms, they may also be motivated to act by conflicting norms. Considering that we did not measure participants' general environmental attitudes in this study, it is not clear how much this may have played a role in their responses to the perceived descriptive and injunctive norms. These considerations were addressed in Study 9.

Study 9

Aims and hypotheses

The purpose of Study 9 was to address some of the limitations of Study 8. This study employed an experimental design to directly manipulate perceived descriptive and injunctive norms. I also accounted for the effects of social identification and biospheric values on the link between social norms and climate change-related behaviour. Biospheric values were measured in place of environmental attitude partly because of the difficulty in obtaining a short and validated measure of the environmental attitude in the literature, and also the fact that previous research addressing the interaction between social norms and attitudes (e.g., McDonald et al., 2013) have actually employed a measure of attitude (the New Ecological Paradigm scale) that is also considered to be a measure of environmental values in other research (e.g., Whitmarsh & O'Neill, 2010).

Based on an understanding that the extent to which individuals identify with the referent group determines the extent to which they are influenced by the group's norms (Abrams & Hogg, 1990; Rimal, 2008), I hypothesized that social identification significantly moderates the indirect effect of descriptive and injunctive norms on climate change behaviour mediated by perceived efficacy, perceived threat and concern; such that descriptive (H7) and injunctive norms (H8) will have a stronger indirect link with behaviour through perceived efficacy, perceived threat and concern among high identifiers. Further, I hypothesized that the indirect influence of the interaction between descriptive and injunctive norms on climate change-related behaviour mediated by perceived efficacy, perceived threat and concern will be significantly greater among individuals with stronger identification with the referent group (H9).

Considering prior evidence that people with stronger attitudes toward the issue in focus may be more responsive to social norms regarding he issue (McDonald et al., 2013), I also hypothesized that biospheric values significantly moderate the indirect influence of descriptive (H10) and injunctive (H11) norms on climate change-related behaviour conveyed by perceived efficacy, perceived threat and concern. I anticipated that the indirect influence of the interaction between descriptive and injunctive norms on climate change-related behaviour conveyed by perceived efficacy, perceived threat and concern would also be moderated by biospheric value (H12).

Method

Participants

334 participants were recruited from the human subject pool at the university of St Andrews to take part in an online study assessing perceptions of self and others' engagement with environmental issues in the town. The study employed a 2 (descriptive norm: positive vs. negative) x 2 (injunctive norm: positive vs. negative) between-subjects design. The data provided by 33 participants who answered the manipulation checks incorrectly were omitted from the analysis, leaving a final sample (N = 301) comprising 87 male (28.9%) and 209 female (69.4%) participants with a mean age of 21.6 years (SD = 4.96). Entry into a raffle for a £50 shopping voucher was offered as an incentive for participation.

Procedure

The study was presented to participants as an online questionnaire which they were free to complete at any place or time of their choosing. The first part of the questionnaire contained measures of demographic information (gender, age, subject and year of study) and the control variables: social identification with other students at the university and biospheric value orientation. After completing these measures, participants were randomly allocated to one of four treatment conditions in which they were presented with the norm manipulations.

The norm manipulations were presented as a memory exercise requiring participants to read and memorize the main facts in an excerpt from a magazine article summarizing the findings from a survey of students' engagement with environmental issues that had been conducted as part of the university's program to achieve carbon neutrality. Participants were told they would need to recall the information presented in the article excerpt when answering questions in a subsequent section of the questionnaire. The introductory paragraph in the excerpt stated that the university aimed to become carbon neutral for energy consumption and highlighted the fact that effective communication of environment and sustainability issues to staff and students was a primary target in the university's plan to achieve its aim. The second paragraph summarized findings from a recent survey of student engagement with environmental issues across the university. Two aspects of engagement were conveyed as between subject variables: the proportion of students who reported that they had engaged in six named pro-environmental behaviours in the preceding year (descriptive norm manipulation: high [74% performance] or low [47% performance]) and the proportion of students who expressed support for the notion that every student and staff member should be personally involved in the effort to achieve a

cleaner and healthier environment (injunctive norm manipulation: high [83% approval] or low [42% approval]). The behaviours named in the manipulation were recycling; walking, cycling or using public transport as primary means of transportation; turning out lights and appliances in unoccupied rooms to save energy; purchasing locally sourced produce when possible; supporting an environmental campaign with donations or time volunteered; and reducing meat consumption or switching to an environment-friendly diet. As a manipulation check, participants were required to answer two questions (one for each variable manipulated) regarding the proportion of students reported to have performed pro-environmental actions in the preceding year and the proportion who expressed approval of the expectation that students and staff members be personally involved in achieving a healthier and cleaner environment (the exact manipulations used are presented in Appendix 11).

The final part of the questionnaire comprised measures of the dependent variables: perceived efficacy, perceived threat, concern, intentions to engage in pro-environmental behaviour and a pro-environmental behaviour measure. Participants were thanked and debriefed after completing these measures.

Measures

Background variables

Social identification (α = .86, M = 4.87, SD = 1.13) with other students at the university was measured with five items: "I identify with University of St Andrews students", "I have a lot in common with other students at the University of St Andrews", "being a student at the University of St Andrews is an important part of how I see myself", I feel personally criticised when someone who is not a student here criticizes University of St Andrews students", and "I feel strong ties with other University of St Andrews students". Responses to these items were recorded using a 7-point format (1 = strongly disagree, 7 = strongly agree).

Biospheric value orientation (α = .89, M = 5.60, SD = 1.12). Following the same procedure detailed in Chapter 4, biospheric value was measured with a scale adopted from (de Groot & Steg, 2008).

Dependent variables

Perceived *descriptive norm* (α = .70, M = 3.47, SD = 1.01) was measured with four items: "most students at the University of St Andrews are personally doing something to help reduce the risk of climate change", "most students at the University of St Andrews are involved in a

charity or society that addresses environmental issues including climate change", addressing climate change is not a priority for most students at the University of St Andrews - reversed", and "most students at the University of St Andrews are not personally doing anything to help address climate change - reversed" (Response: 1 = strongly disagree, 7 = strongly agree).

Perceived *injunctive norm* ($\alpha = .60$[23], M = 4.80, SD = 0.89) was also measured with four items: "most students at the University of St Andrews would support me if I decided to change my behaviour to help reduce climate change", "my colleagues and other students at the University of St Andrews generally do not expect me to do anything personally to help address climate change - reversed", "most students at the University of St Andrews approve of donating to, or fundraising for, environmental groups that focus on climate change", and "most students at the University of St Andrews would not support me if I decided to change my behaviour to help reduce climate change - reversed" (Response: 1 = strongly disagree, 7 = strongly agree).

Perceived threat ($\alpha = .88$, M = 5.15, SD = 1.08) was measured with seven items. The first four items required participants to rate the seriousness of the threat posed by climate change to them personally, the seriousness of climate change impacts around the world, the seriousness of climate change impacts for the natural environment, and the seriousness of climate change impacts for their country (Response: 1 = not serious at all, 7 = very serious). The next three items required participants to judge the likelihood that climate change will have harmful long-term effects on society, on the natural environment, and on their personal health and wellbeing in the course of their lifetime (Response: 1 = very unlikely, 7 = very likely).

Concern (M = 5.42, SD = 1.41) was measured with a single item: "thinking about the seriousness of climate change and its potential impacts, how strongly do you feel the following emotions – Concern?"

Perceived efficacy ($\alpha = .78$, M = 5.87, SD = 0.99) was measured with two items. Participants were asked to rate their level of confidence that the following can make a difference in addressing climate change: "personally changing your behaviour and lifestyle (*e.g.*, purchasing

[23] Excluding the two reverse-worded items increased the reliability of the perceived injunctive norms scale ($\alpha = .76$). However, I chose to use the full set of items, as originally intended, because using the shortened scale did not produce dissimilar results and the reliability of the 4-item scale achieved the minimum threshold considered acceptable for theory testing (Nunnally & Bernstein, 1994).

practices and energy use)" and "efforts made my you as an individual to address climate change" (Response: 1 = not confident, 7 = very confident).

Behavioural intentions (α = .78, M = 4.14, SD = 1.15) were measured with eight items. Participants were asked to rate their likelihood engaging in the following behaviours in the near future: (1) turn off lights in unoccupied rooms at home/work; (2) walk, cycle or use public transport only when commuting; (3) purchase and consume only locally sourced produce; (4) increase current levels of waste-sort and recycling; (5) reduce meat consumption or switch to a meat free diet; (6) sign a petition calling on the government to make stronger commitments to renewable energy and lowering carbon emissions; (7) join or volunteer in an organization involved with climate change; (8) and donate to or raise funds for an environmental group or charity involved with climate change. Factor analysis with oblimin rotation revealed that these items load on to two factors representing consumption behaviours (items 1, 2, 3, 4 and 5: Eigenvalue = 1.21, variance explained = 15.14%, α = .67, M = 4.87, SD = 1.21) and environmental citizenship and activist behaviours (items 6, 7 and 8: Eigenvalue = 3.28, variance explained = 41.05%, α = .75, M = 2.89, SD = 1.51). The correlation between these factors was moderate (r = .49, p<.001). They were consequently treated as separate variables.

Pro-environmental behaviour. I measured this by asking participants if they would like to donate a fraction of their remuneration to an environmental group in the event that they were selected to receive the £50 shopping voucher. They were given an option to donate up to 50% of the value of the voucher. Responses were recorded with a yes/no format. Overall, 48.2% of participants elected to donate a fraction of their reward.

The questionnaire also contained other measures that are not considered in this chapter. These include the impression management sub-scale of the Balanced Inventory of Desirable Responding (BIDR), pro-environmental self-identity, identification with the environmental movement, objective climate change knowledge, objective pro-environmental behaviour and emotional responses to climate change: anger, fear, worry and guilt (see appendix 11).

Results

Preliminary analyses

To verify the effectiveness of the norm manipulation, I compared levels of perceived descriptive and injunctive norms reported by participants in the different experimental conditions. A 2 x 2 ANOVA revealed while injunctive norm manipulation only had an effect

on perceived injunctive norms ($F_{(1, 297)}$ = 16.34, p<.001) and not perceived descriptive norms ($F_{(1, 297)}$ = 3.21, p = .074), the descriptive norm manipulation had significant effect on both perceived injunctive ($F_{(1, 297)}$ = 9.62, p = .002) and descriptive norms ($F_{(1, 297)}$ = 88.64, p<.001). However the interaction between the two norm manipulations had no significant effect on either perceived descriptive ($F_{(1, 297)}$ = 0.00, p = .997) or injunctive norm ($F_{(1, 297)}$ = 0.42, p = .519). Descriptive statistics for the dependent variables across the experimental conditions are presented in Table 5.4. Zero-order correlations among the measured variables are reported in Table 5.5. The tests of hypotheses were conducted with the PROCESS macro for SPSS (Hayes, 2013), gender and age controlled. The confidence intervals associated with the estimates reported are bias-corrected and based on 1,000 resamples (Preacher & Hayes, 2008).

Table 5.4. Means and standard deviations for Study 9

DV	Low Injunctive (N = 141)		High Injunctive (N = 160)	
	Low Descriptive (N = 76)	High Descriptive (N = 65)	Low Descriptive (N = 79)	High Descriptive (N = 81)
Perceived Efficacy	5.97(1.00)	5.89(1.00)	5.94(0.95)	5.70(1.04)
Perceived Threat	5.31(1.13)	5.15(1.00)	5.15(1.08)	5.05(1.06)
Concern	5.46(1.45)	5.54(1.40)	5.21(1.53)	5.59(1.18)
Intentions (Consumption)	4.77(1.29)	5.01(1.16)	4.80(1.20)	4.96(1.22)
Intentions (ECA)	3.04(1.63)	2.92(1.43)	2.70(1.41)	2.92(1.55)
Donation (% Yes)	51.32	50.63	52.31	41.03

Tests of hypotheses

H1: *Perceived efficacy significantly mediates the effect of descriptive and injunctive norms on behavioural responses to climate change*. This hypothesis was not supported by the data. The descriptive and injunctive norm manipulation did not have a significant effect on perceived efficacy (Table 5.6). Further, neither the descriptive (B = -.00, SE = .01, 95% CI: [-.02, .01]) nor injunctive norm (B = .00, SE = .01, 95% CI: [-.01, .01]) manipulation had a significant indirect influence on intentions to engage in pro-environmental consumption behaviours mediated by perceived efficacy. The descriptive (B = .00, SE = .01, 95% CI: [-.01, .03]) and injunctive norm (B = .00, SE = .01, 95% CI: [-.01, .02]) manipulation also had no indirect influence on intentions to engage in pro-environmental citizenship and activist behaviour mediated by perceived efficacy. Lastly, there was no significant indirect influence of the

descriptive (B = .01, SE = .02, 95% CI: [-.01, .06]) or injunctive norm (B = .00, SE = .01, 95% CI: [-.01, .05]) manipulation on participants' choice to donate to an environmental group mediated by perceived efficacy

H2: *Descriptive norms significantly moderate the indirect effects of injunctive norms on behaviour mediated by perceived efficacy.* This hypothesis was not supported. Perceived efficacy did not significantly mediate a link between the injunctive norm manipulation and intentions to engage in pro-environmental consumption behaviours, engage in pro-environmental citizenship and activist behaviours or choice to donate to an environmental group at either low or high levels of descriptive norm (Table 5.6).

H3: *Perceived threat significantly mediates the effects of descriptive and injunctive norm on behavioural responses to climate change.* I found no support for this hypothesis. The descriptive and injunctive norm manipulation had no significant effect on perceived threat (Table 5.6). There was also no significant indirect influence of the descriptive (B = -.01, SE = .01, 95% CI: [-.05, .00]) or injunctive norm (B = -.01, SE = .01, 95% CI: [-.04, .01]) manipulation on intentions to engage in pro-environmental consumption behaviours mediated by perceived threat. Similarly, there was no significant indirect influence of the descriptive (B = -.01, SE = .01, 95% CI: [-.05, .00]) and injunctive norm (B = -.01, SE = .01, 95% CI: [-.04, .01]) manipulation on intentions to engage in pro-environmental citizenship and activist behaviours mediated by perceived threat. Lastly, perceived threat did not significantly mediate the indirect influence of the descriptive (B = -.01, SE = .02, 95% CI: [-.07, .01]) or injunctive (B = -.01, SE = .02, 95% CI: [-.06, .01]) norm manipulation on participants' choice to donate to an environmental group.

H4: *Descriptive norms significantly moderate the indirect effects of injunctive norms on behaviour mediated by perceived threat.* Perceived threat did not significantly mediate an indirect link between the norm manipulation and intentions to engage in pro-environmental consumption behaviour, environmental citizenship and activist behaviours or choice to donate to an environmental group (Table 5.6). Thus, this hypothesis was not supported.

H5: *Concern significantly mediates the effect of descriptive and injunctive norms on behavioural responses to climate change*. This hypothesis was not supported not by the data. The descriptive and injunctive norm manipulation did not have a significant effect on concern (Table 5.6). I found that concern did not significantly mediate an indirect influence of the

descriptive (B = .02, SE = .02, 95% CI: [-.01, .07]) or injunctive (B = -.01, SE = .02, 95% CI: [-.05, .01]) norm manipulation on intentions to engage in pro-environmental consumption behaviours. I also found that concern did not significantly mediate an indirect influence of the descriptive (B = .02, SE = .02, 95% CI: [-.00, .07]) or injunctive (B = -.01, SE = .02, 95% CI: [-.06, .01]) norm manipulation on intentions to engage in pro-environmental citizenship and activist behaviours. Lastly, neither the descriptive (B = .00, SE = .02, 95% CI: [-.03, .05]) nor injunctive (B = -.00, SE = .01, 95% CI: [-.04, .02]) norm manipulation had a significant indirect influence on participants' choice to donate to an environmental group mediated by concern.

H6: *Descriptive norms significantly moderate the indirect effects of injunctive norms on behaviour mediated by concern*. I found no support for this hypothesis. Concern did not mediate an indirect link between the injunctive norm manipulation and intentions to engage in pro-environmental consumption behaviours, environmental citizenship and activist behaviours or participants' choice to donate to an environmental group (Table 5.6).

Table 5.5. Zero-order intercorrelations among the measured variables

	2	3	4	5	6	7	8	9	10
1. Descriptive Norm	.39***	.03	.07	-.00	-.02	-.03	.07	.06	-.02
2. Injunctive Norm		.09	.24***	.10†	.09	.21***	.21***	.17**	.12*
3. Biospheric value			.08	.16**	.46***	.44***	.49***	.40***	.20***
4. Social Identification				.08	.11†	.16**	.13*	.15**	.08
5. Perceived Efficacy					.31***	.23***	.17**	.13*	.04
6. Perceived Threat						.65***	.46***	.34***	.18**
7. Concern							.49***	.37***	.16***
8. Intentions (Consumption)								.49***	.18**
9. Intentions (ECA)									.21***
10. Donation									-

Descriptive Norm and Injunctive Norm reported here are the measured variables. ECA = Environmental Citizenship and Activist, †p<.01, *p<.05, **p<.01, ***p<.001.

Table 5.6. Tests of moderated mediation hypotheses

Mediator Variable Model			
IV	Perceived Efficacy	Perceived Threat	Concern
	B(SE)	B(SE)	B(SE)
Injunctive Norm (Manipulation)	-.05(.06)	-.06(.06)	-.05(.07)
Descriptive Norm (Manipulation)	-.08(.06)	-.07(.06)	.11(.07)
Injunctive*Descriptive	-.02(.06)	.06(.06)	.13(.07)†
Social Identification	.05(.05)	.08(.05)	.17(.07)*
Biospheric Value	.13(.05)*	.42(.05)***	.52(.07)***
Gender	.25(.11)*	.20(.11)†	.30(.14)*
Age	-.01(.01)	.00(.01)	.01(.02)
F	2.64*	12.64***	12.81***
R^2	.06	.23	.24
N		297	
Dependent Variable Model			
	Intentions (C)	Intentions (ECA)	Donate
Perceived Efficacy	.01(.06)	-.01(.08)	-.10(.13)
Perceived Threat	.17(.08)*	.12(.10)	.17(.16)
Concern	.20(.06)***	.17(.08)*	.03(.12)
Injunctive Norm (Manipulation)	.02(.06)	-.07(.08)	-.10(.12)
Descriptive Norm (Manipulation)	.07(.06)	.00(.08)	-.09(.13)
Injunctive*Descriptive	-.03(.06)	.11(.08)	-.10(.12)
Social Identification	.02(.05)	.13(.07)†	.08(.11)
Biospheric Value	.34(.06)	.37(.08)***	.29(.13)*
Gender	.26(.11)*	.29(.15)†	.70(.25)**
Age	-.02(.01)	.02(.02)	-.02(.03)
F	16.39***	9.06***	$\chi 2 = 27.01$**
R^2	.36	.49	Cox & Snell (.09), Nagelkereke (.12)
N		297	
Conditional indirect Effects of Injunctive Norm on Behavioural Intentions (Consumption) at low and high Descriptive Norm			
Mediator	Descriptive Norm	Effect	95% CI
Perceived Efficacy	Low	.00	[-.02, .01]
	High	.00	[-.02, .01]

Index of moderated mediation		.00	[-.02, .02]
Perceived Threat	Low	-.02	[-.07, .00]
	High	-.00	[-.03, .03]
Index of moderated mediation		.02	[-.01, .09]
Concern	Low	-.04	[-.10, .00]
	High	.02	[-.02, .06]
Index of moderated mediation		.05	[.00, .14]

Conditional indirect Effects of Injunctive Norm on Behavioural Intentions (Environmental Citizenship and Activist) at low and high Descriptive Norm

Mediator	Descriptive Norm	Effect	95% CI
Perceived Efficacy	Low	.00	[-.01, .02]
	High	.01	[-.01, .03]
Index of moderated mediation		.00	[-.02, .02]
Perceived Threat	Low	-.02	[-.07, .01]
	High	-.00	[-.03, .02]
Index of moderated mediation		.01	[-.01, .08]
Concern	Low	-.03	[-.10, .00]
	High	.01	[-.01, .06]
Index of moderated mediation		.04	[.00, .13]

Conditional indirect Effects of Injunctive Norm on Donation at low and high Descriptive Norm

Mediator	Descriptive Norm	Effect	95% CI
Perceived Efficacy	Low	.00	[-.01, .06]
	High	.01	[-.01, .09]
Index of moderated mediation		.00	[-.02, .07]
Perceived Threat	Low	-.02	[-.11, .01]
	High	-.00	[-.06, .03]
Index of moderated mediation		.02	[-.01, .12]
Concern	Low	-.01	[-.09, .04]
	High	.00	[-.02, .06]
Index of moderated mediation		.01	[-.05, .12]

C = Consumption, ECA = Environmental Citizenship and Activist, †p<.10, *p<.05, **p<.01, ***p<.001. Confidence intervals are bias-corrected and based on 1,000 resamples (Preacher & Hayes, 2008).

H7: *Social identification significantly moderates the indirect effect of descriptive norms on climate change behaviour mediated by perceived efficacy, perceived threat and concern*[24]. The interaction between social identification and the descriptive norm

[24] The interaction between social identification and the norm manipulations, as well as the interaction between biospheric values and the norm manipulations, were tested in separate regression analyses

manipulation did not have a significant effect on perceived efficacy (B = .06, SE = .05, *p* = .293), perceived threat (B = .04, SE = .05, *p* = .508) or concern (B = -.06, SE = .07, *p* = .258). Further, the descriptive norm manipulation did not have a significant indirect influence on intentions to engage in pro-environmental consumption behaviours mediated by perceived efficacy (IMM[25] - B = .00, SE = .01, 95%CI: [-.01, .02]), perceived threat (IMM - B = .01, SE = .01, 95%CI: [-.01, .03]) or concern (IMM - B = -.01, SE = .02, 95%CI: [-.05, .01]) at any level of social identification. Similarly, the descriptive norm manipulation did not have a significant indirect influence on intentions to engage in pro-environmental citizenship and activist behaviours mediated by perceived efficacy (IMM - B = -.00, SE = .01, 95%CI: [-.02, .01]), perceived threat (IMM - B = .00, SE = .01, 95%CI: [-.01, .04]) or concern (IMM - B = -.01, SE = .02, 95%CI: [-.07, .01]) at any level of social identification. Lastly, the descriptive norm manipulation did not have a significant indirect influence on whether participants chose to donate to an environmental group mediated by perceived efficacy (IMM - B = -.01, SE = .01, 95%CI: [-.05, .01]), perceived threat (IMM - B = .01, SE = .01, 95%CI: [-.01, .07]) or concern (IMM - B = -.00, SE = .01, 95%CI: [-.04, .02]) at any level of social identification. This hypothesis was, therefore, not supported by the data.

H8: *Social identification significantly moderates the indirect effect of injunctive norms on climate change behaviour mediated by perceived efficacy, perceived threat and concern*. This hypothesis was not supported. The interaction between social identification and the injunctive norm manipulation did not have a significant effect on perceived efficacy (B = .04, SE = .05, *p* = .492), perceived threat (B = -.01, SE = .05, *p* = .777) or concern (B = -.04, SE = .07, *p* = .570). The injunctive norm manipulation also did not have a significant indirect influence on intentions to engage in pro-environmental consumption behaviours mediated by perceived efficacy (IMM - B = .00, SE = .00, 95%CI: [-.01, .01]), perceived threat (IMM - B = -.00, SE = .01, 95%CI: [-.04, .01]) or concern (IMM - B = -.01, SE = .02, 95%CI: [-.04, .02]) at any level of social identification. Likewise, the injunctive norm manipulation did not have a significant indirect influence on intentions to engage in pro-environmental citizenship and activist behaviours mediated by perceived efficacy (IMM - B = .00, SE = .01,

controlling for the other variables because PROCESS has no function for testing hypotheses regarding moderated mediation being conditional on multiple variables within the same test.

[25] IMM refers to the index of moderated mediation. This value represents the slope of the line relating an indirect effect to values of a moderator (see Hayes, 2015).

95%CI: [-.02, .01]), perceived threat (IMM - B = -.00, SE = .01, 95%CI: [-.04, .01]) or concern (IMM - B = -.01, SE = .02, 95%CI: [-.05, .02]) irrespective of participants level of social identification. Finally, the injunctive norm manipulation did not have a significant indirect influence on whether participants chose to donate to an environmental group mediated by perceived efficacy (IMM - B = -.00, SE = .01, 95%CI: [-.05, .01]), perceived threat (IMM - B = -.00, SE = .01, 95%CI: [-.05, .02]) or concern (IMM - B = -.00, SE = .01, 95%CI: [-.04, .02]) at any level of social identification.

H9: *The indirect influence of the interaction between descriptive and injunctive norms on climate change-related behaviour mediated by perceived efficacy, perceived threat and concern will be significantly moderated by social identification*. This hypothesis was not supported. The three-way interaction between social identification, the descriptive norm manipulation and the injunctive norm manipulation did not have a significant effect on perceived efficacy (B = -.02, SE = .05, p = .673), perceived threat (B = .01, SE = .05, p = .821) or concern (B = -.02, SE = .07, p = .809). Further, the indirect effects of the injunctive norm manipulation, moderated by the descriptive norm manipulation, on intentions to engage in pro-environmental consumption behaviour, intentions to engage in pro-environmental citizenship and activist behaviour and donation to an environmental group, mediated by perceived efficacy, perceived threat and concern were not significant at any level of social identification[26].

H10: *Biospheric values significantly moderate the indirect effect of descriptive norms on climate change behaviour mediated by perceived efficacy, perceived threat and concern*. This hypothesis was not supported by the data. The interaction between biospheric values and the descriptive norm manipulation did not have a significant effect on perceived efficacy (B = -.05, SE = .05, p = .357), perceived threat (B = .03, SE = .05, p = .579) or concern (B = -.02, SE = .07, p = .717). The descriptive norm manipulation also did not have a significant indirect influence on intentions to engage in pro-environmental consumption behaviours mediated by perceived efficacy (IMM - B = -.00, SE = .01, 95%CI: [-.01, .01]), perceived threat (IMM - B = .01, SE = .02, 95%CI: [-.02, .04]) or concern (IMM - B = -.01, SE = .02, 95%CI: [-.05, .03]) at any

[26] The statistics supporting this result are not reported here due to the extensiveness of the output generated by probing the effects of the independent variable at each level of the descriptive norm manipulation and the social identification at mean and mean ± 1SD.

level of biospheric values. Similarly, the descriptive norm manipulation did not have a significant indirect influence on intentions to engage in pro-environmental citizenship and activist behaviours mediated by perceived efficacy (IMM - B = .00, SE = .01, 95%CI: [-.01, .02]), perceived threat (IMM - B = .01, SE = .02, 95%CI: [-.02, .04]) or concern (IMM - B = -.01, SE = .02, 95%CI: [-.05, .04]) irrespective of participants level of biospheric value endorsement. Lastly, the descriptive norm manipulation did not have a significant indirect influence on whether participants chose to donate to an environmental group mediated by perceived efficacy (IMM - B = .00, SE = .01, 95%CI: [-.01, .04]), perceived threat (IMM - B = .01, SE = .02, 95%CI: [-.02, .07]) or concern (IMM - B = -.00, SE = .01, 95%CI: [-.04, .02]) at any level of biospheric values.

H11: *Biospheric values significantly moderate the indirect effect of injunctive norms on climate change behaviour mediated by perceived efficacy, perceived threat and concern*. The interaction between biospheric values and the injunctive norm manipulation did not have a significant influence on perceived efficacy (B = -.07, SE = .05, p = .188), perceived threat (B = .06, SE = .05, p = .234) or concern (B = -.01, SE = .07, p = .922). Further, the injunctive norm manipulation did not have a significant indirect effect on intentions to engage in pro-environmental consumption behaviours mediated by perceived efficacy (IMM - B = -.00, SE = .01, 95%CI: [-.02, .01]), perceived threat (IMM - B = .02, SE = .02, 95%CI: [-.01, .06]) or concern (IMM - B = -.00, SE = .02, 95%CI: [-.04, .04]) at any level of biospheric values. Likewise, the injunctive norm manipulation did not have a significant indirect influence on intentions to engage in pro-environmental citizenship and activist behaviours mediated by perceived efficacy (IMM - B = .00, SE = .01, 95%CI: [-.01, .02]), perceived threat (IMM - B = .01, SE = .02, 95%CI: [-.01, .06]) or concern (IMM - B = -.00, SE = .02, 95%CI: [-.04, .04]) irrespective of participants level of biospheric values. Finally, the injunctive norm manipulation did not have a significant indirect influence on whether participants chose to donate to an environmental group mediated by perceived efficacy (IMM - B = .01, SE = .01, 95%CI: [-.01, .04]), perceived threat (IMM - B = .02, SE = .02, 95%CI: [-.01, .08]) or concern (IMM - B = -.00, SE = .01, 95%CI: [-.03, .02]) at any level of biospheric values. Thus, this hypothesis was not supported.

H12: *The indirect influence of the interaction between descriptive and injunctive norms on climate change-related behaviour mediated by perceived efficacy, perceived threat*

and concern will be significantly moderated by biospheric values. This hypothesis was partially supported by the data. The three-way interaction between biospheric values, the descriptive norm manipulation and the injunctive norm manipulation did not have a significant effect on perceived efficacy (B = -.08, SE = .05, *p* = .146), perceived threat (B = -.06, SE = .05, *p* = .252), but it had a significant effect on concern (B = -.18, SE = .07, *p* = .008). Additionally, the indirect effects of the injunctive norm manipulation, moderated by the descriptive norm manipulation, on intentions to engage in pro-environmental consumption behaviour, intentions to engage in pro-environmental citizenship and activist behaviour and donation to an environmental group, mediated by perceived efficacy and perceived threat were not significant at any level of biospheric values[27].

Further investigation of the three-way effect of biospheric values, the descriptive norm manipulation and the injunctive norm manipulation on concern revealed that the injunctive norm manipulation had a positive indirect effect on intentions to engage in pro-environmental consumption behaviour, mediated by concern, when descriptive norm was high and biospheric value was low[28] (B = .09, SE = .05, 95% CI: [.00, .21]), but it also had a negative indirect influence, mediated by concern, on intentions to engage in pro-environmental consumption behaviour when both descriptive norm and biospheric value were low (B = -.10, SE = .06, 95%CI: [-.24, -.01]). This demonstrates that the indirect effect of the interaction between the descriptive and injunctive norm conditions on intentions to engage in pro-environmental consumption behaviour conveyed via concern was moderated by biospheric value (ICMM[29] - B = -.10, SE = .05, 95%CI: [-.21, -.03]). Similarly, the injunctive norm manipulation had a significant positive indirect effect on intentions to engage in environmental citizenship and activist behaviours, mediated by concern, when descriptive norm was high and biospheric value was low (B = .08, SE = .05, 95%CI [.00, 20]). However, the injunctive norm manipulation had significant negative effects on intentions to engage in environmental citizenship and activist behaviours, mediated by concern, when descriptive norm was low and biospheric value was low (B = -.09, SE = .05, 95%CI: [-.23, -.01]), as well as

[27] The statistics supporting this result are not reported here due to the extensiveness of the output generated by probing the effects of the independent variable at each level of the descriptive norm manipulation and biospheric values at mean and mean ± 1SD.
[28] A low level of biospheric values is represented as the mean -1SD.
[29] ICMM refers to the index of conditional moderated mediation (see Hayes, 2014).

when descriptive norm was low and biospheric norm was at the mean level (B = -.05, SE = .03, 95%CI: [-.13, -.00]). Again, this shows that the effect of the interaction between the descriptive and injunctive norm manipulation mediated by concern was moderated by biospheric value (ICMM – B = -.09, SE = .04, 95%CI: [-.20, -.02]). The indirect influence of the interaction between descriptive and injunctive norm manipulation, mediated by concern, on donation to an environmental group was not significant at any level of biospheric value (ICMM – B = -.02, SE = .05, 95%CI: [-.15, .06]).

Discussion

The findings in Study 8 were not wholly replicated in Study 9. Here I found no significant indirect links between the two types of social norms and behaviour or behavioural intentions mediated by perceived efficacy and perceived threat. Further, contrary to prior findings (Rimal, 2008; Terry & Hogg, 1996), participants' level of identification with the referent group did not moderate the influence of the descriptive and injunctive norms on climate change perceptions, nor their mediated influence on behaviour and behavioural intentions. However, this study produced an intriguing, and novel finding concerning the role of biospheric value as a moderator of the mediated influence of the interaction between descriptive and injunctive norms on participants' intentions to act pro-environmentally.

I found that injunctive norms had a significant positive influence on pro-environmental behavioural intentions, conveyed via concern, when descriptive norms are high and biospheric value is low. This suggests that, given a belief that most other group members are acting pro-environmentally, people with a low level of intrinsic value-driven motivation, may be significantly influenced to engage in pro-environmental behaviour by perceived social expectations. This finding is somewhat related to my observation in Chapter 4 (Study 4) that people with low biospheric values were more likely to exhibit a change in their perception of the threat posed by climate change as a consequence of imagining an experience of flooding.

On the other hand, among participants who had low biospheric values, and who were exposed to the low descriptive norm manipulation, the indirect influence of injunctive norm on behavioural intentions mediated by concern was negative. In other words, the perception that others are not acting pro-environmentally, combined with a low level

of intrinsic value-driven motivation to act, resulted in people expressing less concern about climate change and lower intentions to act pro-environmentally in response to perceived social expectations. There is a considerable amount of pre-existing evidence that people are likely to act in ways that violate the injunctive norm when they perceive the majority of others to be doing the same (i.e. when descriptive norm is unsupportive) (e.g., Keizer, Lindenberg, & Steg, 2011; Smith, Louis, & Abraham, 2017). Some authors have explained this as an indication that injunctive norms are more easily disrupted than descriptive norms because a greater degree of self-regulation may be required to conform with injunctive norms (Jacobson, Mortensen, & Cialdini, 2011; Jacobson, Mortensen, Jacobson, & Cialdini, 2015; J. R. Smith et al., 2017). In line with this view, the results of the current study also suggest that the extent to which people personally prioritize environmental issues play a role in determining their responses to conflicting social norms regarding environmental actions. Although, previous studies have linked the moderating effects of self-regulation on norm-compliance directly to behaviour (Jacobson et al., 2015), the findings of the current study show that the moderating effect of biospheric values on the influence of the interaction between descriptive and injunctive norms on behavioural intentions is conveyed via affective engagement with climate change (concern). It appears that for people with low biospheric values, unsupportive descriptive norm does not simply reduce the effect of injunctive norm conveyed by concern as I predicted (H9); rather, it inverts the indirect influence of the injunctive norm, causing people to be de-motivated to act.

However, there is a key methodological issue that must be taken into account in interpreting these findings. Although the descriptive and injunctive norm manipulations successfully shifted participants' perception of the prevailing descriptive and injunctive norm, there was also a level of dependence in the effect of the manipulations insofar that the descriptive norm manipulation also had a significant effect on perceived injunctive norms. Therefore, it is not possible to completely disentangle the effects of the injunctive norm on concern, behaviour and behavioural intentions from those of the descriptive norm; as individuals may plausibly have been responding to the effects of the descriptive norm conveyed through their perception of the injunctive norm. This harks back to Thøgersen's (2008) observation on the methodological difficulty inherent in isolating the effects of the two types of norm. Further research employing alternative methods of manipulating and measuring descriptive norms (e.g., anchoring; see

Bohner, Siebler, & Schmelcher, 2016; Eyssel, Bohner, & Siebler, 2006) will be necessary to substantiate the findings of this study.

A second consideration pertains to the absence of a significant interaction between social identification and social norms in their influence on climate change perceptions and behaviour or behavioural intentions. Previous studies in which social/group identification has been found to have a moderating effect on the link between social norms and behaviour have typically invoked a reference group that is clearly relevant to the specific behaviour(s), such as 'students' and 'drinking on campus' (e.g., Rimal, 2008). However, in the current context, there are no clear grounds to assume that identification as a 'student' is necessarily a salient social category regarding participants' evaluation of climate change or environmental issues in general. Considering that the implications and politics of climate change transcend the participants' situation as 'students' and may include other roles and categories such as being 'a young adult' or 'a British citizen' or 'a member of society' or a 'political liberal'; each with its own unique set of associated norms and expectations, there are a variety of plausible social referents that may be more relevant to participants' judgments and actions concerning climate change than 'other students at St Andrews'. Therefore, social identification may have had no effect on participants' perceptual and behavioural responses to the perceived norms because the referent group may not have been particularly salient in the context of the focal issue. Nonetheless, as described above, the interplay between descriptive and injunctive norms may still have influenced behaviour and intentions through concern to the extent that individuals did, or did not, already have a level of intrinsic disposition to engage with environmental issues.

General discussion

The purpose of this research was to examine the effect of the interaction between descriptive and injunctive norms with regard to climate change perceptions and behaviour. Drawing from the existing literature on the role of social influence in shaping behaviour across a variety of domains, I developed a number of hypotheses regarding how the independent and interactive influence of descriptive and injunctive norms on climate change-related behaviour are conveyed via perceived efficacy, perceived threat and concern. I also hypothesized that the independent and interactive

indirect influence of the two types of norms on behaviour is moderated by identification with the referent group and biospheric values. I tested these hypotheses in two studies.

The empirical literature addressing the direct effects of social norms on behaviour and intentions is extensive (see Abrahamse & Steg, 2013; Allcott, 2011; Farrow et al., 2017; Rivis & Sheeran, 2003 for reviews), but empirical research engaging with mediators of the effects of social norms is less so. In the environmental domain, perceived efficacy/effectiveness or control beliefs are the most commonly considered mediators of the effect of social norms on behaviour and intentions (e.g., McDonald et al., 2013; Thøgersen, 2014). To my knowledge, the current research is first to consider how perceived threat and concern may also convey the indirect influence of descriptive and injunctive norms on behaviour.

In Study 8, I found that perceived efficacy, perceived threat and concern significantly mediated indirect links between descriptive and injunctive norms and self-reported pro-environmental behaviour and intentions in a large cross-national student sample. This supports my hypotheses (H1, H3, H5), that the actions and expectations of key social referents significantly affect people's perceptions and feelings regarding climate change, and through this process, they also affect behavioural responses to the issue. As discussed earlier in this chapter, people often look to the actions of others for guidance on what is the appropriate course of action in a given situation (Cialdini & Trost, 1998). The findings from Study 8 suggest that the information gleaned from perceived prevailing social norms do not only have a direct link with intentions and behavioural responses to climate change, but they also contribute to a sense of the threat posed by climate change, affective responses, and beliefs about individual capacity to engage in mitigation action, with these beliefs and affective responses in turn contributing to a motivation to act.

However, contrary to my hypotheses (H2, H4, H6), the interaction between descriptive and injunctive norms was not significantly linked with perceived efficacy, perceived threat or concern, nor did these beliefs and affective response mediate an indirect link between the interaction of the two types of norm and behaviour or intentions in Study 8. This finding could be interpreted as an indication that descriptive and injunctive norms exert independent influences on climate change perceptions and behaviour; whereby people may be motivated to act by the perception that key social referents are

doing the same, even if such action is not associated with the prospect of social approval or disapproval, or people may also act in line with social expectations irrespective of a belief that key social referents are not conforming with the injunctive norm. As indicated by prior research (McDonald et al., 2013), the latter is particularly likely among people who have strong attitudes toward the issue and interpret the lack of action by others as a need for them to take personal action.

Study 9 was designed to address some of the shortfalls in Study 1. Here, I addressed how identification with the referent group, and personal biospheric values, may moderate the effect of descriptive and injunctive norms, and their interaction, on perceived efficacy, perceived threat, concern and behavioural responses. In contrast to Study 8, there were no significant effects of the descriptive and injunctive norms, or their interaction, on the beliefs and concern regarding climate change nor were there any significant indirect effects on intentions and behaviour in Study 9. Further, my hypotheses regarding the moderating effects of social identification on the influence of descriptive norms on climate change beliefs, concern and behaviour were not supported (H7, H8, H9). A key consideration for the lack of an effect of the social norm manipulations, and their interaction with social identification, on beliefs, concern and behavioural responses to climate change pertains to the nature of participants' relationship with the reference group.

As discussed above, the 'student' category may not be the most relevant norm referent for the participants in the context of climate change. If this was the case, then it would explain why the actions and expectations of this group would likely not have a strong effect on how the participants evaluate and act in response to climate change, regardless of the extent to which they identify with the group. In addition to this, research by Masson and Fritsche (2014) suggests that different dimensions of identification can have different moderating effects on norm adherence. In this regard, they showed that self-investment (i.e. the importance of, and satisfaction with, the group) in the group significantly moderated the link between perceived group norms and climate change-related behavioural intentions, while self-definition (i.e. perceived similarities with other members of the group) did not. Individuals who were more self-invested in the group adhered more strongly to climate change-related group norms than those who were less self-invested. Considering different aspects of identification with the

'student' category in Study 9 may have helped better elucidate how identification moderates the effects of descriptive and injunctive norms on climate change-related beliefs, concern and behavioural responses.

The three-way interaction effect between descriptive and injunctive norms and biospheric values on concern, and the conditional moderated mediation effect on behavioural intentions revealed in Study 9 are an intriguing and novel finding. It appears that congruence between descriptive and injunctive norms supportive of pro-environmental behaviour are a potent source of motivation for individuals with low intrinsic value-driven motivation to act. Whereas, incongruence between the two types of norms - particularly when descriptive norms are perceived to be negative, had a negative indirect effect on pro-environmental intentions, mediated by concern, when intrinsic value-driven motivation was average or low. As discussed in the introduction to this chapter, norm incongruence might indicate to individuals that group attitudes[30] toward the issue are weak, and thereby have a de-motivating effect. The results of Study 9 suggest that individuals who personally place a high priority on pro-environmental outcomes (as represented by the strength of their biospheric values) may be more impervious to this de-motivating influence of norm incongruence, while those who place a low priority on pro-environmental outcomes may respond to norm incongruence with reduced concern about climate change and lower motivation to act pro-environmentally. It is important to note, however, that this effect did not extend to participants' decision to donate to an environmental group.

Overall, the studies detailed in this chapter indicate that descriptive and injunctive norms can exert significant indirect influences on climate change-related behaviours and behavioural intentions through their influence on personal beliefs and affective responses to the issue. Incongruence between the two types of norms may also have a de-motivating indirect effect among individuals who do not personally have strong pro-environmental values. However, further research addressing how different dimensions of identification with the referent group affect norm adherence, and moderate the effects of incongruent social norms, is needed to shed more light on the conditions in which individuals are most likely to be motivated by social influence to act pro-

[30] Here, again, the notion of attitude as the degree of difficulty or costs individuals are willing to accept in order to achieve an outcome or attitudinal goal is most relevant (Kaiser et al., 2010).

environmentally. Additionally, as discussed earlier, the independent effects of descriptive and injunctive norms cannot be absolutely disentangled in Study 9. While the injunctive norm manipulation only had an effect on perceived injunctive norms, the descriptive norm manipulation affected both perceived descriptive and injunctive norms. Quite reasonably, people often infer the prevailing social expectations from what is commonly done by relevant others. This means that the effects of injunctive norms on perceptions and behaviour may also partially reflect indirect effects of descriptive norm mediated by injunctive norm. Therefore, it is necessary to attempt replications of the findings from Study 9 in subsequent research using methods that can more reliably ensure the independence of the manipulation of the two types of norms.

Chapter 6

General discussion and conclusion

Through activities such as fossil fuel consumption, agriculture and industrial processes that release greenhouse gases into the atmosphere, humanity has effected unprecedented changes in the global climate system. As discussed in Chapter 1, global climate change is associated with a variety of environmental phenomena including sea level rise, loss of polar ice, ocean acidification and an increase in the frequency of extreme weather events (IPCC, 2007b; Swim et al., 2009). Together, these manifestations of adverse environmental change pose a severe threat to continued human prosperity, security and wellbeing, as well as the ecological systems that support life on earth. However, while the implications of global climate change may seem overwhelming, there are great opportunities for developing effective solutions to the problem in tackling the underlying causal human actions.

Over the last few decades, psychologists have made a remarkable degree of progress in uncovering some of the key factors that facilitate and impede active public engagement with issues relating to environmental change (Nickerson, 2003). The purpose of this thesis was to draw on this accumulated body of knowledge in examining the way attitudinal and behavioural responses to global climate change are determined by intrapersonal psychological factors, and influences arising from the external social and physical environment. Although it is widely recognized that environmental behaviour is influenced by external (e.g., sanction, prompts), interpersonal (e.g., social comparison), and personal influences (e.g., values, beliefs) (Gifford et al., 2011), only a minority of research in psychology has addressed the interactions between these different spheres of influence. The current research was conceived to contribute to addressing this shortfall by assessing the way information emanating from the external environment in the form of information campaigns, extreme weather events and social norms interact with individuals' values, beliefs and emotions in predicting their behavioural responses to global climate change.

I articulated the relationships between the external and internal psychological influences on behavioural engagement with global climate change within an integrative framework based on Bandura's (1986) model of triadic reciprocal determinism. The

studies reported in Chapters 2, 3, 4 and 5 of this thesis examined different aspects of this framework with a specific focus on how externally generated climate change information, experiences with extreme weather and perceived social norms exert indirect influences on climate change-related actions and intentions. In subsequent sections of this chapter, I present summaries of the key findings from each chapter, and follow this with a general discussion of the contributions of the thesis, the limitations of the current research and directions for future research.

Chapter 2: Summary of results

In Chapter 2, I revisited the effect of knowledge and information campaigns as a source of motivation for engagement in pro-environmental behaviour. Several authors have previously argued that knowledge is only weakly linked to behaviour (Abrahamse et al., 2005; Mckenzie-Mohr, 2000), and that informational strategies often fail to produce significant changes in environmental attitudes (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009). However, there are number of reasons why this should not necessarily be taken as an indication that the role of knowledge in the causal antecedence of pro-environmental behaviour is negligible.

Firstly, individuals need to be aware of environmental problems and have a knowledge of potential response options before they can act. On this basis, some authors have argued that it is not just the amount of knowledge, but the convergence of different forms of knowledge, that determines behaviour (Kaiser & Fuhrer, 2003). Secondly, knowledge delivered through awareness campaigns may be crucial for alerting the public when the evidence of environmental problems is not readily perceptible to the lay observer, as is the case with historical weather patterns and anthropogenic climate change (Rasool & Ogunbode, 2015). Thirdly, problematic conceptualizations of knowledge and a pervasive focus on its direct links with behaviour may have contributed to a systematic neglect of the ways in which knowledge contributes indirectly to environmental behaviour through its influence on individuals' beliefs and affective responses to environmental problems (Carmi et al., 2015; Kaiser & Fuhrer, 2003). Lastly, the observed weak links between knowledge and pro-environmental behaviour have been largely based on studies of European and North American societies. Whereas, there is yet to be a systematic assessment of the effects of

knowledge on environmental behaviour in other parts of the world where awareness of environmental problems may be generally lower than in western societies.

Advancing from this background, I conducted three studies designed to examine the link between exposure to climate change information and behavioural engagement with climate change in two sub-Saharan African countries. Drawing from the knowledge-deficit and threat and coping appraisal approaches, I hypothesized that exposure to climate change information exerts an indirect influence on intentions to engage in climate change-related pro-environmental behaviour that is serially mediated by knowledge of the causes and consequences of climate change and perceived threat. I also hypothesized that the indirect link between exposure to information and behavioural intentions is serially mediated by knowledge and concern about climate change.

In Study 1, I found support for both hypotheses in a sample of Nigerians. While exposure to information did not have a significant indirect link with willingness to protest against government inaction on climate change or willingness to pay higher taxes to address climate change, it had a significant relationship with knowledge of climate change causes and consequences, which was conveyed through to the behavioural indicators through perceived threat and concern. In Study 2, I also found support for both hypotheses in a sample of South Africans. Here, again, exposure to information had no direct relationship with willingness to protest against government inaction or willingness to pay higher taxes to address climate change, but it was directly linked to climate change knowledge which along with perceived threat and concern serially mediated an indirect link with the behavioural indicators.

A major limitation of Study 2 was the low reliability of the knowledge measure. In addition to this, Both Study 1 and 2 involved a measure of exposure to information which only required participants to report the frequency of their encounter with climate change information. Considering this measure provided no indication of the nature and quality of information that was being encountered, factors which might play a role in determining how individuals are affected by the information, I conducted a third study examining the effect of information on climate change knowledge, perception and action intentions using experimental methods. In Study 3, I randomly assigned 83 South African participants to one of two experimental conditions. In one condition (control),

they were simply presented with a technical definition of climate change. In a second condition (information), they were presented with the climate change definition, as well as a brief description of the causes and consequences of climate change. Both groups were presented with the climate change definition to ensure that all participants in the experiment had the same concept of climate change in mind when they subsequently answered questions about their perceptions and attitudes toward the issue.

The information condition did not produce a significant difference in participants' knowledge of climate change causes. However, it had a significant effect on knowledge of the consequences of climate change which in turn conveyed this to willingness to act through perceived threat, supporting my first hypothesis. Knowledge of climate change consequences and concern did not serially mediate a significant indirect effect of the experimental manipulation on willingness to act pro-environmentally in response to climate change. The information condition did not have a significant direct effect on perceived threat, concern or willingness to engage in pro-environmental behaviour

Theoretical and practical implications

Together, the studies reported in Chapter 2 illustrate the argument that much of the contribution of knowledge to pro-environmental actions is conveyed indirectly via more proximate predictors of behaviour such as beliefs and affective responses. This understanding is particularly important in contexts like sub-Saharan Africa where climate change awareness is still generally low and calls have been repeatedly made in both academic and policy circles for greater investment in efforts aimed at educating the public about the implications of climate change. Another key issue highlighted in Chapter 2 pertains to the methodological difficulty inherent in reliably operationalizing a measure of knowledge in contexts where knowledge of the focal issue is low. The knowledge measure employed in Study 1 only achieved the minimum threshold of internal consistency deemed acceptable for theory testing (α = .60: Nunnally & Bernstein, 1994), while the measure used in Study 2 failed to attain this threshold. Better levels of reliability were achieved using the measures of climate change cause and consequences knowledge previously validated by van der Linden (2014b), but even these fell markedly below the levels of reliability observed in applications of these measures in Western contexts (α >.70; e.g., van der Linden, 2015). These observations reflect the need for more research focused on addressing public understanding of

climate change in African contexts with a view to developing validated measures that can be used to map the distribution of climate change knowledge among African citizens.

Chapter 3: Summary of results

In Chapter 3, I addressed the link between people's experiences with extreme weather and their attitudes toward climate change. Specifically, I focused on the link between local flood experience, climate change perceptions and preparedness to reduce energy use. Previous research regarding the effects of flooding experience on climate change attitudes in the UK has produced mixed evidence. While some studies showed that experience of local flooding positively predicts perceived threat, concern about climate change and willingness to act-pro-environmentally (e.g., Demski, Capstick, Pidgeon, Sposato, & Spence, 2017; Spence, Poortinga, Butler, & Pidgeon, 2011; Taylor, de Bruin, & Dessai, 2014), others have indicated that there is no significant relationship between flood experiences and climate change attitudes (e.g., Whitmarsh, 2008). I argue in Chapter 3 that this seeming inconsistency in the literature may be due in part to a failure to account for the role of intervening influences that moderate the link between extreme weather experiences and climate change attitudes.

As discussed in Chapter 1, one of the ways values shape our beliefs is by driving us to selectively attend to information based on their congruence with our values. Previous research has shown that shared values can give rise to systematic social biases in the processing of climate change information, whereby people with shared values, reflected by their membership in political or ideological groups, may be more sceptical or less willing to accept the scientific consensus on the reality of climate change (Bruine de Bruin et al., 2014; Kahan, 2013; McCright & Dunlap, 2011; Whitmarsh, 2011). Based on evidence from previous research (Cutler, 2016; L. C. Hamilton, 2011; McCright & Dunlap, 2011), I hypothesized that politically right-leaning individuals are less likely to see a link between flooding and climate change, and that the link between flood experience and climate change attitudes may be weaker among politically right-leaning than politically left-leaning individuals.

I tested these hypotheses using data previously presented by Spence et al. (2011) which showed a positive link between local flooding experience and climate change attitudes in the UK. My re-analysis of the data revealed that left-leaning voters were more likely

to report having noticed signs of climate change in their lifetime and cite flooding when asked what signs they had noticed. Further, I found that a model linking flood experience indirectly with preparedness to reduce energy use and pay higher prices for energy efficient products was not equivalent for left- and right-leaning voters. While flood experiences had an indirect link with preparedness to reduce energy use, which was significantly mediated by perceived instrumentality, concern and perceived vulnerability, among left-leaning voters, this link was not observed among right-leaning voters. However, flood experience had a significant indirect link with willingness to pay higher prices for energy efficient products among both left- and right-leaning voters, but this indirect link was stronger among left-leaning voters. These results provided some support for my predictions that political affiliation significantly covaries with the likelihood that people see a link between flooding and climate change, and the extent to which their experiences with flooding is likely to be linked with positive attitudes toward climate change.

Theoretical and practical implications

The primary theoretical implication of the results obtained in Chapter 3 pertains to its indication of variation in the way people with different political loyalties process their experiences with extreme weather in the context of climate change. A great deal of existing research has simply investigated associations between climate change attitudes and objective exposure to extreme weather, or self-reported experiences of extreme weather deemed to be connected with climate change (e.g., Bruine de Bruin, Wong-Parodi, & Morgan, 2014; Spence et al., 2011), without explicit analyses of individual differences in the interpretation of these experiences and the consequences of different interpretations for subsequent motivation to address climate change. My findings suggest that greater attention needs to be directed at:

(1) assessing plausible differences in the psychological routes through which extreme weather experiences are linked with climate change engagement. For example, I observed that flooding experience was indirectly linked to willingness to pay higher prices for energy efficient appliances via perceived instrumentality among left-leaning voters, and via perceived vulnerability among right-leaning voters.

(2) understanding how these differences may determine the way people draw on their experiences with events such as flooding as a motivational basis to act on climate change.

A practical implication of the results obtained in Chapter 3 is that simply drawing a link between extreme weather and climate change is unlikely to be a broadly effective strategy for promoting public engagement with climate change. Communication strategies that draw on extreme weather experiences as a means of changing climate change attitudes and galvanizing action need to be tailored to the values and motives of specific segments of the general population (Moser & Dilling, 2004). Such communication can only be truly effective if it is guided by an understanding of the processes by which people manage and change their behaviours (Pelletier & Sharp, 2008).

Audience segmentation research in the health risk communication domain shows that communications that target recipients' belief about their self-efficacy are typically more effective in eliciting attitude and behaviour change (Bostrom, Böhm, & O'Connor, 2013), and this observation may also apply to in the climate change context to an extent as I found that the indirect influence of flooding experiences on preparedness to reduce energy use and pay more for energy efficiency was most strongly conveyed via perceived instrumentality among left-leaning individuals. In other words, messages that draw on flooding experiences and emphasize the efficacy of individual action to help address climate change may prove to be effective among the left-leaning demographic.

On the other hand, perceived instrumentality did not mediate a link between flooding experience and preparedness to reduce energy use or pay more for energy efficiency among right-leaning individuals. But, there was evidence of a mediated indirect link between flooding experience and preparedness to pay more for energy efficacy via perceived local vulnerability to climate change impacts among this demographic. Drawing on prior research showing that climate change deniers may be driven to support climate policy by framing climate change mitigation with an emphasis on positive societal outcomes (Bain et al., 2012), it seems plausible that messages that frame flooding events to climate change and negative social impacts may also be effective in eliciting motivation to engage in mitigation actions among politically right-leaning individuals.

Chapter 4: Summary of results

In Chapter 4, I sought to build on the findings reported in Chapter 3 by exploring the role of values and attribution in the link between flood experience and climate change attitudes. Due to the practical constraints inherent in operationalizing actual flood experiences for experimental purposes, flood experience was operationalised in the series of studies presented in Chapter 4 using mental simulation. Drawing on prior research from various fields of psychology showing that imagined situations can elicit similar effects as real-life experiences on cognition, affective responses and behaviour (Crisp et al., 2011; Greenwood, 1989; Ji et al., 2016), I expected that the attitudinal consequences of real flood experiences may be recreated with mentally simulated personal experiences of flooding. Therefore, I hypothesized that a mentally simulated experience of flooding will have positive effects on perceived threat from climate change, concern and perceived efficacy, and that these factors would mediate an indirect effect of the mentally simulated flood experience on behaviour and intentions. Further, I hypothesized that any indirect effects of a mentally simulated flood experience on behaviour mediated by perceived threat, concern and efficacy would be greater among individuals with stronger biospheric values. I tested these hypotheses by comparing people asked to imagine themselves as victims of a severe flooding event with a group who had been asked to imagine a neutral outdoor scene

These hypotheses were not supported in Study 4. However, I found that the imagined flood experience had a significant positive effect on perceived threat after controlling for biospheric values, past flood experience, gender and age. Additionally, there was a significant interaction between the imagined flood experience and biospheric values, whereby the mentally simulated flood experience had a significant effect on perceived threat among individuals with low levels of biospheric values but not those with high levels.

In Study 5, I attempted to address some of the shortfalls of Study 4. Based on previous research suggesting that the vividness and psychological impacts of mental imagery may be enhanced by allowing people to generate their own imagery (Krans et al., 2010), the imagined flood experience task was presented in Study 5 with no accompanying images. Further, I made no indication in the manipulation of a link between climate change and flooding event described.

I found no support for my hypotheses in Study 5. The imagined flood experience had no significant effects on perceived threat, concern or perceived efficacy nor did these factors significantly mediate an indirect link between the mentally simulated flood experience and the pro-environmental behaviour indicator (donation to an environmental group). When I split the participants assigned to the imagined flood experience condition into groups of those who attributed the imagined flood to climate change and those who did not, I found that attribution had a moderating influence on the effect of the imagined flood experience condition.

In this respect, I found that participants who thought the imagined flood may have been linked to climate change reported greater levels of perceived threat and concern than participants in the control group, while those who did not think the imagined flood was likely to have been linked to climate change reported a lower level of perceived threat than participants in the control group. However, perceived threat, concern and perceived efficacy did not significantly mediate an indirect relationship between the imagined flood experience and the behaviour indicator regardless of whether participants thought the flooding may have been linked to climate change. A key limitation of Study 4 and 5 is that no account was taken of pre-existing levels of scepticism among the participants which could have reduced the effectiveness of the imagined flood experience manipulation. Additionally, participants in the control group did not receive any information about the flood so there was no way to account for variability in their inclination to attribute the event to climate change across the sample.

In Study 6, I addressed the limitations of the previous studies. I accounted for pre-existing scepticism, and measured attribution of the flooding event across the sample. Further, I hypothesized that attribution would moderate the effect of the imagined flood experience on perceived threat, concern and perceived efficacy, as well as any indirect effects conveyed through these factors to behavioural intentions. I found that the imagined flood experience did not have a significant effect on perceived threat or perceived efficacy, but the effect on concern was trending towards significance. Further, the imagined flood experience had significant indirect effects on pro-environmental behavioural intentions mediated by concern but not by perceived threat or perceived efficacy. The indirect link between the mentally simulated flood experience and behavioural intentions mediated by concern was not significantly

moderated by attribution. There are no obvious reasons why the imagined flood experience manipulation failed to produce an effect on most of the dependent variables in Study 6. However, seeing as attribution significantly predicted all the dependent variables, I conducted another experiment exploring the extent to which a direct manipulation of participants' attribution of the flood event would influence the effect of the imagined flood manipulation on climate change attitudes.

In Study 7, I hypothesized that participants who attributed the mentally simulated flood to climate change would report higher levels of perceived threat and concern than those in the control group. I also hypothesized that trust in scientists would significantly interact with the manipulation, such that the effects of the manipulation would be strongest among participants with the highest levels of trust in scientists as a source of climate change information. Like the prior studies, the imagined flood experience did not have a significant main effect on perceived threat, concern or perceived efficacy regardless of whether participants attributed the flood to climate change in Study 7. However, there was a significant interaction between the manipulation and trust in scientists. Further examination of this interaction revealed that the climate change-attributed imagined flood experience only had a significant positive indirect effect on behavioural intentions mediated by concern among participants with a high level of trust in scientists. Whereas, the dis-attributed imagined flood experience had significant positive indirect effects on behavioural intentions mediated by concern and perceived efficacy among participants with low trust in scientists, and a negative indirect effect mediated by perceived efficacy on behavioural intentions among those with a high level of trust in scientists. The results of Study 7 show that when the mentally simulated flooding experience was considered in the context of scientific statements regarding the involvement of climate change, the effect of attributing or not attributing the event to climate was dependent on the extent to which individuals see scientists as a trustworthy source of information.

Theoretical and practical implications

The findings presented in Chapter 4 provided some support for my prediction that mentally simulated flooding experiences may elicit similar attitudinal and perceptual responses as actual flooding experiences. However, this support was not consistently found across the four studies detailed in the chapter. Nonetheless, my findings have an

important theoretical implication pertaining to the use of mental simulation techniques as a method of exploring the role of mental imagery in public engagement with climate change. The results obtained in studies 4, 5 and 7 indicate that, depending on individuals' values, attribution of the flooding event envisioned and trust in scientists as a source of climate change information, mentally simulated flooding experiences can exert a significant influence on concern, perceived threat and perceived efficacy regarding climate change with subsequent implications for intentions to engage in mitigation behaviour. This pattern of observations provides a link between previous research in cognitive psychology that has traditionally explored the effects of affectively charged mental images on attitudinal and behavioural outcomes with environmental research addressing the cognitive processing of weather experiences as a source of information on climate change.

This link represents an avenue to draw on the two areas of research in developing and investigating further questions regarding the psychological processes involved in the encoding of climate change-related mental imagery from personal experiences and how such mental imagery operates as an influence on climate change perceptions and attitudes. For example, a question that arises from the current research pertains to the moderating influence of biospheric values in the link between mentally simulated flood experience and perceived threat from climate change. In this regard, it is would be informative to determine the specific role of biospheric values in this link by exploring the likelihood that people are motivated by their values to construct such mental images from their experiences that bolster pre-existing views on the threat posed by climate change and inclination to act, or an alternative possibility that biospheric values simply amplify the link between mental imagery and perceived threat by increasing the salience and accessibility of mental imagery of plausible climate change impacts.

Mentally simulated flood experiences may have some potential as a practical means of influencing perceived threat and concern regarding climate change. However, a considerable amount of research is still necessary to determine the specific set of parameters that define the extent and limit of the applicability of this strategy in real-world settings.

Chapter 5: Summary of results

In Chapter 5, I focused on how perceived descriptive and injunctive norms shape individuals' responses to climate change. Specifically, I addressed the independent and interactive effects of descriptive and injunctive norms on perceived threat change, concern and perceived efficacy regarding climate change. I also addressed how the interactive influence of the two types of norms on climate change-related behaviour and intentions may be mediated by perceived threat, concern and perceived efficacy. There is an extensive literature showing that both descriptive and injunctive norms have direct and indirect effects on environmental behaviour (e.g., Andersson & von Borgstede, 2010; Göckeritz et al., 2010; Goldstein, Cialdini, & Griskevicius, 2008; Klöckner, 2013). However, there are conflicting findings on the effects of incongruence between the two types of norm on attitudes and behaviour. Rimal and Real (2003) proposed that injunctive norms moderate the influence of descriptive norms such that the effects of descriptive norms on behaviour are strongest when injunctive norms are supportive and they are reduced when injunctive norms are unsupportive.

This hypothesis has been supported in the environmental domain by prior studies showing that self-reported conservation behaviours among a sample of California residents were at their highest when both perceived descriptive norms and injunctive norms were supportive, but they were significantly reduced when perceived descriptive norms were supportive and perceived injunctive norms were unsupportive (Göckeritz et al., 2010). Similarly, Smith et al. (2012), found that incongruence between descriptive and injunctive norms weakened intentions to engage in energy conservation behaviour across three experimental studies. However, McDonald et al. (2013) found that norm-conflict does not always result in reduced motivation to conform, and that the effect of norm-conflict on behaviour intentions is mediated by perceived effectiveness of the behaviour. Specifically, they found that norm-conflict had an energizing effect of behaviour intentions among people with strong environmental attitudes, while those with weak environmental attitudes were de-motivated by norm-conflict

Based on these studies and my review of the wider literature, I revisited the interplay between descriptive and injunctive norms as predictors of pro-environmental behaviour. I hypothesized that perceived threat, concern and perceived efficacy

significantly mediate the link between pro-environmental behaviour and perceived descriptive and injunctive norms. I also hypothesized that the interactive influence of descriptive and injunctive norms on pro-environmental behaviour is significantly mediated by perceived threat, concern and perceived efficacy. In Study 8, I found that the link between perceived injunctive, and descriptive, norms and pro-environmental intentions and behaviour was significantly mediated by perceived threat, concern and efficacy in a large cross-national student sample. However, the interaction between the two types of norms was not significantly related to self-reported behaviour or intentions, nor did perceived threat, concern and perceived efficacy mediate a link between the interaction of the two norm types and the behavioural indicators. I suggested in my discussion of the findings from Study 8 that the interaction between descriptive and injunctive norms may be better explored using experimental methods as the two norm types tend to converge at the individual level since individuals might rationally expect that most others conform to the injunctive norm or perceive the descriptive norm to be indicative of the injunctive norm (Thøgersen, 2008). I also argued that the interaction between the two norm types may be contingent on the extent to which individuals identify with the referent group and the strength of their attitudes toward the environmental issues (Christensen et al., 2004; McDonald et al., 2013; Rinker & Neighbors, 2014).

I incorporated these arguments in the design of Study 9. Here, I attempted to manipulate perceived injunctive and descriptive norms in a 2x2 between-subjects experiment. In addition to my initial hypotheses, I predicted that social identification and biospheric values significantly moderate the indirect influence of the descriptive and injunctive norms manipulations, and their interaction, on pro-environmental behaviour that is mediated by perceived threat, concern and perceived efficacy. I found that descriptive and injunctive norms did not have any significant indirect effects on pro-environmental behaviour or intentions mediated by perceived threat, concern or efficacy. I also found that the interaction between the two types of norm did not have any significant influence on pro-environmental behaviour or intentions through any of the mediators.

Further, my hypotheses regarding the moderating influence of social identification on the relationship between descriptive and injunctive norms and behaviour and intentions were not supported. There was a significant three-way interaction between biospheric

values, the descriptive norm manipulation and the injunctive norm manipulation in their influence on concern about climate change. Further examination of this interaction revealed that the injunctive norm manipulation had a significant negative indirect influence on behavioural intentions mediated by concern when biospheric values and descriptive norms were low. However, when descriptive norms were high and biospheric values were low, the injunctive norm manipulation had a positive indirect influence on behavioural intentions mediated by concern. This mediated three-way interaction effect was not observed with pro-environmental behaviour, and biospheric values did not significantly moderate the independent or interactive indirect influence of the two norm types on behaviour and intentions mediated by perceived threat or concern.

Overall, the studies reported in Chapter 5 indicate that descriptive and injunctive norms may exert a significant indirect influence on pro-environmental behaviour and intentions through perceived threat, concern and perceived efficacy. Study 9 also provided some support for previous indications that incongruence between descriptive and injunctive norms may have a de-motivating indirect effect among people with weak environmental values. However, a key limitation of the two studies is that they were entirely based on student samples and there is little certainty that the norm referent categories employed are the most relevant in the context of participants' response to climate change. Further, in Study 9, the descriptive norm manipulation affected both perceived descriptive and injunctive norms which suggests that the intended orthogonal manipulation of the two norm types was not achieved.

Theoretical and practical implications

The findings detailed in Chapter 5 reiterate the importance of social norms as a source of motivation for individual engagement in pro-environmental behaviour insofar that I demonstrated in Study 8 that descriptive and injunctive norms are linked with climate change perceptions, concern and intentions to act pro-environmentally. However, the interaction between the two norm types did not have a significant relationship with any of the indices of climate change engagement measured in Study 8, while I failed to obtain clean independent manipulations of the two norm types in Study 9. Therefore, the evidence from the studies does not provide a strong basis upon which to draw any definite conclusions on the primary theoretical objective of the chapter, which was to

assess the effect of norm incongruence on climate change perceptions and pro-environmental behaviour. Nonetheless, the findings suggest that social norms based communications that draw on pro-environmental descriptive and injunctive norms may have a significant effect in influencing threat perception, concern and perceived efficacy to make a personal impact in addressing climate change.

Contributions of the thesis

The value of information and knowledge provision

As discussed previously in Chapter 2, there is a consensus among many psychologists that information and knowledge play a trivial role in motivating pro-environmental behaviour. However, my research supports a view that the influence of knowledge is generally conveyed via more proximate determinants of environmental behaviour, specifically in perceived threat and concern. Information provision may play a particularly important role in contexts where awareness of the focal issue is relatively low. The results of Study 3 also indicate that different forms of knowledge may influence climate change perceptions and intentions to act pro-environmentally to varying degrees. In this case, only knowledge of the consequences of climate change appeared to have a significant influence on perceived threat and behavioural intentions regarding climate change.

Overall, my research suggests that the influence of knowledge is not negligible and that there are still questions to be investigated, particularly regarding the forms of knowledge that are most likely to produce attitude and behaviour change in presently underexplored contexts such as sub-Saharan Africa. In contrast to the critical view of knowledge campaigns that has been expressed by several authors (e.g., Abrahamse, Steg, Vlek, & Rothengatter, 2005; Steg & Vlek, 2009), there is evidence, even in Western contexts, that information provision can have a significant positive influence on the degree and strength of pro-environmental attitude change (Bidwell, 2016; Delmas, Fischlein, & Asensio, 2013). Fundamentally, the levels of attention and interest directed at uncovering the nuances of how informational strategies contribute to pro-environmental behaviour in the context of climate change is linked with the priorities that guide international scientific activities and funding mechanisms.

The overrepresentation of WEIRD perspectives and case-studies in environmental behaviour research reflects the inequalities in non-Western countries' participation and

representation in global scientific and policy agendas (Blicharska et al., 2017; Karlsson, 2002). The case of research into environmental knowledge and informational strategies illustrates how evidence from a unique and largely unrepresentative subsection of the global human population is often used to substantiate pervasive claims about the universal nature of processes with global relevance. This practice presents a challenge for managing global threats such as climate change because research into aspects of psychological engagement that may prove decisive in creating a large-scale personal motivation to pursue mitigation and adaptation goals among the greater proportion of the world population may not be initiated because these aspects are not a priority in Western societies.

Many non-Western countries have limited capacities to pursue research, inadequate academic resources, and different research priorities than Western countries (Blicharska et al., 2017). However, an understanding of environmental behaviour that is primarily rooted in the experiences of Western societies may not be suited to addressing problems and situations in non-Western contexts (Karlsson, 2002). Given the global nature of climate change, it is necessary for researchers in environmental psychology to strive for an understanding that is commensurate in scope with the requirement of coordinated effort by people in diverse social and cultural contexts to achieve effective responses to the problem.

There is a need for research addressing the effects of knowledge and awareness in African countries, in particular, primarily because Africa is exceptionally vulnerable to climate change impacts (Carter & Parker, 2009; IPCC, 2014), and low awareness of the threat posed, and of appropriate coping strategies, have been widely identified as key barriers to effective mitigation and adaptation (Antwi-Agyei, Dougill, & Stringer, 2015; Muller & Shackleton, 2014; Shackleton, Ziervogel, Sallu, Gill, & Tschakert, 2015). My findings with samples from Nigeria and South Africa suggest that information that fosters a view of climate change as a personal and social threat is likely to motivate engagement in actions aimed at addressing the issue.

However, it is important to note that information provision is only one element in the process of behavioural change (Hornik, 1989; Maio et al., 2007). It is also necessary to tackle situational influences that may limit individuals' capacity or willingness to act on the threat of climate change irrespective of their level of awareness. For instance, in

Study 2, I found that knowledge of climate change was negatively related to willingness to pay higher taxes to address climate change among the South African sample. A reason for this might be a lack of public trust in the government or other relevant institutions to use the funds generated from a 'climate tax' for the intended purpose. It is practically common knowledge that corruption is a salient and pervasive problem in African countries (Lawal, 2007). In many parts of the world, corruption has been consistently linked with low interpersonal and institutional trust (Morris & Klesner, 2010; Seligson, 1999). In Africa, it has been linked with reduced willingness to make voluntary contributions to public goods (Beekman, Bulte, & Nillesen, 2014), increased political participation, particularly willingness to protest (Inman & Andrews, 2009). Therefore, while participants in Study 2 showed increased willingness to protest against government inaction on climate change with increasing climate change knowledge, the relationship between knowledge and willingness to pay higher taxes for addressing climate may plausibly have been inverted by exposure to institutional corruption[31].

Some authors have indicated that increased knowledge of climate change in African societies may engender negative reactions including anger and resentment at the disproportionate ratio of responsibility for the cause of climate change and projected consequences of climate change for the continent (Deane, 2009). Since knowledge only showed a negative relationship with willingness to pay tax and was unrelated to willingness to protest, the negative relationship may also reflect reactance in the sense that individuals may feel less inclined to make personal sacrifices to address climate change with increasing understanding of the causes of the problem.

Although the points made in the preceding two paragraphs are only speculative, they serve to illustrate the idiosyncratic landscape of climate change communication and engagement in Africa. The findings in my research indicate that providing information about climate change can play a role in creating motivation to act on climate change, but they also reflect the need for a broader research program that more holistically examines how the acquisition of such information is likely to interact with other contextual factors in determining the way people respond to climate change.

[31] Low levels of interpersonal trust and exposure to corruption may also explain participants' lack of willingness to participate in the raffle in Study 3

Extreme weather experiences and climate change engagement

A growing amount of literature suggests that extreme weather experiences are positively linked with concern, risk perceptions and pro-environmental behavioural intentions regarding climate change (Akerlof et al., 2013; Broomell, Budescu, & Por, 2015; Demski et al., 2017; A. Taylor et al., 2014). Some authors have expressed optimism regarding the potential of extreme weather experiences to promote climate change engagement against a backdrop of political polarization on the issue (Akerlof et al., 2013; Leiserowitz, Maibach, Roser-Renouf, & Smith, 2010). The literature on this topic suggests that extreme weather experiences can impact climate change attitudes by confirming pre-existing beliefs, increasing the salience of climate change, facilitating personal realization of the immediacy of the problem, and increasing attentiveness (and possibly receptiveness) to climate change information (Demski et al., 2017; Howe et al., 2014; C. Lang & Ryder, 2016; Myers et al., 2013; Spence et al., 2011). However, extreme weather experiences may not universally produce more positive attitudes toward climate change, particularly among individuals who do not make a link between the event and climate change and in situations where the indicator of engagement or attitude change pertains to mitigation actions and policies (McCright et al., 2014; Reser et al., 2012; van der Linden, 2014b).

Previous research in the US has consistently shown a significant effect of political orientation on climate change beliefs, whereby politically right-leaning individuals have been shown to exhibit greater levels of scepticism about climate change on average than their left-leaning counterparts (Marquart-Pyatt et al., 2014; McCright & Dunlap, 2011). A similar pattern of political differences has also been shown in relation to the way US citizens perceive salient weather events as extreme or unusual, and their willingness to act pro-environmentally with regard to climate change (Cutler, 2015; Gromet et al., 2013; Hamilton et al., 2016). The primary contribution of this thesis to research in this area is showing that political orientation may also explain the seeming inconsistency in evidence regarding the link between flood experiences and climate change attitudes in the UK. My findings in Chapter 3 suggest that the indirect influence of flood experiences on preparedness to engage in mitigation behaviour among politically right-leaning individuals was weaker or non-significant compared with left-leaning individuals. I argued that this may be a result of right-leaning individuals being

less likely to attribute extreme weather events to climate change and being likely to have comparatively greater levels of scepticism about climate change.

However, the moderating effect of political orientation observed in Chapter 3 was modest and I reasoned that this may be because political orientation, as measured in that study, was only a rough index of more proximate determinants of individuals' views of extreme weather and their attitudes toward climate change. Prior research suggests that group differences in attitudes toward salient issues such as climate change are often rooted in differences in fundamental shared values (Goebbert et al., 2012; Kahan, 2013). I explored the more proximate moderators of the link between flood experience and climate change attitudes in Chapter 4. The results obtained using the imagined flood experience approach have only made a modest contribution to answering the questions raised in Chapter 3. Attribution of flood experiences to climate change seemed to make a difference with regard to perceived threat, concern and perceived efficacy in two studies (Study 5, Study 7) but these effects were inconsistent and in one study (Study 7) they depended on the extent to which individuals trusted the source of information invoked to back up the attribution claim. Biospheric values also largely showed no effect in moderating the link between the imagined flood experience and climate change attitudes, although they showed the reverse of my hypothesis in Study 1 where the imagined flood experience was found to have a stronger effect on climate change attitudes among individuals with low biospheric values. Overall, the research reported in this thesis indicates that the influence of real and imagined flood experiences on climate change engagement, and how this influence is moderated by intervening variables including values and shared worldviews, remains an open question requiring further research.

Social influence and climate change engagement

Social norms are widely recognized as a potentially powerful mechanism for promoting public engagement with climate change (Griskevicius, Cialdini, & Goldstein, 2008; van der Linden, Maibach, & Leiserowitz, 2015). The results presented in Chapter 5 of this thesis suggest that beyond having simple direct effects on behaviour, descriptive and injunctive norms may also be linked to behaviour and intentions through their influence on perceived threat, concern and perceived efficacy regarding climate change. In contrast to the norm focus approach which emphasizes the

need to act correctly or avoid social disapproval as key motivations for conformity to social norms (Cialdini, 2014; Cialdini et al., 1991), the finding that personal beliefs and emotions mediate the link between social norms and pro-environmental behaviour and intentions (Study 8) suggests that people may also internalize what they perceive to be the responses of relevant social referents to the focal issue. This understanding is consistent with the social identity approach which suggests that shared interests and concerns within a group may become cognitively represented as personal interests and personal concerns depending on the extent to which individuals self-categorize as group members (Hogg & Reid, 2006).

Although the indirect influence of injunctive norms on pro-environmental behaviour and intentions through perceived threat and perceived efficacy was not replicated in Study 9, the findings of that study make a relevant contribution to the literature concerning how social influence may interact with other factors such as individuals' commitment to the issue in determining their motivation to conform with perceived norms. Here, I found that injunctive norms had a negative indirect influence mediated by concern on intentions to act pro-environmentally when descriptive norms were unsupportive and biospheric values were low. Interestingly, when biospheric values were low but descriptive norms were supportive, the injunctive norm had a positive indirect influence on behavioural intentions which mediated by concern. Values typically reflect stable beliefs and preferences which may be resistant to change. On the other hand, social norms-based communication strategies are a low-cost persuasion strategy that have been shown to effective in eliciting behaviour change across a variety of domains. The findings in Study 9 suggest that making congruent, supportive descriptive and injunctive norms salient may be an effect way to motivate climate change engagement among in instances where intrinsic pro-environmental motivation is low.

Conclusion and future directions

This thesis has illustrated that influences arising from the external physical and social environment play a role in shaping individual behavioural responses to climate change through their influence on personal beliefs and concern. Specifically, it has shown that informational strategies that furnish individuals with an understanding of the threat posed by climate change, and evoke concern about the problem, may be effective in

motivating engagement in behaviours aimed at mitigating climate change. Further, it also shows that the perceived behaviours and expectations of relevant social referents has a significant influence on our beliefs and emotional responses regarding climate change with consequences for our subsequent inclinations to personally engage in mitigation actions. Most importantly, it shows that the interpretation of our experiences with flooding may be contingent on the values and attitudes associated with our salient group memberships.

However, each of the studies presented in the thesis have inherent limitations and unresolved questions requiring further investigation. The studies reported in Chapter 2 provided some evidence that knowledge may exert an indirect positive influence on climate change-related behaviour intentions in African contexts through primary appraisal processes. Yet, primary appraisal only represents a fraction of the process leading to attitudinal and behavioural change. Therefore, there is a need to investigate how knowledge affects the way African citizens appraise potential behavioural responses options and how the outcomes of this appraisal process determine the way they engage with climate change. Additionally, the research was only based on opportunistic samples of the two nations surveyed. Subsequent research employing representative sampling strategies are necessary to substantiate the validity of the current results.

The role of political affiliation in the link between flood experiences and climate change engagement in the UK also requires further investigation. The operationalization of political affiliation in the analysis presented in Chapter 3 can only be taken to be a rough reflection of shared values and worldviews that more proximally explain the differences observed in the link between flood experiences and preparedness to engage in mitigation behaviour among politically left and right-leaning individuals. Therefore, there is a need for subsequent research that addresses the key factors that explain political differences in interpretations of extreme weather experiences and how these modulate the motivating influence of such experiences with regard to climate change engagement. Although mental simulation strategies have been shown to effective in eliciting substantial changes in attitudes and behaviour in various domains, the current research failed to produce consistent support for the efficacy of the imagined flood experience as a paradigm for understanding the effects of flood experiences.

Lastly, the interplay between descriptive and injunctive norms as influences on behaviour in the context of climate change and other environmental domains was not definitely addressed in the current research. Subsequent studies employing alternative approaches such as anchoring (e.g., Eyssel, Bohner, & Siebler, 2006) will be necessary to obtain independent manipulations of the two norm types and enable further investigation of their interactive influence on individuals' motivation to engage in pro-environmental behaviours.

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Appendices

Appendix 1

Measure of knowledge of climate change causes and consequences (Study 1)

Please read the following statements carefully and indicate your level of agreement with each one using the scale provided (1= Strongly Disagree, 5 = Strongly Agree).

1. Climate change is caused by increasing carbon dioxide in the atmosphere
2. Climate change is caused by excessive sunshine and volcanic eruptions (Reversed)
3. Climate change is caused by ozone layer depletion (Reversed)
4. Climate change can cause a spread of diseases and illnesses
5. Climate change can result in natural disasters such as floods and droughts
6. Climate change has no effect on economic growth and development (Reversed)
7. Climate change does not affect agriculture and food production (Reversed)
8. Climate change has nothing to do with the rise in sea levels (Reversed)

Items 2 and 4 were dropped to increase the internal consistency of the measure in Study 2.

Appendix 2

Manipulations (Study 3):

1. Control condition (climate change definition only)
   "Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures. Research shows that the climate – i.e. the average temperature of the planet's surface has risen by 0.89ºC from 1901 to 2012. Compared with climate change patterns throughout earth's history, the rate of temperature rise since the industrial revolution is extremely high." – Met Office

2. Information condition (climate change definition + causes + impacts)
   "Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures. Research shows that the climate – i.e. the average temperature of the planet's surface has risen by 0.89ºC from 1901 to 2012. Compared with climate change patterns throughout earth's history, the rate of temperature rise since the industrial revolution is extremely high." – Met Office
   "Most climate scientists agree that human activities are playing a major role in driving the current rate of change in the Earth's climate. Over the last century, the burning of fossil fuels such as coal and oil has increased the concentration of carbon dioxide (CO_2) in the atmosphere. To a lesser extent, the clearing of land for agriculture, industry and other human activities has also increased the atmospheric concentration of carbon dioxide and other greenhouse gases." – NASA
   "The consequences of changing the concentration of carbon dioxide in the atmosphere are difficult to predict precisely, but certain effects seem likely:
1. On average, Earth will become warmer.
2. Warmer conditions will lead to more evaporation and precipitation overall, but individual regions will vary, with some become wetter and others dryer.
3. A stronger greenhouse effect will warm the oceans and partially melt glaciers (- glaciers are slowly moving rivers or masses of ice formed by the accumulation of compacted snow on mountain tops or near the poles) and other ice, increasing sea levels. Ocean water will also expand if it warms, contributing further to sea level rise.
4. While some crops and other plants may respond favourably to increased atmospheric carbon dioxide, higher temperatures and changing climatic patterns may change the areas where crops grow best and affect the composition of natural plant communities" – NASA
   "Across Africa, communities are already experiencing rising temperatures, growing pressure from pests and disease, declining agricultural productivity, and an increase in the frequency of extreme weather events such as floods and drought. Scientists have indicated that this trend is evidence of the reality of climate change in Africa" - (Toulmin 2009; Tadesse 2010; Berrang-Ford et al. 2012).

Appendix 3

Measures of climate change knowledge (Study 3)

Cause - Knowledge

Please indicate, to the best of your knowledge, how much each of the following items contribute to Climate Change							
	Minor contribution			Don't know	Major contribution		
Burning fossil fuels (coal, oil, gas) for heat and electricity	-3	-2	-1	0	1	2	3
The hole in the Ozone Layer	-3	-2	-1	0	1	2	3
Driving a car	-3	-2	-1	0	1	2	3
Aerosol spray cans (containing CFCs)	-3	-2	-1	0	1	2	3
Toxic waste	-3	-2	-1	0	1	2	3
Nuclear power plants	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Agricultural activities (*e.g.*, cattle breeding)	-3	-2	-1	0	1	2	3
The sun	-3	-2	-1	0	1	2	3
Flying/Commercial air travel	-3	-2	-1	0	1	2	3
Smoking cigarettes	-3	-2	-1	0	1	2	3
Deforestation	-3	-2	-1	0	1	2	3

Impact - Knowledge

For each of the items listed below, please indicate whether you believe that they are likely to decrease, remain constant or increase ***as a result of*** Climate Change.							
	Likely to decrease			No Change	Likely to increase		
Global average temperature	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Air pollution	-3	-2	-1	0	1	2	3
Areas in the world experiencing drought	-3	-2	-1	0	1	2	3
Global biodiversity (i.e. variety of plants and animals)	-3	-2	-1	0	1	2	3
Melting of glaciers and polar ice caps	-3	-2	-1	0	1	2	3
Global spread of infectious diseases	-3	-2	-1	0	1	2	3
The hole in the Ozone layer	-3	-2	-1	0	1	2	3
Extreme weather events (e.g. floods, storms etc.)	-3	-2	-1	0	1	2	3
Volcanic eruptions	-3	-2	-1	0	1	2	3
The frequency of hot days and nights	-3	-2	-1	0	1	2	3
Global fresh water supply	-3	-2	-1	0	1	2	3

Appendix 4

Gender comparisons of measured knowledge and climate change attitudes (Study 3).

	Gender			
	Male	Female		
DV	M (SD)		*t*	*p*
Knowledge (Cause)	6.53 (2.09)	5.61 (2.01)	1.97	.052
Knowledge (Consequences)	7.90 (1.45)	7.65 (1.67)	-.69	.492
Concern	5.88 (1.22)	5.65 (1.13)	-.58	.569
Perceived threat	5.64 (1.14)	5.85 (.89)	-.90	.370
Willingness to act	3.55 (.82)	3.83 (.88)	-1.45	.152

Listwise valid $N = 83$ (Control = 45, Information = 38). For Concern: $N = 36$. DV = Dependent Variable

Correlation between age and the dependent variables (Study 3)

DV	Correlation (*r*) with age (in years)
Knowledge (Cause)	-.11
Knowledge (Consequences)	-.14
Concern	.25
Perceived threat	.10
Willingness to act	.00

Cell entries are Pearsons correlations coefficients. None are significant at $p<.05$. $N = 83$ except concern: $N = 36$.

Appendix 5

Multigroup Path Comparisons

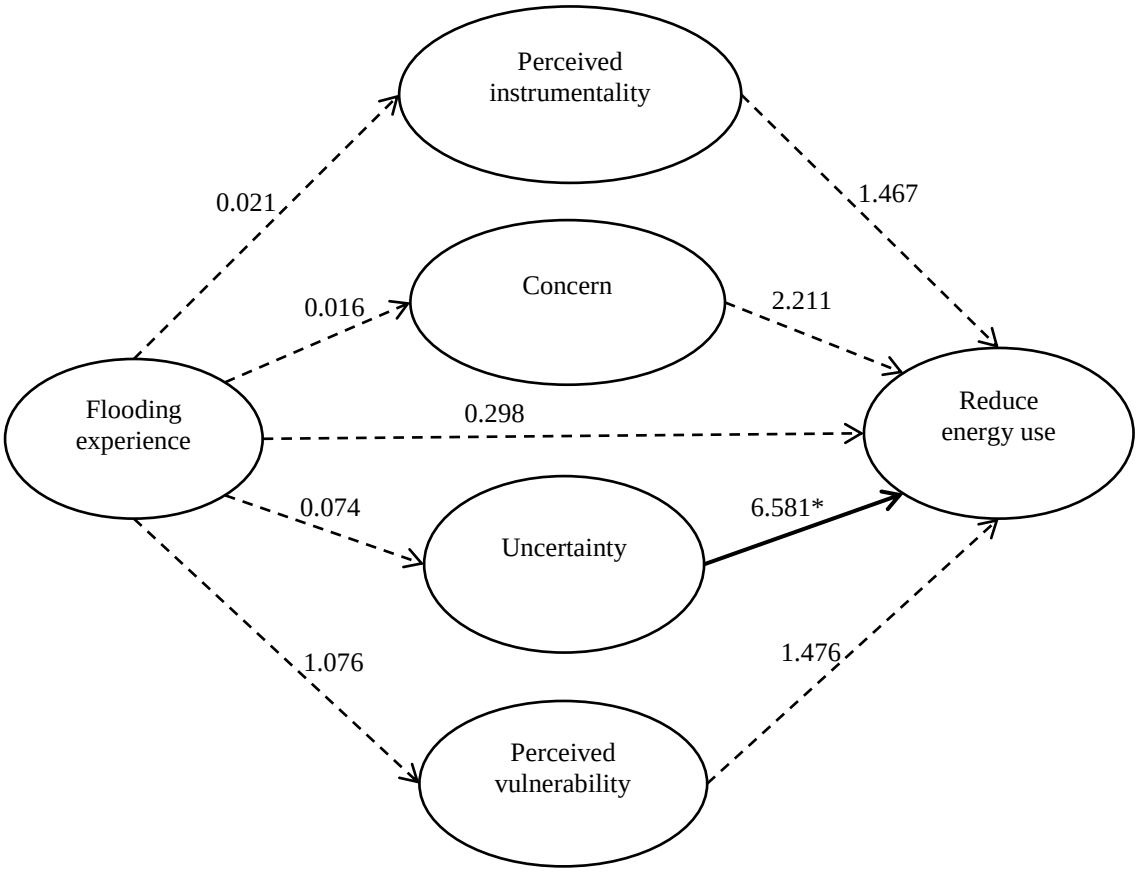

Figure S1: Path comparisons across left and right-leaning voter categories. Dashed paths represent equivalence across groups and solid paths are significantly different for each group. Values are chi-square difference estimates for comparisons of unconstrained model and a model with the specified path constrained (*df* = 1 for each estimate). "*" denotes $p<.05$. Results are derived from multi-group comparisons conducted using AMOS 22.

Chi-square difference estimates and significance for path comparisons:

1. (flood experience, energy use) $X^2 = 0.298$ (1), p = 0.585
2. (flood experience, instrumentality) $X^2 = 0.021$(1), p = 0.885
3. (flood experience, concern) $X^2 = 0.016$(1), p = 0.898
4. (flood experience, uncertainty) $X^2 = 0.074$(1), p = 0.786
5. (flood experience, vulnerability) $X^2 = 1.076$(1), p = 0.300
6. (instrumentality , energy use) $X^2 = 0.218$(1), p = 0.641
7. (concern , energy use) $X^2 = 2.211$(1), p = 0.137
8. (uncertainty , energy use) X^2 = **6.581(1), p = 0.010**
9. (vulnerability , energy use) $X^2 = 1.467$(1), p = 0.226

Appendix 5 Contd.

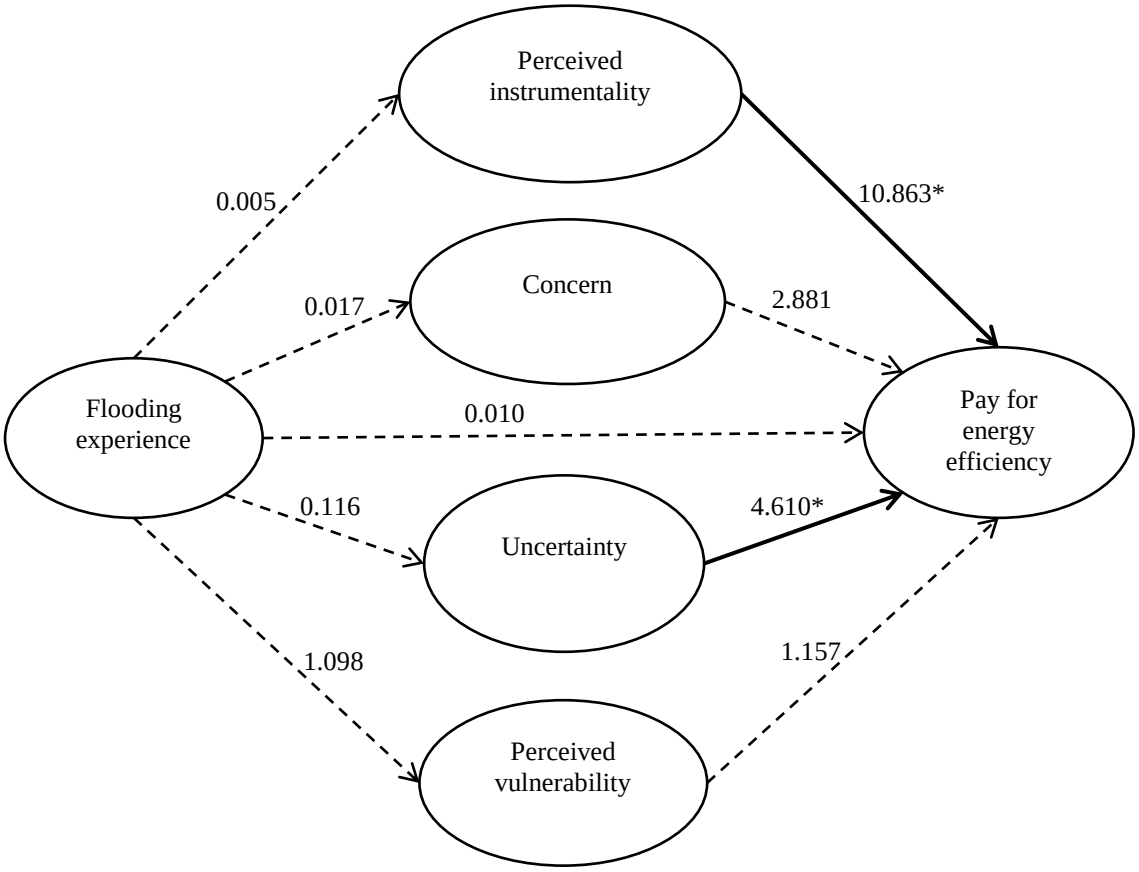

Figure S2: Path comparisons across left and right-leaning voter categories. Dashed paths represent equivalence across groups and solid paths are significantly different for each group. Values are chi-square difference estimates for comparisons of unconstrained model and a model with the specified path constrained (*df* = 1 for each estimate). "*" denotes $p<.05$. Results are derived from multi-group comparisons conducted using AMOS 22.

Chi-square difference estimates and significance for path comparisons:

1. (flood experience, pay for energy efficiency) $X^2 = 0.010(1)$, p = 0.921
2. (flood experience, instrumentality) $X^2 = 0.005(1)$, p = 0.943
3. (flood experience, concern) $X^2 = 0.017(1)$, p = 0.733
4. (flood experience, uncertainty) $X^2 = 0.116(1)$, p = 0.733
5. (flood experience, vulnerability) $X^2 = 1.098(1)$, p = 0.295
6. (instrumentality, pay for energy efficiency) X^2 = **10.863(1), p = 0.001**
7. (concern, pay for energy efficiency) $X^2 = 2.881(1)$, p = 0.090
8. (uncertainty, pay for energy efficiency) X^2 = **4.610(1), p = 0.032**
9. (vulnerability, pay for energy efficiency) $X^2 = 1.157(1)$, p = 0.282

Appendix 6

Experimental Stimuli and Questionnaire (Study 4)

Past experience

1. Have you had a personal experience of unusually intense rainfall and flooding in the last 5 years? □ No □ Yes
2. Have you personally experienced an extreme or unusual weather event (e.g., severe heatwave, freak storm, drought *etc*.) in the last 5 years? □ No □ Yes

Involvement in Environmental Groups

Are you currently a member of an environmental group? □ No □ Yes

Self-rated Knowledge

How would you rate your knowledge of Climate Change?						
Very Low						Very High
1	2	3	4	5	6	7

Measured Knowledge

1. Which of the following do you think contributes the most to global warming and Climate Change (Tick one)?

a. The hole in the Ozone Layer
b. Deforestation
c. Burning fossil fuels for heat and electricity
d. Toxic wastes
e. Volcanic eruptions
f. Cars and trucks
g. Cows

2. The earth's climate is warmer now than it has ever been before
   □ True □ False □ Don't Know
3. The decade from 2000 to 2009 was warmer than any other decade since 1850
   □ True □ False □ Don't Know
4. Nuclear power plants are a key driver of Climate Change
   □ True □ False □ Don't Know
5. Global warming will cause a uniform increase in temperature across the globe
   □ True □ False □ Don't Know
6. Climate Change will increase the incidence of certain vector-borne diseases such as Malaria
   □ True □ False □ Don't Know

Value Orientations

Below are a number of values that some people consider to be important. Please rate the importance of each one as a guiding principle in your life using a scale from 0 (not important) to 7 (extremely important). If you disagree with or are opposed to one of the values, please circle -1.

Influence (having power over people and events)	-1	0	1	2	3	4	5	6	7
Helpful (working for the welfare of others)	-1	0	1	2	3	4	5	6	7
Respecting the earth (harmony with other species)	-1	0	1	2	3	4	5	6	7
Wealth (money and material possessions)	-1	0	1	2	3	4	5	6	7
Equality (equal opportunity for all)	-1	0	1	2	3	4	5	6	7
Protecting the environment (preserving nature)	-1	0	1	2	3	4	5	6	7
Authority (the right to lead or command)	-1	0	1	2	3	4	5	6	7
Social justice (care for the weak, correcting injustice)	-1	0	1	2	3	4	5	6	7
Unity with nature (fitting into nature)	-1	0	1	2	3	4	5	6	7
Social recognition (respect and approval by others)	-1	0	1	2	3	4	5	6	7
A world at peace (free from conflict)	-1	0	1	2	3	4	5	6	7
Preventing pollution	-1	0	1	2	3	4	5	6	7

Demographics

1. What is your gender? □ Male □ Female □ Rather not say
2. Which of the following best describes your ethnicity?
   □ Asian/Asian British/Asian Descent
   □ Black/African/Caribbean/Black British
   □ Caucasian
   □ Mixed/Multiple Ethnicity
   □ Other (please specify) _____
3. Age _____
4. Subject and year of study _____

Experimental stimuli

Images and supporting text



In February 2014, the UK Met Office confirmed that England and Wales had experienced the wettest winter since records began in 1766. Downpours totalling 435mm of rain broke the 250 year old England and Wales precipitation records. Heavy rainfall from late 2013 into early 2014 resulted in severe flooding around the UK, affecting thousands of homes and farms, cutting off critical transport routes, and causing social and economic disruption in many parts of the country. According to the Met office, climate change will lead to an increase in extreme weather in the UK in the coming years.
(Sources: The Guardian, BBC News)

Imagined Experience Prompt Message:

Please take two minutes to imagine yourself as a victim of the flooding described above. Imagine watching your home and property being extensively damaged by floodwater, and being unable to get access to nearby shops for food and groceries, or get to work and school as most roads in the vicinity are now submerged. In the space provided below, please describe as many aspects of the scenario you just imagined as possible.

Additional Questions:

(a) How easy was it for you to imagine yourself being in this situation (7-point: Very Difficult to Very Easy).

(b) How vivid (clear) was your mental imagery of yourself being in this situation (7-point: Not vivid to Very Vivid)

(c) In your imagined scenario, how did you feel about the experience of the flood?

Dependent variables

Attribution

Do you think the extreme rainfall and widespread flooding that occurred in the UK during the winter of 2013/2014 is a result of Climate Change?	□ No	□ Yes	□ Don't Know

How confident are you these events were/were not a consequence of Climate Change?						
Not Confident						Very Confident
1	2	3	4	5	6	7

Perceived issue salience

How accurately do the following statements reflect your view of climate change?							
	Strongly Disagree						Strongly Agree
To me, the topic of climate change is important	1	2	3	4	5	6	7
To me, the topic of climate change is of interest	1	2	3	4	5	6	7
To me, the topic of climate change is relevant	1	2	3	4	5	6	7

Perceived Threat

How do you rate the seriousness of the threat posed by Climate Change to the following?							
	Very Low						Very High
The environment	1	2	3	4	5	6	7
People in the UK	1	2	3	4	5	6	7
You as an individual	1	2	3	4	5	6	7

How do you rate the likelihood that the threat posed by Climate Change will affect the following?							
	Very Low						Very High
Your health and wellbeing	1	2	3	4	5	6	7
The wellbeing of society as a whole	1	2	3	4	5	6	7
Wildlife and natural landscapes	1	2	3	4	5	6	7

Affect

Holistic Affect

Using the scale below, how do you rate Climate Change overall, as a good or bad thing?						
Very Bad						Very Good
-3	-2	-1	0	1	2	3

Discrete Emotions

When you think about climate change, how strongly do you experience the following emotions?							
	Not at all						Very Strongly
Fear	1	2	3	4	5	6	7
Worry	1	2	3	4	5	6	7
Concern	1	2	3	4	5	6	7
Anger	1	2	3	4	5	6	7
Outrage	1	2	3	4	5	6	7

Acceptance of responsibility

Focusing on your current feelings about climate change, how accurately do the following statements describe your attitude?							
	Strongly Disagree						Strongly Agree
You consider it a personal obligation to address climate change in any way you can	1	2	3	4	5	6	7
You feel that individuals like yourself should not be expected to take on the responsibility of addressing climate change	1	2	3	4	5	6	7
You feel a strong sense of responsibility for addressing climate change	1	2	3	4	5	6	7
You feel that you should not be responsible for addressing such a problem	1	2	3	4	5	6	7

Scepticism

Based on your knowledge of climate change, how accurately do the following statements reflect your beliefs?							
	Strongly Disagree						Strongly Agree
The actions of a single person don't make any difference in tackling climate change	1	2	3	4	5	6	7
There is too much conflicting evidence about climate change to know if it is really happening	1	2	3	4	5	6	7
Climate change is part of a natural pattern that has been going on for millions of years	1	2	3	4	5	6	7

Environmentalists do their best to emphasize the worst possible effects of climate change	1	2	3	4	5	6	7
People are too selfish to do anything about climate change	1	2	3	4	5	6	7

Perceived efficacy

Please indicate your level of agreement or disagreement with the following statements							
	Strongly Disagree						Strongly Agree
I can personally help reduce Climate Change by changing my behaviour	1	2	3	4	5	6	7
My personal contribution to collective efforts aimed at addressing Climate Change can make a significant difference	1	2	3	4	5	6	7
I believe that I, as an individual, can make a difference in reducing Climate Change							
The combined efforts of individuals like myself can go a long way in addressing Climate Change	1	2	3	4	5	6	7
I believe that I, as an individual, can make an important contribution to the success of collective efforts to address Climate Change	1	2	3	4	5	6	7
The actions of individuals like myself can collectively achieve the goal of reducing Climate Change	1	2	3	4	5	6	7

Intentions

Based on your current feelings about climate change, how likely are you to engage in the following behaviours in the near future?							
	Not at all likely						Very Likely
Sign a petition calling on the government to make stronger commitments to addressing climate change	1	2	3	4	5	6	7
Donate to an environmental group that focuses on climate change	1	2	3	4	5	6	7
Volunteer in, or join, an environmental group that is engaged with climate change issues	1	2	3	4	5	6	7
Try to limit your energy consumption for the sake of the environment	1	2	3	4	5	6	7

Manipulation Check

There was an unusual amount of rainfall across the UK in the winter of 2013/2014	□ Agree	□ Disagree	□ Don't Know

Appendix 7

Experimental Stimuli and Questionnaire (Study 5)

Background and Controls

Demographics

1. What is your gender? □ Male □ Female □ Rather not say □ Other
2. Which of the following best describes your ethnicity?
   □ Asian/Asian British/Other Asian Descent
   □ Black/African/Afro-Caribbean/Black British
   □ Caucasian/White
   □ Mixed/Multiple Ethnicities
   □ Other (please specify) _____
3. Age (in years) _____
4. Subject and year of study _____
5. Nationality _____

Past experience

a. Considering roughly the 5 years, how often have you personally experienced flooding in your local area?

□ Never □ Once □ Twice □ Three times □ More than 3 times

□ I don't remember

b. Considering roughly the 5 years, how often (in total) have you personally experienced any type of extreme weather event (other than flooding) in your local area (e.g., severe heat waves, droughts, freak storms, hurricanes etc?

□ Never □ Once □ Twice □ Three times □ More than 3 times

□ I don't remember

Pro-environmental self-identity (Whitmarsh & O'Neill, 2010)

Thinking about your attitude toward environmental issues, how accurately do the following statements describe you?							
	Strongly Disagree						Strongly Agree
I think of myself as an environmentally-friendly consumer	1	2	3	4	5	6	7
I would be embarrassed to be seen as having an environmentally-friendly lifestyle	1	2	3	4	5	6	7
I think of myself as someone who is very concerned about environmental issues	1	2	3	4	5	6	7
I would not want my friends and family to think of me as someone who is concerned about environmental issues	1	2	3	4	5	6	7

Identification with the Environmental Movement (McCright &Dunlap, 2015)

"*The environmental movement is a diverse scientific, social and political movement for addressing environmental issues. Environmentalists advocate the sustainable management of resources and stewardship of the earth through changes in public policy and individual behaviour. The movement is centred on ecology, health and human rights.*"

This statement was retrieved from Wikipedia and will be presented at the top of the page in which the following items (a-c) are presented.

a. Are you currently a member of an environmental group? [No] [Yes]

ii. If yes, what is the name of the environmental group? _____

b. Do you consider yourself an environmentalist? [No] [Yes]

ii. If yes, would you say you are a strong environmentalist? [No] [Yes]

c. Thinking specifically about the environmental movement, do you think of yourself as:

1. Unsympathetic toward the environmental movement
2. Neutral
3. Sympathetic toward the environmental movement, but not actively involved
4. An active participant in the environmental movement

Perceived norms (Descriptive + Injunctive)

Please evaluate the extent to which each of the statements below accurately describes the attitudes of students at the University of Leicester by indicating your level of agreement/disagreement with each using the scale provided.

	Strongly Disagree						Strongly Agree
"*Most people around me are personally doing something to help reduce the risk of Climate Change*" (D)	1	2	3	4	5	6	7
"*My friends and relatives would support me if I decided to change my behaviour to help reduce Climate Change*"(I)	1	2	3	4	5	6	7
"*Most people I know generally do not expect me to do anything personally to help address Climate Change*"(I-)	1	2	3	4	5	6	7
"*Most of my colleagues, friends and other people I know are involved with a charity or society that addresses environmental issues including Climate Change*" (D)	1	2	3	4	5	6	7
"*Most people around me approve of donating to, or fundraising for, environmental groups that focus on Climate Change*" (I)	1	2	3	4	5	6	7
"*Addressing Climate Change, is not a high priority for most people I know*" (D-)	1	2	3	4	5	6	7
"*Most of my relatives and friends are not personally doing anything to help address Climate Change*" (D-)	1	2	3	4	5	6	7
"*My friends and relatives would not support me if I decided to change my behaviour to help reduce Climate Change*" (I-)	1	2	3	4	5	6	7

Value Orientations

Below are a number of values that some people consider to be important. Please rate the importance of each one as a guiding principle in your life using a scale from 0 (not important) to 7 (extremely important). If you disagree with or are opposed to one of the values, please circle -1.

Influence (having power over people and events)	-1	0	1	2	3	4	5	6	7
Helpful (working for the welfare of others)	-1	0	1	2	3	4	5	6	7
Respecting the earth (harmony with other species)	-1	0	1	2	3	4	5	6	7
Wealth (money and material possessions)	-1	0	1	2	3	4	5	6	7
Equality (equal opportunity for all)	-1	0	1	2	3	4	5	6	7
Protecting the environment (preserving nature)	-1	0	1	2	3	4	5	6	7
Authority (the right to lead or command)	-1	0	1	2	3	4	5	6	7
Social justice (care for the weak, correcting injustice)	-1	0	1	2	3	4	5	6	7
Unity with nature (fitting into nature)	-1	0	1	2	3	4	5	6	7
Social recognition (respect and approval by others)	-1	0	1	2	3	4	5	6	7
A world at peace (free from conflict)	-1	0	1	2	3	4	5	6	7
Preventing pollution	-1	0	1	2	3	4	5	6	7

Imagined Experience Manipulation

In February 2014, the UK Met Office confirmed that England and Wales had experienced the wettest winter since records began in 1766. Downpours totalling 435mm of rain broke the 250 year old England and Wales precipitation records. Heavy rainfall from late 2013 into early 2014 resulted in severe flooding around the UK, affecting thousands of homes and farms, cutting off critical transport routes, and disrupting social and economic activities across large parts of the country. (Sources: The Guardian, BBC News)

Imagined Experience Prompt Message:

For the next two minutes, please imagine yourself as a victim of the flooding described above. Imagine watching your home and property being extensively damaged by floodwater, and being unable to get access to nearby shops for food and groceries, or get to work/school as most roads in the vicinity are now submerged. In the space provided below, please describe as many aspects of the scenario you just imagined as possible.

Additional Questions:

(d) How easy was it for you to imagine yourself being in this situation (7-point: Very Difficult to Very Easy).

(e) How vivid (clear) was your mental imagery of yourself being in this situation (7-point: Not vivid to Very Vivid)

(f) In your imagined scenario, how did you feel about the experience of the flood?

(g) How likely do you think it is that the flooding that occurred across the UK in 2014 is linked to climate change? (1 = Not at all likely, 7 = Very Likely).

(h) How confident are you that the flooding is linked to climate change? (1 = Not Confident, 7 = Very Confident).

Control Prompt Message

For the next two minutes, please imagine an outdoor scene. Try to imagine aspects of the scene about you (e.g., is it a beach, a forest, are there trees, hills, what's on the horizon?). In the space below, please list the different things you saw in the scene you just imagined.

Dependent variables

Perceived Threat

Please answer the following questions to the best of your ability							
	Not Serious at all						Very Serious
How serious of a threat do you believe Climate Change is to you personally?	1	2	3	4	5	6	7
How serious of a threat would you rate the current impacts of Climate Change around the world?	1	2	3	4	5	6	7
How serious would you estimate the impacts of climate change are for the natural environment?	1	2	3	4	5	6	7
How serious of a threat do you think current Climate Change impacts are for the area you currently live in?	1	2	3	4	5	6	7
	Very Unlikely						Very Likely
In your judgment, how likely do you think it is that Climate Change will have very harmful long-term effects on our society?	1	2	3	4	5	6	7
How likely do you think you are to experience serious threats to your health or overall well-being, sometime during your life, as a result of Climate Change?	1	2	3	4	5	6	7
How likely do you think it is that the natural environment will be severely affected by the impacts of Climate Change?	1	2	3	4	5	6	7

Discrete Emotions

Thinking about the seriousness of climate change right now, and its potential impacts, how strongly do you feel the following emotions?							
	Not at all						Very Strongly
Fear	1	2	3	4	5	6	7
Worry	1	2	3	4	5	6	7
Concern	1	2	3	4	5	6	7
Anger	1	2	3	4	5	6	7
Guilt	1	2	3	4	5	6	7

Perceived Efficacy (Self, Participative, Collective)

How confident are you that the following can make a difference in addressing Climate Change?							
	Not Confident						Very Confident
Personally changing your behaviour and lifestyle (*e.g.* purchasing practices and energy use) (Self)	1	2	3	4	5	6	7
Your personal contribution to collective (group) efforts aimed at addressing Climate Change (Participative)	1	2	3	4	5	6	7
Efforts made by you as an individual to address Climate Change (Self)	1	2	3	4	5	6	7
The combined efforts of multiple individuals like yourself to address Climate Change (Collective)	1	2	3	4	5	6	7
The personal contributions of individuals like you to collective (group) efforts aimed at addressing Climate Change (Participative)	1	2	3	4	5	6	7
The collective actions of individuals such as in campaign groups, charities etc. (Collective)	1	2	3	4	5	6	7

Acceptance of responsibility (last two items adapted from de Groot & Steg, 2008)

Focusing on your current feelings about climate change, how accurately do the following statements describe your attitude?							
	Strongly Disagree						Strongly Agree
You consider it a personal obligation to address climate change in any way you can	1	2	3	4	5	6	7
You feel that individuals like yourself should not be expected to take on the responsibility of addressing climate change	1	2	3	4	5	6	7
You feel a strong sense of responsibility for addressing climate change	1	2	3	4	5	6	7
You feel that you should not be responsible for addressing such a problem	1	2	3	4	5	6	7
You feel your contribution to the cause of Climate Change is negligible	1	2	3	4	5	6	7
You feel everyone, including yourself, is jointly responsible for causing Climate Change	1	2	3	4	5	6	7

Behavioural Intentions (General + Specific)

Please answer the following questions based on your current feelings about Climate Change							
	Strongly Disagree						Strongly Agree
I intend to help reduce Climate Change by changing my behaviour	1	2	3	4	5	6	7
I intend to do my bit to help tackle Climate Change	1	2	3	4	5	6	7
I intend to address Climate Change by taking personal action	1	2	3	4	5	6	7
How likely are you to engage in the following behaviours within the next 4 weeks?							
	Very Unlikely						Very Likely
Turn off lights in unoccupied rooms at home/work	1	2	3	4	5	6	7
Walk, cycle, or use public transport only when commuting	1	2	3	4	5	6	7
Increase current levels of waste-sorting and recycling	1	2	3	4	5	6	7
Donate money to, or raise funds, for an environmental group or charity involved with Climate Change	1	2	3	4	5	6	7
Sign an online petition calling on the government to commit to renewable energy and lowering carbon emissions in the UK (please omit if non-British resident)	1	2	3	4	5	6	7
Join, or volunteer in, an organization involved with Climate Change	1	2	3	4	5	6	7
Purchase and consume only locally sourced produce	1	2	3	4	5	6	7
Reduce meat consumption or switch to a meat-free diet	1	2	3	4	5	6	7

Climate Scepticism (Whitmarsh, 2011)

The following statements have been extracted from recent polls of public opinion on Climate Change in the UK. Please indicate the extent to which each reflects your current beliefs.							
	Strongly Disagree						Strongly Agree
Claims that human activities are changing the climate are exaggerated	1	2	3	4	5	6	7
Climate Change is just a natural fluctuation of the earth's temperature	1	2	3	4	5	6	7
I am uncertain about whether Climate Change is really happening	1	2	3	4	5	6	7
It is too early to say whether Climate Change is really a problem	1	2	3	4	5	6	7

The evidence for Climate Change is unreliable	1	2	3	4	5	6	7
There is too much conflicting evidence about Climate Change to know if it is actually happening	1	2	3	4	5	6	7
Climate change is too complex and uncertain for scientists to make useful forecasts	1	2	3	4	5	6	7
Too much fuss is made about Climate Change	1	2	3	4	5	6	7
Floods and heat waves are not increasing, there's just more reporting of them in the media these days	1	2	3	4	5	6	7
Many leading experts still question if human activity is contributing to Climate Change	1	2	3	4	5	6	7
The media is often too alarmist about issues like Climate Change	1	2	3	4	5	6	7

Self-rated Knowledge

How would you rate your knowledge of Climate Change?						
Very Low						Very High
1	2	3	4	5	6	7

Cause - Knowledge

Please indicate, to the best of your knowledge, how much you believe that each of the following items contribute to Climate Change							
	Minor contribution			Don't know	Major contribution		
Burning fossil fuels (coal, oil, gas) for heat and electricity	-3	-2	-1	0	1	2	3
The hole in the Ozone Layer	-3	-2	-1	0	1	2	3
Driving a car	-3	-2	-1	0	1	2	3
Aerosol spray cans (containing CFCs)	-3	-2	-1	0	1	2	3
Toxic waste	-3	-2	-1	0	1	2	3
Nuclear power plants	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Agricultural activities (*e.g.*, cattle breeding)	-3	-2	-1	0	1	2	3
The sun	-3	-2	-1	0	1	2	3
Flying/Commercial air travel	-3	-2	-1	0	1	2	3
Smoking cigarettes	-3	-2	-1	0	1	2	3
Deforestation	-3	-2	-1	0	1	2	3

Impact - Knowledge

For each of the items listed below, please indicate whether you believe that they are likely to decrease, remain constant or increase ***as a result of*** Climate Change.							
	Likely to decrease			No Change	Likely to increase		
Global average temperature	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Air pollution	-3	-2	-1	0	1	2	3
Areas in the world experiencing drought	-3	-2	-1	0	1	2	3
Global biodiversity (i.e. variety of plants and animals)	-3	-2	-1	0	1	2	3
Melting of glaciers and polar ice caps	-3	-2	-1	0	1	2	3
Global spread of infectious diseases	-3	-2	-1	0	1	2	3
The hole in the Ozone layer	-3	-2	-1	0	1	2	3
Extreme weather events (e.g. floods, storms etc.)	-3	-2	-1	0	1	2	3
Volcanic eruptions	-3	-2	-1	0	1	2	3
The frequency of hot days and nights	-3	-2	-1	0	1	2	3
Global fresh water supply	-3	-2	-1	0	1	2	3

Actual Behaviour Measure

For participating in this study, you will be entered into a raffle for a £50 Amazon voucher. If you are selected to receive the voucher at the end of the survey, you can choose to keep the full amount or donate up to £25 to *People and Planet*, a student-led campaign organization that addresses pressing social and environmental issues.

A. Will you like to donate a part of your remuneration? ( ) Yes ( ) No

B. How much will you like to donate (please select a value below):

i. £5
ii. £10
iii. £15
iv. £20
v. £25

Appendix 8

Experimental Stimuli and Questionnaire (Study 6)

Background and Controls

1. What is your gender? □ Male □ Female □ Other □ Rather not say
2. Age (in years) _____
3. Do you have any of the following qualifications?
   a. No formal qualifications
   b. GCSE/O-Level
   c. A-Level/Higher/BTEC
   d. Vocational/NVQ
   e. Degree or equivalent
   f. Postgraduate Qualification
   g. Other (please specify)_____

4. Do you have any of the following qualifications in a science –related subject?
   a. Vocational/NVQ
   b. Degree or equivalent
   c. Postgraduate Qualification
   d. Other (please specify)_____

6. Which of the following political parties are you most likely to vote for in an election?
   □ Conservative
   □ Green
   □ Labour
   □ Liberal Democrat
   □ Labour
   □ UKIP
   □ Other (please specify) _____
   □ Prefer not to say
   □ Would not vote

7. Annual household income (please select one category below)
   □ Up to £9,999
   □ £10,000 - £19,999
   □ £20,000 - £29,000
   □ £30,000 - £39,000
   □ £40,000 and above
   □ Prefer not to say

8. Do you believe the world's climate is changing?
   □ No □ Yes □ Don't know

8b. Do you think human activities are contributing to current changes in the world' climate?
   □ No □ Yes □ Don't know

8c. How concerned are you about global climate change?

□	□	□	□	□
Not at all				Highly concerned

9**. Shortened NEP – New Ecological Paradigm (Dunlap et al. 2000; Whitmarsh, 2011) and Shortened Scepticism scale (Whitmarsh, 2011)**

To what extent do the following statements reflect your views on climate change and the environment?							
	Strongly Disagree						Strongly Agree
Humans have the right to modify the environment to suit their needs	1	2	3	4	5	6	7
Humans are severely abusing the planet	1	2	3	4	5	6	7
Nature is strong enough to cope with the impact of modern industrial nations	1	2	3	4	5	6	7
Humans were meant to rule over the rest of nature	1	2	3	4	5	6	7
The balance of nature is very delicate and easily upset	1	2	3	4	5	6	7
Plants and animals have the same rights as humans to exist	1	2	3	4	5	6	7
I do not believe climate change is a real problem	1	2	3	4	5	6	7
The evidence for climate change is unreliable	1	2	3	4	5	6	7
Recent floods and heat-waves in this country are due to climate change	1	2	3	4	5	6	7
Floods and heat-waves are not increasing, there's just more reporting of it in the media these days	1	2	3	4	5	6	7
It is impossible to link a single event, such as a flood, to climate change	1	2	3	4	5	6	7
Claims that human activities are changing the climate are exaggerated	1	2	3	4	5	6	7

10. **Perceived norms (Descriptive + Injunctive)**

Please evaluate the extent to which each of the statements below accurately describes the attitudes of people you know, and British citizens in general by indicating your level of agreement/disagreement with each using the scale provided.							
	Strongly Disagree						Strongly Agree
"*Most people around me are personally doing something to help reduce the risk of climate change*" (D)	1	2	3	4	5	6	7
"*My friends and relatives would support me if I decided to change my behaviour to help reduce climate change*"(I)	1	2	3	4	5	6	7
"*Most people I know **do not** expect me to do anything personally to help address climate change*"(I-)	1	2	3	4	5	6	7
"*Most of my colleagues, friends and other people I know are involved with an organization or group that addresses environmental issues including climate change*" (D)	1	2	3	4	5	6	7
"*Most people around me approve of donating to, or fundraising for, environmental groups that focus on Climate Change*" (I)	1	2	3	4	5	6	7
"*Addressing Climate Change, is **not** a high priority for most people I know*" (D-)	1	2	3	4	5	6	7
"*Most people I know are not personally doing anything to address Climate Change*" (D-)	1	2	3	4	5	6	7
"*My friends and relatives **would not** support me if I decided to change my behaviour to help reduce Climate Change*" (I-)	1	2	3	4	5	6	7

"*Most people in Britain are concerned about climate change*"	1	2	3	4	5	6	7
"*Most people in Britain are making personal efforts to address climate change*"	1	2	3	4	5	6	7

Past experience

a. Considering roughly the last 5 years, how often have you personally experienced flooding in your local area?

□ Never □ Once □ Twice □ Three times □ More than 3 times

□ I don't remember

b. Considering roughly the 5 years, how often (in total) have you personally experienced any type of extreme weather event (other than flooding) in your local area (e.g., severe heat waves, droughts, freak storms, hurricanes etc.?

□ Never □ Once □ Twice □ Three times □ More than 3 times

□ I don't remember

Imagined Experience Manipulation

Beginning on Saturday, 4th December 2015, Storm Desmond brought exceptionally heavy rainfall to large parts of northern England, southern Scotland and north Wales. The rainfall resulted in record-breaking flooding in Cumbria, Northumberland and the Scottish Borders. In the course of the following three days, 45,700 homes across the UK were left without power, over a thousand people were evacuated from their homes, and three people lost their lives due to the severity of the wind and rainstorms. Further, the storm also caused extensive disruption to critical road, rail and air transport services across the country. According to Met Office Chief Scientist, Professor Dame Julia Slingo, the "extraordinary amounts of water" dumped by the storm broke precipitation records going back to the 1800s. (Sources: BBC News; Met Office).

Imagined Experience Prompt Message:

For the next two minutes, please imagine yourself as a victim of the floods described above. Imagine watching your home and property being extensively damaged by floodwater, being unable to get access to nearby shops for food and groceries, and being unable to go to work as most roads in the vicinity are now submerged. In the space provided below, please describe as many aspects of the scenario you just imagined as possible.

Additional Questions:

(i) How easy was it for you to imagine yourself being in this situation (7-point: Very Difficult to Very Easy).
(j) How vivid (clear) was your mental imagery of yourself being in this situation (7-point: Not vivid to Very Vivid)
(k) In your imagined scenario, how did you feel about the experience of the flood?
(l) How likely do you think it is that Storm Desmond and the extreme flooding it caused are linked to climate change? (1 = Not at all likely, 7 = Very likely).
(m) How confident are you that the storm and flooding are linked to climate change? (1 = Not Confident, 7 = Very Confident).

Control Prompt Message

The control group will be presented with the text describing Storm Desmond and the floods at the end of the questionnaire along with questions (d) and (e) above.

Dependent variables

Perceived Threat

Please answer the following questions to the best of your ability							
	Not Serious at all						Very Serious
How serious of a threat do you believe climate change is to you personally?	1	2	3	4	5	6	7
How serious of a threat do you think climate change impacts are for the area you currently live in?	1	2	3	4	5	6	7
How serious do you estimate the impacts of climate change are for the natural environment?	1	2	3	4	5	6	7
How serious of a threat do you think the impacts of climate change are across the world?	1	2	3	4	5	6	7
	Very Unlikely						Very Likely
In your judgment, how likely do you think it is that climate change will have harmful effects on your local area?	1	2	3	4	5	6	7
How likely do you think it is that you will experience serious threats to your health or overall well-being, sometime during your lifetime, as a result of Climate Change?	1	2	3	4	5	6	7
How likely do you think it is that the natural environment (including wildlife and biodiversity) will be affected adversely by climate change?	1	2	3	4	5	6	7
How likely do you think it is that British society as a whole will experience adverse long-term consequences from climate change?	1	2	3	4	5	6	7

Discrete Emotions

When you think about the seriousness of climate change, and its potential impacts, how strongly do you feel the following emotions?							
	Not at all						Very Strongly
Fear	1	2	3	4	5	6	7
Worry	1	2	3	4	5	6	7
Concern	1	2	3	4	5	6	7
Anger	1	2	3	4	5	6	7

Perceived Efficacy (Self, Collective, Response)

How confident are you that the following can make a difference in addressing Climate Change?							
	Not Confident						Very Confident
Changing your behaviour and lifestyle (*e.g.* purchasing, consumption and energy use practices) (Self)	1	2	3	4	5	6	7
Efforts made by you as an individual to influence climate policies (e.g. petitioning local politicians, participation in demonstrations) (Self)	1	2	3	4	5	6	7
The combined efforts of groups of individuals like yourself to address climate change (Collective)	1	2	3	4	5	6	7

The collective actions of individuals such as in campaign groups, charities etc. (Collective)	1	2	3	4	5	6	7

Acceptance of responsibility

Focusing on your current feelings about climate change, how accurately do the following statements describe your attitude?							
	Strongly Disagree						Strongly Agree
You consider it a personal obligation to address climate change in any way you can	1	2	3	4	5	6	7
You feel that individuals like yourself should not be expected to take on the responsibility of addressing climate change	1	2	3	4	5	6	7
You feel a strong sense of responsibility for addressing climate change	1	2	3	4	5	6	7
You feel that you should not be responsible for addressing such a problem	1	2	3	4	5	6	7

Climate Scepticism (Whitmarsh, 2011)

The following statements have been extracted from recent polls of public opinion on climate change in the UK. Please indicate the extent to which each reflects your current beliefs.							
	Strongly Disagree						Strongly Agree
The media is often too alarmist about issues like climate change	1	2	3	4	5	6	7
I am uncertain about whether climate change is really happening	1	2	3	4	5	6	7
Climate change is too complex and uncertain for scientists to make useful forecasts	1	2	3	4	5	6	7
There is too much conflicting evidence about climate change to know if it's really happening	1	2	3	4	5	6	7
Many leading experts still question if human activity is contributing to climate change	1	2	3	4	5	6	7
Claims that human activity is changing the climate are exaggerated	1	2	3	4	5	6	7

Behavioural Intentions (General + Specific)

Please answer the following questions based on your current feelings about Climate Change							
	Strongly Disagree						Strongly Agree
I intend to help reduce climate change by changing my behaviour	1	2	3	4	5	6	7
I'm willing to greatly reduce my energy use to help tackle climate change	1	2	3	4	5	6	7
How likely are you to engage in the following behaviours within the next 4 weeks?							
	Very unlikely						Very likely
Mostly walk, cycle, or use public transport when commuting	1	2	3	4	5	6	7
Launch or sign a petition calling on the government to make stronger commitments to lowering carbon emissions and investing in renewable energy	1	2	3	4	5	6	7
Join, or volunteer in, an organization involved with climate change	1	2	3	4	5	6	7
Donate to, or raise funds for, an environmental group involved with climate change	1	2	3	4	5	6	7

Purchase and consume only locally sourced produce	1	2	3	4	5	6	7
Conserve energy by switching off lights in unoccupied rooms and turning off unused appliances at home/work	1	2	3	4	5	6	7

Self-rated Knowledge

How would you rate your knowledge of Climate Change?						
Very Low						Very High
1	2	3	4	5	6	7

Cause - Knowledge

Please indicate, to the best of your knowledge, how much you believe that each of the following items contribute to Climate Change							
	Minor contribution			Don't know	Major contribution		
Burning fossil fuels (coal, oil, gas) for heat and electricity	-3	-2	-1	0	1	2	3
The hole in the Ozone Layer	-3	-2	-1	0	1	2	3
Driving a car	-3	-2	-1	0	1	2	3
Aerosol spray cans (containing CFCs)	-3	-2	-1	0	1	2	3
Toxic waste	-3	-2	-1	0	1	2	3
Nuclear power plants	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Agricultural activities (*e.g.*, cattle breeding)	-3	-2	-1	0	1	2	3
The sun	-3	-2	-1	0	1	2	3
Flying/Commercial air travel	-3	-2	-1	0	1	2	3
Smoking cigarettes	-3	-2	-1	0	1	2	3
Deforestation	-3	-2	-1	0	1	2	3

Impact - Knowledge

For each of the items listed below, please indicate whether you believe that they are likely to decrease, remain constant or increase ***as a result of*** Climate Change.							
	Likely to decrease			No Change	Likely to increase		
Global average temperature	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Air pollution	-3	-2	-1	0	1	2	3
Areas in the world experiencing drought	-3	-2	-1	0	1	2	3
Global biodiversity (i.e. variety of plants and animals)	-3	-2	-1	0	1	2	3
Melting of glaciers and polar ice caps	-3	-2	-1	0	1	2	3
Global spread of infectious diseases	-3	-2	-1	0	1	2	3
The hole in the Ozone layer	-3	-2	-1	0	1	2	3
Extreme weather events (e.g. floods, storms etc.)	-3	-2	-1	0	1	2	3
Volcanic eruptions	-3	-2	-1	0	1	2	3
The frequency of hot days and nights	-3	-2	-1	0	1	2	3
Global fresh water supply	-3	-2	-1	0	1	2	3

Appendix 9

Questionnaire and Experimental Stimuli (Study 7)

Background and Controls

1. Do you believe the world's climate is changing?
   □ No □ Yes □ Don't know
2. Do you think human activities are contributing to current changes in the world' climate?
   □ No □ Yes □ Don't know
3. How concerned are you about global climate change?
   □ □ □ □ □
   Not at all Highly concerned

4. Trust

How much do you trust the following groups to provide the public with reliable information on climate change?							
	No trust						A lot of trust
Politicians	1	2	3	4	5	6	7
Scientists	1	2	3	4	5	6	7
Journalists	1	2	3	4	5	6	7
Environmental Organizations/Charities	1	2	3	4	5	6	7
Meteorologists	1	2	3	4	5	6	7

5. Self-rated Knowledge

How do you rate your knowledge of climate change?						
Very Low						Very High
1	2	3	4	5	6	7

6. Shortened Scepticism scale (Whitmarsh, 2011)

To what extent do the following statements reflect your views on climate change and the environment?							
	Strongly Disagree						Strongly Agree
I am uncertain about whether climate change is really happening	1	2	3	4	5	6	7
The evidence for climate change is unreliable	1	2	3	4	5	6	7
Many experts still question the notion that human activity is contributing to climate change	1	2	3	4	5	6	7
Floods and heat-waves are not increasing, there's just more reporting of it in the media these days	1	2	3	4	5	6	7
There is too much conflicting evidence about climate change to know if it's really happening	1	2	3	4	5	6	7
Claims that human activities are changing the climate are exaggerated	1	2	3	4	5	6	7

7. Past experience

a. Considering roughly the last 5 years, how often have you personally experienced flooding in your local area?

□ Never □ Once □ Twice □ Three times □ More than 3 times □ I don't remember

b. Considering roughly the 5 years, how often (in total) have you personally experienced any type of extreme weather event (other than flooding) in your local area (e.g., severe heat waves, droughts, freak storms, hurricanes etc.?

□ Never □ Once □ Twice □ Three times □ More than 3 times □ I don't remember

8. **Perceived Norms (Descriptive + Injunctive)**

Please evaluate the extent to which each of the statements below accurately describes the attitudes of people you know, and people in Britain in general, by indicating your level of agreement/disagreement using the scale provided.							
	Strongly Disagree						Strongly Agree
"*Most people around me are personally doing something to help reduce the risk of climate change*" (D)	1	2	3	4	5	6	7
"*My friends and relatives would support me if I decided to change my behaviour to help reduce climate change*"(I)	1	2	3	4	5	6	7
"*Most people I know **do not** expect me to do anything personally to help address climate change*"(I-)	1	2	3	4	5	6	7
"*Most of my colleagues, friends and other people I know are involved with an organization or group that addresses environmental issues including climate change*" (D)	1	2	3	4	5	6	7
"*Addressing Climate Change, is **not** a high priority for most people I know*" (D-)	1	2	3	4	5	6	7
"*Most people I know are **not** personally doing anything to address Climate Change*" (D-)	1	2	3	4	5	6	7
"*My friends and relatives **would not** support me if I decided to change my behaviour to help reduce Climate Change*" (I-)	1	2	3	4	5	6	7
"*Most people in Britain are concerned about climate change*"	1	2	3	4	5	6	7
"*Most people in Britain are making personal efforts to address climate change*"	1	2	3	4	5	6	7

9. Demographics

4. What is your gender? □ Male □ Female □ Other □ Rather not say
5. Are you currently a student (if no, please skip next question)? □ No □ Yes
6. Course and year of study _____
7. Age (in years) _____
8. Nationality _____
9. Which of the following political parties are you most likely to vote for in an election?
   - □ Conservative
   - □ Green
   - □ Labour
   - □ Liberal Democrat
   - □ UKIP
   - □ Other (please specify) _____
   - □ Prefer not to say
   - □ Would not vote
   - □ Not eligible to vote

Imagined Experience Manipulation (Attributed)

Beginning on Saturday, 4th December 2015, 'Storm Desmond' brought exceptionally heavy rainfall to large parts of northern England, southern Scotland and north Wales. The rainfall resulted in record-breaking flooding in Cumbria, Northumberland and the Scottish Borders. In the course of the following three days, 45,700 homes across the UK were left without power, over a thousand people were evacuated from their homes, and three people died as a result of the severity of the wind and rainstorms. The storm also caused extensive disruption to critical road, rail and air transport services across the country. According to Met Office Chief Scientist, Professor Dame Julia Slingo, the "extraordinary amounts of water" dumped by the storm broke precipitation records going back to the 1800s". Scientists at the Center for Atmospheric Sciences also added that "the characteristics of Storm Desmond appear to be consistent with the pattern of extreme weather events that are expected to become more likely as a consequence of global climate change." (Sources: BBC News; Met Office).

Imagined Experience Manipulation (Disattributed)

Beginning on Saturday, 4th December 2015, Storm Desmond brought exceptionally heavy rainfall to large parts of northern England, southern Scotland and north Wales. The rainfall resulted in record-breaking flooding in Cumbria, Northumberland and the Scottish Borders. In the course of the following three days, 45,700 homes across the UK were left without power, over a thousand people were evacuated from their homes, and three people lost their lives due to the severity of the wind and rainstorms. The storm also caused extensive disruption to critical road, rail and air transport services across the country. According to Met Office Chief Scientist, Professor Dame Julia Slingo, the "extraordinary amounts of water" dumped by the storm broke precipitation records going back to the 1800s. However, scientists at the Center for Atmospheric Sciences also added that "the characteristics of Storm Desmond do not appear to be consistent with the pattern of extreme weather events that are expected to result from global climate change". (Sources: BBC News; Met Office).

Imagined Experience Prompt Message:

For the next two minutes, please imagine yourself as a victim of the floods caused by 'Storm Desmond'. Imagine watching your home and property being extensively damaged by floodwater, being unable to get access to nearby shops for food and groceries, and being unable to go to work as most roads in the vicinity are now submerged. In the space provided below, please describe the scenario you just imagined in as much detail as possible.

Additional Questions:

(n) How easy was it for you to imagine yourself being in this situation (7-point: Very Difficult to Very Easy).
(o) How vivid (clear) was your mental imagery of yourself being in this situation (7-point: Not vivid to Very Vivid)
(p) In your imagined scenario, how did you feel about the experience of the flood?
(q) How likely do you think it is that Storm Desmond and the extreme flooding it caused are linked to climate change? (1 = Not at all likely, 7 = Very likely).
(r) How confident are you about your answer to question (d) above? (1 = Not Confident, 7 = Very Confident).

Control Prompt Message

Beginning on Saturday, 4th December 2015, 'Storm Desmond' brought exceptionally heavy rainfall to large parts of northern England, southern Scotland and north Wales. The rainfall resulted in record-breaking flooding in Cumbria, Northumberland and the Scottish Borders. In the course of the following three days, 45,700 homes across the UK were left without power, over a thousand people were evacuated from their homes, and three people died as a result of the severity of the wind and rainstorms. The storm also caused extensive disruption to critical road, rail and air transport services across the country. According to Met Office Chief Scientist, Professor Dame Julia Slingo, the "extraordinary amounts of water" dumped by the storm broke precipitation records going back to the 1800s"

The control group will be presented with the text describing Storm Desmond and the floods at the end of the questionnaire along with questions (d) and (e) above.

Dependent Variables

Perceived Threat

Please answer the following questions to the best of your ability							
	Not Serious at all						Very Serious
How serious of a threat do you believe climate change is to you personally?	1	2	3	4	5	6	7
How serious of a threat do you think climate change impacts are for the area you currently live in?	1	2	3	4	5	6	7
How serious do you estimate the impacts of climate change are for the natural environment?	1	2	3	4	5	6	7
How serious of a threat do you think the impacts of climate change are across the world?	1	2	3	4	5	6	7
	Very Unlikely						Very Likely
In your judgment, how likely do you think it is that climate change will have harmful effects in your local area?	1	2	3	4	5	6	7
How likely do you think it is that you will experience serious threats to your health or overall well-being, sometime during your lifetime, as a result of Climate Change?	1	2	3	4	5	6	7
How likely do you think it is that the natural environment (including wildlife and biodiversity) will be affected adversely by climate change?	1	2	3	4	5	6	7
How likely do you think it is that society as a whole will experience adverse consequences from climate change?	1	2	3	4	5	6	7

Discrete Emotions

When you think about climate change, and its potential impacts, how strongly do you feel the following emotions?							
	Not at all						Very Strongly
Fear	1	2	3	4	5	6	7
Worry	1	2	3	4	5	6	7
Concern	1	2	3	4	5	6	7
Anger	1	2	3	4	5	6	7

Perceived Efficacy (Self, Collective, Response)

How confident are you that the following can make a difference in addressing Climate Change?							
	Not Confident						Very Confident
Changing your behaviour and lifestyle (*e.g.* purchasing, consumption and energy use practices) (Self)	1	2	3	4	5	6	7
Efforts made by you as an individual to influence climate policies (e.g. petitioning local politicians, participation in demonstrations) (Self)	1	2	3	4	5	6	7
The combined efforts of groups of individuals like yourself to address climate change (Collective)	1	2	3	4	5	6	7
The collective actions of individuals such as in campaign groups, charities etc. (Collective)	1	2	3	4	5	6	7

Acceptance of Responsibility

Focusing on your current feelings about climate change, how accurately do the following statements describe your attitude?							
	Strongly Disagree						Strongly Agree
You consider it a personal obligation to address climate change in any way you can	1	2	3	4	5	6	7
You feel that individuals like yourself should not be expected to take on the responsibility of addressing climate change	1	2	3	4	5	6	7
You feel a strong sense of responsibility for addressing climate change	1	2	3	4	5	6	7
You feel that you should not be responsible for addressing such a problem	1	2	3	4	5	6	7

Climate Scepticism (Whitmarsh, 2011)

The following statements have been extracted from recent polls of public opinion on climate change in the UK. Please indicate the extent to which each reflects your current beliefs.							
	Strongly Disagree						Strongly Agree
The media is often too alarmist about issues like climate change	1	2	3	4	5	6	7
I am uncertain about whether climate change is really happening	1	2	3	4	5	6	7
Climate change is too complex and uncertain for scientists to make useful forecasts	1	2	3	4	5	6	7
There is too much conflicting evidence about climate change to know if it's really happening	1	2	3	4	5	6	7
Many leading experts still question if human activity is contributing to climate change	1	2	3	4	5	6	7
Claims that human activity is changing the climate are exaggerated	1	2	3	4	5	6	7

Behavioural Intentions (General + Specific)

Please answer the following questions based on your current feelings about Climate Change							
	Strongly Disagree						Strongly Agree
I intend to help reduce climate change by changing my behaviour	1	2	3	4	5	6	7
I'm willing to greatly reduce my energy use to help tackle climate change	1	2	3	4	5	6	7
How likely are you to engage in the following behaviours within the next 4 weeks?							
	Very unlikely						Very likely
Mostly walk, cycle, or use public transport when commuting	1	2	3	4	5	6	7
Launch or sign a petition calling on the government to make stronger commitments to lowering carbon emissions and investing in renewable energy	1	2	3	4	5	6	7
Join, or volunteer in, an organization involved with climate change	1	2	3	4	5	6	7
Donate to, or raise funds for, an environmental group involved with climate change	1	2	3	4	5	6	7
Purchase and consume only locally sourced produce	1	2	3	4	5	6	7

Conserve energy by switching off lights in unoccupied rooms and turning off unused appliances at home/work	1	2	3	4	5	6	7

Cause - Knowledge

Please indicate, to the best of your knowledge, how much you believe that each of the following items contribute to Climate Change							
	Minor contribution			Don't know	Major contribution		
Burning fossil fuels (coal, oil, gas) for heat and electricity	-3	-2	-1	0	1	2	3
The hole in the Ozone Layer	-3	-2	-1	0	1	2	3
Driving a car	-3	-2	-1	0	1	2	3
Aerosol spray cans (containing CFCs)	-3	-2	-1	0	1	2	3
Toxic waste	-3	-2	-1	0	1	2	3
Nuclear power plants	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Agricultural activities (*e.g.*, cattle breeding)	-3	-2	-1	0	1	2	3
The sun	-3	-2	-1	0	1	2	3
Flying/Commercial air travel	-3	-2	-1	0	1	2	3
Smoking cigarettes	-3	-2	-1	0	1	2	3
Deforestation	-3	-2	-1	0	1	2	3

Impact - Knowledge

For each of the items listed below, please indicate whether you believe that they are likely to decrease, remain constant or increase ***as a result of*** Climate Change.							
	Likely to decrease			No Change	Likely to increase		
Global average temperature	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Air pollution	-3	-2	-1	0	1	2	3
Areas in the world experiencing drought	-3	-2	-1	0	1	2	3
Global biodiversity (i.e. variety of plants and animals)	-3	-2	-1	0	1	2	3
Melting of glaciers and polar ice caps	-3	-2	-1	0	1	2	3
Global spread of infectious diseases	-3	-2	-1	0	1	2	3
The hole in the Ozone layer	-3	-2	-1	0	1	2	3
Extreme weather events (e.g. floods, storms etc.)	-3	-2	-1	0	1	2	3
Volcanic eruptions	-3	-2	-1	0	1	2	3
The frequency of hot days and nights	-3	-2	-1	0	1	2	3
Global fresh water supply	-3	-2	-1	0	1	2	3

Appendix 10

Questionnaire (Study 8)

1. What is your gender?
    - Male
    - Female

2. In what year were you born?
3. What subject are you studying? (e.g. Law, Economics, Psychology)
4. Using the scale below, how would you rate the severity of climate change impacts in your country? (circle a number)

Not Severe Very Severe

1 – 2 – 3 – 4 – 5 – 6 – 7 – 8 – 9 – 10

5. Considering the severity of climate change impacts in your country, to what extent do you agree that climate change is a threat to:

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
Your Lifestyle	❍	❍	❍	❍	❍	❍	❍
Your Health	❍	❍	❍	❍	❍	❍	❍
Your Livelihood	❍	❍	❍	❍	❍	❍	❍
Your Family	❍	❍	❍	❍	❍	❍	❍
Your Community	❍	❍	❍	❍	❍	❍	❍
Your society in general	❍	❍	❍	❍	❍	❍	❍

6. When you think about the threat of climate change, how strongly do you experience the following emotions?

	Not at all	Very Mildly	Mildly	Moderately	A bit Strongly	Strongly	Very Strongly
Concern	❍	❍	❍	❍	❍	❍	❍
Fear	❍	❍	❍	❍	❍	❍	❍
Frustration	❍	❍	❍	❍	❍	❍	❍
Powerlessness	❍	❍	❍	❍	❍	❍	❍
Indifference	❍	❍	❍	❍	❍	❍	❍
Anger	❍	❍	❍	❍	❍	❍	❍
Worry	❍	❍	❍	❍	❍	❍	❍

7. Have you ever had a personal direct experience of the effects of climate change?
    - No
    - Yes

8. How often do you come across general information about climate change?
    - Never
    - Rarely
    - Fairly Regularly
    - Weekly
    - Daily

9. How often do you come across information on actions by which you could personally address climate change issues in your country?
    - Never
    - Rarely
    - Fairly Regularly
    - Weekly
    - Daily

10. How would you rate yourself in the following aspects?

	Very Low	Low	Less than Average	Moderate	Above Average	High	Very High
General Knowledge of Climate Change	❍	❍	❍	❍	❍	❍	❍
Knowledge of personal actions by which to address climate change	❍	❍	❍	❍	❍	❍	❍

11. Have you engaged in any of the following activities recently?

	No	Yes
Joined an environmental group	❍	❍
Talked to friends/family about climate change and other environmental issues	❍	❍
Looked for information about climate change in books, magazines or websites	❍	❍
Attended a climate change related event, lecture or seminar	❍	❍
Chosen or avoided a product because of its climatic impact	❍	❍
Changed any aspect of your lifestyle because of climate change	❍	❍
Tried to do things in a way that minimizes your impact on the environment	❍	❍
Volunteered in, or donated money to an environmental organization	❍	❍
Participated in climate change related public sensitization campaign	❍	❍

12. Based on your knowledge of yourself and others around you, <u>how confident are you about the accuracy of the following statements</u> at the present time?

	Not at all Confident	Very Weakly Confident	Less than moderately Confident	Moderately Confident	More than moderately Confident	Confident	Very Confident
Your personal efforts can significantly help in	❍	❍	❍	❍	❍	❍	❍

reducing the threat of climate change in your country							
You are capable of getting information that will help you understand climate change issues affecting your present locality	❍	❍	❍	❍	❍	❍	❍
You can make lifestyle changes that will significantly help in reducing the threat of climate change in your area	❍	❍	❍	❍	❍	❍	❍
You can help in pressuring local leaders and the government to address climate change issues in your locality	❍	❍	❍	❍	❍	❍	❍
Collective action, like the efforts of people in environmental groups, can help reduce the threat of climate change in your country	❍	❍	❍	❍	❍	❍	❍
Participating in environmental groups can help everyone improve their understanding of climate change issues in your country	❍	❍	❍	❍	❍	❍	❍
Through collective efforts, people in your country could be influenced to make lifestyle changes that will reduce the threat of climate change	❍	❍	❍	❍	❍	❍	❍
Yourself and other people you know can collectively influence the government and public leaders to address climate change issues in your country	❍	❍	❍	❍	❍	❍	❍

13. Based on your personal worldviews, to what extent do you agree with the following statements about the issue of climate change in your country?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
Climate change is partly evidence of mother nature's displeasure at humanity's unnatural activities	❍	❍	❍	❍	❍	❍	❍
Climate change cannot be resolved solely by scientific interventions, but with some form of divine intervention	❍	❍	❍	❍	❍	❍	❍
Climate change is a sign of God's reaction to humanity's many sins	❍	❍	❍	❍	❍	❍	❍
Climate change is ultimately beyond human control	❍	❍	❍	❍	❍	❍	❍
Climate change is part of our destiny, and human efforts to resolve climate change issues are unlikely to succeed	❍	❍	❍	❍	❍	❍	❍
Climate change is uncontrollable and attempting to tackle it with human ability is a waste of time	❍	❍	❍	❍	❍	❍	❍

14. Thinking about people close to you and others you know, to what extent do you agree that the following statements accurately describe your social circumstances?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
Your friends/relatives think climate change is a serious threat	❍	❍	❍	❍	❍	❍	❍
Your close friends and relatives think you should personally do something to address climate change	❍	❍	❍	❍	❍	❍	❍

Your friends and family expect you to be concerned about climate change	❍	❍	❍	❍	❍	❍	❍
Your friends and relatives think being concerned about climate change is a waste of time	❍	❍	❍	❍	❍	❍	❍
Most people you know are already trying to do something about climate change	❍	❍	❍	❍	❍	❍	❍
Some people you know are trying to reduce the negative environmental impacts of their lifestyles	❍	❍	❍	❍	❍	❍	❍
Some people close to you have volunteered in, or contributed money to environmental groups	❍	❍	❍	❍	❍	❍	❍
Some people you know are members of environmental groups	❍	❍	❍	❍	❍	❍	❍

15. Now, focusing on your own feelings about the issue of climate change, to what extent do you agree that the following statements accurately reflect your attitude?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Some what Agree	Agree	Strongly Agree
You feel a strong sense of personal responsibility for addressing climate change issues	❍	❍	❍	❍	❍	❍	❍
You do not feel you should be personally responsible for such a general problem as climate change	❍	❍	❍	❍	❍	❍	❍
Individuals like yourself should not be burdened with the responsibility of addressing climate change issues	❍	❍	❍	❍	❍	❍	❍
You consider it your personal duty to try to address climate change in whatever way you can	❍	❍	❍	❍	❍	❍	❍

16. Thinking about the possible consequences of climate change, to what extent do you think each of the following is likely to affect you and other people around you?

	Not Likely	2	3	4	5	6	Very Likely
Increasing frequency of extreme weather events such as heat-waves, droughts and floods	❍	❍	❍	❍	❍	❍	❍
A climate change induced decline in economic growth and development	❍	❍	❍	❍	❍	❍	❍
Increase in weather-related health issues such as heat-stress and vector-borne disease infection	❍	❍	❍	❍	❍	❍	❍
A climate-related reduction in overall quality of life	❍	❍	❍	❍	❍	❍	❍
Increasing human mortality from natural disasters	❍	❍	❍	❍	❍	❍	❍
An increase in terrorism and violent social conflicts	❍	❍	❍	❍	❍	❍	❍

17. Based on your present feelings about climate change, do you intend to engage in any of the following activities in the near future?

	No	Yes
Talk to friends/relatives about climate change	❍	❍
Attend a seminar or public lecture on climate change	❍	❍
Try to learn more about climate change from books, websites and TV programs	❍	❍
Stop buying/using products that have a negative impact on the environment	❍	❍
Try to do more things that minimize your environmental impact	❍	❍
Join an environmental group	❍	❍
Volunteer in, or donate money to an environmental group	❍	❍
Participate in a climate change related public sensitization campaign	❍	❍
Take up a climate-friendly lifestyle	❍	❍

Appendix 11

Norms Experiment – Questionnaire & Stimuli

Background and Controls

5. What is your gender? □ Male □ Female □ Rather not say □ Other
6. Which of the following best describes your ethnicity?
   □ Asian/Asian British/Other Asian Descent
   □ Black/African/Afro-Caribbean/Black British
   □ Caucasian/White
   □ Mixed/Multiple Ethnicities
   □ Other (please specify) _____
7. Age _____
8. Subject and year of study _____
9. Nationality _____

6. Social Identification

Please rate the level to which the following statements represent your view of other students of the University of St Andrews by indicating agreement or disagreement as appropriate.							
	Strongly Disagree						Strongly Agree
"*I identify with University of St Andrews students*"	1	2	3	4	5	6	7
"*I have a lot in common with other students at the University of St Andrews*"	1	2	3	4	5	6	7
"*Being a student at the University of St Andrews is an important part of how I see myself*"	1	2	3	4	5	6	7
"*I feel personally criticised when someone who is not a student here criticises University of St Andrews students*"	1	2	3	4	5	6	7
"*I feel strong ties with other University of St Andrews students*"	1	2	3	4	5	6	7

7. Impression Management (Shortened BIDR scale: Paulhus, 1991; Milfont, 2009)

Using the scale provided, please indicate your level of agreement with each statement below							
	Not True						Very True
"*I sometimes tell lies if I have to*"	1	2	3	4	5	6	7
"I never cover up my mistakes"	1	2	3	4	5	6	7
"*There have been occasions where I have taken advantage of someone*"	1	2	3	4	5	6	7
"*I never swear*"	1	2	3	4	5	6	7
"*I sometimes try to get even rather than forgive and forget*"	1	2	3	4	5	6	7
"*I always obey laws, even if I am unlikely to get caught*"	1	2	3	4	5	6	7

"*I have said something bad about a friend behind his or her back*"	1	2	3	4	5	6	7
"*When I hear people talking privately, I avoid listening*"	1	2	3	4	5	6	7
"*I have received too much change from a salesperson without telling him or her*"	1	2	3	4	5	6	7
"*I have never dropped litter on the street*"	1	2	3	4	5	6	7

8. Value orientations (de Groot & Steg, 2008)
Below are a number of values that some people consider to be important. Please rate the importance of each one as a guiding principle in your life using a scale from 0 (not important) to 5 (extremely important). If you disagree with or are opposed to one of the values, please write -1.

_____Influence (having power over people and events)
_____Helpful (working for the welfare of others)
_____Respecting the earth (harmony with other species)
_____Wealth (money and material possessions)
_____Equality (equal opportunity for all)
_____Protecting the environment (preserving nature)
_____Authority (the right to lead or command)
_____Social justice (care for the weak, correcting injustice)
_____Unity with nature (fitting into nature)
_____Social recognition (respect and approval by others)
_____A world at peace (free from conflict)
_____Preventing pollution

9. **Pro-environmental self-identity** (Whitmarsh & O'Neill, 2010)

Thinking about your attitude toward environmental issues, how accurately do the following statements describe you?							
	Strongly Disagree						Strongly Agree
I think of myself as an environmentally-friendly consumer	1	2	3	4	5	6	7
I would be embarrassed to be seen as having an environmentally-friendly lifestyle	1	2	3	4	5	6	7
I think of myself as someone who is very concerned about environmental issues	1	2	3	4	5	6	7
I would not want my friends and family to think of me as someone who is concerned about environmental issues	1	2	3	4	5	6	7

10. Identification with the Environmental Movement (McCright &Dunlap, 2015)
"*The environmental movement is a diverse scientific, social and political movement for addressing environmental issues. Environmentalists advocate the sustainable management of resources and stewardship of the earth through changes in public policy and individual behaviour. The movement is centred on ecology, health and human rights.*"

This statement was retrieved from Wikipedia and will be presented at the top of the page in which the following items (a-c) are presented.

a. Are you currently a member of an environmental group? [No] [Yes]

ii. If yes, what is the name of the environmental group? _____

b. Do you consider yourself an environmentalist? [No] [Yes]

ii. If yes, would you say you are a strong environmentalist? [No] [Yes]

c. Thinking specifically about the environmental movement, do you think of yourself as:

1. Unsympathetic toward the environmental movement
2. Neutral
3. Sympathetic toward the environmental movement, but not actively involved
4. An active participant in the environmental movement

11. Personal experience of extreme weather

a. Considering roughly the 5 years, how often have you personally experienced flooding in your local area?

□ Never □ Once □ Twice □ Three times □ More than 3 times
□ I don't remember

b. Considering roughly the 5 years, how often (in total) have you personally experienced any type of extreme weather event (other than flooding) in your local area (e.g., severe heat waves, droughts, freak storms, hurricanes etc?

□ Never □ Once □ Twice □ Three times □ More than 3 times
□ I don't remember

In the next section of this study, you will be asked to read an excerpt from a magazine article. The text will be presented to you for a period of 10 minutes before you are automatically moved on to the next page without an option to return. Please read the text carefully and try to identify and memorize the main facts it contains as you will need to recall these when completing a subsequent section of the questionnaire. Click the "next" button to proceed.

(Norms manipulation)

Pro-descriptive + Pro-injunctive

"The University [of St Andrews] aims to become carbon neutral for energy consumption, to understand the carbon impact and reduce this footprint in the key areas of resource use, waste, travel, transport and ultimately procurement" (Sustainable Development Policy and Strategy, 2012). A primary target outlined in the university's plan to be carbon neutral by 2020 is to achieve effective communication of environment and sustainability issues to all staff and students. The results of a survey recently commissioned by the University reflect a high level of engagement with environmental issues within the student body. 74% of student respondents in the survey (N = 465) reported that they had made efforts to reduce their environmental impact and taken advantage of opportunities to act pro-environmentally in the preceding year. Examples of pro-environmental actions reportedly taken by these respondents include:

1. Recycling (81%)
2. Walking, cycling or using public transport as primary means of getting around (74%)
3. Turning out lights and appliances in unoccupied rooms to save energy (68%)
4. Purchasing only locally sourced produce when possible (56%)

5. Supporting an environmental campaign with donations or time volunteered (51%)
6. Reducing meat consumption/switching to an environment-friendly diet (42%)

Further, the majority of respondents (86%) in the survey expressed a strong approval of the University's mission to minimize its carbon footprint, and a similar proportion (83%) indicated agreement or strong agreement with the notion that every student and member of staff at the university should be personally involved in the effort to achieve a cleaner and healthier environment. According to the Environment Officer, [*name redacted*], the results of the survey are a substantive reflection of progress made through the University's commitment to establishing environmental consciousness and sustainability as core values among students and staff.

Anti-descriptive + Anti-injunctive

"The University [of St Andrews] aims to become carbon neutral for energy consumption, to understand the carbon impact and reduce this footprint in the key areas of resource use, waste, travel, transport and ultimately procurement" (Sustainable Development Policy and Strategy, 2012). A primary target outlined in the university's plan to be carbon neutral by 2020 is to achieve effective communication of environment and sustainability issues to all staff and students. The results of a survey recently commissioned by the University reflect a weak to moderate level of engagement with environmental issues within the student body. Only 47% of student respondents (N = 465) reported that they had consciously made efforts to reduce their environmental impact and taken advantage of opportunities to act pro-environmentally in the preceding year. Examples of pro-environmental actions reportedly taken by these respondents include:

1. Turning out lights and appliances in unoccupied rooms to save energy (48%)
2. Waste sorting and recycling (47%)
3. Walking, cycling or using public transport as primary means of getting around (44%)
4. Purchasing only locally sourced produce when possible (26%)
5. Supporting an environmental campaign with donations or time volunteered (19%)
6. Reducing meat consumption/switching to an environment-friendly diet (8%)

Further, the most of the respondents (63%) in the survey were unaware of the University's carbon management plan, and only a minority (42%) indicated agreement with the notion that every student and member of staff at the university should be personally involved in the effort to achieve a cleaner and healthier environment. According to the Environment Officer, [*name redacted*], the results of the survey are a substantive reflection of the challenge faced by the University in its commitment to establishing environmental consciousness and sustainability as core values among students and staff.

Pro-descriptive + Anti-injunctive

"The University [of St Andrews] aims to become carbon neutral for energy consumption, to understand the carbon impact and reduce this footprint in the key areas of resource use, waste, travel, transport and ultimately procurement" (Sustainable Development Policy and Strategy, 2012). A primary target outlined in the university's plan to be carbon neutral by 2020 is to achieve effective communication of environment and sustainability issues to all staff and students.

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6. Reducing meat consumption/switching to an environment-friendly diet (42%)

However, the majority of respondents (63%) in the survey were unaware of the University's carbon management plan, and only a minority (42%) indicated agreement with the notion that every student and member of staff at the university should be personally involved in the effort to achieve a cleaner and healthier environment. According to the Environment Officer, [*name redacted*], the results of the survey are a substantive reflection of the progress made, and some of the challenges yet to be tackled, by the University in its commitment to establishing environmental consciousness and sustainability as core values among students and staff.

Anti-descriptive + Pro-injunctive

"The University [of St Andrews] aims to become carbon neutral for energy consumption, to understand the carbon impact and reduce this footprint in the key areas of resource use, waste, travel, transport and ultimately procurement" (Sustainable Development Policy and Strategy, 2012). A primary target outlined in the university's plan to be carbon neutral by 2020 is to achieve effective communication of environment and sustainability issues to all staff and students. The results of a survey recently commissioned by the University reflect a weak to moderate level of engagement with environmental issues within the student body. Only 47% of student respondents (N = 465) reported that they had consciously made efforts to reduce their environmental impact and taken advantage of opportunities to act pro-environmentally in the preceding year. Examples of pro-environmental actions reportedly taken by these respondents include:

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establishing environmental consciousness and sustainability as core values among students and staff.

Manipulation Check:

Based on the information provided in the article, please identify each of the following statements as "true" or "false".

1. Most St Andrews students agree that staff and students should all be personally involved in ensuring a cleaner and healthier environment
   ( ) True ( ) False
2. Most respondents in the survey reportedly made a conscious effort to act pro-environmentally in the preceding year
   ( ) True ( ) False

12. Perceived norms (Descriptive + Injunctive)

Please evaluate the extent to which each of the statements below accurately describes the attitudes of students at the University of St Andrews by indicating your level of agreement/disagreement with each using the scale provided.							
	Strongly Disagree						Strongly Agree
"*Most students at the University of St Andrews are personally doing something to help reduce the risk of Climate Change*" (D)	1	2	3	4	5	6	7
"*Most students at the University of St Andrews would support me if I decided to change my behaviour to help reduce Climate Change*"(I)	1	2	3	4	5	6	7
"*My colleagues and other students at the University of St Andrews generally do not expect me to do anything personally to help address Climate Change*"(I-)	1	2	3	4	5	6	7
"*Most students at the University of St Andrews are involved with a charity or society that addresses environmental issues including Climate Change*" (D)	1	2	3	4	5	6	7
"*Most students at the University of St Andrews approve of donating to, or fundraising for, environmental groups that focus on Climate Change*" (I)	1	2	3	4	5	6	7
"*Addressing Climate Change, is not a high priority for most students at the University of St Andrews*" (D-)	1	2	3	4	5	6	7
"*Most students at the University of St Andrews are not personally doing anything to help address Climate Change*" (D-)	1	2	3	4	5	6	7
"*Most students at the University of St Andrews would not support me if I decided to change my behaviour to help reduce Climate Change*" (I-)	1	2	3	4	5	6	7

13. Perceived Efficacy (Self, Participative, Collective)

How confident are you that the following can make a difference in addressing Climate Change?							
	Not Confident						Very Confident
Personally changing your behaviour and lifestyle (*e.g.* purchasing practices and energy use) (Self)	1	2	3	4	5	6	7
Your personal contribution to collective (group) efforts aimed at addressing Climate Change (Participative)	1	2	3	4	5	6	7
Efforts made by you as an individual to address Climate Change (Self)	1	2	3	4	5	6	7
The combined efforts of multiple individuals like yourself to address Climate Change (Collective)	1	2	3	4	5	6	7
The personal contributions of individuals like you to collective (group) efforts aimed at addressing Climate Change (Participative)	1	2	3	4	5	6	7
The collective actions of individuals such as in campaign groups, charities etc. (Collective)	1	2	3	4	5	6	7

14. Response Efficacy

The following are examples of potential climate change mitigation actions. To what extent to do you think that each ***will be effective*** in addressing Climate Change?							
	Strongly Disagree						Strongly Agree
Petitioning government(s) to make stronger commitments to developing renewable energy sources	1	2	3	4	5	6	7
Reducing energy use in homes and workplaces	1	2	3	4	5	6	7
Reducing personal car use and substituting with cycling and public transport when possible	1	2	3	4	5	6	7
Donating to, or fundraising for, groups and charities working to help reduce the risk of Climate Change	1	2	3	4	5	6	7
Only purchasing and consuming locally-sourced food	1	2	3	4	5	6	7
Eating less meat	1	2	3	4	5	6	7
Joining an environmental group	1	2	3	4	5	6	7

15. Acceptance of responsibility (last two items adapted from de Groot & Steg, 2008)

Focusing on your current feelings about climate change, how accurately do the following statements describe your attitude?							
	Strongly Disagree						Strongly Agree
You consider it a personal obligation to address climate change in any way you can	1	2	3	4	5	6	7
You feel that individuals like yourself should not be expected to take on the responsibility of addressing climate change	1	2	3	4	5	6	7

You feel a strong sense of responsibility for addressing climate change	1	2	3	4	5	6	7
You feel that you should not be responsible for addressing such a problem	1	2	3	4	5	6	7
You feel your contribution to the cause of Climate Change is negligible	1	2	3	4	5	6	7
You feel everyone, including yourself, is jointly responsible for causing Climate Change	1	2	3	4	5	6	7

16. Perceived Threat

Please answer the following questions to the best of your ability							
	Not Serious at all						Very Serious
How serious of a threat do you believe Climate Change is to you personally?	1	2	3	4	5	6	7
How serious of a threat would you rate the current impacts of Climate Change around the world?	1	2	3	4	5	6	7
How serious would you estimate the impacts of climate change are for the natural environment?	1	2	3	4	5	6	7
How serious of a threat do you think current Climate Change impacts are for your country?	1	2	3	4	5	6	7
	Very Unlikely						Very Likely
In your judgment, how likely do you think it is that Climate Change will have very harmful long-term effects on our society?	1	2	3	4	5	6	7
How likely do you think you are to experience serious threats to your health or overall well-being, sometime during your life, as a result of Climate Change?	1	2	3	4	5	6	7
How likely do you think it is that the natural environment will be severely affected by the impacts of Climate Change?	1	2	3	4	5	6	7

17. Discrete Emotions

Thinking about the seriousness of climate change right now, and its potential impacts, how strongly do you feel the following emotions?							
	Not at all						Very Strongly
Fear	1	2	3	4	5	6	7
Worry	1	2	3	4	5	6	7
Concern	1	2	3	4	5	6	7
Anger	1	2	3	4	5	6	7
Guilt	1	2	3	4	5	6	7

18. Climate Scepticism (Whitmarsh, 2011)

The following statements have been extracted from recent polls of public opinion on Climate Change in the UK. Please indicate the extent to which each reflects your current beliefs.							
	Strongly Disagree						Strongly Agree
Claims that human activities are changing the climate are exaggerated	1	2	3	4	5	6	7
Climate Change is just a natural fluctuation of the earth's temperature	1	2	3	4	5	6	7
I am uncertain about whether Climate Change is really happening	1	2	3	4	5	6	7
It is too early to say whether Climate Change is really a problem	1	2	3	4	5	6	7
The evidence for Climate Change is unreliable	1	2	3	4	5	6	7
There is too much conflicting evidence about Climate Change to know if it is actually happening	1	2	3	4	5	6	7
Climate change is too complex and uncertain for scientists to make useful forecasts	1	2	3	4	5	6	7
Too much fuss is made about Climate Change	1	2	3	4	5	6	7
Floods and heat waves are not increasing, there's just more reporting of them in the media these days	1	2	3	4	5	6	7
Many leading experts still question if human activity is contributing to Climate Change	1	2	3	4	5	6	7
The media is often too alarmist about issues like Climate Change	1	2	3	4	5	6	7

19. Behavioural Intentions (General + Specific)

Please answer the following questions based on your current feelings about Climate Change							
	Strongly Disagree						Strongly Agree
I intend to help reduce Climate Change by changing my behaviour	1	2	3	4	5	6	7
I intend to do my bit to help tackle Climate Change	1	2	3	4	5	6	7
I intend to address Climate Change by taking personal action	1	2	3	4	5	6	7
How likely are you to engage in the following behaviours within the next 4 weeks?							
	Very Unlikely						Very Likely
Turn off lights in unoccupied rooms at home/work	1	2	3	4	5	6	7
Walk, cycle, or use public transport only when commuting	1	2	3	4	5	6	7
Increase current levels of waste-sorting and recycling	1	2	3	4	5	6	7
Donate money to, or raise funds, for an environmental group or charity involved with Climate Change	1	2	3	4	5	6	7
Sign an online petition calling on the government to commit to renewable energy and lowering carbon emissions in the UK (please omit if non-British resident)	1	2	3	4	5	6	7
Join, or volunteer in, an organization involved with Climate Change	1	2	3	4	5	6	7

Purchase and consume only locally sourced produce	1	2	3	4	5	6	7
Reduce meat consumption or switch to a meat-free diet	1	2	3	4	5	6	7

20. Cause - Knowledge

Please indicate, to the best of your knowledge, how much you believe that each of the following items contribute to Climate Change							
	Minor contribution			Don't know	Major contribution		
Burning fossil fuels (coal, oil, gas) for heat and electricity	-3	-2	-1	0	1	2	3
The hole in the Ozone Layer	-3	-2	-1	0	1	2	3
Driving a car	-3	-2	-1	0	1	2	3
Aerosol spray cans (containing CFCs)	-3	-2	-1	0	1	2	3
Toxic waste	-3	-2	-1	0	1	2	3
Nuclear power plants	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Agricultural activities (*e.g.*, cattle breeding)	-3	-2	-1	0	1	2	3
The sun	-3	-2	-1	0	1	2	3
Flying/Commercial air travel	-3	-2	-1	0	1	2	3
Smoking cigarettes	-3	-2	-1	0	1	2	3
Deforestation	-3	-2	-1	0	1	2	3

21. Impact - Knowledge

For each of the items listed below, please indicate whether you believe that they are likely to decrease, remain constant or increase ***as a result of*** Climate Change.							
	Likely to decrease			No Change	Likely to increase		
Global average temperature	-3	-2	-1	0	1	2	3
Acid rain	-3	-2	-1	0	1	2	3
Air pollution	-3	-2	-1	0	1	2	3
Areas in the world experiencing drought	-3	-2	-1	0	1	2	3
Global biodiversity (i.e. variety of plants and animals)	-3	-2	-1	0	1	2	3
Melting of glaciers and polar ice caps	-3	-2	-1	0	1	2	3
Global spread of infectious diseases	-3	-2	-1	0	1	2	3
The hole in the Ozone layer	-3	-2	-1	0	1	2	3
Extreme weather events (e.g. floods, storms etc.)	-3	-2	-1	0	1	2	3
Volcanic eruptions	-3	-2	-1	0	1	2	3
The frequency of hot days and nights	-3	-2	-1	0	1	2	3
Global fresh water supply	-3	-2	-1	0	1	2	3

22. Behaviour Measure

For participating in this study, you will be entered into a raffle for a £50 Amazon voucher. If you are selected to receive the voucher at the end of the survey, you can choose to keep the full amount or donate up to £25 to *People and Planet*, a student-led campaign organization that addresses pressing social and environmental issues.

A. Will you like to donate a part of your remuneration? ( ) Yes ( ) No

B. How much will you like to donate (please enter a value between £1 and £25)

Ethics approval notices for the studies reported in the thesis

University of St Andrews
from first to foremost

600 YEARS
1413 – 2013

Project Title	A Cross-Cultural Comparison of Attitudes Toward Climate Change
Researcher's Name	Charles Adedayo Ogunbode
Supervisor	Dr Nicole Tausch
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code (Approval allocated to Original Application)	PS9785
Original Application Approval Date	24 April 2013
Amendment Application Approval	11 April 2014

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 9th April 2014. The following documents were reviewed:

1. Ethical Amendment Application Form 11/04/2014
2. Questionnaire (Japanese version) 11/04/2014

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

Approval is given for three years from the original application only. Ethical Amendments do not extend this period but give permission to an amendment to the original approval research proposal only. If you are unable to complete your research within the original 3 three year validation period, you will be required to write to your School Ethics Committee and to UTREC (where approval was given by UTREC) to request an extension or you will need to re-apply. You must inform your School Ethics Committee when the research has been completed.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf) are adhered to.

Yours sincerely

pp

Convenor of the School Ethics Committee

Ccs Dr Nicole Tausch (Supervisor)
School Ethics Committee

University of St Andrews
from first to foremost

600 YEARS
1413 – 2013

Project Title	Attitudes Toward Climate Change in Nigeria
Researcher's Name	Charles Adedayo Ogunbode
Supervisor	Dr Sana Sheikh
Department/Unit	School of Psychology & Neuroscience
Ethical Approval Code	PS9785
Original Application Approval Date	24 April 2013
Amendment Application Approval	03 December 2013

Ethical Amendment Approval

Thank you for submitting your amendment application which was considered at the Psychology & Neuroscience School Ethics Committee meeting on the 20th November 2013. The following documents were reviewed:

1. Ethical Amendment Application Form 03/12/2013
2. Participant Information Sheet 03/12/2013
3. Consent Form 03/12/2013
4. Debriefing Form 03/12/2013
5. External Permissions 03/12/2013
6. Questionnaire 03/12/2013

The University Teaching and Research Ethics Committee (UTREC) approves this study from an ethical point of view. Please note that where approval is given by a School Ethics Committee that committee is part of UTREC and is delegated to act for UTREC.

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Yours sincerely

Convenor of the School Ethics Committee

Ccs Dr Sana Sheikh (Supervisor)
School Ethics Committee

School of Psychology & Neuroscience, St Mary's Quad, South Street, St Andrews, Fife KY16 9JP
Email: psyethics@st-andrews.ac.uk Tel: 01334 462071

University of St Andrews | FOUNDED 1413

University Teaching and Research Ethics Committee

08 February 2017

Dear Charles

Thank you for submitting your ethical application which was considered at the School of Psychology & Neuroscience Ethics Committee meeting on 25th January 2017; the following documents have been reviewed:

1. Ethical Application Form
2. Recruitment Protocol (Paper-based version)
3. Advertisement (Online version)
4. Participant Information and Consent (Paper-based and Online versions)
5. Debriefing (Paper-based and Online versions)
6. Questionnaire (Paper-based and Online versions)
7. Data Management Plan (Paper-based and Online versions)

The School of Psychology & Neuroscience Ethics Committee has been delegated to act on behalf of the University Teaching and Research Ethics Committee (UTREC) and has granted this application ethical approval. The particulars relating to the approved project are as follows -

Approval Code:	PS12577	**Approved on:**	07/02/2017	**Approval Expiry:**	07/02/2022
Project Title:	The effects of information exposure on climate change beliefs and attitudes				
Researcher:	Charles Adedayo Ogunbode				
Supervisor:	Dr Nicole Tausch				

Approval is awarded for five years. Projects which have not commenced within two years of approval must be re-submitted for review by your School Ethics Committee. If you are unable to complete your research within the five year approval period, you are required to write to your School Ethics Committee Convener to request a discretionary extension of no greater than 6 months or to re-apply if directed to do so, and you should inform your School Ethics Committee when your project reaches completion.

If you make any changes to the project outlined in your approved ethical application form, you should inform your supervisor and seek advice on the ethical implications of those changes from the School Ethics Convener who may advise you to complete and submit an ethical amendment form for review.

Any adverse incident which occurs during the course of conducting your research must be reported immediately to the School Ethics Committee who will advise you on the appropriate action to be taken.

Approval is given on the understanding that you conduct your research as outlined in your application and in compliance with UTREC Guidelines and Policies (http://www.st-andrews.ac.uk/utrec/guidelinespolicies/). You are also advised to ensure that you procure and handle your research data within the provisions of the Data Provision Act 1998 and in accordance with any conditions of funding incumbent upon you.

Yours sincerely

Convener of the School Ethics Committee

cc Dr Nicole Tausch (Supervisor)

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University Teaching and Research Ethics Committee

12 October 2016

Dear Charles

Thank you for submitting your ethical application which was considered at the School of Psychology & Neuroscience Ethics Committee meeting on 6th October 2016; the following documents have been reviewed:

1. Ethical Application Form
2. Advertisements
3. Participant Information Sheet
4. Consent Form
5. Debriefing Form
6. Questionnaires
7. Data Management Plan

The School of Psychology & Neuroscience Ethics Committee has been delegated to act on behalf of the University Teaching and Research Ethics Committee (UTREC) and has granted this application ethical approval. The particulars relating to the approved project are as follows -

Approval Code:	PS12378	**Approved on:**	11/10/2016	**Approval Expiry:**	11/10/2021
Project Title:	The effects of attributing experiences of extreme weather to climate change on perceptions and attitudes				
Researcher:	Charles Adedayo Ogunbode				
Supervisor:	Dr Nicole Tausch				

Approval is awarded for five years. Projects which have not commenced within two years of approval must be re-submitted for review by your School Ethics Committee. If you are unable to complete your research within the five year approval period, you are required to write to your School Ethics Committee Convener to request a discretionary extension of no greater than 6 months or to re-apply if directed to do so, and you should inform your School Ethics Committee when your project reaches completion.

If you make any changes to the project outlined in your approved ethical application form, you should inform your supervisor and seek advice on the ethical implications of those changes from the School Ethics Convener who may advise you to complete and submit an ethical amendment form for review.

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Approval is given on the understanding that you conduct your research as outlined in your application and in compliance with UTREC Guidelines and Policies (http://www.st-andrews.ac.uk/utrec/guidelinespolicies/). You are also advised to ensure that you procure and handle your research data within the provisions of the Data Provision Act 1998 and in accordance with any conditions of funding incumbent upon you.

Yours sincerely

Convener of the School Ethics Committee

cc Dr Nicole Tausch (Supervisor)

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University Teaching and Research Ethics Committee

15 September 2015

Dear Charles

Thank you for submitting your amendment application which comprised the following documents:

1. Ethical Amendment Application Form

The School of Psychology & Neuroscience Ethics Committee is delegated to act on behalf of the University Teaching and Research Ethics Committee (UTREC) and has approved this ethical amendment application. The particulars of this approval are as follows –

Original Approval Code:	PS11190	**Approved on:**	13/10/2014
Amendment Approval Date:	15/09/2015	**Approval Expiry Date:**	13/10/2017
Project Title:	Personal responses to extreme weather and climate change		
Researcher:	Charles Adedayo Ogunbode	**Supervisor:**	Dr Nicole Tausch

Ethical amendment approval does not extend the originally granted approval period of three years, rather it validate the changes you have made to the originally approved ethical application. If you are unable to complete your research within the original 3 three year validation period, you are required to write to your School Ethics Committee Convener to request a discretionary extension of no greater than 6 months or to re-apply if directed to do so, and you should inform your School Ethics Committee when your project reaches completion.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that you adhere to the 'Guidelines for Ethical Research Practice' (https://www.st-andrews.ac.uk/utrec/guidelinespolicies/).

Yours sincerely

Convener of the School Ethics Committee

cc Dr Nicole Tausch (Supervisor)

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University Teaching and Research Ethics Committee

22 January 2016

Dear Charles

Thank you for submitting your amendment application which comprised the following documents:

1. Ethical Amendment Application Form
2. Experimental Stimuli and Questionnaire

The School of Psychology & Neuroscience Ethics Committee is delegated to act on behalf of the University Teaching and Research Ethics Committee (UTREC) and has approved this ethical amendment application. The particulars of this approval are as follows –

Original Approval Code:	PS11881	**Approved on:**	15/12/2015
Amendment Approval Date:	22/01/2016	**Approval Expiry Date:**	15/12/2020
Project Title:	Public perceptions of climate change		
Researcher:	Charles Adedayo Ogunbode		
Supervisor:	Dr Nicole Tausch		

Ethical amendment approval does not extend the originally granted approval period of five years, rather it validates the changes you have made to the originally approved ethical application. If you are unable to complete your research within the original five year validation period, you are required to write to your School Ethics Committee Convener to request a discretionary extension of no greater than 6 months or to re-apply if directed to do so, and you should inform your School Ethics Committee when your project reaches completion.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that you adhere to the 'Guidelines for Ethical Research Practice' (http://www.st-andrews.ac.uk/media/UTRECguidelines%20Feb%2008.pdf).

Yours sincerely

Convener of the School Ethics Committee

cc Dr Nicole Tausch (Supervisor)

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University Teaching and Research Ethics Committee

17 December 2015

Dear Charles

Thank you for submitting your ethical application which was considered at the School of Psychology & Neuroscience Ethics Committee meeting on 15th December 2015; the following documents were reviewed:

1. Ethical Application Form
2. Participant Information Sheet
3. Consent Form
4. Debriefing Form
5. Questionnaires
6. Data Management Plan

The School of Psychology & Neuroscience Ethics Committee has been delegated to act on behalf of the University Teaching and Research Ethics Committee (UTREC) and has granted this application ethical approval. The particulars relating to the approved project are as follows -

Approval Code:	PS11881	**Approved on:**	15/12/2015	**Approval Expiry:**	15/12/2020
Project Title:	Public perceptions of climate change				
Researcher:	Charles Adedayo Ogunbode				
Supervisor:	Dr Nicole Tausch				

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Any adverse incident which occurs during the course of conducting your research must be reported immediately to the School Ethics Committee who will advise you on the appropriate action to be taken.

Approval is given on the understanding that you conduct your research as outlined in your application and in compliance with UTREC Guidelines and Policies (http://www.st-andrews.ac.uk/utrec/guidelinespolicies/). You are also advised to ensure that you procure and handle your research data within the provisions of the Data Provision Act 1998 and in accordance with any conditions of funding incumbent upon you.

Yours sincerely

Convener of the School Ethics Committee

cc Dr Nicole Tausch (Supervisor)

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University Teaching and Research Ethics Committee

23 October 2015

Dear Charles

Thank you for submitting your amendment application which comprised the following documents:

1. Ethical Amendment Application Form
2. Advertisement

The School of Psychology & Neuroscience Ethics Committee is delegated to act on behalf of the University Teaching and Research Ethics Committee (UTREC) and has approved this ethical amendment application. The particulars of this approval are as follows –

Original Approval Code:	PS11760	**Approved on:**	21/09/2015
Amendment Approval Date:	22/10/2015	**Approval Expiry Date:**	21/09/2018
Project Title:	Know me, knowing you: student perceptions of personal and others' engagement with environmental issues in the University of St Andrews		
Researcher:	Charles Adedayo Ogunbode		
Supervisor:	Dr Nicole Tausch		

Ethical amendment approval does not extend the originally granted approval period of three years, rather it validate the changes you have made to the originally approved ethical application. If you are unable to complete your research within the original 3 three year validation period, you are required to write to your School Ethics Committee Convener to request a discretionary extension of no greater than 6 months or to re-apply if directed to do so, and you should inform your School Ethics Committee when your project reaches completion.

Any serious adverse events or significant change which occurs in connection with this study and/or which may alter its ethical consideration, must be reported immediately to the School Ethics Committee, and an Ethical Amendment Form submitted where appropriate.

Approval is given on the understanding that you adhere to the 'Guidelines for Ethical Research Practice' (https://www.st-andrews.ac.uk/utrec/guidelinespolicies/).

Yours sincerely

pp

Convener of the School Ethics Committee

cc Dr Nicole Tausch (Supervisor)

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University Teaching and Research Ethics Committee

24 September 2015

Dear Charles

Thank you for submitting your ethical application which was considered at the School of Psychology & Neuroscience Ethics Committee meeting on 12th August 2015. The following documents have been reviewed:

1. Ethical Application Form
2. Advertisement
3. Participant Information Sheet
4. Consent Form
5. Debriefing Form
6. Data Management Plan

The School of Psychology & Neuroscience Ethics Committee has been delegated to act on behalf of the University Teaching and Research Ethics Committee (UTREC) and has granted this application ethical approval. The particulars relating to the approved project are as follows -

Approval Code:	PS11760	**Approved on:**	21 September 2015	**Approval Expiry:**	21 September 2018
Project Title:	Knowing me, knowing you: student perceptions of personal and others' engagement with environmental issues in the University of St Andrews				
Researcher:	Charles Adedayo Ogunbode				
Supervisor:	Dr Nicole Tausch				

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University Teaching and Research Ethics Committee

15 September 2015

Dear Charles

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1. Ethical Amendment Application Form

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Project Title:	Personal responses to extreme weather and climate change		
Researcher:	Charles Adedayo Ogunbode	**Supervisor:**	Dr Nicole Tausch

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Yours sincerely

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cc Dr Nicole Tausch (Supervisor)

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