Climate change behaviours: Improving the use of psychology and communication models in mitigation campaigns

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Abstract

Mitigation to reduce the potentially catastrophic impacts of climate change requires significant collective human action over the coming decades. Such large scale changes in individual behaviour will require encouragement and facilitation if they are to be achieved in the short timeframes necessary to avert disaster. Current models of behaviour provide some insight into the predictors of climate change mitigation behaviour, but their diverse theoretical approaches and predictive capabilities make the research findings complex—and sometimes contradictory—when attempting to apply them in climate change action campaign designs. In addition, guidance material for campaign design often provides generalised advice that is insufficient for effective and efficient campaign design.

This research aimed to improve our understanding of the factors that influence the mitigation behaviours of individuals, and how this can be used to improve communication campaigns targeting these behaviours. A series of three studies were undertaken that included the development of an integrated theoretical model of climate change mitigation behaviour (the Campaign Focus Model; CFM) that was tested using meta-analytic statistical modelling in Study 1, then with data from an Australian sample in Study 2; followed by interviews with campaign designers in Study 3 to examine industry uptake of research and any associated issues.

Key findings support the value of an integrated model for predicting behaviour, and suggest that the predictors of mitigation behaviours vary across behaviours and communities. These nuances are valuable for effective campaign designs, however critical challenges exist for researchers in terms of retaining such nuances in research syntheses, and in ensuring practitioners are aware of relevant research findings. The research highlights high variability in the use of research by practitioners, and diverse barriers including lack of recognition of the existence of behavioural research, difficulty identifying the most relevant research, and difficulty selecting and applying models due to conflicting published research. Suggestions are provided for future research and for research-practice collaboration.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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Contents

Chapter 1: Introduction to Issues Surrounding Climate Change Mitigation Progress 1
Climate Change Mitigation 1
Behaviour Change Campaigns 3
Assistance From Psychology Research 8
Methodology Overview 12
Summary and Thesis Structure 12
Chapter 2: Climate Change Communication Research and Campaign Literature 14
Campaign Media 14
Audiences and Media Engagement Theories 15
Contemporary Media Effects Theories 19
Media Effects and Climate Change Communication 21
Campaign Guidance and Knowledge Transfer 23
Summary and Implications 27
Chapter 3: The Psychology of Climate Change Mitigation Behaviour 28
Introducing the Pathways to Behaviour 28
Rational Choice Theories 31
Normative Theories 35
Habit Theory 45
Existing Integrated Models 47
Integrating the Pathways of Campaign Relevance 50
Summary 52
Chapter 4: Research methodology 53
Methodological Provenance 53
Mixed Methods Research 54
Study 1: Meta-Analytic Modelling of Mitigation Behaviours 56
Study 2: Modelling of Australian Mitigation Behaviours 63
Study 3: Campaign Designer Perspectives 70
The Final Research Step 72
Summary 72
Chapter 5: Study 1 – Meta-Analysis for Predictive Modelling of Behaviour 74
Sample Characteristics 75
Data Screening and Preparation 77
Results 86
Discussion 90
Summary and Implications 93
Chapter 6: Study 2 – Model Testing Using an Australian Sample 95
Sample Characteristics 96

Data Screening and Preparation 97
Results 105
Discussion 115
Summary and Implications 120
Chapter 7: Study 3 – Campaign Designer Perspectives and Processes 122
Interview Sample 123
Contextual Issues Facing Campaigns 123
Perceived Campaign Effectiveness 128
Accessing and Utilising Research 130
Differential Audience and Behaviour Targeting 138
Conclusion 142
Chapter 8: Discussion and Conclusions 144
Climate Change Communication and Mitigation Behaviour Research 145
Modelling Mitigation Behaviour 147
Campaign Engagement with Research 150
Conclusion and Implications 158
References 160
Appendix A: Study 1 MASEM – Supporting Tables and Charts 188
Source Article Contributions 188
Funnel Plots Testing for Publication Bias 190
Appendix B: Study 2 SEM – Supporting Tables and Charts 196
Data Coding and Preparation 196
Sample Representativeness Tests 199
CFM Variable Correlations 201
Modelling Results for Grouped and Specific Behaviours 202
Appendix C: Study 3 – Supporting Tables 208

Chapter 1: Introduction to Issues Surrounding Climate Change Mitigation Progress

The uptake of actions necessary to mitigate climate change has been insufficient to prevent the increasing atmospheric greenhouse gas levels that are impacting both human and natural systems across the globe through continuing rises in temperature, more extreme weather events, and further increases in sea levels (IPCC, 2014). This is despite the vast accumulation of information, and global agreement regarding the significance of climate change. If the behavioural changes required are to occur, we must improve our interventions for mitigation of climate change. While these behavioural changes must occur across all sectors of society (including action by governments, businesses, and communities), changing the behaviour of individuals and households through low cost communication campaigns offers valuable mitigation potential. This thesis aims to improve our understanding of the factors that influence the mitigation behaviours of individuals, and how this can be used to improve communication campaigns targeting these behaviours. This chapter outlines the gaps in adoption of climate change mitigation behaviours and why behaviour change campaigns offer a viable intervention option for addressing these gaps. It establishes the valuable contribution that psychology research can offer behaviour change campaigns in terms of insight into which predictors of mitigation behaviour are most influential in predicting adoption. It also establishes that existing research and campaign guidance material fail to offer appropriate levels of detail on which techniques work best in which situations, for which behaviours, for which audiences, and why. Finally, the chapter introduces the research questions designed to address these issues, and the structure by which the thesis reports on this research.

Climate Change Mitigation

The global climate is changing and, unchecked, these changes could have "severe, pervasive and irreversible impacts for people and ecosystems" (IPCC, 2014, p. v). With climate science strongly supporting the human causes of climate change, and the global spread of likely impacts, humans must work together to ensure our collective survival (IPCC, 2014). In the decades since the First World Climate Conference was held 1979, we have witnessed significant increases in atmospheric greenhouse gas concentrations and there is very real concern that our globally committed contributions to limit emissions are insufficient to achieve the goals of the *Paris Agreement* (Rogelj et al., 2016). Action to address climate change still requires "an urgent and fundamental departure from business as usual" (IPCC, 2014, p. v). Such transformation must involve changes to the behaviour of both individuals and the collective for the long term continuation of our species.

There are many different actions that can help address climate change and its expected impacts. While some actions are primarily aimed at reducing the severity of climate change (i.e., mitigation activities), other actions aim to reduce the impacts of the changes caused by climate change (i.e., adaptation). The compounding long term adaptation requirements associated with delays in

mitigation increases the benefit of shorter term mitigation efforts (IPCC, 2014). Thus, this research focused specifically on mitigation actions.

Mitigation activities extend from personal actions such as environmentally-friendly purchasing behaviour, to nation-state actions including the establishment of renewable energy targets and policies. While personal behaviours fall within the mandate of individual members of the general public in relatively autonomous (if socially situated) decision processes, organisational and nation-state actions fall within complex group and political decision-making processes that are influenced by (and influence) the actions of individuals. Several studies have identified significant mitigation potential offered by the actions of individual members of the public (e.g., Dietz, Gardner, Gilligan, Stern, & Vandenbergh, 2009; Druckman & Jackson, 2009), and it is these personal behaviours that are the focus of this thesis. Examples of these behaviours include household consumer behaviours, personal transport choices, and household energy conservation measures.

Research conducted in Australia and overseas on individual mitigation behaviours has investigated many different types of behaviour from civic actions (e.g., signing petitions), to energy conservation, sustainable consumption and more. With so many potentially relevant behaviours, it is important to understand their relative mitigation potential. Several studies conducted in the US (Bin & Dowlatabadi, 2005; Dietz et al., 2009) and the UK (Druckman & Jackson, 2009) found significant potential for greenhouse gas emissions reduction that could be achieved through changes to household activities. These studies considered the mitigation potential of changes to both direct and indirect household emissions. While direct emissions reduction are associated with direct consumption of energy and fuel consumption (e.g., driving a car), indirect emissions[1] are those that occur during production of products and services prior to household purchase or engagement (Druckman & Jackson, 2009). Significant potential was identified for emissions reduction through changes to frequent, low-cost household behaviours—for example, a potential annual reduction of 11.7 $MtCO_2$ in US emissions achievable through changes in the use of standby electricity practices (Dietz et al., 2009). Roughly equivalent levels of direct and indirect emissions were also identified as produced by household activities, with US household direct emissions of 2,230 $MtCO_2$ and indirect emissions of 3,289 $MtCO_2$ in 1997 (Bin & Dowlatabadi, 2005), and UK household direct emissions of approximately 250 $MtCO_2$ and indirect emissions of 260 $MtCO_2$ in 2004 (Druckman & Jackson, 2009). This highlights the importance of including household behaviours associated with indirect emissions in mitigation interventions. With many of these behaviours outside the realm of government or corporate intervention in most countries, their voluntary adoption requires other forms of encouragement.

[1] Indirect emissions are also sometimes referred to as embedded or imported emissions (Druckman & Jackson, 2009).

Two national survey projects have been undertaken to understand the mitigation behaviours adopted by Australians. These multi-year projects were conducted by CSIRO (see Leviston, Greenhill, & Walker, 2015) and Griffith University (see Reser, Bradley, Glendon, Ellul, & Callaghan, 2012a), and found little denial of climate change—7.9 percent and 6.5 percent strong sceptics, respectively. Their results revealed that Australians believe that individuals, corporate Australia, and all levels of government, should be acting on climate change (Leviston et al., 2015; Reser et al., 2012a), however personal adoption of mitigation behaviours is highly variable. Both studies also identified varying reasons for adoption of these behaviours. For example, CSIRO observed that the most adopted behaviour in their 2014 sampling event was switching off lights whenever possible (adopted by 94 percent of participants), however 58 percent of participants adopted this behaviour mostly for non-environmental reasons compared with 36 percent mostly for environmental reasons (Leviston et al., 2015). Griffith University noted similar results, with actions to conserve electricity practiced by 40 percent of participants in their 2011 sample for reasons unrelated to climate change, in contrast to 42 percent 'at least partly due to climate change' (Reser et al., 2012a).

Not all behaviours were so well adopted, however. While this adoption of electricity conservation practices was found by both projects to be quite high, the use of low carbon transport options was generally lower. For example, 45 percent of Griffith University's 2011 sample reported walking, cycling, or scooting, and 38 percent reported using public transport (Reser et al., 2012a). This is somewhat similar to the 61 percent of CSIRO's 2014 sample who reported 'usually' walking, cycling, carpooling, or using public transport (Leviston et al., 2015). With so many Australians failing to adopt valuable mitigation behaviours, significant effort is required to achieve the necessary changes. With climate change so well accepted, and the voluntary adoption of these valuable behaviours remaining sub-optimal, some forms of intervention are necessary to promote adoption, as has been done for many other behaviours from road safety to healthy eating and exercise.

Behaviour Change Campaigns

Behaviour change interventions may be designed to reduce the adoption of unsupported behaviours (e.g., car use) or increase the adoption of supported behaviours (e.g., privileging of energy-efficient appliances), and can include a range of different intervention types with varying levels of associated cost and efficiency. Klöckner (2015) identifies that the more resource-intensive intervention options (e.g., structural changes, or the provision of rewards) have generally been shown to be most efficient, with low to moderate resource demand options being somewhat less efficient but still providing valuable outcomes. Klöckner also identifies intervention strategies with varying levels of resource requirements that have been shown to be inefficient (e.g., provision of purely information), and still further strategies that have insufficient empirical evidence to evaluate their

efficiency (e.g., making salient the discrepancies between an individual's ideal self and his or her actual behaviour).

The low to moderate resource demand interventions with highest efficiency are communications-based interventions such as increasing awareness of need, provision of prompts, encouraging goal setting, and the provision of social models of the target behaviour (Klöckner, 2015). These strategies can be implemented without face-to-face interaction; for example, through targeted media campaigns. The opportunities offered by low to moderate resource demand options like campaigns can allow available resources to target larger numbers of individuals, and potentially allows campaigns to be implementation by organisations with fewer resources. It is important to note, however, that campaigns are unlikely to be effective for behaviours that have significant structural barriers—whether cultural, physical, economic, skill, or ability (Klöckner, 2015). Campaigns using communication-based interventions including the effective strategies discussed above are the focus of this thesis.

Behaviour change campaigns targeting mitigation behaviours. Communication can take many forms, including both direct and mediated interactions. Rice and Atkin (2009, p. 436) define campaigns as:

> "(1) purposive attempts (2) to inform, persuade, or motivate behavior [sic] changes (3) in a relatively well-defined and large audience, (4) generally for noncommercial benefits to the individuals and/or society at large, (5) typically within a given time period, (6) by means of organized communication activities involving mass media, and (7) often complemented by interpersonal support (adapted and expanded from Rogers & Storey, 1987)".

With the expanded use of social media, which are increasingly being adopted for campaign purposes (Klöckner, 2015), and the varying scale of organisations—and their audiences—addressing climate change mitigation behaviour (Doyle, 2011), this thesis takes a more expansive definition of mitigation campaigns as purposive attempts to increase the adoption of climate change mitigation behaviours by individuals within a relatively well-defined audience, by means of organized communication activities involving the distribution via mass, social, or other media, of messages that inform, persuade, and motivate.

Australian mitigation campaigns are run by a range of different organisations, including government (e.g., Sustainability Victoria's *Take2* campaign), nongovernment (e.g., ClimateWorks Australia's *Generation Yes* campaign), and industry (e.g., Ben and Jerry's Australian *If it's Melted, it's Ruined* campaign). United Nation's (2015, p. 2) *Paris Agreement* formally recognised the importance of diverse national and subnational actors in mitigating climate change. This thesis focuses on climate change mitigation campaigns targeting individual members of the public, and such

campaigns may be implemented by organisations from diverse sectors, including government bodies, nonprofit organisations, and community groups. These campaigns are distinct from industry marketing campaigns, which may focus on similar behaviours as part of promoting the sale of the campaigning organisation's products or services. This distinction is, however, becoming blurred where campaigns are run under company banners, but with behavioural focus separate to product sales—for example Ben and Jerry's Australian *If it's Melted, it's Ruined* campaign encouraging signatures on a petition to government regarding climate policies.

The extent and complexity of the campaigns differs across organisations due to their mandate, and available skills and resources, so this thesis includes a broad range of communication approaches and varying levels of cohesion within the classification of mitigation campaigns. These communication approaches may include social media posts, flyers, posters, fact sheets, newsletters, and blog posts, as well as linked websites and materials (e.g., videos). Cohesion may range from a stream of Facebook posts related to a community group's local area or focal topic, to a highly structured, well-resourced, multimedia, multi-platform campaign.

Many resources exist to help organisations design campaigns targeting pro-environmental and climate change mitigation behaviours. These are offered in published books, journal articles, and grey literature. Books offered as references include those authored by academic researchers (e.g., McKenzie-Mohr, 2000; van Trijp, 2014). Literature canvassing relevant behaviours and messaging approaches often discusses the implications of findings for campaign reference (e.g., Baek, Yoon, & Kim, 2015; Bodur, Duval, & Grohmann, 2015), or involve campaign evaluations (e.g., Abrahamse, Steg, Vlek, & Rothengatter, 2005). Grey literature resources include documents: that government departments have prepared (e.g., Australian Public Service Commission, 2015) or promoted (e.g., those prepared by consultants as per Ryan & Rudland, 2002); published by nongovernment organisations (e.g., National Council for Voluntary Organisations, 2017; Pike, Doppelt, & Herr, 2010); or prepared by industry (e.g., Fenton Communications, 2009). Some design guides are specifically tailored for pro-environmental or climate change campaigns (e.g., McKenzie-Mohr, 2000); and some are pitched more broadly for any type of social change campaign (e.g., Fuld, 2018). Still other guides focus on campaign evaluation, and thus include campaign design components as they relate to good evaluation design (e.g., Premier and Cabinet, n.d.; The Campaign Workshop, 2017). With so many resources available from such a variety of sources, campaign designers must assess which sources offer the most reliable, appropriate, and accessible information to inform campaign designs.

The design guidance offered in these sources comes with various scales of strategic focus, and commonly includes recommendations related to two overarching themes. The strategic focus varies from strategic level planning that considers goals, budgets, and tactics (e.g., Fenton Communications, 2009); to message-focussed planning that outlines how to craft an individual campaign message (e.g.,

Robinson, 2011). Some resources focus on one aspect of either socio-psychological predictors of behaviour or messaging, while others provide synthesised advice drawn from general psychology research, the evaluation of previous campaigns, and social marketing research (e.g., Trijp, 2014; McKenzie-Mohr, Lee, Schultz, & Kotler, 2012). The two complementary, overarching themes that these syntheses typically highlight are the importance of addressing the social-psychological predictors of behaviour (e.g., attitudes), and tailoring messages to segmented audiences such as through social marketing techniques.

"Social marketing is the systematic application of marketing concepts and techniques to achieve specific behavioural goals relevant to the social good" (Lazer & Kelley, 1973, as cited in Corner & Randall, 2011, p. 1006). It involves a strategic process of five steps: selection of the target behaviour; identification of the barriers to, and benefits of its adoption; development of strategies to promote the benefits and reduce the barriers; pilot testing; and evaluation of full implementation (McKenzie-Mohr, 2000). Social marketing has shown good results in changing behaviours targeted by campaigns, however without consideration of additional social-psychological aspects this technique can have unintended negative consequences for long term implementation of mitigation behaviours (Corner & Randall, 2011). With the broad range of behaviours that each individual will need to adopt to achieve sufficient reduction in greenhouse gas emissions, the implications of individual campaigns for both target and nontarget behaviours should be considered, as effective targeting of one behaviour may have negative consequences for other behaviours (Truelove, Carrico, Weber, Raimi, & Vandenbergh, 2014).

Information on the social-psychological predictors of behaviour is often presented in generalised terms, which highlights important behaviour predictors and processes but does not provide sufficient detail for effective campaign targeting. The audience segmentation approach used in social marketing offers the capacity for tailoring campaigns to account for audience differences across socio-psychological variables, however the relative importance of these socio-psychological variables can differ across behaviours (e.g., Heeren et al., 2016; Whitmarsh & O'Neill, 2010). So while the social marketing process asks questions about why the audience might implement (or fail to implement) the target behaviour, if generalised psychological knowledge is used to answer these questions then inappropriate answers might be concluded. For example, general advice might pose that what other people think we should do (i.e., social norms) are important predictors of behaviour, and while that might be true for reusing water bottles and buying second hand clothes, these norms have been shown not to be significant predictors for using reusable cloth shopping bags or buying organically grown food (Heeren et al., 2016).

Not only are opportunities missed by ineffective targeting of behavioural predictors, unintended negative consequences can result if the psychology of pro-environmental behaviours is not sufficiently well understood. The flow-on effects of one behaviour on a subsequent behaviour is

known as spillover (Truelove et al., 2014), and these are often unintended consequences. Spillover effects can be positive (enhancing subsequent implementation) or negative (reducing subsequent implementation). Negative spillover has been found to occur with purchases such as energy efficient heating or cooling appliances, where the purchase of an efficient device results in using the appliance with less efficient settings (Khazzoom, 1980). Such spillover effects can be mitigated but, without clear understanding of the interaction of socio-psychological variables for the target behaviours, there is the potential for campaigns to target the wrong variables, incorrectly prioritise variables, or trigger unintended negative consequences, and thus reduce the effectiveness and efficiency of campaigns. Some organisations may have the knowledge and resources to obtain nuanced information about their audience and likely behavioural responses to messaging, however organisations with fewer resources (e.g., grassroots community organisations) or less understanding of the risks posed by using generalised advice may not have access to appropriately specific foundational information for designing effective campaigns.

Evidence of campaign successes (and failures). Understanding the success or failure of campaigns is critical for improving effectiveness, reducing unintended consequences, and for informing research agendas aiming to address associated knowledge gaps. Evaluations of campaigns targeting a range of different direct and indirect mitigation behaviours have been published in various journal articles, including campaigns targeting energy use (e.g., Abrahamse et al., 2005; Litvine & Wüstenhagen, 2011) and water conservation (e.g., Syme, Nancarrow, & Seligman, 2000), transport behaviours (e.g., Bamberg, 2000; Davies, 2012), and waste management (e.g., Brown, Ham, & Hughes, 2010; Vining & Ebreo, 1989). Some of these intervention evaluations were constructed specifically as experiments testing the effects of provision of campaign-style material (e.g., Brown et al., 2010; Litvine & Wüstenhagen, 2011). Results of campaign evaluations can also be found published in books as case studies (e.g., McKenzie-Mohr et al., 2012), and in grey literature including some government and nonprofit campaign analyses (e.g., Cugelman & Otero, 2010; Sustainability Victoria, 2017).

Learnings provided by published evaluations show that campaigns can impact behaviour, however it can be difficult to extract exactly which techniques work best in which situations and why. Individual studies provide results for specific contexts, audiences, and mixes of interventions, however methodological complexities associated with attribution of effect potentially confound the results and their implications for future campaigns (Büchs, Edwards, & Smith, 2012; Coffman, 2002). With the resourcing and skill deficits faced by some campaign organisations (Büchs et al., 2012), however, it is likely that still more evaluations remain unpublished or are not conducted, thus limiting the collective knowledge of what works in different contexts. Under the limitations faced by many

campaign organisations, researchers can offer valuable support for understanding behaviour and identifying appropriate approaches for design of targeted campaigns.

Assistance From Psychology Research

Psychology research has been synthesised into many of the existing resources for campaign design to some extent, but the discipline can still fill a valuable role towards addressing the issues facing campaigns. This assistance lies particularly in further improving our understanding of the main factors underlying target behaviours, and in assisting with the design, application, and evaluation of campaigns (Steg & Vlek, 2009; Stern, 2011). Existing psychology research offers a significant body of research on the predictors of mitigation behaviours and how communication material may affect them. There are critical issues associated with translating this research into meaningful advice for campaign designs, however, particularly in synthesising this complex research without oversimplification (Moser, 2016). A good understanding of the predictors of behaviour would involve knowledge of which socio-psychological characteristics are related to target behaviours for which populations. The scale of the task of identifying, collating, and distilling the findings from complex research across diverse disciplines, behaviours, and populations, is a critical barrier to the use of this research in campaign designs. The translation of this vast quantity of knowledge into suitably scaled input for campaign designs is a critical gap that existing resources do not adequately address, thus this thesis' overarching research question is: How can predictive models of climate change mitigation behaviours better inform the design of effective climate change mitigation campaigns?

An international research base. Predictive modelling of mitigation behaviours has been conducted by many researchers across many different behaviours in many different countries and contexts, with many different theoretical bases, and published in many different places. The volume and diversity of this research and its findings poses complex issues for identifying critical relationships and drawing generalisable conclusions (Frederiks, Stenner, & Hobman, 2015). For example, a Google Scholar search returns over 140,000 results for the terms: "predict" "climate change" "behaviour"; and over 59,000 results for: "predict" "energy conservation" "behaviour". With mitigation behaviours spanning many fields, the research modelling mitigation behaviours are published across diverse disciplines and journals including: general psychology journals (e.g., *Journal of Applied Social Psychology*, *Journal of Social Psychology*, and *Personality and Individual Differences*), those specific to climate change and sustainability (e.g., *Climatic Change*, *Environment and Behavior*, *Global Environmental Change*, *Journal of Environmental Psychology*, and *Nature Climate Change*), and journals relevant to each behaviour type (e.g., *Energy Policy*; *Journal of Consumer Behaviour*; *Resources, Conservation and Recycling*; and *Transportation Research*). The

large volume and disparate repositories for this research can make accessibility problematic, especially for organisations with fewer resources and skills.

Even if accessible, the diversity of both the focus and explanations for behaviour, and sometimes conflicting results, can be problematic to interpret for specific campaign application. Research predicting mitigation behaviours are built upon a wide variety of theoretical bases, for example Ajzen's (1991) theory of planned behaviour; Stern, Dietz, Abel, Guagnano, and Kalof's (1999) value-belief-norm theory; Stryker and Serpe's (1982) self-identity theory; Schwartz's (1977) norm activation theory; Tajfel's (1974) social identity theory; Rogers' (1975) protection motivation theory; Lazarus' (1999/2006) model of stress and coping; Bandura's (1986) social cognitive theory; and many more. Added to this theoretical diversity are issues associated with instances where a single predictor is used to broaden an existing theory of behaviour, but is then rarely (if ever) tested further with other socio-psychological characteristics (Teisl, Noblet, & Rubin, 2009). Gaps such as these can preclude assessment of the relative importance of different predictors that campaigns could target.

Even within studies with theoretically consistent models, results can differ across behaviours and participant groups. For example, Cordano, Welcomer, Scherer, Pradenas, and Parada (2011) found that attitudes were a critical predictor of an index of multiple behaviours for Chilean participants but not for US participants. Similarly, Soyez (2012) found that anthropocentric values predicted an index of multiple consumer behaviours negatively for Russian participants, positively for German participants, and not at all for US and Australian participants. Across different behaviours across their US participants Heeren and colleagues' (2016) found that attitudes were predictors of the purchase of organic food and the use of public transport, but not for the use of reusable water bottles or turning off lights in empty rooms. The sheer volume and complexity of the published research makes the identification of research specifically applicable to an individual campaign design problematic—especially for organisations with fewer resources (e.g., those without members having the necessary interpretive skills, time, and journal access).

Despite these issues, psychological research can offer important assistance towards understanding potential campaign effect mechanisms and thus towards effective campaign design. The identification of broad themes from the diverse research base has led to the development of the generalised advice as discussed earlier in this chapter, however the generalisation of results can remove the very specificity necessary for tailoring campaigns. Acknowledgement of the opportunities offered by a broad research base, and issues associated with distilling useful nuances from this complexity, leads to the proposition of the following two research questions for this thesis. Together, the first two research question allow for comparison between the generalised predictors of mitigation behaviour (Research Question 1) and the predictors under more contextualised conditions.

These research questions are:

- Research Question 1: Which predictors of mitigation behaviours does international research indicate are most likely to be suitable and influential for use in behaviour change campaigns?
- Research Question 2: Does this same pattern of influence of predictors of mitigation behaviours apply in the Australian context?

These form the first two out of four research questions guiding this thesis. While the first research question aims to capture the broader international findings, the second research question offers the opportunity to drill down into the more nuanced application of these findings to the Australian context.

The application of psychology research. In addition to understanding the socio-psychological predictors of behaviour, social-psychological communication research can offer insight into the rhetoric and pragmatic aspects of campaign design. The rhetoric situation of a message consists of the issue to be addressed, the logical and emotional arguments, and the context of both the sender and receiver of the message (Bauer & Glăveanu, 2011). The pragmatics of communication are concerned with the specifics of the interaction and meaning-making between sender and receiver of a message (Franks & Green, 2011). Together, these rhetoric and pragmatic aspects have manifested in research as studies on heuristic and systematic/elaborative processes as described in Petty and Cacioppo's (1986, as cited in Klöckner, 2015) elaboration likelihood model, or the drive for cognitive consistency as explained by Festinger's (1957) theory of cognitive dissonance. Framing research has also tested fear appeals using Rogers' (1975) protection motivation theory and Witte's (1992) extended parallel processing model, as well as testing the role of appeals as in Schwartz and Bilsky's (1987) values theory or Kahneman and Tversky's (Kahneman & Tversky, 1979) prospect theory (i.e., gain and loss frames). Still further research has considered the importance of the timing and placement of messages (e.g., Brown et al., 2010). These rhetoric and pragmatic characteristics can be related to the message targeting strategies through considerations of timing (e.g., prompts, goal setting, and foot-in-the-door strategies), sources (e.g., social models as referents for behaviour), and content (e.g., awareness of need). The characteristics of the audience also fall into the realm of campaign rhetoric and pragmatics, and can feature in all aspects of design choice as is proposed by social marketing approaches.

There is a significant volume of pro-environmental and climate change communication research conducted to identify and test these messaging effects. Research has identified a range of social psychological characteristics that may be influenced—either directly or through changes to salience—by messages as might be used by campaigns, for example: sense of agency/control and emotional responses (Hartmann, Apaolaza, D'Souza, Barrutia, & Echebarria, 2014; van Zomeren,

Spears, & Leach, 2010), values (Bolderdijk, Steg, Geller, Lehman, & Postmes, 2013; Evans et al., 2013), self-identity (van der Werff, Steg, & Keizer, 2013a), social norms (Rabinovich, Morton, Postmes, & Verplanken, 2012; Spangenberg et al., 2012), personal norms (Brown et al., 2010; Steg & De Groot, 2010), and norm conflicts (McDonald, Fielding, & Louis, 2013). The manipulation effects of these messaging experiments offer some confidence in the capacity of campaign messages to influence the socio-psychological predictors of mitigation behaviours indicating that, with sufficient understanding of which predictors to target for specific audiences and behaviours, campaigns may be able to effectively support necessary behaviour changes.

The existence of this evidence confirming the potential for campaigns to influence the predictors of behaviour, leads to the remaining two research questions of this thesis:

- Research Question 3: What barriers prevent or limit campaign designers' use of behaviour research to inform campaign design and why might this be the case?
- Research Question 4: To what extent do campaign processes reflect the findings of the quantitative analyses of this thesis?

While the third research question focuses on understanding what might be preventing the transfer of research knowledge to practitioner application, the fourth research question focuses on confirming the extent to which campaign designers are targeting the predictors of behaviour that this research's modelling identified as most influential. These research questions and the gaps they address, are outlined in Figure 1.

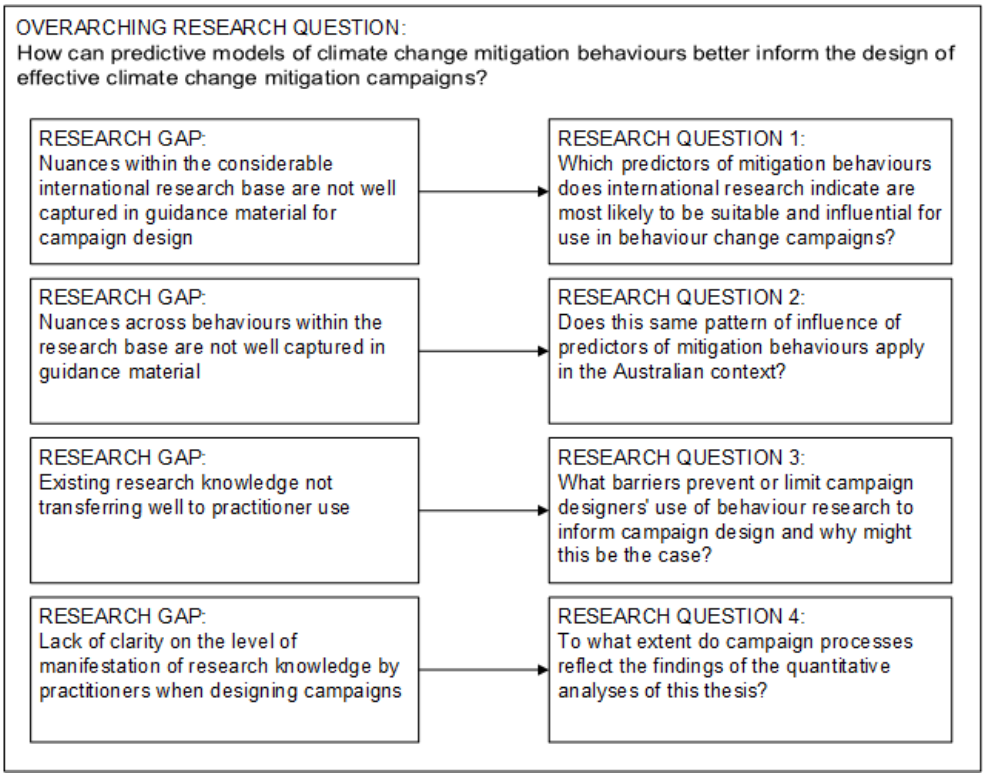

Figure 1. Research gaps and this thesis' associated research questions.

Methodology Overview

This thesis adopted a mix of methods to answer these research questions across a series of three studies. The first two research questions focused on the psychology of mitigation behaviours, addressing gaps around the identification of specific predictors to target for effective behaviour change campaigns. Research Question 1 focused specifically on addressing the need for improved synthesis of the considerable international research base, and was addressed in Study 1 using quantitative meta-analysis statistical techniques to data from internationally published mitigation behaviour research to test a behaviour model specifically designed for maximum relevance for campaign design. Research Question 2 focused on the need to tease out the nuances of relationships between predictors across different behaviours, and focused on doing so within an Australian context for comparison with the international literature addressed in the first research question. This question was answered by Study 2 through structural equation modelling using survey data collected by CSIRO from a large Australian sample. This study used a similar statistical technique to that of Study 1, but modelled behaviours at finer scales of differentiation to identify patterns of difference across behaviours that may offer campaigns the specificity lacking in existing design guidance material.

The third and fourth research questions shift the focus back to the campaigns themselves, by focusing on how research knowledge is used by campaign designers and the barriers that may influence this. Research Question 3 specifically focused on understanding to what level the existing psychology research has been translated into practitioner knowledge, while Research Question 4 aimed to understand how the model findings of Study 1 and Study 2 might relate to campaign practices. These questions were examined through qualitative interviews with Australian campaign designers in Study 3. These interviews investigated campaign designers' perceptions and processes relating to campaign design, with specific focus on: the use of behaviour research in campaign design, the campaign design and delivery processes, and the conduct and findings from any campaign evaluations undertaken. These interviews aimed to capture diverse perspectives, experiences, and knowledge, and thus provide a breadth of coverage to answer this exploratory research question.

Together, these three studies responded to the identified research gaps by applying a mix of methods to answering the four research questions. In combination, they attempt to answer the overarching research question, indicating how psychology's behaviour prediction research can assist to improve campaign designs and thus encourage greater adoption of mitigation behaviours.

Summary and Thesis Structure

This chapter has provided the background necessary to understand the nature and scale of the problems facing behaviour researchers and campaign designers in translating research knowledge into more effective campaigns. It has outlined the focus of this thesis in response to this research problem. The following two chapters extend the understanding of the research problem and provide the

theoretical and empirical bases to support this thesis' empirical studies. Chapter 2 provides a review of campaign literature, focusing on the communication theories relevant to campaigns, as well as available campaign guidance and evaluation material. The psychology literature review in Chapter 3 summarises the multiple disciplines and theoretical bases relevant to predicting mitigation behaviours. It examines the evidence of relationships between the different predictors of behaviour and of capacity to influence these predictors, and it integrates these to develop the Campaign Focus Model (CFM).

The methodology of this thesis is detailed in Chapter 4, beginning with the underlying research assumptions, and including justification for the selected methods for answering each research question. The following three chapters report on, and discuss, the processes and findings of the research—one for each empirical study. Chapter 5 describes the meta-analysis addressing Research Question 1. Chapter 6 focuses on the structural equation modelling using Australian data to answer Research Question 2. Study 3's qualitative interviews with campaign designers are reported in Chapter 7 in response to Research Question 3 and Research Question 4. While each empirical chapter includes a discussion of the findings with regard to its specific research question, Chapter 8 includes a separate discussion that examines the findings from across all four empirical studies and draws key conclusions. It also summarises both the limitations and significance of this research, and provides recommendations for further research.

Chapter 2: Climate Change Communication Research and Campaign Literature

Communication campaigns have been used in attempts to change the attitudes and behaviours of Australians for over a hundred years—from war propaganda promoting enlistment and policy support in the 1910s and 1940s (Saunders, 1997; Waller, 1995), to the sun protection campaigns of the 1980s (Timms, 2002), and the environmental campaigns of the 1960s and 1970s (Doyle, 2002). Research into the role and influence of mediated communication has a long history. Lazarsfeld's (1941) categorisation of media communications research as 'critical' or 'administrative' is seen as less differentiated than they appear on face value (Katz & Katz, 2016). While administrative research investigates the functioning and effects of media, critical research takes a step removed and adopts more psycho-analytic and philosophical approaches that examines the societal role of media and audiences. These categorisations relate to the study of the role and influence of campaigns.

The current research's concentration on campaigns for mitigation behaviour change focuses attention primarily on administrative research associated with campaign influence. Campaign influences on these behaviours are variable. While considerable gaps exist in the design and practice of campaign evaluations (Coffman, 2002), campaigns have been found to effect low to high levels of change across mitigation behaviours, and also across messaging strategies—for example, providing behaviour justifications versus prompts of when to implement the behaviour (Osbaldiston & Schott, 2012). The diverse strategies that can be adopted by campaigns are related to the various barriers to or enablers of behaviour (e.g., prompts can assist in overcoming habit), and understanding the interaction between communication and behavioural science is critical to effective campaign design.

This chapter establishes the state of campaign design guidance and the challenges facing practitioners wishing to utilise related research knowledge. Beginning with a description of campaign media, the chapter then reviews contemporary media theories and the empirical evidence of media effects in climate change communication. This is followed by an examination of campaign design guidance material, and finally by conclusions regarding implications for the current research.

Campaign Media

Many media channels are available for campaign use to encourage the adoption of climate change mitigation behaviours, including both mass media and new media[2]. "Mass media are distinguished by, among other things, the fact that communication is at a distance with an undefined ['mass'] audience; that the substance of the communication can be stored, can be reproduced and can be sold" (Street, 2011, p. 6). While the concept of 'new' media is relative (Marvin, 1988), this thesis

[2] While other media channels exist that can be used to communicate about climate change (e.g., books, movies, and the arts), these do not typically support the communication-based intervention techniques useful for targeting environmental behaviours—for example, those described by Klöchner (2015)—and so are excluded from this analysis.

includes internet, social, and mobile media within this category. These new media are highly interconnected and interdependent, making their separation a complex undertaking (Lee, Leung, Qiu, & Chu, 2013), hence the inclusion of the internet (which is not a recent invention) in this category. Many theories initially used in mass media research have been applied or adjusted for use in new media research, however additional theories have also emerged to explain consumer engagement with new media—particularly social media. A range of media theories exist that assist in understanding how campaigns might engage with audiences to affect behaviour changes. These include theories related to how and why individuals might be motivated (or not) to engage with campaigns, and how such engagement might result in behaviour change (i.e., media effects)[3]. The following sections review the theories associated with relevant aspects of each of these categories, beginning with media engagement and then following with media effects.

Audiences and Media Engagement Theories

Contemporary theories of engagement with media offer more blending across the lines of Lazarsfeld's (1941) administrative and critical categories than was found in earlier theories. This generally occurs through the adoption of less deterministic explanations of media-audience interactions and attendant recognition of the reciprocal influences between media and society. Two theories from media studies that offer valuable explanations for why individuals might engage (or not engage) with campaigns are uses and gratifications (e.g., Katz, Blumler, & Gurevitch, 1973) and Slater's (2007) reinforcing spirals theory. Uses and gratifications theory suggests that individuals use media to satisfy social and psychological needs (Ruggiero, 2000). Under this theory individuals would actively choose to engage with campaigns due to social, cognitive (informational), or emotional motivations, and understanding these motivations would provide campaigns with tools to enhance engagement. Reinforcing spirals theory, however, posits feedback loops between media use and identity whereby engagement with media is selected based on identity, which is then reinforced by that engagement (Slater, 2007). In this way, campaigns with high relatability are more likely to be engaged with and would reciprocally strengthen the related identities. This research's focus on behaviour change suggests that media effects theories are of most relevance for guiding specific campaigns, however these two theories offer explanations of engagement and non-engagement within which the differential media effects on audiences might be explained.

A common component of these and other engagement theories that is highly relevant to contemporary campaigns is the concept of a media 'audience', and conceptualisations of audience and the processes of mediated communication have evolved significantly in recent decades. Couldry

[3] Theories of broader, industry or societal level processes and media effects have been excluded from this discussion due to this thesis' focus on campaigns that target individuals. The influence of social context on individual psychology, however, is considered from Chapter 3 onwards.

(2011, p. 215) defines the audience as “the domain of media-related practice outside production within specialist institutions”. This definition encapsulates the complexities of contemporary media consumption and production in which individuals that would previously have been considered as consumers, have now also become producers. Early mass media theories tended to take a deterministic approach that rendered the audience as passive receivers of information, whose responses were determined solely by the messages they received (Cunningham & Finn, 1996). Widespread adoption of the internet and social media, however, has transformed how, when, and where media audiences engage with media (Napoli, 2011). This has fragmented audiences, and reduced the distinction between consumers and producers, shifting the dynamic of communication away from the simple conceptualisation of senders and receivers to a more pluralistic and interactive relationship (Napoli, 2011).

Media conceptualisations of audience are diverse, offering a range of audience typologies, as well as debate following three key themes: audience exposure, activeness, and locus of meaning (Potter, 2009). Many audience typologies are descriptive (e.g., adopting delineations including media channel, audience demographics, or the nature of the media interaction), however these typically fail to support an understanding of audience meaning making or assist with theoretical integration (Potter, 2009). Potter (2009) offers a typology that addresses these issues by integrating the three dimensions of this debate into two axes for typifying audiences—the media exposure model. Axis one categorises audiences based on exposure states ranging from automatic through to the more thoughtful, self-reflexive state. Axis two focuses on the information processing task, including filtering, meaning matching, and meaning construction. Thus, the model merges characteristics of media engagement and message processing in a way that assists in theorising media effects. In this way, the model offers the capacity to differentiate communities of audience similar to the consideration of markets or interpretive communities (Carpentier, 2011).

Message targeting by differentiation (i.e., segmentation) of campaign audiences as part of social marketing approaches, is a commonly used approach in successful social and environmental campaigns, and follows the concepts of audience as differentiated communities (Corner & Randall, 2011). Despite many successful campaigns using this approach, audience segmentation in campaigns targeting sustainable behaviours has been criticised as potentially conflicting with longer term societal needs as in some instances it may promote unsustainable values (Corner & Randall, 2011). For example, by tailoring messages to meet the self-focused values of an audience—such as appealing to materialistic values to promote a money-saving behaviour—campaigns can unintentionally reduce the adoption of important behaviours that do not offer these same benefits. The gains made by some tailored messages may also be superficially achieved, and thus more susceptible to forfeit when the behaviour is no longer seen as serving personal interest (Hine et al., 2014). Campaigns must, therefore, carefully consider the broader implications of segmentation messages before

implementation. The effectiveness of the values approach has also been found to occur by "acting as filters on the interpretation of the information to which individuals are exposed about climate change" rather than by directly affecting behaviour (Corner, Markowitz, & Pidgeon, 2014, p. 415). Thus, effective audience segmentation is likely to increase campaign engagement.

Engagement through segmentation. Audience reach and engagement are terms used to conceptualise the potential breadth of media message uptake, and segmentation is a key approach used by campaigns specifically for improving audience engagement. Rohrs (2014, p. 71) defines reach as "the percentage of your audience that sees your message", while engagement is a measure of attention to messages. In social media, engagement is typically measured through interactions with the content, for example sharing, 'liking', or commenting on posts (Rohrs, 2014). The process of audience segmentation has been much researched for its potential to improve campaign targeting and attendant outcomes, however the theoretical and methodological approaches adopted in that research have been questioned in terms of their rationales and a need to better connect segmentation with effects research (Hine et al., 2014). Audience segmentation in climate change studies has been conducted using a range of different grouping methods for a range of different purposes. A review of climate change audience segmentation literature by Hine and colleagues (2014) identified that few studies used theoretical bases for segmentation. The vast majority of studies applied factoring or clustering techniques to survey data for a broad range of variables without specified theoretical rationales for each variable's expected role (Hine et al., 2014). Some recent studies have taken up this advice and shifted towards segmentation variables selected of theoretical grounds. One example is research by Poortinga and Darnton (2016), which segmented participants based on theoretically derived sustainability motivations and then tested these segments for predicting behaviour. The resulting segments provided some distinction across demographic characteristics, had intuitive logic, and matched generalised behaviour trends. They provided limited explanation of specific behaviours or groups of behaviour, however (i.e., only up to 11 percent of behaviour explained).

Segmenting Australian audiences. Several segmentation studies have been conducted in the Australian context (e.g., Ashworth, Jeanneret, Gardner, & Shaw, 2011; Bain, Hornsey, Bongiorno, & Jeffries, 2012; Hine et al., 2013; Morrison, Duncan, & Parton, 2013; Morrison, Parton, & Hine, 2018; Muriuki, Dowd, & Ashworth, 2016; Sherley, Morrison, Duncan, & Parton, 2014). Five of these have replicated studies conducted in the US by Maibach and colleagues (2011), using clustering techniques with a broad range of measures to identify four (Ashworth et al., 2011), five (Hine et al., 2013), or six (Morrison, Duncan, & Parton, 2013; Morrison et al., 2018; Sherley et al., 2014) segments that generally correspond with different aggregations of the six audience segments found in the US. These segments have been labelled alarmed, concerned, cautious, disengaged, doubtful, and dismissive

(Maibach et al., 2011)—all broadly related to participants' climate change beliefs and engagement, and with some demographic differences. The majority of Australians do not deny the existence of climate change (Leviston et al., 2015; Morrison et al., 2018; Reser, Bradley, Glendon, Ellul, & Callaghan, 2012b), and a recent review of trends in these segments have identified that positive trends in these beliefs have shifted more of the public away from the doubtful and dismissive categories (Morrison et al., 2018). These shifts were predominantly towards the cautious and disengaged categories, where reengagement potential is higher than in the doubtful and dismissive categories. Segmentation of a sample of Brisbane participants by Muriuki and colleagues (2016) adopted a sustainability focused approach that used social identity theory, along with attitudinal and lifestyle characteristics in a clustering approach. This segmentation adopted broader motivational considerations than were used in the climate change segmentations discussed above. Such an approach acknowledges the diverse motivations that can exist behind the adoption of specific behaviours. This categorisation, however, showed limited difference in demographics across segments (typically only two of the four clusters differed on any particular characteristic) and there was no difference in the two highest and lowest sustainability priorities across segments.

These segmentation studies offer a range of categorisations for consideration of the Australian public, however, their relevance for specific campaigns or behaviours is less certain. They may offer an initial layer of segmentation for targeting in which only one segment is defined as the campaign audience—as in research by Sherley, Morrison, Duncan, and Parton (2014) who identified sub-segments of *Cautious* Australians to separately test image and message responses. With different types of segmentation showing limited differentiation across segments either for behaviour adoption (Morrison et al., 2018) or sustainability priorities (Muriuki et al., 2016), and varying levels of interpretive differentiation in message responses (Bain et al., 2012; Hine et al., 2016; Sherley et al., 2014) it is unclear whether such approaches would be consistently effective across a variety of campaigns. Decisions leading to the identification of audience segments should be built on theoretically determined grouping variables rather than through ad hoc statistical combination of available data, as different included and excluded variables will construct different audience segments and influence the individuals and communities that are targeted (Hine et al., 2014). Campaigns must consider the theoretical and practical implications of segmentation with respect to campaign goals (Hine et al., 2014), as targeting may be more effective with segmentation by other characteristics such as lifestyles or social roles, rather than the specific concepts of belief and engagement with climate change. An integrated theoretical model of the social and psychological predictors of target behaviours, may provide a framework for identifying interpretive communities most suitable for campaign application.

Contemporary Media Effects Theories

Media effects are the social and psychological changes in audiences as a result of media consumption (Bryant & Zillman, 2009), and are theorised from both sociological and psychological perspectives, with some theories having implications for both societal and individual effects in line with the previously mentioned blending of Lazarsfeld's (1941) administrative and critical categorisations. Media effects can be behavioural, cognitive (learning), affective (e.g., emotional responses and attitude formation), and have been found to be influenced by audience and situational characteristics (Perse & Lambe, 2017). Media effects studies for mass media have typically shown limited evidence of broad societal impacts, and this has partly been blamed on poor research design. In his critical commentary, Gauntlett (2006) raised ten common flaws underpinning approaches to media effects research primarily related to methodological issues (e.g., inverted causal structures, and lack of consideration of context and meaning), as well as a lack of acknowledgement of underlying ideological and ontological assumptions and biases (e.g., assumption of audience deficits). Gauntlett suggested that research should instead focus on media influences on cognition, perception, and ways of being. In line with these criticisms and suggestions, this section reviews media effects grouped as primarily related to either perceptions of reality or message processing[4]. Theories with implications for perceptions of reality include agenda setting and cultivation. While theories with highest import for message processing include framing, priming, elaboration likelihood, source effects, and system of reasoning (exposure) theory.

Theories of effect relating to perceptions of reality. Zucker's (1978) agenda setting and Gerber and Gross' (1976) cultivation are related theories that incorporate both sociological and psychological perspectives, and suggest mechanisms for media influence on the perception of reality. Agenda setting theory posits that media messages have three key effects: (a) priming issues in the mind of the audience (i.e., making them easily accessible for recall), (b) raising unfamiliar issues into audience awareness, and (b) providing narratives that tell the public how to think about a topic (Rosenberry & Vicker, 2017). While sitting within agenda setting theory as societal artefacts, framing and priming also relate to message processing (Shah, McLeod, Gotlieb, & Lee, 2009) and will be discussed later in that context. Cultivation theory expands individual effects to societal level by proposing that engagement with mass media develops a common or 'mainstream' view of society based on media's representation, and that these effects are stronger for individuals whose reality more closely matches (or resonates with) that representation (Rosenberry & Vicker, 2017). Thus both theories suggest that the amount of attention given to topics by the media skews individual perception

[4] Theories relating to individual differences are covered in discussion of the psychology literature in Chapter 3. Message processing theories, while based in psychology, are covered here for their generalisable effects, rather than individual differences.

to believe that this reflects reality—with stronger effect for individuals who resonate with the media messages.

The fragmentation of audiences, complexity of message sources, and self-selection of messages by individuals within new media (especially social media), further complicate these theories' predictions (Metzger, 2009). Media messages are unlikely to reach audiences with the breadth and consistency offered in the past by mass media, but may have stronger effects within the resonant communities they do reach (Metzger, 2009). Therefore, well-targeted campaign messages may affect the level of societal priority that individuals perceive for the target topics, provide new narrative frameworks (frames), prime these topics and frames for easy recall, and have stronger effects due to resonance with target audiences.

Theories of effect relating to message processing. The framing and priming effects suggested by agenda setting theory also operate as message processing mechanisms, but are not the only processing effects relevant to campaigns. Other message processing theories include elaboration likelihood and source effects. Media's framing theory was proposed by Goffman (1974/1986) and priming theory by Iyengar, Peters, and Kinder's (1982), although both framing and priming are utilised as both sociological and psychological concepts across a range of research fields. Framing is "a process by which the emphasis or construction of a message affects the interpretation of the receiver" (Shah et al., 2009, p. 85), and can include both verbal and visual elements. Media priming posits that media material makes certain information or ideas more easily accessed than others, and this effects decision making by biasing judgements in favour of the primed knowledge (Iyengar et al., 1982). Framing effects are evident when the same information presented in different ways, leads to different interpretations (Shah et al., 2009). For example, framing an issue as benefiting 70 percent of a community will trigger different interpretations than framing the same issue as not benefiting (or perhaps harming) 30 percent of the same community, despite these statistics reflecting the same distribution. Framing effects are immediate cognitive responses to the message, whereas priming effects are delayed, only coming into effect by making certain interpretations more likely at later time due to the salience of the primed message (Shah et al., 2009). These effects can be influenced by the individual characteristics of the recipient, the message source, the level of message deliberation or evaluation undertaken, and the context in which the message is received (Shah et al., 2009).

In addition to these attentional effects, the primary effect theory relating to message deliberation is the elaboration likelihood model proposed by Petty and Cacioppo (1986). This is a dual process theory that explains communication material's influence as occurring through one of two cognitive pathways—high and low effort (Petty & Briñol, 2015). Influence achieved through the deliberative (central or high effort) pathway involves more thoughtfully consideration and is likely to be more persistent than that achieved through the automatic (peripheral or low effort) pathway's more

heuristic processing (Petty & Briñol, 2015). The deliberative pathway can be encouraged by the message's relevance, content, direction, quality, source, and the context of receipt—especially with respect to ease of engagement and the level of distraction present (O'Keefe, 2009; Petty & Briñol, 2015). Automatic pathway influence, however, can be achieved with repeated message exposure as a method of priming.

Message framing, priming, and deliberation effects can all be influenced by source factors, primarily through perceptions of the source's (a) credibility or bias, (b) similarity to the message recipient, and (c) perceived power (Petty & Briñol, 2015). Source effects predominantly impact the attention to and acceptance of messages and can act as cues for automatic responses, but have interactions and moderating effects related to topic relevance and the message processing pathway used by the recipient. High topic relevance can bypass source effects by triggering the deliberative processing pathway, while high source similarity, credibility, and power, can enhance a message's persuasive effects (e.g., due to mechanisms like self-validation) by serving as a peripheral cue under heuristic processing, or biasing thoughts under deliberative processing (Petty & Briñol, 2015). The use of well-matched, credible, and powerful sources, therefore, can enhance campaign message reception under heuristic processing, and source matching may also help to promote more deliberative processing.

These media effects theories offer a range of explanations of mechanisms that may influence the cognitions and behaviours of campaign audiences. Common themes across these theories are the effects of subliminal or automatic processes on perceptions of reality and message reception, as well as the moderating influences of individual factors such as topic relevance and source relatability and credibility. Testing of these mechanisms within the context of pro-environmental and climate change mitigation behaviours has offered support for these various mechanisms, and highlighted the complexity of their interactions with each other and with audience members' individual differences.

Media Effects and Climate Change Communication

Media effects in the context of climate change communication occur through the combined impacts of the multifaceted cultural circuits of climate change messages. Hulme (2009, pp. 215-216) explained that "[w]e need to understand the complex 'cultural circuits' of science communication in which framing, language, imagery, marketing devices, media norms and agendas all play their part in the construction, mediation and reception of messages." This is particularly critical for a heavily politicised topic as climate change is in Australia. Despite acknowledgement of these cultural circuits in broader communications and even science communication theories (Bauer, 2009; Metzger, 2009), climate change communications research has been slow to integrate these theoretical advances (Ballantyne, 2016; Moser, 2010; Pearce, Brown, Nerlich, & Koteyko, 2015). Media effects research specific to climate change and sustainability issues has, however, investigated aspects of these cultural

circuits through audience segmentation and the influences of both framing (verbal and visual; and as priming) and message sources. Despite the controversy surrounding audience segmentation approaches as discussed earlier in this chapter, audience segmentation has been included in comparative media effects analyses to determine differential message effects. This section will outline the empirical evidence supporting framing and source effects in the context of climate change and mitigation behaviours.

Message framing and priming effects. In the context of climate change communication, verbal framing is well-researched, however few studies were identified that examined visual framing effects or interactions between verbal and visual frames. Climate change framing and priming effects have been found to vary due to individual differences between message recipients (Newman, Howlett, Burton, Kozup, & Tangari, 2012; Nisbet, Hart, Myers, & Ellithorpe, 2013; Wolsko, Ariceaga, & Seiden, 2016), and to differ across audience segments (Bain et al., 2012; Hine et al., 2016). Effects also differ across frames, and for different dependent measures (e.g., attitudes versus behaviour). Many different message frames have been investigated in climate change studies, including distance and outcome frames (Spence & Pidgeon, 2010), global warming versus climate change frames (Schuldt, Konrath, & Schwarz, 2011), episodic versus thematic frames (Hart, 2011), moral versus civic duty frames (Wolsko et al., 2016), health framing (Myers, Nisbet, Maibach, & Leiserowitz, 2012; Petrovic, Madrigano, & Zaval, 2014), positive and negative frames (Avineri & Waygood, 2013), global versus local framing (Scannell & Gifford, 2013), frames highlighting danger to humans versus animals (Dickinson, Crain, Yalowitz, & Cherry, 2013), and frames focusing on energy conservation versus financial versus carbon emissions outcomes (Spence, Leygue, Bedwell, & O'Malley, 2014). While many studies have tested verbal framing effects in terms of attitude shifts, some few studies have investigated behaviour effects and found individual differences and differential responses across frames. For example, individual differences in ideology was associated with differential messaging effects for civic duty and moral frames. The former were effective in promoting mitigation intentions for conservative individuals but reduced these intentions for liberal individuals, while moral frames reduced intentions for conservatives but had limited effect on liberals (Wolsko et al., 2016). This example highlights a key concern with framing effects: the potential for unintended consequences, including boomerang effects.

The potential for perverse framing and priming effects is a critical concern for the long term effectiveness of climate change mitigation campaign messaging, and primarily relates to immediate and longer term effects. Immediate consequences include the boomerang effect in the example above where the use of civic duty frames reduced liberal individuals' intention to adopt target behaviours. The key concern regarding longer term effects, however, is associated with the targeting of extrinsic and self-enhancement values (rather than intrinsic and self-transcendent values). These types of

frames can result in less positive climate change attitudes as well as comparatively lower and less persistent adoption of the target behaviours (Bolderdijk et al., 2013; Evans et al., 2013; Sheldon, Nichols, & Kasser, 2011; Spence & Pidgeon, 2010), irrespective of individual differences in value priorities, and of previously primed values (Crompton et al., 2014). These frames can also have detrimental flow-on effects on attitudes to other behaviours (e.g., from car-sharing to recycling; Evans et al., 2013) and to other social issues (e.g., from disability rights to biodiversity protection; Crompton et al., 2014). These findings support the higher order arguments regarding message tailoring that were discussed under audience segmentation in earlier sections of this chapter, as they raise the potential for significant unintended consequences if messages are tailored to tap into audiences' extrinsic and self-enhancement values to promote the short term adoption of behaviours targeted by a specific campaign.

Source effects. Who delivers these messages also influences message reception, with both source credibility and similarity found to effect the reception of climate change and pro-environmental messages. Not all studies have found source effects, however, with specific message topics potentially overriding these effects by triggering the deliberative processing pathway (e.g., the analysis of large appliance purchase messages by Hafner, Elmes, & Read, 2017). Perception of source expertise and bias have been found to influence message acceptance, with bias correction discounting source expertise to account for differences in worldview (Kahan, Jenkins-Smith, & Braman, 2011; Lombardi, Seyranian, & Sinatra, 2014), and leading to enhancement of message effects when expected source bias is countered by message content (e.g., a US Republican as the source of a message supporting climate change; Benegal & Scruggs, 2018). Similarity with a message source increases trust and reduces perceptions of threat and associated negative reactance, and thus results in more positive attitudes and behavioural intentions related to message instructions (Song, McComas, & Schuler, 2018). Perception of source dissimilarity or undesirability (e.g., possession of negative attributes) can result in a desire for distancing from the source, and thus reduced receptiveness to messages (Bashir, Lockwood, Chasteen, Nadolny, & Noyes, 2013). Thus, while perceptions of similarity can improve message uptake, perceptions of negative source characteristics can encourage distancing and reduce message uptake, and practitioners must consider source characteristics within campaign designs in order to maximise message reception and campaign outcomes.

Campaign Guidance and Knowledge Transfer

Translating the knowledge gained through research relevant to climate change mitigation campaigns, and making it accessible for practitioner learning, are challenging processes. Learning is a social process that occurs through both personal (enactive) experience and vicarious observation of

others—including direct and recorded modelling (Bandura, 1986). Campaign practitioners, therefore, are able to learn about effective campaign approaches through conducting campaigns, or through directly or indirectly observing the effectiveness of others' campaign strategies or related research. Such 'others' may include peer organisations or researchers. The effectiveness of such learning will generally be dependent upon four process components: (a) accessibility of opportunities for learning, (b) attention to the opportunity, (c) the quality and complexity of the models or experiences provided, and (d) integration of the new knowledge into the learner's internal, cognitive models (Bandura, 1986). In collaborative learning processes with others (e.g., researchers or peers), ongoing, broad-based, real-time communications between the partners enhances knowledge transfer (Sherwood & Covin, 2008). Thus, practitioners must have access to high quality experiences or research outcomes that provide meaningful knowledge that can be translated for later application in new contexts, and can benefit from repeated interactions with learning collaborators.

Learning opportunities may be accessed by running campaigns, discussing campaign experiences with other practitioners, reading about relevant research or campaign evaluations, or directly working with or discussing findings with researchers. In terms of dissemination of research findings, environmental communication researchers are not always effective at making their knowledge accessible to wider audiences (Anderson, 2015), or in collaborating with practitioners (Moser, 2016). This challenge is evident in the typically generalised nature of guidance for campaign design. Achieving the right balance of specificity and generalisability in published guidance material synthesised from the complexity of climate change communication research is also highly challenging (Moser, 2016). Once synthesised, the guidance material must then make it into practitioners' environment in order to be attended to. Outreach to practitioners is also not strongly encouraged (Moser, 2016), and simply publishing knowledge does not guarantee it's uptake (Cash, Borck, & Patt, 2006). This is particularly so amid the plethora of information available to today's global internet society, which can make it problematic to identify the most useful and reliable information for any specific purpose.

Many different guidance materials exist that can support practitioners to integrate relevant climate change communication research knowledge into campaign designs, however their coverage and specificity varies considerably and this affects their practical utility for individual campaigns. The most useful guidance material for campaign design would provide advice around which strategies to use, in which conditions, and for which audiences, to achieve which campaign goals. The range of material available on these topics is substantial, spanning from:

- categorisations of options within one area of guidance (e.g., behaviour change strategies categorised by Michie et al., 2013; audience categories by Morrison, Duncan, & Parton, 2013) to full case study examples of campaign implementations (e.g., Gilg & Barr, 2005);

- web pages with simply framed information for community groups (e.g., National Council for Voluntary Organisations, 2017) to experimental research behind journal paywalls (e.g., Wolsko et al., 2016);
- broad guidance for campaigns covering any topic (e.g., Rice & Atkin, 2013) to guides specifically for pro-environment campaigns (e.g., McKenzie-Mohr et al., 2012); and
- guidance on communicating climate change that is not specific to behaviour change (e.g., Filho, Manolas, Azul, Azeiteiro, & McGhie, 2017).

The ease with which relevant, general rules can be extracted from such learning materials strongly effects knowledge acquisition (Bandura, 1986). Guidance material must maximise relevance and support learners to sift pertinent features from irrelevant ones (Bandura, 1986). Learning materials must avoid the oversimplification of critical complexities that often results from well-intentioned reductive bias, as these complexities are necessary for learning when contexts and conceptual application can differ greatly across cases (Spiro, Feltovich, Jacobson, & Coulson, 1991). The diversity of organisations (e.g., mandates and resources), individuals (e.g., prior training), and objectives (e.g., target behaviours and audiences) associated with mitigation campaigns provide a clear example of such case variability, but also supports a desire for guidance material with high generalisability. The need to balance the objectives of reach and specificity has resulted in a broad range of guidance materials as listed above, that vary greatly in their level of specific relevance to mitigation behaviour, as well as the various campaign engagement channels and levels of resourcing available to campaign organisations. The majority of these guidance materials provide general 'rules of thumb' from media effects and behavioural science research that may not provide the level of specificity necessary for effective and efficient campaigns targeting specific audiences and behaviours. The following sections examine the integration of communication and behavioural science theory in these guidance materials.

Communication theory in guidance material. Communication theory is included in many of these resources, with dominant focus on messaging effects considerations and considerably less coverage of issues of engagement (or non-engagement). Audience targeting is one of the most common concepts addressed, with approaches typically encouraging message development based on frames that resonate with audience ideologies, values, and so on (e.g., McKenzie-Mohr et al., 2012; National Council for Voluntary Organisations, 2017; Pike et al., 2010). In contrast, there is considerably less coverage of motivations for different types or levels of engagement with messages as might be explained by uses and gratifications or reinforcing spirals theories, or coverage of message processing mechanisms. Anderson (2015) and Ballantyne (2016) highlight two factors that may contribute to the limited presence of communication theory in campaign guidance material. Anderson (2015, p. 382) stresses that "[a]s environmental communication scholars, we are not always

very good at meaningfully translating our research so that it is accessible to wider audiences both within and outside academia." While Ballantyne (2016, p. 329) suggests that "climate change communication is characterized by diverging and incompatible understandings of communication as a theoretical construct", primarily due to the field emerging from various disciplines other than communication. In taking a top down, audience deficit model as climate change communication historically has, the knowledgeable sender is prioritised over the deficient receiver and audience motivations for engagement can be overlooked. A stronger integration of communication and media effects theory in guidance material may, therefore, strengthen campaign designs and outcomes.

Climate change communication theory and guidance material. Climate change communication has distinct challenges that are not faced in the communication of other environmental issues (Moser, 2010), and thus involves some specialised theoretical considerations in campaign design. While climate change communication began in the hands of the physical scientists who first became aware of the issue (Moser, 2010), the specific nature of climate change and its associated socio-political context (Holmes & Star, 2018) and psychological artefacts (Gifford, 2011) raise unique challenges to effective communication. For example, campaigns are hampered by difficulties associated with promoting message relevance for many audiences (especially in Western countries) where the impacts of climate change appeared spatially and temporally distant (Gifford, 2011; Leviston, Price, & Bishop, 2014). Similar challenges face campaigns in trying to representing the complex and abstract concepts of climate change through effective and engaging visual frames (Manzo, 2010; Nicholson-Cole, 2005; O'Neill, Boykoff, Niemeyer, & Day, 2013). Compound these with the strong denialist voices (particularly in Australia and the US) that only recently appear to be losing sway (Holmes & Star, 2018; Hulme, 2009; Morrison et al., 2018), and it is clear that campaigns face considerable challenges. Theories from psychology have typically been adopted to explain these issues, for example judgemental discounting's account of the reduced priority placed on risks that appear distant in either time or space, and terror management theory's reasoning that denial is a means to escape from mortality fears (Gifford, 2011). While these theories are not specific to climate change, the results of their contextual application to the topic is comparatively better covered in campaign guidance material than is broader communication theory.

Behavioural science theory in guidance material. The psychology of climate change mitigation behaviours has been extensively studied, however the inclusion of this research is variable in guidance materials relevant to campaigns. Much of the specific scholarly knowledge resides in individual journal articles, but syntheses of these have been included in diverse materials. While general campaign guidance materials may not include climate change psychology (e.g., Rice & Atkin, 2011), resources that do include behavioural science information provide varying levels of relation to

mitigation campaigns: (a) providing summaries of climate change psychology research separate from the context of communication (e.g., Clayton & Manning, 2018); (b) relating broadly to climate change communication (e.g., Klöckner, 2015); (c) tailored to communication for behaviour change (e.g., Moser & Dilling, 2007); or (d) focusing on one specific psychological theory in relation to campaigns (e.g., Crompton & Weinstein, 2015). Some few also offer tailored procedural advice with case study examples (e.g., McKenzie-Mohr et al., 2012). The majority of these resources, however, do not provide specific guidance regarding the particular psychological factors of relevance for specific behaviours and audiences. In many instances, guidance is provided as disparate information or lists covering a wide range of different theories or socio-psychological factors known to influence behaviour (e.g., Trijp, 2014) without provision of clear guidance on how to choose between them. Are these all relevant for all behaviours and audiences? Are they all equally relevant across behaviours and audiences? Such choices are essential for minimising inefficiencies in campaign targeting, and guidance for these decisions is particularly critical where insufficient campaign resources exist for undertaking the often recommended formative evaluations[5]. The ability to provide more specific guidance on the selection of target factors for various campaign contexts, would greatly improve the ability of learners to distinguish the most relevant and effective strategies for targeting in each campaign instance.

Summary and Implications

These analyses have identified a range of challenges facing campaign designers trying to acquire new knowledge for improved campaign strategies. The complexity of the cultural circuits surrounding campaign messaging complicates both design and evaluation, and balancing the need for specificity and generalisability of research knowledge has led to inconsistencies in the level of incorporation of both communication and behavioural science theory in campaign guidance material. In particular, the considerable volume of psychology research available regarding mitigation behaviour is typically synthesised into highly generalised rules of thumb without guidance on how to distinguish which factors are appropriate to target in any specific campaign instance. This raises questions regarding the ability of the existing mitigation psychology research to provide this necessary level of specificity in advice, and what such counsel might be. The following chapter examines the psychology literature in the context of campaign relevance, and specifies the campaign focus model for analysis in Study 1 and Study 2, in the hope of identifying more specific focal points for campaign targeting.

[5] Formative evaluations are processes in the early stages of a campaign, where information is collected about audiences, and pretests are conducted to evaluate the effectiveness of draft messages (Rebich-Hespanha & Rice, 2016).

Chapter 3: The Psychology of Climate Change Mitigation Behaviour

Not all behaviours are conducted with conscious decision making or consciousness of motivation, but rather behaviour occurs through an interplay of the conscious and unconscious (Baumeister, Masicampo, & Vohs, 2015). Understanding this interplay is an important step in assisting individuals to change their behaviour, and has been the focus of considerable and diverse psychology research since the discipline began. Psychological research on climate change mitigation behaviours has been undertaken from a range of different perspectives, has identified several dominant motivational pathways to behaviour, and has investigated many different predictors involved in encouraging or discouraging behaviour within these pathways. This chapter draws together this diverse research to outline the main pathways to behaviour and identify the key predictors of behaviour of most relevance for communication campaigns. Message processing theories were covered in the previous chapter and are excluded from this chapter's analysis as they are relevant to *how* to target campaign messages, while this chapter focuses on theories to assist in identifying *what* to target with campaign messages. The chapter ends by summarising these findings to establish the campaign focus model (CFM), which aims to provide a more targeted explanation of behaviour with specific relevance to campaign design.

Introducing the Pathways to Behaviour

Climate change mitigation behaviours are often framed as pro-social due to their global benefits, however these behaviours are not always driven by social motivations, or even by conscious decision-making. Some scholars take the view that self-interest is the primary driver of both adoption and nonadoption of mitigation behaviours, and research from various disciplinary perspectives offers support for this idea. Both evolutionary psychology and social marketing research have suggested that sustainability for its own sake is not a great motivator, with self-interest and instant gratification much more motivating reasons for behaviour (van Trijp, 2014). Neuroscience research also suggests self-control difficulties when trying to balance these two motivations (van Trijp, 2014). Despite this dour-seeming prognosis, self-interest is not always a demotivating factor for sustainable behaviour, but can also play a promoting role through status signalling and social conformance (Aagerup & Nilsson, 2016; Griskevicius, Cant, & van Vugt, 2012; van Trijp, 2014). These and other motivations may not be consciously recognised, but some of them can be influenced and some can be consciously changed.

The interconnections and influence of these and other conscious and unconscious factors have been theorised by diverse researchers, and can be considered in terms of a series of pathways. A framework of three categories or sets of pathways to behaviour is used in this thesis based on a combination of the five categories adopted by Jackson (2005). The three sets of pathways are rational choice (a combination of Jackson's rational choice and adjusted rational choice categories), normative

(combining Jackson's categories labelled "moral and normative" and "sociality and the self"), and habit. The rational choice or agentic pathways include theories that conceptualise behaviour as the result of conscious deliberation and the evaluation of the associated costs and benefits, but are often adjusted from purely economic models through additional factors (e.g., social influences), due to the poor predictive ability of purely economic models (Jackson, 2005). Normative pathways theories aim to explain the processes that lead to the development and application of norms, the social influences on an individual's perceptions of the self, and the relationship of the self to society (Jackson, 2005). Habit pathway theories address the notion that certain behaviours become part of routines and fail to trigger the cognitive deliberations that are the focus of rational theories (Jackson, 2005).

Many different theories have been used in the prediction of mitigation behaviours, often adopted from other disciplines such as health and education, and evolving over time to include common elements to adapted specifically for the prediction of mitigation behaviours by the inclusion of tailored variables. Figure 2 provides a summary of the theories with strongest empirical support and relevance for behaviour campaigns and which will be discussed in this chapter, illustrating the temporal progression of ideas where these theories have been refined and expanded over time with connecting (solid) arrows highlighting these evolutionary relationships. Nine theories align primarily under one of the three pathway categories (unshaded in Figure 2), while three theories incorporate concepts drawn from all three categories to overcome the limitations of single-category models (shaded grey in Figure 2).

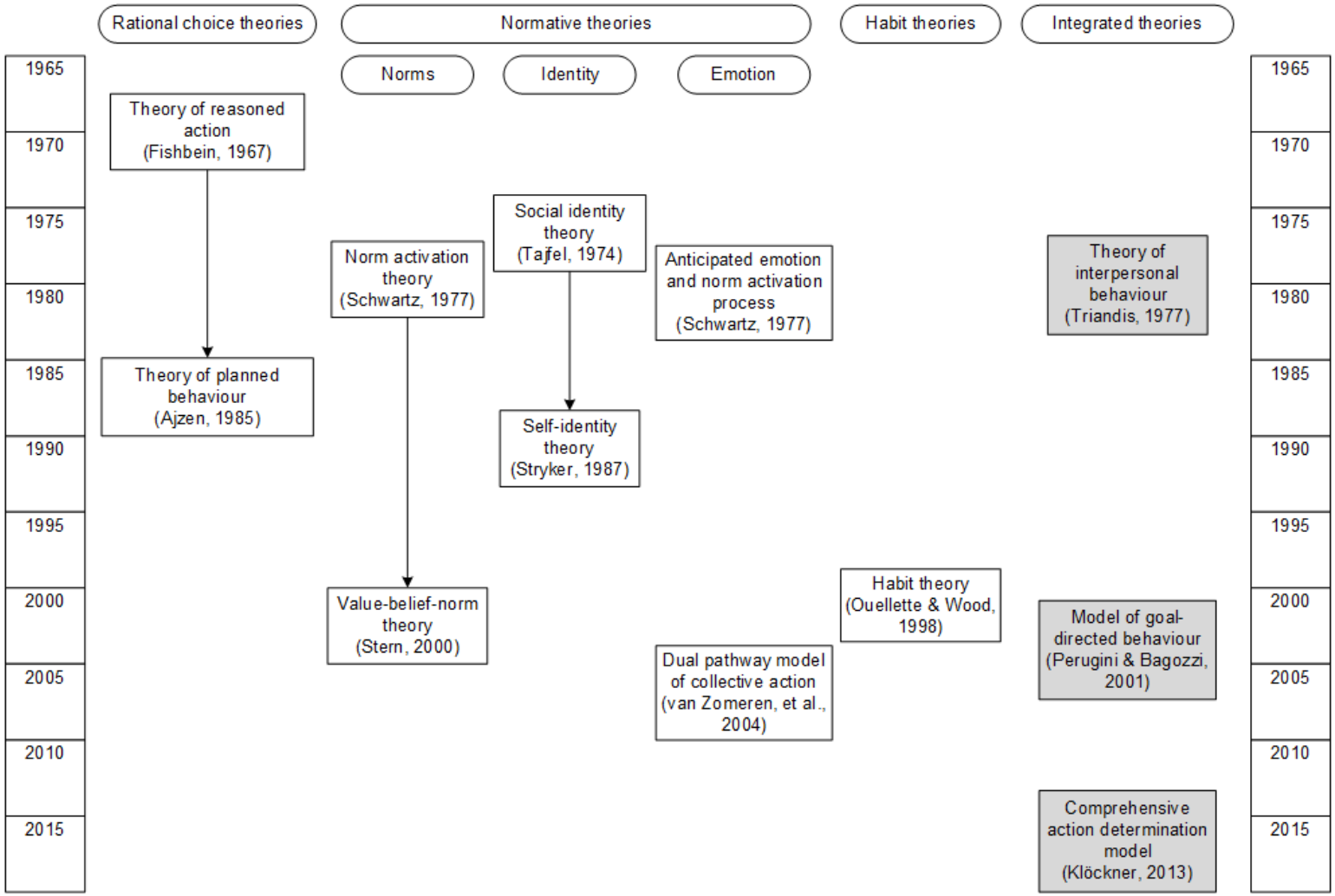

Figure 2. Evolutionary connections and category (pathway) of key theories used in mitigation behaviour research.

Note. The sources listed here are for the versions of the theories as discussed in this chapter where various versions have been published. Theories shaded grey are multi-dimensional, including concepts from all three categories of pathways to adoption. Connecting arrows indicate evolution pathways connecting related theories

Rational Choice Theories

Theories explaining behaviour through rational pathways focus on cost-benefit (also referred to as expectancy-value) evaluations associated with behaviour options, to determine the most beneficial option for implementation (Jackson, 2005). These models typically follow a self-interested agenda to behaviour (Bamberg & Möser, 2007), and despite the inclusion of 'rationality' in the category title, these theories do not necessarily imply that the beliefs involved in evaluations are rational or well-formed, but rather that attitudes follow from the logical interplay of beliefs—however irrational those beliefs might be (Fishbein & Ajzen, 2010).

These theories have a strong history of use in research on mitigation behaviour, but show only moderate ability to explain behaviour and are often criticised as overvaluing self-interest by ignoring the roles of morality and altruism in decision-making, and overvaluing cognitive deliberation by ignoring the roles of emotion, bias, heuristics, and habit (see Chan & Bishop, 2013; Jackson, 2005; Klöckner, 2013). Many researchers have chosen to counter these weaknesses by expanding upon these models with additional variables from other pathways discussed in this chapter—a process known as *theory broadening* (Perugini & Bagozzi, 2001). However, these integrations lack consistency across the literature with studies using a wide variety of augmenting variables[6] and applying diverse interpretations of the paths of influence between variables. Despite these weaknesses, rational choice models offer important explanations of the deliberative components of behaviour, and have been shown to improve the predictive capacity of models from other pathways (Abrahamse & Steg, 2011; Bamberg & Möser, 2007). In mitigation behaviour research, this category of theories is dominated by the theory of planned behaviour (TPB; Ajzen, 1985, 1991) and the theory of reasoned action (TRA; Fishbein & Ajzen, 1975)[7].

TPB (Ajzen, 1985, 1991) is one of the most frequently used theories within research on mitigation behaviour and evolved from TRA through the inclusion of perceived behavioural control (PBC)[8], which acknowledges that the perception of volitional control is critical to the effort expended towards implementation (refer to Figure 3 and Figure 4 for comparison). TRA was posed by Fishbein in 1967 (Fishbein & Ajzen, 1975) and is still used occasionally in its own right within mitigation behaviour research. Ajzen (1985, 1991) proposed TPB as an explanation of volitional behaviour, where: attitudes towards a target behaviour, perceptions of the expectations of significant others' with

[6] Study 1 of this thesis provides a snapshot of this diversity in its description of the characteristics of the included sample studies.

[7] Other theories exist in this category that are occasionally used in mitigation research but were excluded from this analysis due to limited additional explanatory value above the dominant theories—for example, the model of responsible environmental behaviour (Hines, Hungerford, & Tomera, 1987), and attitude-behaviour-context theory (Stern & Oskamp, 1987).

[8] PBC is considered generally equivalent to Bandura's (1977a) self-efficacy concept (Ajzen, 1985), which is also used to broaden theories and has been the focus of considerable study separate to TPB. References to PBC throughout this thesis also encompass self-efficacy.

regard to the behaviour (i.e., subjective or social norms, which are discussed under Normative), and PBC, are key factors determining behavioural intentions. Behaviour is jointly predicted by intentions and PBC. The rational, evaluative concepts within these theories dictate their inclusion as a rational choice theory.

Ajzen (1985) considers TRA to be a special case of TPB, which applies when perceived and actual expectations of successful behavioural implementation are highest. This is due to the TPB's inclusion of consideration of evaluations of both failure and success in the formation of attitude and PBC in comparison to TRA's focus on perceptions relating only to successful implementation. TPB considers attitudes as a form of rational, but subjective, expectancy-value evaluations that are a function of attitudes towards the successful and unsuccessful performance of the behaviour, and the perceived probability of success or failure (Ajzen, 1991). The inclusion of PBC was another key change between TRA and TPB (refer to Figure 3 and Figure 4 for comparison), and some researchers interpret these changes to imply that TPB is a more behaviour-specific model less suitable for use in the prediction of aggregated behaviours in comparison to TRA (e.g., Kaiser & Gutscher, 2003, as cited in Chao, 2012; Cordano et al., 2011). However, both theories were posited in terms of explaining specific behaviours, recognising individual differences in the weighting of each variable's influence across behaviours (Ajzen, 1985; Ajzen & Fishbein, 1980).

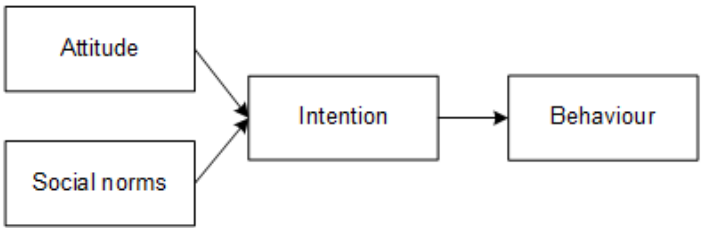

Figure 3. Fishbein & Ajzen's (1975) theory of reasoned action.

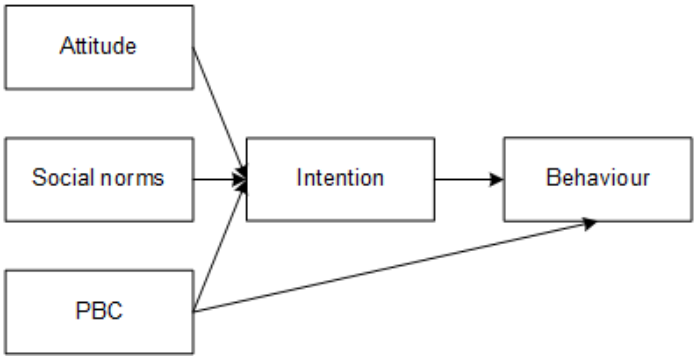

Figure 4. Ajzen's (1991) The theory of planned behaviour.

Several meta-analytic reviews of the efficacy of TPB have shown the theory to have moderate capacity to predicting behaviour, with the inclusion of PBC improving the model's results. These studies found that TPB explained between 19 and 27 percent of behaviour and between 29 and 44

percent of intention (Armitage & Conner, 2001; McEachan, Conner, Taylor, & Lawton, 2011; Rivis, Sheeran, & Armitage, 2009). PBC tended to add approximately 5 percent to explanations of both intention and behaviour (Armitage & Conner, 2001; McEachan et al., 2011), supporting the value of this predictor and raising TPB above TRA as an explanation of behaviour. These results indicate that rational choice theories like TPB offer important contributions to the explanation of behaviour, and also illustrate the significant amount of variance in behaviour not accounted for by these models.

Empirical support and campaign relevance of rational choice predictors. The rational choice theories of TPB and TRA have empirical support for their role in explaining (and predicting) behaviour, and this section examines the empirical support regarding the amenability of each of these theories' rational choice variables (intention, attitudes, and PBC)[9] to influence through communication as might be used in mitigation campaigns. Research on intentions has found them amenable to influence in ways relevant for campaigns. The value of intentions towards predicting behaviour has been supported by many TPB studies across a range of mitigation behaviours (Kaiser, Hübner, & Bogner, 2005; Onwezen, Gerrit Antonides, & Bartels, 2013), although this relationship is stronger for self-report behaviour than for observation behaviour (Chao & Lam, 2011).

Interventions typically manipulate intent indirectly but such approaches have produced moderate changes in participants' intentions to implement target behaviours (average $d = 0.66$; 95% CI [0.51; 0.82]), and small to moderate changes in behaviour (average $d = 0.36$; 95% CI [0.22; 0.50]; Webb & Sheeran, 2006). The intent-behaviour relationship can also be affected by the amount of elapsed time between formulation of intention and implementation of behaviour, with greater time weakening the intent-behaviour relationship (Sheeran and Orbell, 1998, as cited in Webb & Sheeran, 2006). The accessibility of intentions at the time of behaviour also moderates the intent-behaviour relationship (Fishbein & Ajzen, 2010). Thus, through influencing the predictors of intention, reminding individuals of previously made intentions, and reducing the time between formulation of intention and implementation of behaviour, campaigns can strengthen the likelihood of the development of intentions that result in implementation.

The first of TPB's predictors of intention is attitudes, which have been influenced through messaging by a range of studies. The predictive value of attitudes for mitigation behaviours has been illustrated by many TPB studies across a range of different behaviours (e.g., Harland, Staats, & Wilke, 1999; Ho, Liao, & Rosenthal, 2015; Kaiser & Scheuthle, 2003; Nigbur, Lyons, & Uzzell, 2010). The process of forming attitudes was tested by Glasman and Albarracín (2006) in a meta-analysis of data from 41 experimental studies reporting attitude and behaviour relationships. They confirmed a strong correlation between attitude and behaviour, and that the attitude-behaviour relationship was

[9] Social norms are examined under normative pathways.

influenced by the nature of the experimental material (e.g., presenting information from one or two perspectives; $b^* = .14$, $p < .09$). Glasman and Albarracín also found that the attitude-behaviour relationship was influenced by the accessibility (salience) of attitudes ($b^* = .16$, $p < .001$), which partially mediated the effect of repeated expression of attitudes ($b^*_{\text{mediated}} = .77$, $p < .001$; $b^*_{\text{direct}} = .11$, $p < .001$). This meta-analysis only included data from studies focusing on novel attitude objects (specifically excluding experiments relating to attitude change), but provides support for the potential for campaigns to influence attitudes through priming (i.e., increasing salience) and repeated engagement with attitudes.

Marketing research has long recognised the value of attitudes in terms of product sales, and advertising material has been shown to successfully influence product and brand attitudes (e.g., Lutz, 1975; Miniard, Bhatla, & Rose, 1990; Stuart, Shimp, & Engle, 1987). An early study by Lutz (1975) specifically aimed at changing attitudes towards a brand by manipulating the outcome beliefs (i.e., likelihood of consequence) and qualitative evaluations (e.g., good/bad) theorised behind the attitude construct by Fishbein (1967, as cited in Lutz, 1975), and which were later included in TRA and TPB. Lutz found that both beliefs and evaluations were open to change through messages about the behaviour, and that changes in either of these cognitive aspects resulted in changes in attitudes. These various intervention studies suggest that communication campaigns could target attitudes using a range of strategies as a potential point of influence for increasing the adoption of mitigation behaviours.

While attitudes are the strongest predictors for intent or behaviour in many studies (including the TPB meta-analyses already discussed), they are not consistently so. Some studies have found attitudes to be nonsignificant predictors in favour of other factors such as social norms or PBC (for TPB models). For example, comparative analyses conducted by Harland, Staats, and Wilke (1999) using TPB to predict intentions for a range of behaviours, identified that attitudes were the dominant predictor for reducing meat consumption (with PBC nonsignificant), PBC was the dominant predictor for turning off the water while brushing teeth (with social norms nonsignificant), while attitudes, social norms, and PBC were all significant for using unbleached paper. Other studies comparing across mitigation behaviours have found similar diverse relationships between TPB predictors (e.g., Heeren et al., 2016; Kaiser & Gutscher, 2003), and this diversity is also found when comparing across studies of single behaviours. Such variability across behaviours has important implications for campaign designs, and understanding which variables are relevant to which behaviours could greatly improve the effectiveness and efficiency of campaign designs.

PBC may not be consistent in its influence, but it has been found to be an important predictor of mitigation behaviours in many studies, and is open to influence through message design. Similar to attitudes, PBC has been the focus of considerable research due to its inclusion in TPB, although many studies broaden other theories with Bandura's (1977a) equivalent: self-efficacy. TPB-based research

has confirmed its value as a direct predictor of both intention and behaviour (e.g., Bamberg, 2013; Chan & Bishop, 2013; Thøgersen & Zhou, 2012), as has self-efficacy research (e.g., Abraham, Pane, & Chairiyani, 2015; Park & Yang, 2012; Tabernero & Hernández, 2011). Research by van Zomeren, Spears, & Leach (2010) tested the role of self-efficacy in predicting a range of mitigation behaviours, and included an experiment aimed at influencing participants' sense of self-efficacy through message manipulation. These manipulations were successful [F (1, 101) = 8.14, $p < .01$, $\eta^2 = .08$], although in those instances the influence of self-efficacy did not reach significance.

Rational choice pathways' contributions for campaign interventions. Empirical studies support the potential for behaviour change through mitigation campaign interventions targeting behaviour and intentions via attitudes and PBC. While the influence of attitudes on behaviour is fully mediated by intentions, that of PBC is only partially mediated by intentions. All three of these predictors are worthy of inclusion in models supporting campaign targeting.

Normative Theories

Theories explaining behaviour through normative pathways include three primary, and interconnected, foci: norms, identity, and emotion. Norms-based theories explain the influences of perceptions of what is 'correct' behaviour (Triandis, 1994), where social and personal norms differ by the level of internalisation of the norm (Schwartz, 1973). Identity theories explain the categorisation of the self in terms of relationships with others, and incorporate associated normative expectations of attitude, belief, and behaviour relevant to those categorisations (Stryker & Serpe, 1982; Tajfel, 1974). Theories of emotion focus on either retrospective emotion in response to awareness of environmental issues (van Zomeren, Spears, Fischer, & Leach, 2004; van Zomeren, Spears, et al., 2010), or emotions triggered through anticipation of future norm conformity or violation (Schwartz, 1977). These normative pathways theories aim to explain the development and influence of norms, identity, and emotion, and strong theoretical linkages exist that support their integration into a single category of interconnected pathways, although with multiple lines of influence as was seen for the rational choice theories.

Normative category theories have a strong history of use in mitigation behaviour research, with increasing use of identity and emotion theories evident in recent years. Theories in this category offer important insight into the social motivations for behaviour, and have been shown to increase model explanatory potential when combined with rational choice theories (e.g., Abrahamse & Steg, 2011; Onwezen et al., 2013). Theories within the normative category of pathways are dominated[10] in

[10] The focus theory of normative conduct (Cialdini, Reno, & Kallgren, 1990) is also occasionally used in mitigation behaviour research, but was excluded from this review due its limited additional explanatory value above the dominant theories.

mitigation behaviour research by value-belief-norm (VBN) theory (Stern, 2000; Stern et al., 1999) and its precursor the norm activation theory (NAT; Schwartz, 1973, 1977). Other theories being given increasing attention include social identity theory (Tajfel, 1974, 1982), self-identity theory (Stryker & Serpe, 1982, 1994), and the anticipated emotion and norm activation process (Schwartz, 1977).

Norms-based theories. NAT was developed by Schwartz (1973, 1977) and proposed that personal norms serve a motivational role towards the implementation of altruistic behaviours. Schwartz (1973) posited that the personal norms of each individual are derived from the socially shared norms, suggesting personal norms will vary across individuals due to unique constellations of roles performed by each individual in diverse social interactions. Personal norms are feelings of moral obligation (Schwartz, 1977)[11]. These personal norms are activated by awareness of a need to address a problem, along with the personal ascription of responsibility for action (Schwartz, 1977). *Figure 5* illustrates these relationships. While social norms (as in TPB) are followed to avoid social sanctions, Schwartz (1977) explains that sanctions for personal norms are tied to the self-concept and invoke emotional responses in anticipation of (or upon actual) conformity (e.g., pride) or violation (e.g., guilt). Similar to TPB's notion of control, Schwartz (1973) includes feeling a certain level of control over the behaviour as inherent in his concept of responsibility. He also noted that a variety of potentially conflicting norms may be triggered in certain situations, and that the level of salience (and acceptance or denial) of the consequences and responsibility will influence norm activation.

VBN extends and refines NAT by rearranging these predictors of personal norms into a causal chain of influence, and adding more distal variables—including values and the new ecological paradigm—to explain the development of awareness of need (Stern et al., 1999). Values are relatively stable across an individual's lifetime, and are defined as the long-term guiding goals/principles by which individuals evaluate behaviour (Schwartz & Bilsky, 1987). Stern's (2000) VBN theorises that values (including the pro-social 'altruistic' values, self-focused 'egoistic' values, and pro-environmental 'biospheric' values) lead to the adoption of a new ecological paradigm (NEP). This paradigm represents environmental concern and leads to awareness of the consequences of an environmental problem and personal ascription of responsibility for action. These then lead to the development of pro-environmental personal norms related to the target behaviours, and finally adoption of pro-environmental behaviours (refer to *Figure 6*). While proposing VBN as an explanation of how personal norms develop as a predisposition towards pro-environmental behaviour,

[11] Personal norms are sometimes referred to as moral norms (Rivis et al., 2009), although social norms also include moral norms (Bamberg & Möser, 2007), so the term 'personal norms' is used throughout this thesis for clarity.

Stern (2000) acknowledged that behaviour is also influenced by other normative, agentic (rational choice), and habit factors.

The specific predictive paths between the variables in NAT and VBN may not be as straightforward as those theories suggest. The causal relationships among NAT predictors have been tested in a range of configurations, and tend more towards a causal chain as is encompassed in VBN (De Groot & Steg, 2009; Steg & De Groot, 2010). VBN's basic causal chain, however, has been found overly simplistic with many predictor relationships found to be only partial mediations (e.g., Sahin, 2013; Yeboah & Kaplowitz, 2016).

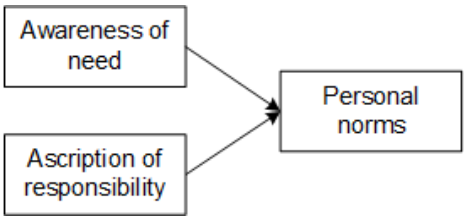

Figure 5. Schwartz's (1973) norm activation theory.

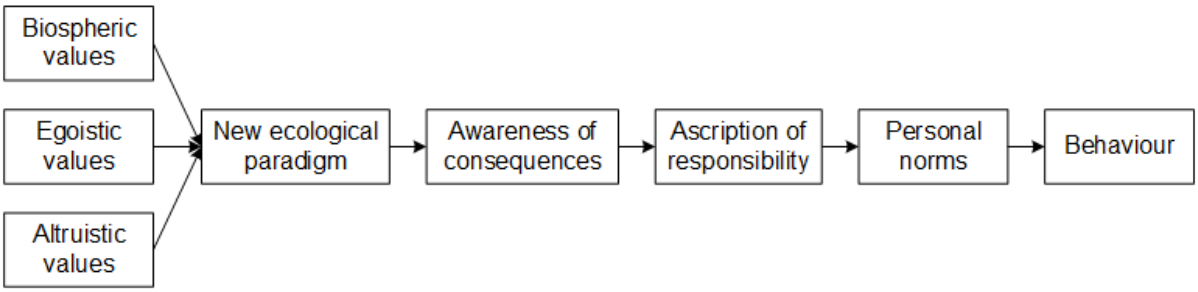

Figure 6. Stern's (2000) value-belief-norm theory.

VBN and NAT appear less frequently in the literature than the dominant rational choice theories[12], with studies testing VBN somewhat more common than NAT studies, although both are often drawn upon when broadening other theories (e.g., TPB). No meta-analyses were found for these theories, but a range of individual studies have tested them either separately or in comparison. One study comparing NAT, VBN, and TPB for predicting intentions to implement diverse pro-environmental behaviours, found somewhat similar levels of prediction across the three models (R^2_{NAT} = .53 and .58, R^2_{VBN} = .55 and .54, and R^2_{TPB} = .50 and .49 for US and Chilean samples, respectively; Cordano et al., 2011). As predictors of behaviour (rather than intent as in the study above), Stern and colleague's (1999) own tests comparing VBN and NAT showed VBN to outpredict NAT by approximately 2 to 8 percent explained variance in behaviour. Studies testing NAT across a

[12] The lower appearance of these two theories in the literature may partly be due to their focus on explaining pro-social behaviours generally for NAT, and pro-environmental behaviours specifically for VBN. In contrast, TPB and TRA were designed to explain a much wider variety of behaviours (as evident in the meta-analyses previously discussed).

range of pro-social behaviours found the model predicted between 18 and 42 percent of behaviour (De Groot & Steg, 2009; Ebreo, Vining, & Cristancho, 2003; Stern et al., 1999). A similar review of VBN studies showed more substantial variation in prediction, ranging from 6 to 64 percent of behaviour explained (Chen, 2015a; Ibtissem, 2010; Kaiser et al., 2005; Sahin, 2013; Stern et al., 1999; Yeboah & Kaplowitz, 2016). Thus norms-based theories offer valuable, if somewhat inconsistent, predictive potential for mitigation behaviours, and warrant further consideration for their potential for providing focal points for campaign interventions.

Identity theories. Identity theories have been receiving greater attention in mitigation behaviour research in recent years, although they were first proposed decades past. Both social identity theory and self-identity theory posit that our sense of identity develops through our interactions with others (Stryker & Serpe, 1982; Tajfel, 1974), and it is the role expectations (norms) associated with these interactions and identities that place these theories in the normative pathways category. Identity can be considered a somewhat fluid concept in which multiple identities coexist in complement or competition depending on salience (Hirsh & Kang, 2016), and it is the level of internalisation that separates social identities from self-identities. These multiple identities do not to imply that individuals suffer from mental disturbance but rather that an individual may identify as, for example, both an environmentalist and a coffee-lover, which may provide identities in conflict when ordering take-away coffee in a non-recyclable, single-use cup.

Tajfel's (1974) social identity theory predominantly focuses on the role that identification as a member of a particular group plays in interactions between groups. Despite its social label, the theory suggests that continued group identification is predicated on the ongoing value of such membership to the individual (i.e., a certain level of self-interest). Tajfel explains this identity "as that part of an individual's self-concept which derives from his knowledge of his membership of a social group (or groups) together with the emotional significance attached to that membership" (p. 69). This perception of membership then leads to comparison with other groups, which establishes subjective (psychological) differentiation from these 'others' and results in bias towards members of one's group (Tajfel, 1974). Figure 7 illustrates social identity theory's key processes. In terms of mitigation behaviour, for example, identification with a nation expected to be heavily impacted by climate change could promote the adoption of mitigation behaviours to protect that nation (one's own group).

In contrast, Stryker and Serpe's (1982) self-identity theory focuses on the categorisation of the self in terms of relational roles, which is a more abstract form of group than that of social identity theory (e.g., mother as a role rather than as a member of a particular mothers' support group). These roles are inclusive of a set of behavioural expectations and the stronger the commitment to that role, the more salient the identity, which leads to implementation of role behaviours (see Figure 8). These behaviours are influenced by situational characteristics and the shared values and norms associated

with the role (Stryker & Serpe, 1982). Under both social identity and self-identity theories, multiple identities can exist simultaneously for the individual (Stryker & Serpe, 1982; Tajfel, 1974), and this multiplicity can result in conflicts regarding which behaviours to implement in a certain situation.

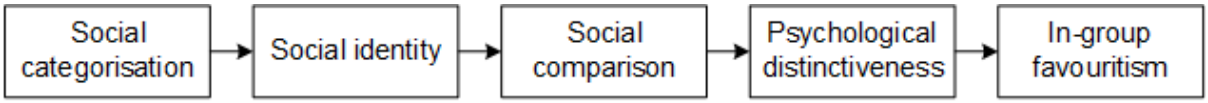

Figure 7. Tajfel's (1974) social identity theory.

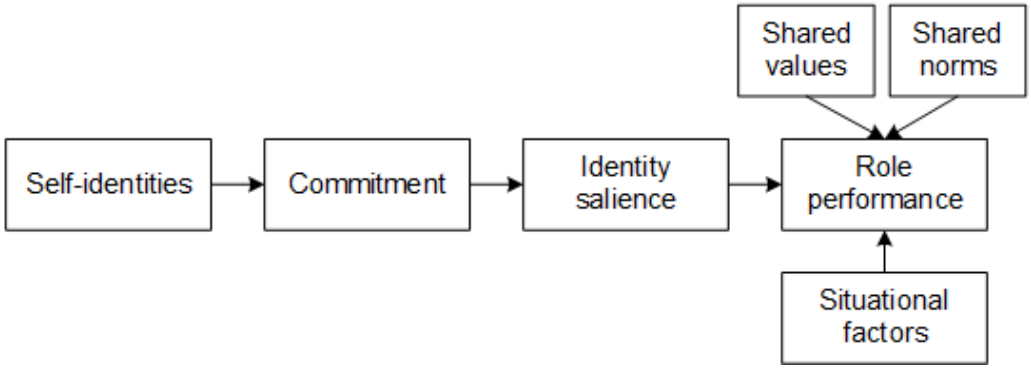

Figure 8. Stryker and Serpe's (1982) self-identity theory.

These identity theories are typically included in mitigation behaviour research as single constructs used in broadening other theories (e.g., Fielding, McDonald, & Louis, 2008; Nigbur et al., 2010; Terry, Hogg, & White, 1999), rather than testing all stages of the respective identity theory. As such, no studies were available to provide empirical support for their full application as explanations of behaviour. As single constructs, however, both social identity and self-identity have been found to be relevant predictors of mitigation behaviour (Dono, Webb, & Richardson, 2010; Rise, Sheeran, & Hukkelberg, 2010). Research by Terry, Hogg, and White (1999) also confirmed the connection between norms and identity, such that social identity and related behavioural (social) norms are generally enacted when particular group membership is salient, and self-identity and associated personal norms are enacted when group membership is not applicable or not salient. Henceforth, all references to self-identity and social identity are as constructs rather than theories.

Theories of emotion. Emotions are typically included in mitigation behaviour research as constructs within broader explanations of behaviour rather than as theories of emotion per se. In the context of climate change, both retrospective and anticipated emotions have been investigated. Retrospective emotions are experienced in response to awareness of climate change and attribution of causality (Bamberg & Möser, 2007), and have typically appeared in mitigation behaviour research as negative emotions including anger, guilt, or fear. Anticipated emotions as conceptualised in this thesis, are those emotions theorised by Schwartz (1977) as resulting from anticipated conformity or

violation of norms, and are activated (made salient) through an awareness of need for action (refer to Figure 9). Research on these emotions has investigated both positive emotions such as pride, and negative emotions such as guilt, and has typically used these concepts to broaden other theories (e.g., Kim, Njite, & Hancer, 2013; Onwezen et al., 2013). The role of retrospective emotions, however, have been most commonly tested in cognitive processing models that focus on two coping pathways: problem-focused coping (also called approach coping or adaptive behaviour) and emotion-focused coping (also labelled avoidance coping or maladaptive coping). The most current[13] in this suite of theories is van Zomeren and colleagues' (2004) dual pathway model of collective action (DPM; refer to Figure 10).

DPM was developed based on a long history of emotion processing theoretical developments and was adapted specifically for collective issues, originally focusing on collective disadvantage (van Zomeren et al., 2004) and later applied to climate change (van Zomeren, Spears, et al., 2010). DPM proposes and explanation of problem-focused coping, and posits that action towards addressing unfairness (e.g., the impacts of climate change caused by past actions) occurs through two motivational pathways: group-based anger and group efficacy (also referred to as collective efficacy; van Zomeren et al., 2004) as shown in Figure 10. These paths are influenced by perceptions of the unfairness, and support from within the group in terms of opinion agreement (social opinion support) and willingness to act together (social action support). This model can be applied to climate change due to the levels of inequality experienced throughout communities with respect to both impacts and responsibility. The social focus of the theory allows for broad interpretations of 'group' across a range of scales.

A series of studies offer support for the efficacy of DPM. The model explained between 34 and 44 percent of the variance in action tendencies (van Zomeren et al., 2004) and 25 percent for intention (van Zomeren, Spears, et al., 2010). The relative importance of the dual model pathways was context specific in terms of whether or not the unfairness was towards the in-group or out-group, with unfairness towards the in-group invoking both anger and efficacy pathways, but unfairness towards the out-group triggering only the anger pathway (van Zomeren et al., 2004). These studies suggest that group-related (retrospective) emotion and efficacy offer pathways to behaviour worthy of consideration for the mitigation campaign interventions.

[13] Coping theories originated from fear appeals theory (Janis & Feshbach, 1953), and include protection motivation theory (Rogers, 1975; Rogers & Prentice-Dunn, 1997), the cognitive theory of stress (Lazarus, 1999/ 2006), and the extended parallel processing model (Witte, 1992).

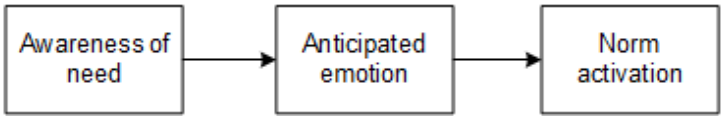

Figure 9. Schwartz's (1977) anticipated emotion and norm activation process.

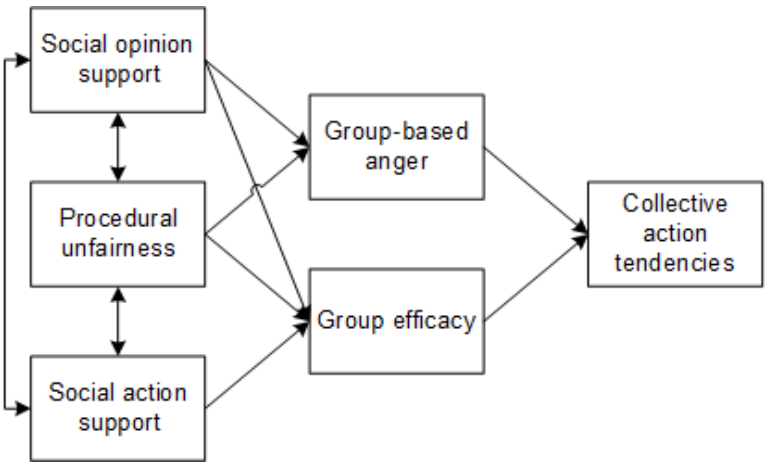

Figure 10. Van Zomeren and colleagues' (2004) dual pathway model of collective action.

The value of combining normative and rational choice pathways. Studies integrating rational choice and normative pathway theories have shown such models to better predict mitigation behaviours than single pathway models. Mitigation behaviour studies that have reported comparative results have shown the inclusion of VBN to add between 6 and 11 percent to TPB's explanation of public transport use (Heath & Gifford, 2002), while the addition of just personal norms to TPB raised prediction by between 1 and 11 percent for intention and between 3 and 7 percent for behaviours across a range of mitigation actions (Harland et al., 1999). Studies integrating TPB into models containing diverse combinations of normative pathways theories and predictors (e.g., emotions and NAT) have also shown the combined models to have increases of between 17 and 23 percent for predicting mitigation behaviours (Bamberg, Hunecke, & Blöbaum, 2007; Onwezen et al., 2013). These findings suggest considerable predictive value can be gained by integrating normative and rational choice pathways, and that these gains add value across diverse mitigation behaviours.

Empirical support and campaign relevance of normative predictors. This section reviews each of key variables from these normative pathways theories, examining evidence regarding the variables' predictive influences, and amenability to influence by interventions as might be employed by campaigns. These key variables include: social and personal norms; values; awareness

of consequences and ascription of responsibility; new ecological paradigm; social and self-identity; retrospective and anticipated emotions; and group efficacy[14].

Social and personal norms are both amenable to campaign influence, but are not consistent predictors of behaviour, rather offering value to predictive models in certain situations. Within TPB studies, social norms have been found (on average) to be the least predictive of the contributors to intent (Armitage & Conner, 2001), however comparative studies suggest that social norms may have higher influence for certain behaviours and cultures (e.g., Ando, Ohnuma, & Chang, 2007; Greaves, Zibarras, & Stride, 2013). Personal norms within VBN studies also have variable predictive potential (e.g., Kaiser et al., 2005; Yeboah & Kaplowitz, 2016), but are typically good predictors of intentions for behaviours that could be considered 'moral' (Rivis et al., 2009). This suggests that intention mediates the influence of both types of norm on behaviour. Studies incorporating both constructs have supported Schwartz's (1973) theoretical proposition that personal norms are constructed from social norms over time. Personal norms and social norms have been shown to be related concepts. Personal norms are typically stronger predictors of intention than are social norms, and partially or fully mediate the influence of social norms (Bamberg et al., 2007; Harland et al., 1999; Sparks, Hinds, Curnock, & Pavey, 2014; Thøgersen, 1999). Communications-based experimental studies have confirmed that both types of norms can be activated through messages, with social norms amenable to direct activation (Bolsen, Leeper, & Shaprio, 2014; van der Linden, 2015), and personal norms activated via the NAT pathways (De Groot & Steg, 2009). Collectively, this suggests that both forms of norms may offer value to mitigation campaign interventions, with social norms predicting personal norms, and personal norms predicting intentions.

Values are another internal evaluative concept and have been most commonly tested in mitigation behaviour research using Stern's (2000) VBN categorisations of biospheric, altruistic, and egoistic values[15]. Values have been successfully activated or primed by messages in experimental studies to influence beliefs or behaviours (Evans et al., 2013; Maio, Pakizeh, Cheung, & Rees, 2009), but typically offer negligible direct contribution to the prediction of behaviour (Ibtissem, 2010; Sahin, 2013; Yeboah & Kaplowitz, 2016). As more distal predictors, however, values have been shown to predict personal norms (Ruepert et al., 2016; Sahin, 2013; Yeboah & Kaplowitz, 2016), awareness of

[14] Group efficacy could be considered a rational choice predictor due to its similarity with individual efficacy (PBC/self-efficacy), but is included here due to its appearance in the normative pathways DPM theory and to the predictor's social characteristic.

[15] Stern's (2000) egoistic values esteem the self, and are conceptually equivalent to Schwartz' (1994) self-enhancement values, and Thompson and Barton's (1994) egocentric values. Stern (2000) separates altruistic (human-favoured) and biospheric (nonhuman-focused) values, which have some similarities with Thompson and Barton's (1994) anthropocentric (human) from ecocentric (nonhuman) values, however Schwartz' (1994) self-transcendence categorisation values both humans and nonhumans. While there are other types of values (e.g., openness to change also in Schwartz, 1994) and alternative foci in categorisation systems (e.g., cultural values as per Hofstede, 2001), these are much less studied in mitigation research and were excluded from analysis as having limited empirical support above the values included herein.

consequences (Sahin, 2013; Yeboah & Kaplowitz, 2016), ascription of responsibility (Yeboah & Kaplowitz, 2016), and self-identity (Ruepert et al., 2016) for some behaviours. The distal nature of values with respect to behaviour and their long term stability, suggest that they offer limited potential for campaign intervention. Values have, however, been found to influence message processing (e.g., attention and filtering) rather than behaviour (Corner et al., 2014), which explains the focus on self-transcendent value framing promoted by much of the campaign guidance literature.

The remaining three distal variables included in VBN (awareness of consequences, ascription of responsibility, and new ecological paradigm) offer limited direct potential to influence intentions and behaviour. Awareness of consequences and ascription of responsibility have been shown to be open to influence through communication messages, as a mechanism for activating personal norms (Steg & De Groot, 2010). They are, however, relatively distal predictors with limited direct influence on either intention or behaviour (Heath & Gifford, 2002; Yeboah & Kaplowitz, 2016). The new ecological paradigm is a measure of worldview that has been found to be well-represented within VBN's causal chain of influence, but with no substantial influence on behaviour (Chen, 2015a; Sahin, 2013; Yeboah & Kaplowitz, 2016). No research was identified that specifically aimed to manipulate NEP, but its supported place in the VBN causal change suggests it may be able to be manipulated through awareness of consequences, ascription of responsibility. The distal nature of these three predictors suggest they have limited value for behaviour models relevant to campaign interventions.

Mitigation behaviour research on social identity and self-identity has most commonly focused on versions of 'pro-environmental identity', but offers stronger support for the role of self-identity. Studies testing different predictive pathways for the influences of these two forms of identity have found some differences in these across behaviours. The effect of self-identity has been found to predict intention (Rise et al., 2010), and path analyses have shown these effects to be mediated by personal norms (Ruepert et al., 2016)[16]. Few studies have included both self-identity and social identity, however comparison of behaviour-specific self-identity and a social identity relating to peers and friends (rather than pro-environment) found that self-identity was mediated by intention, while social identity operated as a mechanism for strengthening social norms (Terry et al., 1999). No manipulation studies were identified that attempted to influence or prime these identities, however the contribution of values to self-identity (van der Werff, Steg, & Keizer, 2013b) suggests that priming may be possible through values. Taken together, social identity appears to offer considerably less

[16] The influence of behaviour-specific self-identity (rather than simply 'pro-environmental' self-identity) on behaviour has been found to not be fully mediated by personal norms (Nigbur et al., 2010), however few studies have tested the value of this form of self-identity, or its amenability to manipulation. It also may offer limited potential for encouraging adoption by nonadopters where such identity doesn't currently exist, thus the more general form of self-identity has been considered more relevant in the context of campaign interventions.

contribution to behaviour than self-identity, which could potentially be used by campaigns to prime relevant personal norms.

Both retrospective and anticipated emotion have been found to help motivate mitigation behaviour, with evidence that such emotions are open to influence by campaigns. Retrospective emotions arising from consideration of the contributors to and impacts of climate change have been found to predict mitigation intentions (Harth, Leach, & Kessler, 2013; Rees, Klug, & Bamberg, 2015). The path relationships of retrospective emotions as predictors of mitigation behaviour appear to be untested, however the conceptual link between ascription of responsibility and these resultant emotions is empirically supported (Ferguson & Branscombe, 2010; Nabi, Gustafson, & Jensen, 2018). Tests of fear appeals have also supported separate paths of influence of this retrospective emotion and PBC (van Zomeren, Spears, et al., 2010). This suggests that these emotions may be somewhat distal to behaviour, and on a parallel path to PBC as might occur through personal norms although this relationship has not been tested. These retrospective emotions have, however, been successfully manipulated through campaign-style messages by several researchers (Harth et al., 2013; van Zomeren, Spears, et al., 2010).

The influence of anticipated emotions such as pride or guilt in expectation of adoption or nonadoption of target behaviours is also mediated by intention (Kaiser, Schultz, Berenguer, Corral-Verdugo, & Tankha, 2008; Kim et al., 2013; Onwezen et al., 2013). Path models have found conflicting mediation relationships between personal norms and anticipated emotions, however, with some suggesting that anticipated emotions partially mediates personal norms (Onwezen et al., 2013) and others suggesting that these norms (and other variables including attitudes and PBC) mediate the effects of these emotions (Bamberg & Möser, 2007). The theoretical progression whereby anticipated emotions are a result of normative evaluations suggest that personal norms should precede anticipated emotions, however. No manipulation tests were found for these anticipated emotions, however the amenability of emotion to manipulation in other situations (e.g., retrospective) has been established. Thus both forms of emotion may be relevant for campaign interventions, with retrospective emotions more distal predictors potentially operating via personal norms, and anticipated emotions more proximal predictors likely to partially mediate the effect of personal norms on intention.

Group (collective) efficacy is less commonly investigated in mitigation behaviour research than PBC, and mediation studies suggest it is a relative distal predictor of behaviour. Analyses predicting participation in group climate change activities have found low or no direct contribution of collective efficacy to participation intentions (Bamberg, Rees, & Seebauer, 2015; Rees & Bamberg, 2014), with indications of mediation by social identity, social norms, and more personal forms of efficacy (Bamberg et al., 2015; Park & Yang, 2012). While group efficacy has been effectively manipulated using communication materials (van Zomeren, Leach, & Spears, 2010), the distal nature of this variable suggests it offers limited value for campaign interventions.

Normative pathways' contributions for campaign interventions. Empirical studies support the potential for behaviour change through campaign interventions that target normative variables. Personal norms, social norms, self-identity, and both retrospective and anticipated emotions are all indicated as relevant for inclusion in models for supporting campaign design. Each of these variables are both open to influence by communication material, and sufficiently proximal as influencers of behaviour. Theory and mediation analyses suggest that such a model would include social norms, self-identity, and retrospective emotions as predictors for activating personal norms. The influence of personal norms on intentions to implement target behaviours would then be partially mediated by anticipated emotions. These are the normative pathways to behaviour of relevance to campaign interventions.

Habit Theory

Habits are behavioural tendencies that develop through repetition of action in stable conditions (Ouellette & Wood, 1998). Habit is typically included in theoretical models as a single construct—frequently using the frequency of past behaviour as a surrogate, but also using script-based, heuristic behaviour response measures (Klöckner, Matthies, & Hunecke, 2003). Despite the use of frequency measures as surrogates, habit is more than just frequent implementation of a behaviour (Ouellette & Wood, 1998). Frequent implementation of behaviour in stable contexts leads to the development of routinised habits that are triggered by contextual cues at the point of implementation rather than through conscious decision-making as is represented in rational choice pathways (Ouellette & Wood, 1998). In contrast to habit, previous implementation of less frequent behaviour (or frequent behaviour in highly variable contexts) influences future implementation via attitudes and social norms (Ouellette & Wood, 1998). Habits offer efficient ways to achieve intended goals as they require little cognitive load, and the repeated implementation from which they form, provides evidence to the actor of the habit's successful achievement of the desired outcome in that given situation (Verplanken & Aarts, 1999).

The theory of habit confirmed by Ouellette and Wood's (1998) meta-analysis is illustrated in Figure 11. In this theory, habits are formed as a consequence of repeated implementation of a behaviour in stable context, in response to a desired goal. The stability of the context in which these repetitions occur decides whether a habit forms (stable and frequent behaviour), or if the past behaviour is instead mediated by norms, which then predict future intentions. Despite the separate paths of habit and intention, intention retains slight influence even for habitual behaviours (Ouellette & Wood, 1998), suggesting that habit moderates the intention-behaviour relationship.

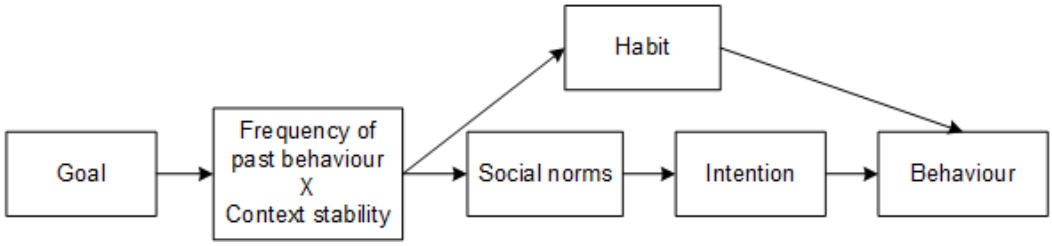

Figure 11. Ouellette and Wood's (1998) theory of habit.

The value of combining habit with rational choice and normative pathways. Habitual behaviours are poorly predicted by rational choice and normative models, however the addition of habit to these models has been shown to improve predictive capability (e.g., Chen & Chao, 2011; Klöckner & Matthies, 2004; Verplanken, Aarts, van Knippenberg, & Moonen, 1998). Ajzen (2002) argues that any residual effect of past behaviour not mediated through intention within TPB, is likely due to inaccurate perceptions of control or insufficiently formed intentions. Recognising the fallibility of human perception and prediction (see Gifford, 2011), and the frequent nature of many of the target mitigation behaviours of this thesis, habit offers an important pathway for understanding these behaviours.

Empirical support and campaign relevance of habit as a predictor. In stable contexts, habit has predicted PBC (Bamberg, Rölle, & Weber, 2003; Chen & Chao, 2011), social norms (Bamberg et al., 2003), personal norms, behaviour (Bamberg & Schmidt, 2003), and intent. The relationships of habit with attitudes and intent are not consistent, however. Some studies find habit predicts attitudes (Bamberg et al., 2003) and intent (Chen & Chao, 2011), while other studies suggest no relationship for attitudes (Chen & Chao, 2011; Ouellette & Wood, 1998) or intent (Ouellette & Wood, 1998). Intervention studies focusing on habit reveal that context changes (e.g., moving house) offer valuable points for breaking habit (Bamberg et al., 2003), and that stronger personal norms improved intervention outcomes (Eriksson, Garvill, & Nordlund, 2008). Personal norms also appear to have stronger effect when habits are weaker (Klöckner & Matthies, 2004).

While the theory of habit supported by Ouellette and Wood's (1998) meta-analysis did not include relationships with personal norms, PBC, or intention, some level of awareness of one's past behaviour (habits) may lead to incorporation of these into expectations for future behaviour (Bem, 1965). This could influence PBC and intentions, or lead to defensive adjustments that rationalise these behaviours and adjust moral interpretations (personal norms) where habits do not match the desired behaviour. The importance of personal norms for habit intervention outcomes also provides valuable opportunity for helping overcome habits associated with undesirable behaviours, and reinforcing desirable habits. Understanding which behaviours have a strong habit component would also help campaigns target contextual cues through strategies offering timely reminders of intentions

and norms. Thus, models supporting migitation campaigns should incorporate habit as a predictor of PBC, personal norms, intent, and behaviour to improving understanding of which of these influence pathways has most effect for different target behaviours.

Existing Integrated Models

While many researchers have broadened the theories discussed above through the addition of individual concepts from these or less frequently used theories, or by combining theories from two categories, three models integrate concepts more fully from across all three categories: Triandis' (1977) theory of interpersonal behaviour (TIB), Perugini and Bagozzi's (2001) model of goal-directed behaviour (MGB), and Klöckner's (2013) comprehensive action determination model (CADM)[17]. Only CADM was developed specifically with mitigation behaviour in mind, however TIB and MGB have been successfully used by researchers investigating these behaviours. Each of these models was developed through the integration of a rational choice model (e.g., TRA or TPB), normative concepts or models (e.g., NAT or VBN), and habit-related concepts. The inclusion of different combinations of predictors resulted in three unique explanations of behaviour with different interpretations of path relationships between predictors. These integrated models have tended to be used in significantly fewer studies than the dominant theories discussed earlier in this chapter, but results from the available studies support the value added by integrating these pathways.

Triandis' (1977) theory of interpersonal behaviour. TIB[18] includes rational choice aspects such as attitudinal evaluations (similar to that of TPB and TRA) and facilitating situational characteristics; normative pathway concepts (personal norms, emotion, affect, role beliefs, and self-concept); and the influences of past experience and habit. TIB is illustrated in Figure 12, and was designed to explain social behaviours. TIB incorporates self-concept and roles (similar to self-identity) alongside personal norms, emotions, and attitudes as joint predictors of intention. The influence of intention on behaviour is then moderated by facilitating conditions, but contributes to behaviour jointly with habit. These TIB relationships are not consistent with the results of the theoretical and empirical analysis in this Chapter, however. For example, the self-identity aspects represented by self-concept and role beliefs are proposed to influence intention in parallel with personal norms rather than in a mediated relationship. Similarly, Triandis' emotional beliefs related behaviour are not linked with norms as was theorised by Stryker and Serpe (1982) who suggested that

[17] Some researchers have attempted integrating across pathways using stage models of behaviour that attempt to capture the process of change (e.g., Bamberg, 2013), however the information available to campaigns regarding audiences is unlikely to typically include this level of detail (see Chapter 2) so decision models rather than stage/change models were the focus of this research.

[18] While Triandis (1994) proposed a more complex culture-based model of behaviour built upon his TIB, the revised model is rarely acknowledged in the pro-environmental behaviour literature and so was excluded from this analysis.

emotions result from the anticipation of sanctions or rewards due to violation of, or conformity with, personal norms. The habit path is also included as only predicting behaviour, rather than acknowledging the empirical support for the influence of habit via personal norms, PBC, and intention.

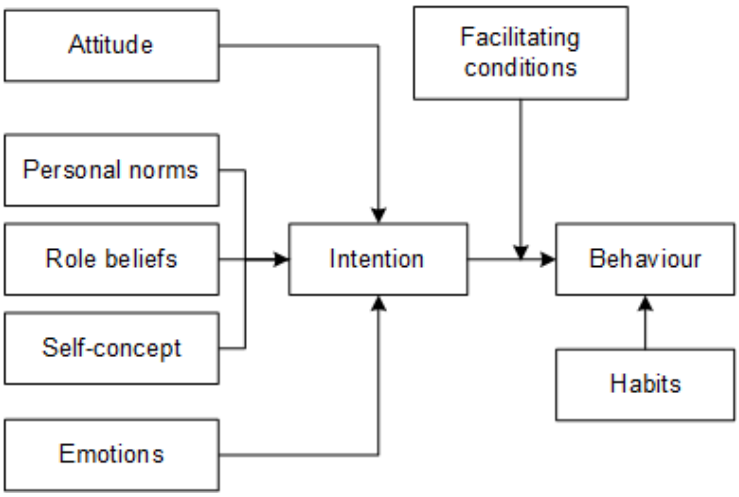

Figure 12. Triandis' (1977) theory of interpersonal behaviour.

While TIB is referenced by several researchers as being relevant to mitigation behaviours (e.g., Egmond & Bruel, 2007; Klöckner, 2013; Wu, Zhou, & Song, 2016), only one study was identified that empirically tested the model. Bamberg and Schmidt (2003) compared the efficacy of TIB, TPB, and NAT models, to predict German university students' travel mode choices. They found that TIB explained 51 percent of the variance in behaviour (and 68 percent for intention), while NAT explained 14 percent of the variance in behaviour, and TPB explained 45 percent of variance in behaviour (and 60 percent for intention). These tests support for the value of TIB's integrated, yet relatively parsimonious approach to integration of the three categories of pathways.

Perugini and Bagozzi's (2001) model of goal-directed behaviour. The MGB integrates TPB (rational choice pathways) with anticipated emotions (from the normative pathways), and frequency of past behaviour (representing habit), but also includes the new mediating variable of desire to implement (see Figure 13). Desire is included as the immediate predictor of intention, and operates as a mediator for social norms, attitudes, and anticipated emotions. Desire also partially mediates the influences of PBC and frequency of past behaviour on intention. The inclusion of desire aimed to explain how the various predictors resulted in an intention (Perugini & Bagozzi, 2001), just as TPB's inclusion of intention aimed to explain how that theory's predictors result in behaviour (Ajzen, 1991). As seen in TIB, the normative and habit pathways do not represent the empirically supported relationships suggested by this chapter's analyses. Specifically, MGB's anticipated

emotions and social norms were proposed as parallel pathways rather than causally related, and the influence of frequency of past behaviour (habit) on PBC and on behaviour is not reflected in MGB. Indeed, the original proposition of the model does not directly include behaviour, making model comparison more difficult.

Comparison studies have, however, found MGB to have strong prediction of behavioural intentions in comparison with models from a single category of pathways to behaviour. Carrus, Passafaro, and Bonnes (2008) found MGB to have substantially better prediction of intention than TPB alone (past behaviour and desire added 24% explained variance). This implies that the inclusion of emotion and habit offer important value above that of rational choice pathways. Han, Lee, and Hwang (2016) also found MGB to better predict intention than NAT, but a combined NAT-MGB model was better than either separate model (R^2_{NAT} = .68; R^2_{MGB} = .76; $R^2_{MGB\text{-}NAT}$ = .83). This supports the additional behavioural explanation that personal norms offer, but which the original MGB fails to incorporate. Together, these studies offer support for the value of integrating across the three categories of pathways to behaviour, and highlight critical gaps in MGB that reduce its overall effectiveness for supporting campaign design.

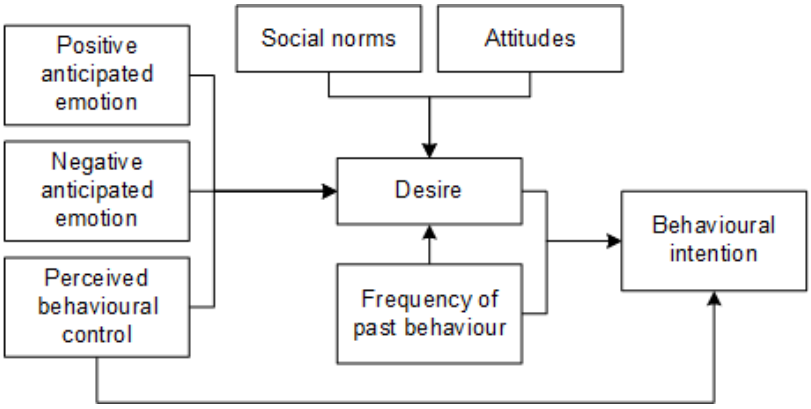

Figure 13. Perugini and Bagozzi's (2001) model of goal-directed behaviour

Klöckner's (2013) comprehensive action determination model. CADM is the most recently developed of the integrated models, and draws together TPB, VBN, and habit as shown in Figure 14. The inclusion of VBNs full suite of predictors means that this is the most comprehensive of the integrated models. CADM includes VBN's variables as parallel predictors of personal norms rather than in series, but with additional paths from the values to the new ecological paradigm. In addition to TPB's social norms, attitudes, and PBC as predictors of intention to implement, CADM adds personal norms, with personal norms also predicted by PBC and social norms. Habit is included as a parallel predictor of behaviour alongside intent and PBC, but also partially mediates the effects of intent and PBC. Awareness of consequences is also included as a predictor of habit. This intricate

pattern of paths in part captures the complex relationships of habit with intent, personal norms, and PBC. Emotions are not included in this model.

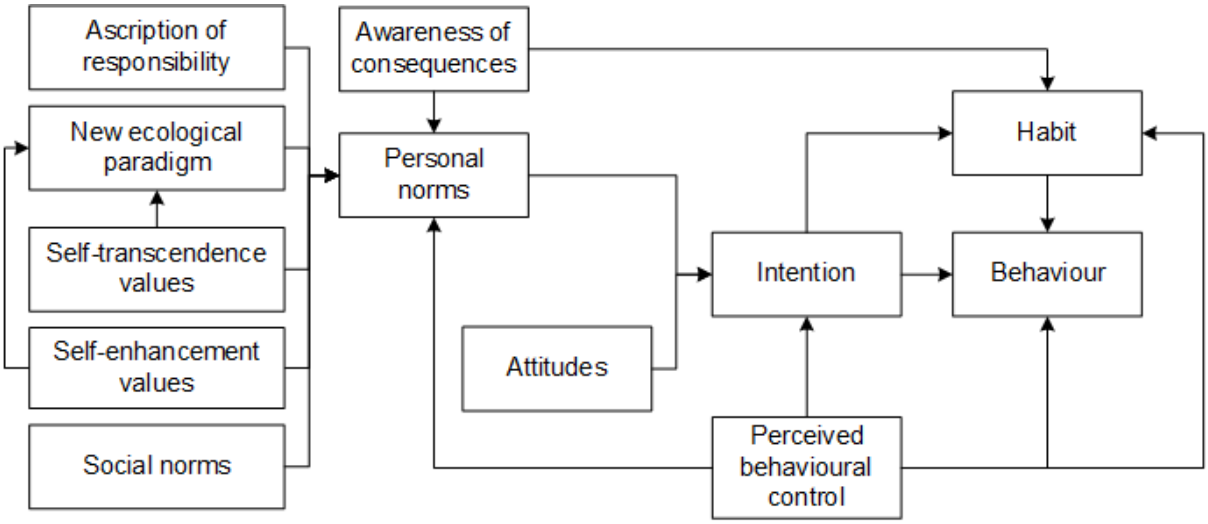

Figure 14. Klöckner's (2013) comprehensive action determination model.

Earlier versions of CADM were tested across a series of studies (Klöckner & Blöbaum, 2010; Klöckner & Friedrichsmeier, 2011; Klöckner & Oppedal, 2011), but was supported in its current version by a meta-analysis by Klöckner (2013). CADM explained 55 percent of the variance in intention for his meta-analytic sample, and 36 percent of the variance in behaviour (Klöckner, 2013). This is a similar level of explanation of behaviour to that found in TPB meta-analyses (Armitage & Conner, 2001; McEachan et al., 2011; Rivis et al., 2009). In individual studies using primary data, however, the earlier versions of CADM offered between 44 and 65 percent explained variance in behaviour (Klöckner & Blöbaum, 2010; Klöckner & Friedrichsmeier, 2011; Klöckner & Oppedal, 2011). Indeed, Klöckner and Blöbaum (2010) found that CADM offered better prediction of behaviour than either TPB or NAT (R^2_{NAT} = .54; R^2_{TPB} = .59; R^2_{CADM} = .65). CADM offers one interpretation of relationships between VBN, TPB, and habit variables. The omission of emotion and identity may reduce potential intervention leverage points, however, and the inclusion of more distal predictors complicates the model beyond that which is most useful for campaign interventions.

Integrating the Pathways of Campaign Relevance

Models are abstractions of reality that help us conceptualise and explain phenomena, and to do this requires decisions on where to focus (and not focus) and on the desired balance between comprehensiveness and parsimony. Building the CFM is no different. As the aim of this research is to improve the useability of research on mitigation behaviour for informing behaviour change campaign designs, the review and selection of predictors for inclusion in the CFM used this aim to assist in balancing comprehensiveness with parsimony. The CFM focuses on the predictors of most

relevance for assisting campaign designers decide where to target for optimal behaviour change outcomes, and recognises that not all possible contributors to behaviour will be open to influence by communication campaigns.

The most suitable predictors for inclusion are those that are both susceptible to influence (or activation) by campaigns, and proximal to behavioural implementation. For the purposes of this research, *influence* indicates changes to the predictor value (e.g., from having low to high PBC). In contrast, *activation* indicates no change to the predictor value itself, but rather changes to the level of salience of the predictor's value (e.g., bringing to top of mind one's existing personal norms). Thus, relevant predictors could be considered as those which are:

- proximal to behaviour and potentially susceptible to influence by campaigns,
- proximal to behaviour and potentially suitable for activation by campaigns,
- more distal to behaviour but potentially susceptible to influence by campaigns in place of less amenable, but more proximal predictors, or
- more distal to behaviour but potentially suitable for activation by campaigns in place of less amenable, but more proximal predictors.

Application of these inclusion criteria to the predictors and paths discussed in the key theories in this chapter, identified a subset of paths for inclusion in the CFM.

The findings of this chapter's analysis of existing theories and empirical evidence provide the basis for building the CFM. Starting with TPB as the base model, this section draws together the campaign-relevant predictors and their relationships to build the CFM. Leaving aside TPB's social norms for inclusion with other normative constructs, Stage 1 of the CFM includes behaviour predicted by intention and PBC, and intention predicted by attitudes and PBC as illustrated in Figure 15. Stage 2 adds the normative pathways. Personal norms and anticipated emotions are included as the most proximal predictors to intention (refer to Figure 16), with anticipated emotions also operating in response to the activation of personal norms (i.e., partially mediating the effect of these norms). Personal norms can be activated by three parallel predictors: self-identity, retrospective emotion, and social norms. Personal norms are also representations of the moral aspects of attitudes and thus are expected to contribute, along with other attitudinal beliefs, to the formation of attitudes and so a direct path is included between personal norms and attitudes. Stage 3 includes the habit pathways. Habit is included as a single construct that contributes to personal norms, PBC, intention, and behaviour (see Figure 17).

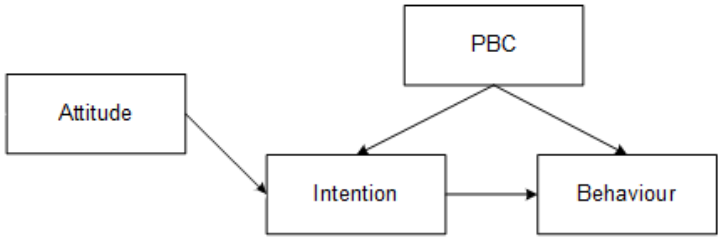

Figure 15. Stage 1 of the CFM incorporating rational choice pathways.

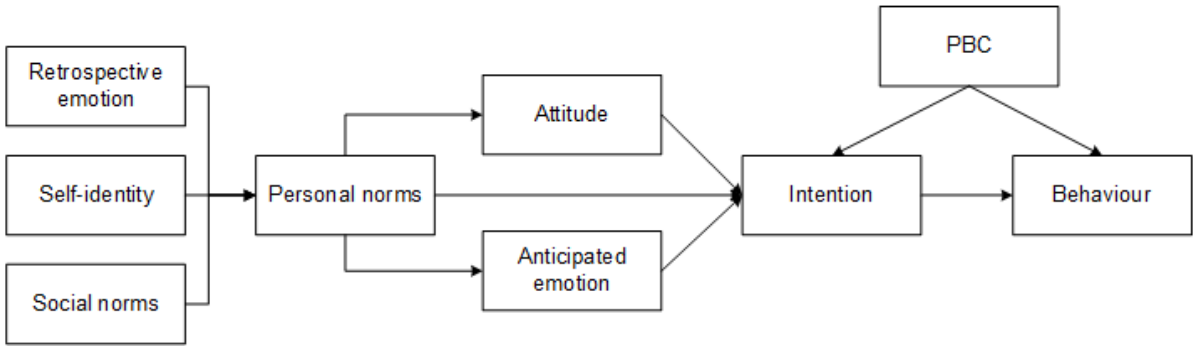

Figure 16. Stage 2 of the CFM incorporating normative pathways.

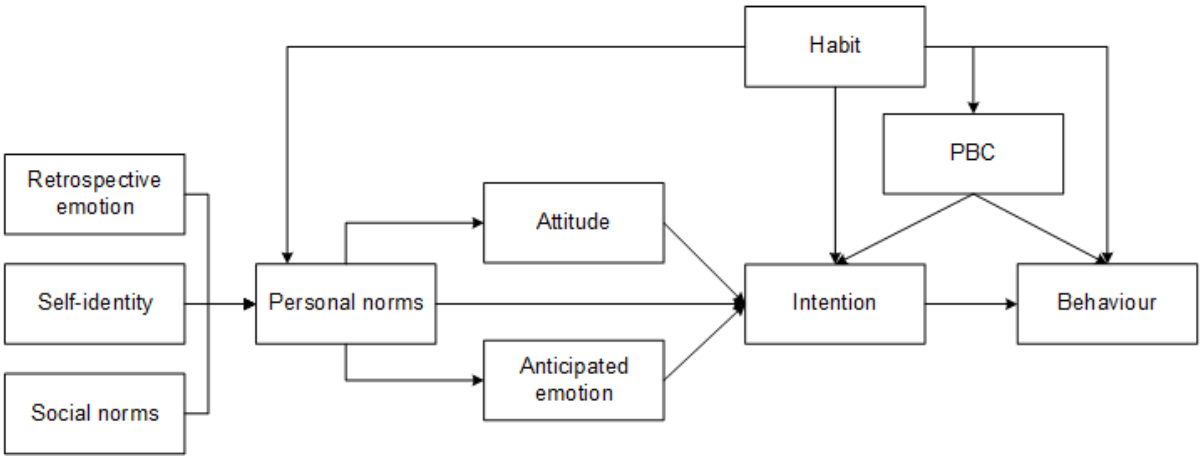

Figure 17. Stage 3 of the CFM incorporating habit pathways.

Summary

This chapter has analysed key rational choice, normative, and habit theories. Each theory was described, and empirical evidence was examined regarding their relative predictive potential and the value of theoretical integration. The predictive contribution of variables from each theory was also reviewed, along with evidence supporting their amenability to influence or activation through communication material. The CFM was built from the results of these analyses, and provides a model with specific relevance for campaign interventions that may provide a useful framework for identifying target variables for behaviour change campaign focus. The CFM was tested in Study 1 and Study 2 to establish its performance in comparison to existing models, and to identify the relative importance of each pathway for predicting a range of mitigation behaviours.

Chapter 4: Research methodology

This chapter outlines the methodological rationale for this thesis, including the ontological and epistemological assumptions upon which the selected methods are based. These assumptions are implicit in the research questions posed for this research, and are explicitly stated here to assist in clarifying the chosen research approach. An overview of the adopted methods and data sources is also provided, along with justification for their selection.

Methodological Provenance

The focus and methods of this research is underpinned by a specific combination of paradigm, ontology, and epistemology. Paradigms are the major theoretical traditions within which certain ontologies and epistemologies are incorporated (Blaikie, 2010). Ontologies are assumptions relating to the nature of reality (what phenomena exist, how it exists, and how these phenomena might interact or relate), while epistemological assumptions are "concerned with what kinds of knowledge are possible ... and with criteria for deciding when knowledge is both adequate and legitimate" (Blaikie, 2010, p. 92).

This thesis sits within a complexity theory paradigm, which is a contemporary, systems-based paradigm that accepts complex, non-linear interactions between elements and processes (Blaikie, 2010). This paradigm aims for a middle ground between the traditional scientific views (e.g., determinism, experimental control, and linear logic), and the postmodernist anti-scientific views (Blaikie, 2010). Complexity theory does this by accepting the belief in multiple realities, while contending the existence of underlying causal structures and mechanisms for events, and thus maintaining that phenomenological explanations are possible (Blaikie, 2010).

Both social and psychological ontologies underpin this research. In terms of social research, this thesis assumes a tempered, idealistic ontology as per Blaikie's (2010, p. 94) third form of idealism, whereby individuals' realities can be considered as "different (multiple) perspectives on an external world". From a psychological perspective this thesis adopts psychology's general materialist ontology, whereby human cognitive and behavioural configurations develop within biological structures through:

> "... an evolved genetic inheritance, which interacts with the environment over the course of ontogeny to produce individual configurations capable of ongoing calibration and learning. The overt reactive behaviors [sic] of such organisms are the result of both real-time sensory stimulation, and acquired biases and variations in neural structures owing to past experience" (Marsh & Boag, 2014, p. 51).

These assumptions fit within complexity theory's social realism framework, and together form a social-psychological ontology of (multiple) individual realities formed through individual experiences

of physical and social phenomena, resulting in diverse cognitions and behaviours surrounding similar phenomena.

Within the framework of this social-psychological ontology, a constructionist-conventionalism epistemology is adopted, which accepts knowledge of unobservable entities (e.g., cognitions). Constructionism is described by Blaikie (2010) as assuming that knowledge is created as ways of making sense of experiences (both physical and social). This assumption relates equally to the subjects of research as to the researcher; and thus recognises the impossibility of objectivity, and the fallibility of both parties. This epistemology allows for the complementary adoption of conventionalism's epistemological assumptions, which assumes that scientific theories are tools for making sense of the world by providing focus areas for examining reality rather than describing reality (Blaikie, 2010). A constructionist-conventionalism epistemology thus supports that knowledge of the observable (i.e., behaviour) and unobservable (i.e., cognitions) phenomena associated with individuals' internally constructed realities can be understood through focusing theories, although never as true representations of an objective reality.

Together this specific paradigm, ontologies, and epistemologies, form underlying assumptions (summarised in Figure 18) for this research. These foundations were integral in the selection of research focus and the choice of methods for addressing the resulting research questions.

Mixed Methods Research

The manifestation of these framing assumptions occurs within the chosen research questions and in the methods selected to address them. Consideration of the nature of each research question led to the selection of a range of deductive and inductive research approaches using both quantitative and qualitative methods. The rationale for the selection of mixed methods is outlined below, along with examples of the previous use of the selected approaches in related research. Figure 19 provides a summary of these approaches.

The first two research questions focused on the prediction of behaviour, and the deductive, quantitative testing of an hypothesised theoretical model was selected as the most appropriate approach for answering these. These research questions acknowledge the observable and unobservable influences of behaviour, and accepts that these are able to be measured and influenced with some level of consistency. Deductive research approaches test hypotheses that were developed from existing theory, taking these from the general theoretical level to a specific testable circumstance (Bryman, 2012). Existing models of climate change mitigation behaviour have been illustrated by this thesis as not having been adapted for direct relevance to behaviour change campaigns (see Chapters 2 and 3), so a new theoretical model was required to focus the analysis and answer these research questions.

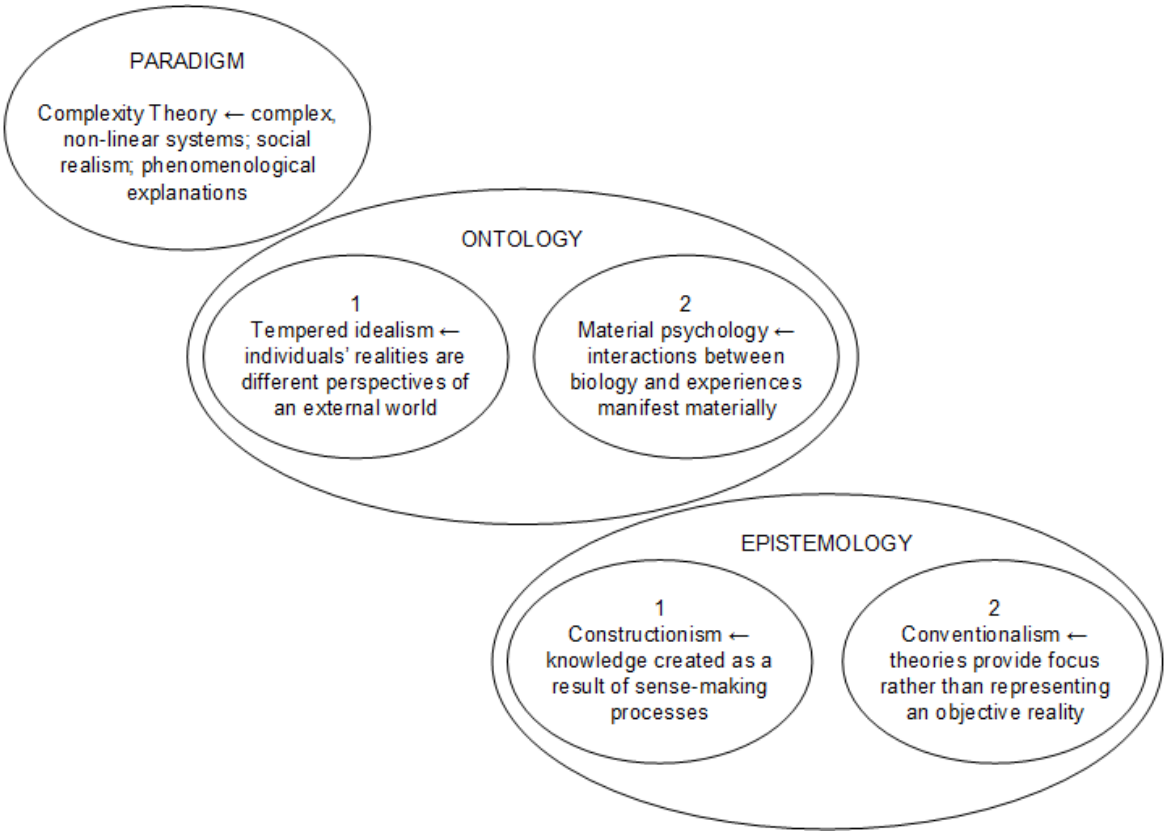

Figure 18. Summary of this thesis' underlying assumptions: paradigm, ontology, and epistemology.

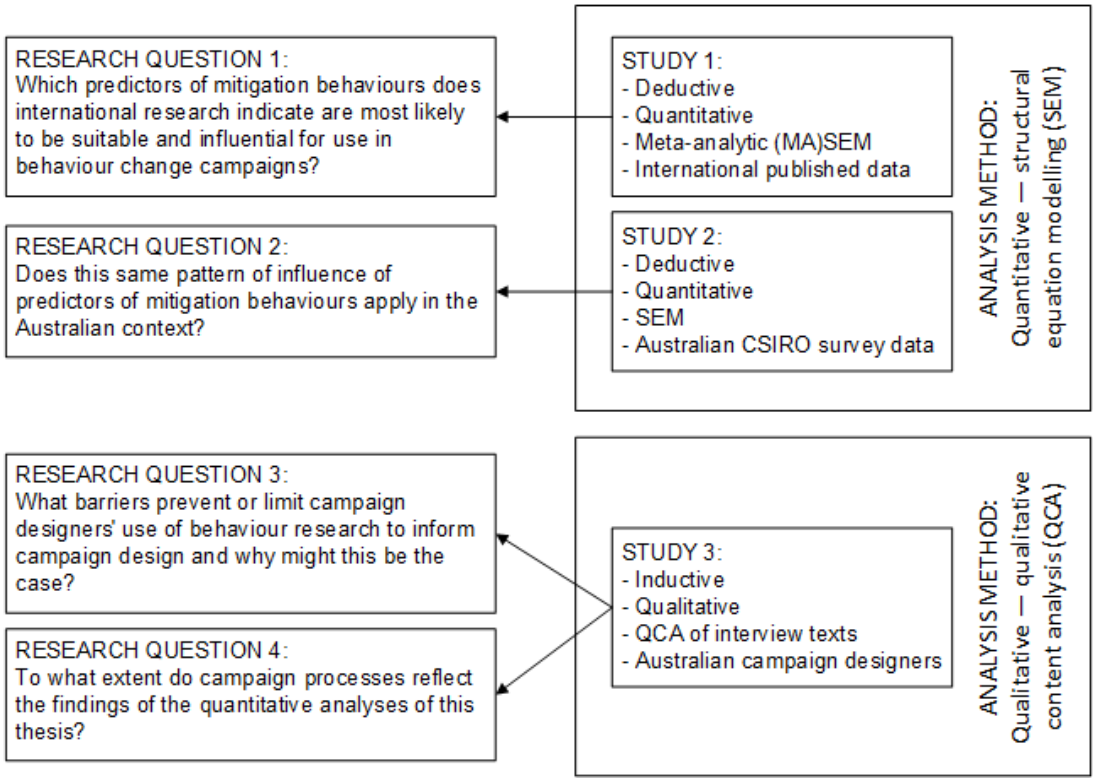

Figure 19. Overview of this thesis' research questions and methods.

The hypothesised model, known as the campaign focus model (CFM), was developed from existing theoretical and empirical knowledge. Testing the model to answer the first two research questions required slightly different methods and datasets, although both methods are based on the statistical technique of structural equation modelling (SEM). Details of the specific SEM approaches and datasets for answering each of these two research questions are discussed under Study 1 (addressing Research Question 1) and Study 2 (addressing Research Question 2) later in this chapter.

The third and fourth research questions relate closely to the concept of process evaluation, and the chosen approach used in Study 3 to address these questions was inductive, qualitative content analysis (QCA) applied to interview data. These two research questions acknowledge the multiple perceptions gained by campaign designers through their diverse experiences, and that the knowledge accrued by these designers through making sense of their experiences (both personal and vicarious[19]) manifests in the material they create for campaigns. Process evaluation assesses project implementation appropriateness and quality, and typically considers: a project's critical components, the links between these and the project's desired outcomes, and the enablers and barriers to success (Mertens & Wilson, 2012). Inductive research approaches develop hypotheses based on observations—the opposite process to deduction—and are often used to answers to exploratory research questions, providing hypotheses for testing in further research (Bryman, 2012). Inductive approaches are appropriate for the third and fourth research questions as inductive methods allow for the development of hypotheses around the processes used by campaign designers, the issues they face, and why these issues might exist.

Study 1: Meta-Analytic Modelling of Mitigation Behaviours

Quantitative meta-analytic structural equation modelling (MASEM) was identified for Study 1 as the most appropriate tool for answering the first research question. This question's focus on international behaviour required data from a broad international sample, and meta-analytic techniques offer an efficient approach for accessing and analysing such data from past research. MASEM is a statistical technique for analysing aggregated participant data from previous studies (Cheung, 2015). Many previous studies have considered the internal and contextual preconditions of behaviour through participant surveys, and have reported their findings in published articles. Quantitative meta-analysis has been found to be superior to narrative approaches (also known as systematic reviews) for combining the findings of published research, due to the application of more structured study selection and data aggregation methods, which reduce the potential for bias (Kühberger, Scherndl, Ludwig, & Simon, 2016). As a structural equation modelling (SEM) approach, MASEM is an

[19] The term vicarious is used here in line with Bandura's (1977b) usage, indicating a learning method whereby individuals learn from the experiences of others (e.g., through observation or reading) rather than through directly experiencing events and outcomes for themselves.

extension of traditional regression techniques that allows for testing of the relationships between the predictors themselves—not just prediction of the dependent variable (Cheung, 2015). MASEM has previously been used for testing models of climate change mitigation behaviour by researchers including Bamberg and Möser (2007) and Klöckner (2013), and is an excellent tool for answering the first research question.

Model specification. The first steps in this study included the specification of the model (in this case, the CFM) and the collection of relevant data for testing. Models for SEM are developed from theory and tested to determine how well they explain the observed data (Jak, 2015). The CFM was developed by integrating theoretical and empirical evidence from the behaviour research described in Chapter 2, and considered the campaign relevance of, and relationships between, known predictors of mitigation behaviours. Campaign relevance assessment considered each variable's predictive proximity to behavioural implementation, and their openness to campaign influence—as either enablers or barriers to implementation. This model specification process identified the expected relationships between the nine behavioural predictors of most relevance to behaviour change campaigns, including: attitudes, behaviour, emotions (retrospective and anticipated), habit, intention to implement, norms (personal and social), perceived behavioural control, and self-identity. In order to give context to the predictive capacity of the CFM, it was analysed in comparison with three pre-existing comparison models discussed in Chapter 2: TPB, VBN, and CADM. The TPB and VBN models are the most commonly applied in mitigation behaviour studies, while CADM was included as a more recently developed, integrated model.

Data collection. MASEM input data are reported effect sizes extracted from published literature (Cheung, 2015), typically bivariate[20] correlation data (Furlow & Beretvas, 2005). The identification of suitable articles for obtaining this data, was undertaken through searches conducted using both PsycINFO and Scopus databases. The use of two databases was critical to ensure the capture of relevant research across the diverse disciplines researching mitigation behaviour. PsycINFO offers strong coverage of psychology journals, however Scopus has stronger coverage of various other relevant disciplines (e.g., transport, and consumer behaviour). Studies targeted for inclusion were those published between 1995[21] and the time of sampling in April 2017, that conducted predictive analyses for mitigation behaviours that may be conducted frequently by adults (e.g.,

[20] Bivariate correlations indicate the direct relationship between two variables without considering the influence of other variables. The use of this type of correlation is important as multivariate correlations (also known as partial correlations) change depending on how many and which other variables are considered.

[21] Similar timescales have been included in previous MASEM focusing on similar mitigation behaviours, for example those by Bamberg and Möser (2007) who included data published between 1995 and 2006, and Klöckner (2013) who included data published between 1997 and 2013.

transport mode selections, daily household energy conservation behaviours, and 'green' consumption), and reported sample details along with correlation data for at least two variables included in the CFM[22]. The theories used in each sample study's model specification, and participants' country of origin, were also collected to assist with understanding these aspects of the MASEM sample's diversity. Key word searches were limited to abstracts to avoid the inclusion of articles containing only isolated references to these terms, with key words including combinations of: climate change, global warming, environment, sustainability, action, behaviour, model, and prediction.

The removal of duplicates and articles on irrelevant topics (e.g., biophysical environment, climate science, and medicine/health) was done manually based on article titles initially, followed by screening of abstracts, then full article reviews (refer to Figure 20 for article counts across these steps). This resulted in final sample of 114 studies in 100 articles from 42 journals[23] offering a total of 742 correlation data points across the CFM and comparison models.

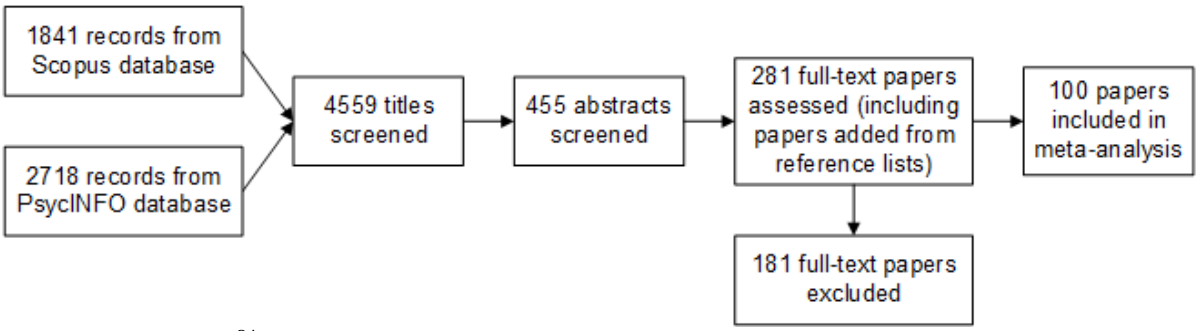

Figure 20. PRISMA[24] flow chart illustrating the results of the article search and screening processes.

Data screening. Data screening aims to ensure that the data are fit for analysis, and that the analyses are appropriate for the nature of the data. For this study, this involved testing the correlation data for publication bias, heterogeneity, and the presence of outliers. Publication bias is the tendency to publish significant results over non-significant results—especially for studies with small sample sizes (Jin, Zhou, & He, 2015). It can result in data skewed towards higher effect sizes (Jin et al., 2015), and was tested using two complementary approaches. The first was visual inspection of funnel

[22] As the CFM was the focus model for this study, articles were filtered for availability of data for its variables, rather than for those of the comparison theories (which included some additional variables). Thus, every included study contributed to the CFM dataset, but only some articles contributed to each alternative theory's data. Unpublished correlations were only sought from authors of articles used in the CADM meta-analysis to support replication of that MASEM. This process reintroduced five studies that had been previously excluded due to lack of published correlations.

[23] See Chapter 5's Sample Characteristics section for details on the sources of the sample data.

[24] The PRISMA statement (Moher, Liberati, Tetzlaff, Altman, & The PRISMA Group, 2009) offers best practice guidance for reporting meta-analyses.

plots[25], which are the simplest and most commonly used approach for the identification of such bias (Pigott, 2012). Funnel plots can be prepared where at least 10 sample data points exist, and provide a visual illustration of the distribution of effect sizes against their associated standard error measure, with symmetrical plots expected around the 'true' effect size where no publication bias exists (Mavridis & Salanti, 2014). Visual reviews were undertaken with consideration of the potential for influence from misinterpretation due to heterogeneity across the studies, some published studies only reporting a subset of their results, or chance (Mavridis & Salanti, 2014). The second method for assessing publication bias was through calculation of weighted failsafe *N* values, adopting random effects assumptions. These are a variation on the Rosenthal's (1979) original failsafe N calculations. Rosenberg's (2005) weighted failsafe *N* values[26] compensate for study sizes, but still provide an estimate of the number of unpublished studies with null results that would be required to exist in order to reduce the significance of the 'true' effect to just significant at the .05 level. When the failsafe *N* value is more than ten plus five times the number of known studies, there is a low chance that missing studies would substantially reduce the calculated effect size (Rosenthal, 1979). Together, funnel plots and failsafe *N* analyses provide confidence in the appropriateness of the data for modelling.

While funnel plot asymmetry can indicate publication bias, heterogeneity can have similar effects, and can also affect assumptions regarding within- and between-study differences that can influence the selection of analysis approaches. Heterogeneity was tested to confirm the appropriateness of the proposed random effects approaches. Heterogeneity was assessed using the I^2 statistic (refer to Box 1 for equation), which has intuitive interpretation and provides an estimate of the extent of heterogeneity rather than simply presence or absence (Huedo-Medina, Sanchez-Meca, Marin-Martinez, & Botella, 2006)[27]. An I^2 statistic of 25 percent shows low heterogeneity, 50 percent indicates moderate heterogeneity, and 75 percent represents high heterogeneity (Huedo-Medina et al., 2006). Due to sensitivity issues for effects with less than 20 data points (Huedo-Medina et al., 2006), only correlations meeting this minimum criteria were assessed.

[25] A review by Jin, Zhou, are He (2015) identified no suitable statistical funnel plot asymmetry tests for use with continuous data of high heterogeneity, and identified the alternative selection model testing approaches as complicated, requiring large sample sizes, lacking suitable software, and generally recommended for sensitivity analyses.

[26] Calculations for weighted failsafe N values with random effects are too complex to represent here. Refer to Rosenberg (2005) for full details.

[27] Meta-analyses have traditionally applied Cochran's Q statistic for assessment of homogeneity (e.g., Bamberg & Möser, 2007; Klöckner, 2013), however it has sensitivity issues when the number of sample studies is either small or very large, and provides limited indication of the extent of heterogeneity (Huedo-Medina et al., 2006). The I^2 statistic builds upon Cochran's Q statistic to form a more intuitive and explanatory measure of heterogeneity. Rosenberg's (2005) random effects Q calculation was adopted to best suit the nature of the data.

Equation 1: $$I^2 = \frac{Q - (k-1)}{Q} \times 100\%$$

Where:
Q is Cochran's Q statistic for heterogeneity (for random effects formulae, see Rosenberg, 2005)
k is the number of contributing correlations
I^2 is the extent of heterogeneity of the sample

Box 1. Formulae for heterogeneity I^2 statistic (Huedo-Medina et al., 2006).

Outliers can also skew pooled correlations, and were identified using Huffcutt and Arthur's (1995) sample-adjusted meta-analytic deviancy statistic (SAMD; see Box 2 for equations). No standard criteria exists for evaluating this statistic, however Huffcutt and Arthur discuss the use of scree plots to identify natural change points in SAMD distributions for use as cutoffs. The subjective nature of this approach, along with the SAMD statistic's bias towards the removal of smaller correlations with small sample sizes (particularly when few data points are included), has been raised as likely leading to the overestimation of population effects (Beal, Corey, & Dunlop, 2002). The use of z-transforms of correlations[28], and cutoff SAMD values have been suggested as one solution to help address this issue (Beal et al., 2002). Beal and colleagues suggested absolute SAMD cutoffs of 2.0 to 2.25, however small numbers of data points resulted in Han and Hansen (2012) adopting a substantially higher cutoff of 7.0. A combination of these evaluation approaches was used in identifying outliers, with a nominal cutoff of 5.0 and visual inspection of plots used to assess the consistency of potential outlying correlations with regard to the full sample. A total of 11 percent of the sample was removed as outliers from the Study 1 dataset, which was similar to that of other research (e.g., 10 percent for Han & Hansen, 2012; 7 percent for Scannell & Gifford, 2013) and to the 5-10 percent range identified by Beal, Corey, and Dunlop (2002) at their recommended SAMD cutoff values.

Equation 2: $$Var(\bar{r}) = \frac{(1 - \bar{r}_w{}^2)^2}{(\bar{N} - 1)(k - 1)}$$ Equation 3: $$SAMD = \frac{r_i - \bar{r}_w}{\sqrt{Var(i) + Var(\bar{r})}}$$

Where:
$Var(..)$ is the variance
$SAMD$ is the sample-adjusted meta-analytic deviancy statistic
r_i is the correlation from the *i*th study
$\bar{r}$ is the average correlation including all studies
$\bar{r}_w$ is the average correlation without the *i*th study
$\bar{N}$ is the average sample size across all studies
k is the number of contributing correlations

Box 2. Formulae for SAMD calculation (Beal et al., 2002).

[28] Z-transforms are further explained under **Data pooling.**

Data pooling. Due to the varying number and sample sizes of studies contributing to each pooled correlation, the screened data were weighted and pooled using Fisher's *z* transformations and associated sample variances (refer to Box 3 for equations). Fisher's z-transformation normalises correlation values, which tend to exhibit non-normal distributions the further the population correlation trends from zero (Cheung, 2015). Weighting the individual correlations based on their study variance also assists with reducing the effect of small-sample bias, and together these processes provide the most representative pooled correlations (Pigott, 2012). Small-sample bias can also occur where the number of participants contributing to pooled correlations vary due to some predictors having been more heavily studied than others in the published literature. This small-sample bias was also addressed in determining the overall sample size for adoption in Study 1 by calculating the harmonic mean across the pooled correlation matrix (rather than using the arithmetic mean), as recommended by (Viswesvaran & Ones, 1995).

Equation 4: $$z = 0.5\, ln\left(\frac{1+r}{1-r}\right)$$

Equation 6: $$r = \frac{e^{2z}-1}{e^{2z}+1}$$

Equation 5: $$Var_i = \frac{1}{n_i - 3}$$

Equation 7: $$\bar{z} = \sum\left(\frac{z_i}{Var_i}\right) \div \sum\left(\frac{1}{Var_i}\right)$$

Where:
z is the z-transformed correlation
r is the bivariate correlation
Var_i is the individual study variance of the *i*th study
n_i is the sample size of the *i*th study
$\bar{z}$ is the pooled correlation in z-transformed form (requiring back-transformation to a simple correlation using Equation 6)

Box 3. Formulae for Fisher's *z* transformation and individual study variance (Pigott, 2012).

Analysis. Model testing using the resultant matrix of pooled correlations, was run in SPSS AMOS (Version 24) for the CFM and for the three pre-existing comparison models: TPB, VBN, and CADM (see Chapter 3 for descriptions of these models). Comparison of the four models aimed to allow for an assessment of the added value offered by a campaign-tailored model compared with pre-existing models. This study adopted a random effects approach using maximum likelihood estimation when testing the models. Cheung (2015) recommends that the treatment of effects be determined based on the conceptual differences between the expected nature of the effects relevant to the proposed research question. Random effects[29] assume that effect sizes in the sample are different

[29] Alternative approaches include fixed and multiple effects, however the heterogeneous nature of the meta-analytic data (in terms of source study aims, models, participants, and target behaviours), and insufficient data to account for studyvariables, precluded the use of these alternative approaches (Cheung, 2015; Pigott, 2012).

because they come from a series of random samples from within a single population (Cheung, 2015) and includes both within-study and between-study variance (Pigott, 2012). This assumption is used for diverse (heterogonous) samples and was considered most appropriate for this study where the data was compiled from samples across a broad range of countries and focal behaviours, with diverse research questions. Maximum likelihood[30] estimation is an iterative calculation that: (a) estimates missing values, (b) determines population parameters, (c) uses these to re-estimate the missing values, then (d) continues this cycle until the population parameters converge (Pigott, 2012). Such estimations were adopted in other recent MASEM studies (e.g., Han & Hansen, 2012; Klöckner, 2013), and is a commonly included function in MASEM software applications (Cheung, 2015), so was adopted this meta-analysis[31].

Prior to any review of the model's path and explained variance results, the fit of each model was assessed to ensure its match to the data and, thus, the reliability of the results. Models that do not fit the data do not provide reliable results, so only those models that met the fit criteria were analysed further. Model fit can be assessed using a range of different calculations that generally compare the proposed model's ability to predict the data, with the ability of alternate models based on the least and most restrictive models possible with the specified variables—known as *saturated* and *independence* models, respectively (Division of Statistics + Scientific Computation, 2012). Due to the differences in approaches and limitations associated with the various fit statistics, Hooper, Coughlan, and Mullen (2008) recommend the use of multiple statistics to assess model fit. The recommended fit statistics include root mean square error of approximation (RMSEA), standardised root mean square residual (SRMR), comparative fit index (CFI), and parsimony goodness-of-fit index (PGFI). Chi-square (χ^2) is also commonly reported, but is rarely used to dismiss models due to a number of severe limitations to its use—for example, often rejecting models tested with large sample sizes (Hooper et al., 2008). Table 1 lists the statistics and associated criteria used in assessing model fit.

[30] A refined version of the maximum likelihood method known as restricted (or residual) maximum likelihood, estimates the variance based on transformed data (i.e., having removed the fixed effects), which addresses the negative bias of the maximum likelihood method but is less suitable for multi-level models and not typically included in current modelling software (Cheung, 2015).

[31] Alternative approaches to addressing missing values are list-wise and pair-wise deletion, however both of these approaches reduce the number of contributing correlations (which is a problem when there are low numbers of contributing data points as was the case for some parameters in this study) and can be more prone to bias than maximum likelihood estimates (Cheung, 2015).

Table 1
Recommended Model Fit Statistics and Criteria

Statistic	Criteria
Chi-square (χ^2)	non-significant at alpha of .05
RMSEA	less than .06, with confidence intervals between 0 and .08
SRMR	less than .08, and preferably below .05
CFI	greater or equal to .95
PGFI	no guidelines exist

Note. Data from Hooper et al. (2008).

For models that fit the data, two key types of results were analysed. These common outputs from SEM analyses are the amount of variance explained by the model at key points in the model (explained variance or R^2), and the relative contributions of variables to the predictions at those points (standardised regression weights or b^*). Explained variance values are standardised and can be compared across models, with easy interpretation as percentages (i.e., $R^2 = .35$ equates to 35 percent of variance explained by the model). The standardisation process for regression weights (or path weights) allows for comparison of the relative importance of predictors within a single model (e.g., which are the stronger predictors of an outcome variable). They are partially dependent upon the number and nature of the variables included in the model at each point, however, so path weights can only be compared across models for sections or models with the same structure. This allows comparison of path weights across studies for the same model (e.g., TPB studies), but limits comparison across diverse model structures. The combination of explained variance estimates and path weights supports the identification of which predictors show the strongest influences towards behaviour as relevant for campaign interventions, allowing Study 1 to respond to Research Question 1.

Study 2: Modelling of Australian Mitigation Behaviours

SEM was selected as the most appropriate method for Study 2 to answer the second research question, however individual participant data was considered more appropriate than aggregated, published data. This was due to the expectation of insufficient published studies using Australian data, and the known availability of an extensive national dataset expected to cover the predictors of interest. SEM uses the same statistical techniques as MASEM, but performs the data aggregation from individual participant data within the modelling process rather than this occurring externally through data pooling as with MASEM. The use of SEM allows for continuity of testing of the model from Study 1, including comparison of the specific relationships between the predictors themselves against the findings from Study 1. Many published studies of climate change mitigation behaviour have adopted SEM, including several using Australian samples with a range of theoretical models

(e.g., Chan & Bishop, 2013; Dono et al., 2010; McDonald et al., 2013; Soyez, 2012), and it is an excellent tool for answering the second research question.

Data collection. The data for this study were drawn from responses to a series of five annual surveys conducted by CSIRO from 2010 and 2014 as part of their Climate Adaptation Flagship project (Leviston et al., 2015). Within the Flagship project, these surveys aimed to investigate:

> "... the ways in which Australians think about climate change, and the activities they are undertaking to mitigate or adapt to its impacts. [CSIRO's] goal was to understand the prevalence of different responses Australians have to climate change, including perceptions and opinions about its causes, personal and social attitudes directly and indirectly related to climate change, the climate-relevant behaviours people are engaging in, the types of initiatives people want taken to address the impacts of climate change, and the patterns within and between each of these" (Leviston et al., 2015, p. 1).

Similar to the ultimate aim of the this thesis, CISRO undertook these tasks because "[s]uch understandings are important to consider in constructing climate change communication strategies, and are key to mobilising widespread behaviour change" (Leviston et al., 2015, p. viii). Research has been published from analyses of this survey data in several journal articles (e.g., Leviston, Price, & Bishop, 2014; Leviston & Walker, 2012; Leviston, Walker, & Morwinski, 2013; Walker, Leviston, Price, & Devine-Wright, 2015), as well Leviston's PhD thesis (Leviston, 2013). None of these studies analysed the data across integrated theoretical grounds for informing communication campaigns such as is the focus of this thesis.

CSIRO's annual surveys collected climate change-related attitudinal and behavioural data from 17,493 adult Australians (aged 18 years and over) from 2010 to 2014, with 4,999 respondents completing two or more surveys (Leviston et al., 2015). The content of each annual survey series differed slightly as measures were included or excluded to meet annual research needs. The survey was administered by the Australian-based Online Research Unit (Leviston et al., 2015), which is certified to international standards under ISO 20252 'Market, opinion and social research' and ISO 26362 'Access panels in market, opinion and social research' (ORU, 2014). Participants were drawn from a research panel of 300,000 individuals, and were representative of metropolitan, regional, and rural Australia (Leviston et al., 2015). CSIRO's Social Science Human Research Ethics Committee approved the original data collection and the sharing of the de-identified data for use in this thesis. The Monash University Human Research Ethics Committee also supported the use of the CSIRO data for this research.

Not all measures required for the CFM were collected in all sampling events, and a predictive (rather than cross-sectional) design was preferable to best match Research Question 2, so data from

three of the five sampling events were required for a complete analysis of the model's predictive relationships. Behavioural data was taken from the fifth wave (2014) of the survey, as were demographic data. Self-identity and attitude data were taken from the first wave (2010), and all remaining predictor data was taken from the fourth wave (2013). Table 2 lists the specific CFM variables taken from each wave of the survey.

A priori power estimates indicated that a minimum sample of 1,454 was required for detection of a .10 level effect (i.e., .10 difference in model path weights) at 80 percent power level and .05 probability level for the number of variables and indicators included in the CFM. To achieve this sample size, missing data was accepted for the predictors of behaviour for participants who did not complete all the necessary survey waves. In order that there was no missing behaviour data, however, all included participants were required to have completed the fifth wave (2014) of the survey. Over 2,000 participants completed both the fourth and fifth waves (2013 and 2014), which met the minimum sample size requirement, so data from all of these participants were included. In addition, to capture the self-identity and attitude predictor variables only measured in the first wave (2010), participants who answered all three target waves were also included. Figure 21 illustrates this pattern of included repeat participants. This resulted in data from a total of 2,427 individuals included in the sample: 2,076 participants who completed only the fourth and fifth waves, and a further 351 participants completed the first, fourth, and fifth waves. Missing data for some participants for self-identity and attitudes required a range of pretests of the data and specific analysis processes to mitigate the potential issues associated with missing data. These are described in the following sections.

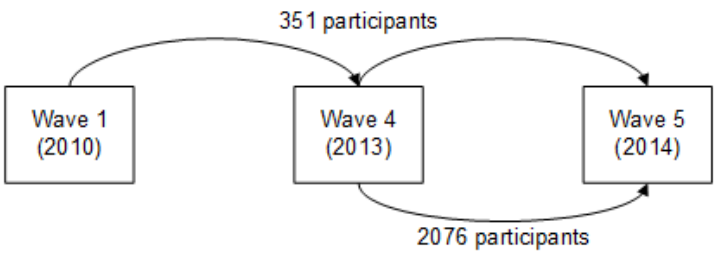

Figure 21. Sample participant numbers across the first, fourth, and fifth waves (2010, 2013, and 2014) of the CSIRO survey.

Table 2
Included Measures and Associated Source Sampling Events

Measure	Wave 1 (2010)	Wave 4 (2013)	Wave 5 (2014)
Preconditions			
Retrospective emotions		✓	
Anticipated emotions		✓	
PBC		✓	
Personal norms		✓	
Social norms		✓	
Self-identity	✓		
Attitudes	✓		
Intention[a]		✓	
Behaviours			
Changed diet			✓
Walk/cycle/carpool (general)			✓
Eco cleaning products			✓
Switched products			✓
Bought local products			✓
Reduced gas/electricity			✓
Switch lights off			✓
Fix things			✓
Bought ‘green’ power			✓
Reduced water use			✓
Recycle waste			✓
Reduced petrol use			✓
Changed gardening practices			✓
Demographic characteristics			
Age	✓	✓	✓
Gender	✓	✓	✓
Household income	✓	✓	✓
Education	✓	✓	✓

Note. Items included in each measure are listed in Appendix B. No items measuring habit were included in the CSIRO survey.
[a] A direct measure of intention was not included in the survey, however a surrogate measure was available that captured participants’ willingness “to put in extra effort to do as many of these behaviours as possible on a regular basis”.

Data screening. Three screening process were implemented for Study 2: (a) evaluation of the multivariate normality of the data, (b) assessment of the representativeness of the sample, and (c) confirmation of the appropriateness of the survey items used to represent the model variables[32]. Multivariate normality is assumed in most SEM modelling calculations, and violation of this assumption can lead to incorrect treatment of missing data (Pigott, 2012) and rejection of models due to inflated model fit statistics (Wang & Wang, 2012). Most instances of multivariate non-normality are evident in univariate distributions (Pigott, 2012), so the data were screened using visual techniques (e.g., histograms and Q-Q plots) along with the Kolmogorov-Smirnov statistic for normality (Coakes, Steed, & Price, 2008). Many variables exhibited distributions varying from normal, so estimators robust to multivariate non-normality were adopted for analysis, as recommended by Wang and Wang (2012). This required the use of MPlus (Version 8.1) software for Study 2 rather than SPSS AMOS as was used in Study 1, as SPSS does not currently include such robust estimators.

The representativeness of the sample is important for the generalisability of results, and was assessed in terms of demographic and response representativeness. This approach aimed to ensure that the sample and the treatment of missing data resulted in representative modelling results with respect to the broader Australian population. Examination of the demographic representativeness of the Study 2 sample included comparison against the wider CSIRO survey pool, as well as the Australian population more broadly. Demographic survey items were analysed from the each of the three included waves of the survey, comparing the included and excluded participants' responses for gender, age, household income, level of education, and State/Territory of residence. These were also compared with the national population distributions from the Australian Bureau of Statistics' 2010 census data. Response representativeness analyses were most relevant to the self-identity and attitude data from the first wave (2010) subsample, as these variables were not measures were only sampled from this group, and the proportion included was small in comparison to the wider sample.

Confirmatory factor analyses (CFA) are used to confirm the relationships between the observed variables (measured in the survey) and the latent variables they are intended to represent (e.g., PBC) and are a common first step in SEM (Cheung, 2015). As many of the measures included from the CSIRO survey were not part of established scales, CFAs were conducted in two stages. Individual CFAs were conducted initially for each variable with only its selected indicators, to confirm sufficient contribution to the variable—i.e., with factor loading closer to zero than ± .30 (Child, 2006). Next, a joint CFA was conducted that included all the variables with their indicators.

[32] Data transformations were required for a selection of measures prior to screening, to provide data in suitable format for model testing and interpretation of results. This included reverse coding of some items (e.g., one PBC item), conversion of behaviour data from a nominal three response option measure to binary adoption/non-adoption values, and rescaling of some items to remove negative scales (e.g., transformation from a -5 to 5 scale to a 1 to 11 scale).

This second analysis aimed to confirm that each indicator was specific to only its own variable (i.e., discriminant validity) rather than contributing to multiple latent variables (i.e., no factor loadings to other latent variables of more than .30 either side of zero; Kline, 2011). After each analysis, measures that did not load appropriately were excluded from the study.

Not all variables were able to be tested individually due to limitations inherent in the software calculation requirements. Estimating factor loadings requires the appropriate balance of known and unknown quantities. When tested in isolation, each latent variable must have at least four contributing observed indicators, however testing multiple variables together in discriminant CFA analyses requires each variable to have at least four relationships—which may involve three contributing indicators and a relationships with another latent variable, or four contributing indicators (Muthén & Muthén, 2017). These requirements meant that some variables were unable to be tested individually, however some of those were able to be included in the discriminant CFA.

Data preparation. In addition to simple scale transformations, two additional data preparation actions were required: item parcelling for predictor variables, and grouping of behaviours. Once CFA discriminant analysis had confirmed the inclusion of individual measures, these were then combined into single measures of the latent variables through item parcelling. Item parcelling is frequently undertaken to simplify models, usually through the averaging or summing of indicator values (Wang & Wang, 2012). All-item parcelling is the combination of all items for a specific variable into a single value (Matsunaga, 2008). As all measures contributing to any individual predictor variable were measured using the same scales, simple averaging was adopted to combine these measures. This was particularly valuable for predictors that had too few measures for CFA analyses. When items are parcelled into a single item, specification of the factor loading and the error variance is required to ensure the model is sufficiently specified for analysis (Matsunaga, 2008). Factor loadings must be fixed at 1.0, and the error variance is fixed at one minus the scale's reliability coefficient (i.e., Cronbach's alpha) multiplied by the variance of the composite-score (Matsunaga, 2008). As scale reliabilities are unable to be determined for scales with less than three items, no scale reliabilities were able to be developed for several of the attitude variables or the single-item measures (e.g., self-identity). Measures without scale reliabilities function as observed variables and, with over half of the model parameters thus operating as observed variables, structural equation modelling with latent variables was not feasible. The all-item parcelled values were included in the model as observed variables, and path analyses were conducted in place of SEM. Path analyses are a special case of SEM where SEM accounts for measurement error through the inclusion of latent variables whereas path analysis assumes that the observations directly represent the variables (Kline, 2011).

Behaviour change campaigns may target individual or multiple behaviours, so analyses were conducted to identify if certain surveyed behaviours naturally grouped together. Different levels of

grouping of behaviour has been undertaken in past research, with some researchers (comparatively) modelling individual, ungrouped behaviours (e.g., Eriksson & Forward, 2011; Heeren et al., 2016); others predicting a generalised index of diverse behaviours (e.g., Brick & Lewis, 2016; Mobley, Vagias, & DeWard, 2010); and still others analysing grouped, dimensionally similar behaviours (e.g., Dono et al., 2010). Grouping behaviours in Study 2 aimed to identify simplifications of predictor relationships across behaviours in ways that could provide more readily accessible guidance for campaign designers. Exploratory factor analysis (EFA) was used to determine behaviour groupings, and was conducted using the WLSMV[33] estimation method that the software authors' recommend when factoring binary data (Muthén et al., 1997). Once the EFA had confirmed which behaviours contributed to each grouping, a CFA was conducted to confirm that data reduction (i.e., the removal of low-level cross-loadings) did not negatively affect the fit of the model. Similar EFA-CFA approaches have been undertaken by other researchers of sustainable behaviour (e.g., Verain, Sijtsema, Dagevos, & Antonides, 2017).

Analysis. SEM analyses were conducted using MPlus (Version 8.1), which supports a range of robust estimation approaches relevant to the results of data screening. Data for two of the predictors (self-identity and attitudes) were missing from a large proportion of the sample due to having been collected in only the first wave of the survey. Missing data has been shown as best handled by full information maximum likelihood (FIML) estimation, which is more efficient and less biased than traditional approaches due to its use of all available data (Larsen, 2011; Wang & Wang, 2012). The specification of the variance of these missing variables is recommended by the MPlus software developers (Muthen, 2009) to assist with estimation under FIML, however no evidence was found in the literature of previous use of this approach. FIML and cross-sectional imputation (i.e., within one sampling event) have been found to offer similar efficacy for treatment of missing data in SEM analyses (Ferro, 2014), so the FIML results were compared against results from imputed data based on the distribution of responses of the full first survey wave to confirm the appropriateness of the MPlus approach. The number of required imputations was determined using von Hippel's (in press) two stage approach that uses a quadratic function based on the results of an initial small number of imputations. These tests confirmed that FIML with specified variance offered equivalent results to that of imputation from the full first wave's data, so the simpler FIML approach was used to account for missing data in all SEM analyses.

The CFM and comparison TPB models were initially tested for prediction of mitigation behaviour as a single aggregated measure, and then the CFM was further tested for prediction of the EFA grouped behaviours and selected individual behaviours where behaviour-specific measures were

[33] WLSMV is a form of weighted least squares estimation that is robust to non-normal distribution, and is generalised for application with binary outcome variables (Muthén, du Toit, & Spisic, 1997).

available. The evaluation of the fit of the initial CFM and TPB models adopted the recommended standard parameters for model fit as discussed for Study 1 and recommended by Hooper, Coughlan, & Mullen (2008), including criteria for the Chi-square ($\chi 2$) statistic, RMSEA, SRMR, CFI, and PGFI (refer to Table 3). Once model fit was determined as suitable, the ability of the models to predict behaviour (R^2) and the relative influence of different predictors (b*) were also assessed as per Study 1. As individual behaviours, factor grouped behaviour indexes, and a generalised behaviour index were all used as dependent variables in different modelling events, these two forms of model assessment were compared across each of grouping to determine if and when the model was effective at explaining the adoption of target behaviours.

Study 3: Campaign Designer Perspectives

Qualitative content analysis (QCA) of interview texts was selected as the most appropriate inductive research approach to answer Research Question 3 and Research Question 4 regarding the research-related perceptions and processes of campaign designers, and how well these match the findings of Study 1 and Study 2. QCA is a systematic approach to analysing texts, and aims to provide descriptions and interpretations, including the identification of patterns (Drisko & Maschi, 2015). It considers manifest content (i.e., the overt or literal meaning), latent content (i.e., implicit or implied meaning that may be spread across broader sections of content), and context; and can be applied to a range of textual forms (Drisko & Maschi, 2015). This approach was chosen for analysis of the campaign designer interview data as it supports a deeper and broader analysis and integration of meaning, patterns, and context. This method is a relatively recent adaptation of previous approaches to content analysis (Drisko & Maschi, 2015), and while no examples related to sustainability contexts were identified, the method has been used to analyse transcripts from interviews related to interviewee perceptions in areas such as health (e.g., Broström et al., 2010; Ebrahimi, Torabizadeh, Mohammadi, & Valizadeh, 2012), and speeches aimed at influencing behaviour in fields like law (e.g., Hastie & Kothari, 2009).

Data collection. Qualitative data collected through interviews can provide rich detail; exploring participants' subjective experiences (Liamputtong, 2013). A semi-structured approach was adopted for Study 3's interviews as this allows for both a basic level of consistency of topic coverage across the sample, while retaining a certain amount of flexibility for the exploration of nuanced differences between cases where these occur. Interviews have been used in previous research when exploring campaign design processes and the perceptions of designers across diverse fields including climate change (Hestres, 2014), health behaviour (Anwar-McHenry et al., 2016; Goodwin, Peerbhoy, Murphy, & Stratton, 2014), disaster recovery (Calder, D'Aeth, Turner, Fox, & Begg, 2016), and marketing (Elias, Malden, & Deas, 2009).

Purposive sampling was adopted rather than probabilistic sampling for the selection of interview participants. Purposive sampling selects what is expected to be most informative and appropriate sample for the research purpose (Drisko & Maschi, 2015). This approach supports the exploratory nature of these research questions by allowing for a purposeful range of participant (i.e., organisation) types to be sampled, thus maximising the potential for capturing diverse (rather than representational) perspectives and issues from interviews. A sampling frame was developed from online web searches using Google and focusing on search phrases including "climate change behaviour campaign Australia"; "government sustainability campaign Australia"; "sustainability awards Victoria"; and "Victoria local government sustainability". Organisations included in the initial sampling frame were limited to those that were either known to have conducted active communication campaigns to promote adoption of one or more of the target climate change behaviours by individuals, or were of a type that could be expected to conduct such campaigns. Only those with members in Melbourne were included, to support face to face interviews. The websites of potential participants were also searched to identify other related organisations to add to the list in a form of snowball sampling. The online snowball sampling process identified a total of 30 potential organisations for interview across four categories of organisations: local government, state government, local nonprofit, and national nonprofit.

Ten interviews were conducted, with three organisations each selected from the local government, local not-for-profit, and national not-for profit categories, and one from the state government category (due to insufficient options for more). The stratification across organisational categories aimed to capture possible variation in campaign resourcing, team research training, or other structural differences across these organisations. The initial organisations for invitation were selected first if the researcher had contacts in common with organisation members (for improved access potential), and then randomly from the list to meet the chosen quota. Where an organisation did not wish to participate or was identified as not meeting the target criteria, another organisation was selected from the same category and approached, until the desired number of interviews was reached. Where possible, potential interviewees were contacted first by telephone with follow-up emails providing the project details and consent materials as per the study's ethics approval. Where the initial contact person felt another within their organisation was a more appropriate interviewee for the purpose of the interviews, the alternative representative was contacted following the same pattern of telephone call with supporting email. Interviews were recorded on the researcher's iPhone, and were transcribed by the researcher. Each interviews covered the following topics: the nature of campaigns conducted by the organisation, the skills and resources of the organisation/team, the processes of campaign design, the processes and results of campaign evaluations, the use of research/models in campaign design.

Analysis. The analysis was conducted in NVivo (Version 11), with all transcription and coding undertaken using the same approach by a single researcher. Manifest and latent data relevant to each of the focusing topics was thematically coded, including codes relating to the organisation, the nature of research used, access channels for research, internal and external barriers to research use (including perceived lack of research existence), internal and external enablers of research use, campaign design and evaluation processes more broadly. Emergent codes were added within each of these coding groups during the coding process to establish the breadth and patterns of responses and themes occurring across organisations. The purposive selection of organisations for participation, along with the use of QCA with semi-structured interviews supported the capture of diverse perspectives, experiences, and knowledge, and thus provided a breadth of coverage to develop hypotheses regarding campaign designers' research use in response to Research Question 3.

The Final Research Step

The final step in this research was to combine the findings of all three studies. Drawing together these findings provided insight into climate change communication and behavioural science research, mitigation campaign organisations and their practices, and issues across these. These insights were then translated into recommendations for future research and research practice that would enable improvements to assist campaigns to achieve greater adoption of climate change mitigation behaviours.

Summary

This research is situated within a framework of ontological and epistemological assumptions that guide the selection of both research questions and methods as detailed in Figure 19. This framework starts with the overarching paradigm of complexity theory, which acknowledges the complex interplay of systems and social realities. Within this paradigm, the thesis falls under the combined ontologies of tempered realism and material psychology, which support social psychology's understanding of the interplay of human experiences and biology within the material world, and the resulting individual biological manifestations and diverse perceptions of the world. This ontological perspective intersects with a constructionist-conventionalist epistemology, which accepts that these multiple perceptions of reality (for both subjects and researchers) develop through sense-making processes, but allows that measurement is possible—although not representative of an objective reality. This framework guided the choice of research questions, and is manifest in the selected methods for addressing each research question.

A mix of methods were adopted to answer the research questions, and these were undertaken in a series of three studies. Study 1 responded to the first research question by adopting a deductive, quantitative approach applying MASEM to internationally published research data to test the

hypothesised theoretical model (the CFM). Study 2 responded to the second research question by the deductive use of the quantitative approach of SEM with individual participant data from CSIRO's Australian Attitudes to Climate Change survey data to test the CFM. Study 3 responded to the third and fourth research questions through the inductive use of qualitative interviews with Australian campaign designers to explore diverse perceptions and develop hypotheses on the processes used in the industry, and the barriers they face regarding the use of research in campaign designs. The results of each study is provided in the following chapters along with discussion of their implications for this thesis and for future research.

Chapter 5: Study 1 – Meta-Analysis for Predictive Modelling of Behaviour

Psychological research can offer important assistance towards understanding potential campaign effect mechanisms and thus assist with effective campaign design. The typically generalised advice developed from the diverse and complex corpus of psychological research fails to distil the useful nuances around which predictors of behaviour are most effective targets for specific campaign interventions (i.e., for which behaviours and audiences). The rich international research base may assist in establishing this behavioural specificity necessary for tailoring campaigns, and was the focus of Study 1's quantitative, meta-analytic structural equation modelling (MASEM) in response to Research Question 1. This chapter reports on the conduct and findings of Study 1, beginning with a description of the characteristics of the sample, then outlining data screening and preparation procedures. This is followed by the results of meta-analytic testing of the structural equation models, and then discussion of the implications of the results in terms of future research, campaign design, and the conduct of Study 2 and Study 3.

> *Research Question 1: Which predictors of mitigation behaviours does international research indicate are most likely to be suitable and influential for use in behaviour change campaigns?*

This study addressed the first research question by integrating and simplifying the complex, multi-disciplinary, multi-theoretical research space around individual climate change mitigation. It offers a streamlined approach for understanding the predictors of these behaviours that is relevant for communication campaign targeting. Previous meta-analytic studies of climate change behaviour (e.g., Bamberg & Möser, 2007; Klöckner, 2013) have not included the full suite of predictors relevant to campaign interventions that have been incorporated into the campaign focus model (CFM). Similar to these studies, however, Study 1 applied MASEM, which uses published research as the source of data for testing relationships within a predictive path model of behaviour. The CFM was established by theoretically integrating relevant predictors from a range of theories, supported by empirical evidence (refer to Chapter 3 for details). The CFM forms the basis of analyses for both Study 1 (using internationally published data in MASEM) and Study 2 (using data from an Australian sample).

The information provided in this chapter meets the best-practice guidelines for the reporting of meta-analyses, by addressing items in the *Checklist of Items to Include When Reporting a Systematic Review or Meta-Analysis* specified in the PRISMA Statement (Moher et al., 2009, p. 266). This includes the specification of methodological detail as well as the reporting of results. Refer to Chapter 4 for a detailed description and justification of the study methods.

Sample Characteristics

The final data sources for this study include articles published between the search dates of January 1995 and April 2017 as listed in Appendix A[34], which also details the number of contributing participants (i.e., sample size) and the number of included predictors from each study. A total of 114 studies contributed data[35].

Sampled countries. Participants in the contributing studies totalled 47,542 individuals sampled from 23 countries, with a further 5 studies that aggregated data from multiple countries as shown in Table 3. The sample was predominantly drawn from Europe, North America, and the Asia-Pacific region. Germans were the most studied group, with 16 studies sampling a total of 7,486 Germans (16 percent of the Study 1 sample). Nine studies sampled 2,802 Australians participants, which represents six percent of the total participant sample. Nine countries were sampled only once, and together these accounted for nine percent of the participant sample (4,243 individuals). This resulted in a diverse sample from many different cultures (predominantly from developed countries) with varying levels of direct threat from climate change. Individual studies have suggested that culture influences the pathways to behaviour (see for example, Kim, Jeong, & Hwang, 2012; Yang, Kahlor, & Griffin, 2014), so this high level of diversity raised the potential for heterogeneity in the data and its likelihood for reducing the predictive strength of modelling.

Sample behaviours. The sample studies investigated a broad range of climate change mitigation behaviours. Table 4 illustrates the behavioural focus of the studies, and the type of dependent variable predicted. Multiple indexed behaviours and recycling were the most commonly studied (25 percent of studies each), followed closely by consumer behaviours (23 percent), transport behaviour (22 percent), citizenship behaviours (13 percent), and energy conservation (10 percent). While the majority of studies (60 percent) predicted behaviour, intention to implement was the dependent variable in 45 percent of articles, and other types of dependent variables (willingness or preference) were the focus in 8 percent of articles.

[34] Each study is also highlighted by an asterisk in the Reference list.

[35] Refer to Figure 20 in Chapter 4 for the PRISMA flow chart. The distribution of articles across the two searched databases supports the value of searching multiple databases in such a diverse field as climate change mitigation. The 114 studies came from 100 articles across 42 journals. While 44 percent of these articles were published in just three journals, 27 percent of journals contributed only one article. As predicted, neither PsycINFO nor Scopus included all the final set of sampled articles. PsycINFO contributed 12 articles not available through Scopus, and Scopus contributed 44 articles not available through PsycINFO.

Table 3
Distribution of Participants Across Countries Within Sample Studies

Country	Total number of participants	Number of studies
Germany	7,486	16
Sweden	4,809	5
US	4,803	14
Taiwan	3,490	8
Norway	3,474	4
UK	3,198	12
Australia	2,802	9
Switzerland	2,757	5
Netherlands	2,742	11
Aggregated (multiple)	2,694	5
China	2,101	4
Italy	1,509	6
Singapore	1,168	1
Zagreb	712	1
Vietnam	682	1
Malaysia	641	2
Denmark	633	1
Japan	447	2
South Korea	346	2
Finland	270	1
Romania	244	1
Canada	241	1
Hong Kong	173	1
Spain	120	1

Table 4
Frequency of Focal Behaviour Types in Individual Studies Split by Dependent Variable Type

		Number of studies by dependent variable		
Behaviour type	Number of studies	Behaviour	Intention	Other [a]
Multiple behaviours	29 (25%)	21	2	6
Recycling	25 (22%)	13	12	0
Consumer behaviour	23 (20%)	11	12	0
Transport behaviour	22 (19%)	13	8	1
Citizenship	13 (11%)	3	9	1
Energy conservation	10 (9%)	5	5	0
Unique studies	114	60	45	8

Note. The total number of studies appears to be more than the 114 sampled due to some studies separately modelling more than one category of behaviour, or predicting both indexed and separate behaviours.
[a] Other dependent variable types included *willingness* and *preference*

This diversity in dependent variables in terms of both behavioural focus and proximity to behavioural implementation, raises two potential issues for predictive studies. The first is the potential for issues due to heterogeneity that may be associated with aggregating data across multiple behaviours, similar to that raised for aggregation across cultures. Studies have shown behavioural differences in model path weights (see for example, Greaves et al., 2013; Ho et al., 2015) that may reduce the predictive capacity achieved through modelling aggregated behaviours. Secondly, the acknowledged gap between intent and behaviour (Ajzen, 1991; Bagozzi, 1993) suggests that studies relying on intention as a dependent variable may overlook valuable information regarding the relationship between intent and behaviour. For contributing studies that include rarer predictors, a lack of inclusion of behaviour data would substantially reduce the effectiveness of meta-analytic modelling.

Theoretical bases of the sample. A total of 51 different theories were used to build and justify the predictive models used in the sampled articles. Figure 22 illustrates the comparative frequency of use of each theory, highlighting the theory of planned behaviour (TPB) as the most frequently examined theory (in 71 percent of articles). Norm activation theory (NAT) was included in 45 percent of articles, the theory of reasoned action (TRA) in 28 percent, and value-belief-norm theory (VBN) in 24 percent of the sample. The article using the highest number of theories discussed nine separate theories. A large proportion of the sample (32 percent) also included empirically supported concepts (e.g., personal norms) without including discussion of related theories. Some studies applied individual theories on their own (e.g., TPB as in Chao & Lam, 2011; and VBN in Chen, 2015a). Other studies broadened a main theory with predictors isolated from more complete theories (e.g., broadening TPB with personal norms but not NAT or VBN's other predictors as in Chan & Bishop, 2013). Still further theories integrated two or more theories—sometimes in combination with isolated predictors—(e.g., TPB, NAT, and anticipated emotion as in Bamberg et al., 2007). While the sample was clearly dominated by TPB, NAT, TRA and VBN theories, 45 percent of theories were included in single articles only, and a further 25 percent of theories were discussed in only two articles. Thus, the majority of the theories (71 percent) contributed to model development in only one or two articles, despite most studies' findings suggesting value in their models. This theoretical diversity offers a breadth of perspectives for improving understanding of behaviour, but raises potential issues with lack of replication and theoretical progression.

Data Screening and Preparation

Data screening was undertaken to ensure appropriate treatment of data by testing assumptions regarding data representativeness and distribution. These screening tests facilitate evaluation of likely

data gaps (publication bias) and suitability of the data for the selected analysis techniques. Three sets of assumption tests were completed, including:

- reviews of funnel plots and failsafe *N* values to ensure that the combined effect sizes (i.e., pooled correlations) would not be overestimated due to publication bias;
- assessment of the heterogeneity of the data using the I^2 statistic to confirm the random effects assumption;
- review of confidence intervals to confirm the statistical significance of pooled correlations and support the identification of discrepancies in the specified model.

Insufficient data for a subset of variable pairs was a repeat issue for data review across all tests. This issue is discussed further under Pooling the correlations.

Publication bias. Funnel plots were created for the sample correlations relevant to the CFM, and generally exhibited similar patterns of asymmetry. Funnel plots can be prepared where at least 10 sample data points exist (Mavridis & Salanti, 2014). Sixteen of the CFM's pairs variables were plotted as the remainder had insufficient data. Copies of the funnel plots are included in Appendix A, with two example plots provided in this section to illustrate key issues. The funnel plots generally exhibited the expected symmetrical, inverted funnel shape about the pooled correlation with no obvious gaps in the lower extremities that might suggest bias, although the spread of correlations was often wide. Figure 23 and Figure 24 are plots for attitude-intention and attitude-personal norm correlation sets, respectively. In each chart a single large-sample study with lower correlation appears (top left of the graph), which may indicate overestimation of the pooled value but may also simply be a characteristic of study differences since the remaining plot follows the expected funnel form. The wide spread of correlations in each plot may be a characteristic of the diversity of the source studies' target behaviours and samples, and warranted further investigation (see the following Heterogeneity section).

Failsafe *N* values highlighted eight CFM correlations that failed to meet the test criterion as highlighted in bold in Table 5[36]. Most of these were for the less studied variables where the possibility of null results is still relatively high, however two were for more frequently studied variable pairs: perceived behavioural control (PBC)-social norms, and PBC personal norms. Comparison against previous meta-analyses showed that the pooled correlation for PBC-social norms was within .01 of that found by other researchers across pro-environmental and health studies (Bamberg & Möser, 2007; Klöckner, 2013; McEachan et al., 2011). The pooled correlation of .26 [.23, .29] between PBC and personal norms was considerably lower than the .35 found by other researchers (Bamberg & Möser, 2007; Klöckner, 2013). These other studies used similar data sets to

[36] Failsafe *N* values are only relevant for statistically significant pooled correlations (i.e., confidence intervals not spanning zero), so were not calculated for non-significant correlations.

each other, and no other meta-analyses were found that reported this statistic. This value had no influence on the overall findings of this study as this correlation was not relevant for the TPB model (refer to Results section regarding the CFM).

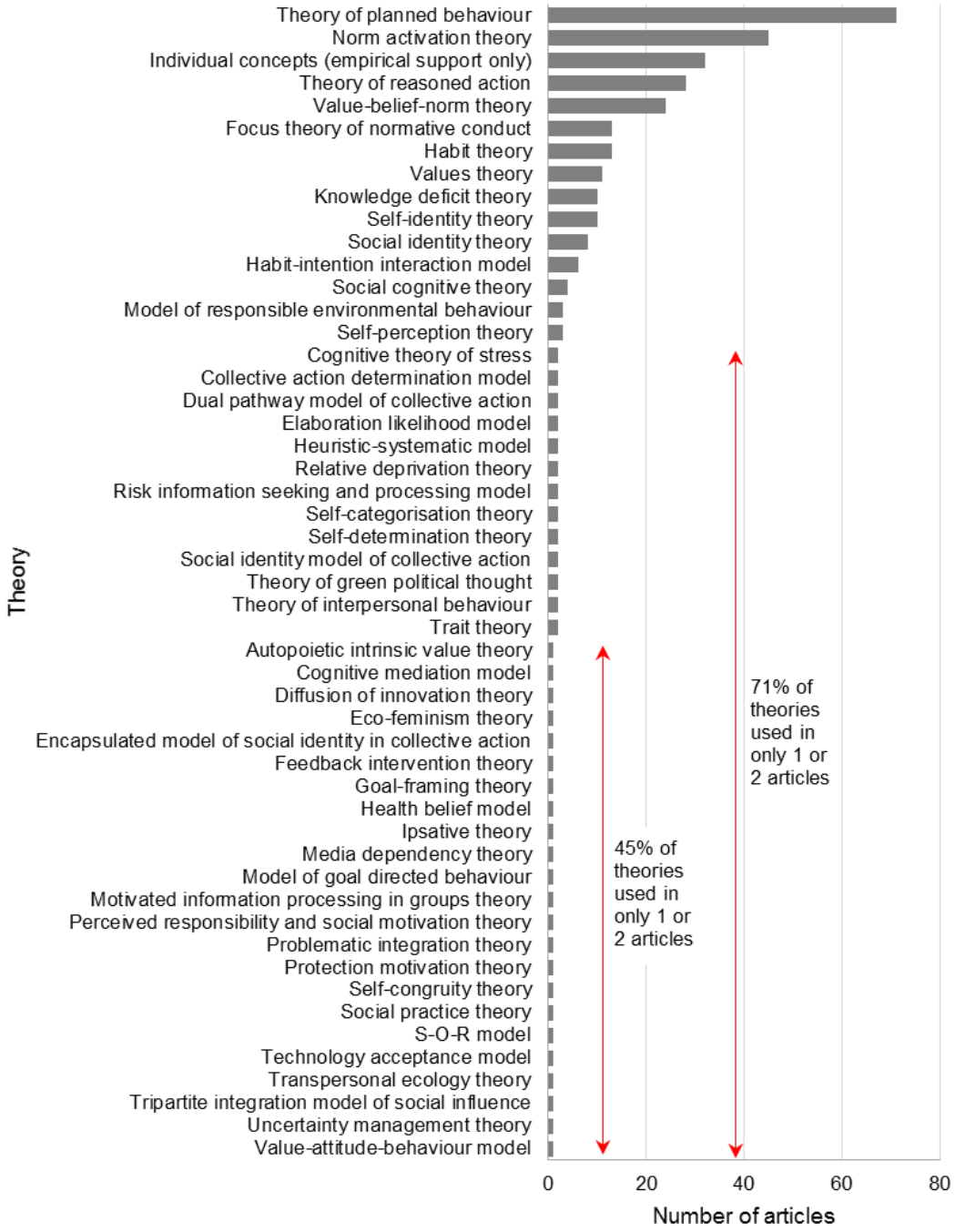

Figure 22. Theories used in sample articles to build and justify predictive models of behaviour.

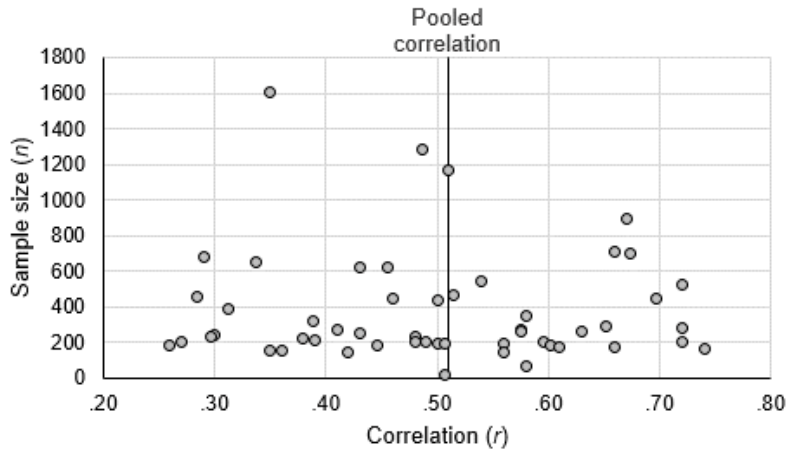

Figure 23. Funnel plot of attitude-intention correlations (*k* = 52 studies).

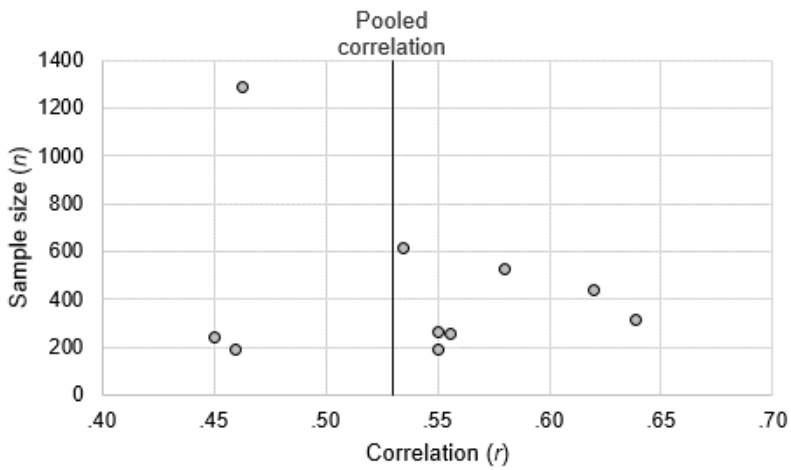

Figure 24. Funnel plot of attitude-personal norm correlations suggesting general symmetry but with few data points (*k* = 10 studies).

Heterogeneity. The heterogeneity of the data was tested using the I^2 statistic for each pair of variables, which allowed testing of 34 pairs of CFM variables (see Chapter 4 for formulae). The results of these tests are provided in Table 6, and indicate generally high heterogeneity with 26 of the tested pairs showing more than 70 percent heterogeneity. Three pairs of variables had *Q*-statistics lower than the number of degrees of freedom, which truncates the I^2 values to zero (see Huedo-Medina et al., 2006). These included anticipated emotion-behaviour, habit-PBC, and intention-retrospective emotion. Each of these had three or less contributing studies, low to moderate correlations (.19 to .40), relatively small ranges (.025 to .102), and adequate sample sizes (aggregated samples of between 626 and 835). The overall high I^2 values of these data support the adoption of random effects approaches, and raises the potential for this heterogeneity to influence model fit.

Table 5
Failsafe N Values and Test Ratios for CFM Variable Pairs

Variables	k	Failsafe N	$5k + 10$	Test ratio
Anticipated emotion-Attitude	3	31	25	1.2
Anticipated emotion-Behaviour	2	0	20	**0.0**
Anticipated emotion-Intention	3	2	25	**0.1**
Anticipated emotion-PBC	1	13	15	**0.9**
Anticipated emotion-Personal norms	1	97	15	6.5
Anticipated emotion-Social norms	3	4	25	**0.2**
Attitude-Behaviour	30	1117	160	7.0
Attitude-Habit	5	53	35	1.5
Attitude-Identity	10	342	60	5.7
Attitude-Intention	52	8418	270	31.2
Attitude-PBC	19	433	105	4.1
Attitude-Personal norms	10	1445	60	24.1
Attitude-Social norms	53	5485	275	19.9
Behaviour-Habit	8	178	50	3.6
Behaviour-Identity	6	44	40	1.1
Behaviour-Intention	27	2140	145	14.8
Behaviour-PBC	11	356	65	5.5
Behaviour-Personal norms	18	623	100	6.2
Behaviour-Retrospective emotion	9	388	55	7.1
Behaviour-Social norms	36	1081	190	5.7
Habit-Intention	7	109	45	2.4
Habit-PBC	3	0	25	**0.0**
Habit-Personal norms	4	181	30	6.0
Habit-Social norms	11	105	65	1.6
Identity-Intention	7	799	45	17.7
Identity-PBC	7	147	45	3.3
Identity-Personal norms	2	100	20	5.0
Identity-Retrospective emotion	1	19	15	1.3
Identity-Social norms	7	334	45	7.4
Intention-PBC	19	800	105	7.6
Intention-Personal norms	13	692	75	9.2
Intention-Retrospective emotion	3	170	25	6.8
Intention-Social norms	53	7666	275	27.9
PBC-Personal norms	8	13	50	**0.3**
PBC-Social norms	21	107	115	**0.9**
Personal norms-Social norms	14	483	80	6.0
Retrospective emotion-Social norms	4	1	30	**0.0**

Note. k is the number of studies, $\bar{n}$ is the average sample size. Test ratios greater than one indicate low risk of publication bias causing overestimation of pooled values (Huedo-Medina et al., 2006). Failsafe N ratios in bold failed to meet the cutoff criteria of 1.0.

Pooling the correlations. The matrix of pooled correlations is presented in Table 7, along with each correlation's confidence limits, and the number of studies and participants contributing to each correlation value[37]. A total of 105 pooled correlations were required to complete the matrix, however data was not available in the sample for 21 pairs of variables. The CFM requires 45 of these correlations (with the remainder relevant for the comparative models only), however 7 of these pairs of variables had no correlations reported in the study sample[38]. While these gaps precluded testing the CFM with this data, sufficient data existed to test the comparative models. The available pooled correlations for variables in the CFM did, however, offer useful insight into the model relationships. Thus pooling was undertaken to support the testing of the comparative models and for correlational review of the CFM.

The number of studies and participants contributing to the pooled correlation matrix varied considerably across the different pairs of variables. The pooled correlations came from between 1 and 59 studies, and involved between 617 and 27,276 participants. The variables included in TPB typically had the largest number of contributing studies and participant numbers due to that theory's popularity. The correlations with the least contributing studies and lower participant numbers were typically those linking VBN and TPB variables, or including emotion, habit, or identity. The harmonic mean sample size of 1,949 was used rather than the arithmetic mean, to account for this disparity in participant numbers across the correlation matrix.

[37] Outlier identification and removal methods and outcomes were detailed in Chapter 4. Eleven percent of the sample was removed, which was similar to that of other research (e.g., 10 percent for Han & Hansen, 2012; 7 percent for Scannell & Gifford, 2013) and to the 5-10 percent range identified by Beal, Corey, and Dunlop (2002) at their recommended SAMD cutoff values.

[38] This lack does not imply that these variable pairs have never been investigated together (e.g., in health rather than mitigation studies), but they did not have correlation data reported in the articles identified through the Study 2 search approach outlined in Chapter 4.

Table 6

Heterogeneity (I^2) and Sampling Error ($100 – I^2$) of Samples for 13 CFM Correlation Sets

Variables	*k*	*Q*	I^2	$100 – I^2$
Anticipated emotion-Attitude	3	9.9	80%	20%
Anticipated emotion-Behaviour	2	0.1	0%	100%
Anticipated emotion-Intention	3	62.0	97%	3%
Anticipated emotion-Social norms	3	6.4	69%	31%
Attitude-Behaviour	30	315.9	91%	9%
Attitude-Habit	5	7.6	47%	53%
Attitude-Identity	10	78.7	89%	11%
Attitude-Intention	52	680.2	93%	7%
Attitude-PBC	19	366.3	95%	5%
Attitude-Personal norms	10	34.4	74%	26%
Attitude-Social norms	53	612.7	92%	8%
Behaviour-Habit	8	50.7	86%	14%
Behaviour-Identity	6	69.9	93%	7%
Behaviour-Intention	27	462.8	94%	6%
Behaviour-PBC	11	43.7	77%	23%
Behaviour-Personal norms	18	184.4	91%	9%
Behaviour-Retrospective emotion	9	33.2	76%	24%
Behaviour-Social norms	36	482.2	93%	7%
Habit-Intention	7	66.6	91%	9%
Habit-PBC	3	1.6	0%	100%
Habit-Personal norms	4	7.2	58%	42%
Habit-Social norms	11	69.2	86%	14%
Identity-Intention	7	26.5	77%	23%
Identity-PBC	7	42.3	86%	14%
Identity-Personal norms	2	5.1	80%	20%
Identity-Social norms	7	18.5	68%	32%
Intention-PBC	19	376.0	95%	5%
Intention-Personal norms	13	215.4	94%	6%
Intention-Retrospective emotion	3	0.2	0%	100%
Intention-Social norms	53	701.3	93%	7%
PBC-Personal norms	8	37.7	81%	19%
PBC-Social norms	21	169.7	88%	12%
Personal norms-Social norms	14	31.3	58%	42%
Retrospective emotion-Social norms	4	22.2	86%	14%

Note. *k* is the number of studies for each variable, *Q* is the Cochran statistic, I^2 is the heterogeneity (i.e., between-study variability), and $100 – I^2$ is the sampling error (i.e., within-study variability). Where *Q* is less than or equal to the number of degrees of freedom (i.e., k-1), I^2 is truncated at zero (Huedo-Medina et al., 2006).

Table 7

Pooled Correlations [with 95 Percent Confidence Limits] and the Number of Contributing Participants (and Studies)

	1.	2.	3.	4.	5.	6.	7.	8.
1. Anticipated emotions				1,114 (3)	797 (2)			
2. Awareness of consequences			5,054 (12)	4,940 (12)	9,539 (21)	2,162 (4)	4,268 (7)	2,267 (5)
3. Ascription of responsibility		.54 [.52, .56]		2,736 (6)	5,294 (13)	2,631 (5)	2,443 (4)	1,450 (2)
4. Attitudes	.37 [.32, .42]	.45 [.42, .47]	.37 [.34, .40]		9,667 (30)	2,886 (2)	1,588 (2)	2,363 (5)
5. Behaviour	.38 [.32, .44]	.19 [.17, .21]	.17 [.15, .20]	.35 [.33, .36]		4,565 (8)	3,789 (5)	2,088 (8)
6. Biospheric values		.42 [.38, .45]	.30 [.26, .33]	.29 [.25, .32]	.28 [.26, .31]		3,239 (7)	1,283 (1)
7. Egoistic values		-.04 [-.07, -.01]	.01 [-.03, .05]	-.11 [-.16, -.06]	-.07 [-.10, -.04]	.03 [.00, .07]		1,283 (1)
8. Habit		.11 [.06, .15]	.16 [.11, .21]	.14 [.10, .18]	.51 [.48, .54]	.14 [.08, .19]	-.07 [-.13, -.02]	
9. Identity				.50 [.47, .52]	.31 [.27, .35]			
10. Intent	.45 [.40, .50]	.41 [.39, .44]	.49 [.46, .52]	.51 [.50, .52]	.53 [.52, .55]	.30 [.27, .33]	-.01 [-.05, .03]	.37 [.34, .40]
11. NEP		.51 [.48, .54]	.45 [.43, .48]	.27 [.23, .32]	.11 [.08, .14]	.48 [.42, .54]	-.08 [-.12, -.04]	.18 [.13, .23]
12. PBC	.33 [.23, .43]	.15 [.11, .18]	.14 [.09, .19]	.44 [.42, .46]	.33 [.30, .36]	.03 [-.03, .08]	-.01 [-.06, .05]	.25 [.18, .32]
13. Personal norms	.58 [.52, .63]	.50 [.49, .52]	.57 [.55, .59]	.53 [.51, .55]	.34 [.32, .36]	.40 [.37, .42]	-.03 [-.06, .01]	.44 [.39, .49]
14. Retrospective emotions					.30 [.28, .33]	.54 [.49, .58]		
15. Social norms	.35 [.30, .40]	.29 [.26, .31]	.35 [.32, .39]	.43 [.42, .44]	.29 [.27, .30]	.16 [.10, .21]	-.02 [-.06, .03]	.20 [.17, .23]

Note. Lower-left triangle are pooled correlations with lower and upper confidence limits included in brackets. Upper right triangle are the number of contributing participants with the number of discrete contributing participant samples included in parentheses. NEP = new ecological paradigm; PBC = perceived behavioural control.

Table 7 continued

	9.	10.	11.	12.	13.	14.	15.
1. Anticipated emotions		1,114 (3)		317 (1)	617 (1)		1,114 (3)
2. Awareness of consequences		4,819 (13)	2,773 (5)	3,644 (9)	8,023 (17)		7,251 (18)
3. Ascription of responsibility		3,233 (7)	3,102 (5)	1,472 (2)	4,277 (8)		2,564 (5)
4. Attitudes	3,030 (10)	19,635 (52)	1,798 (3)	7,047 (19)	4,323 (10)		18,484 (53)
5. Behaviour	1,965 (6)	10,268 (27)	3,827 (6)	3,707 (11)	8,780 (18)	5,354 (9)	14,691 (37)
6. Biospheric values		3,006 (3)	613 (2)	1,283 (1)	4,773 (5)	972 (1)	1,283 (1)
7. Egoistic values		2,226 (4)	2,016 (4)	1,283 (1)	3,306 (4)		1,849 (2)
8. Habit		3,227 (7)	1,283 (1)	628 (3)	1,079 (4)		4,202 (11)
9. Identity		2,224 (7)		1,741 (7)	791 (2)	652 (1)	1,948 (7)
10. Intent	.68 [.66, .70]		2,072 (5)	7,957 (19)	5,688 (13)	835 (3)	20,599 (53)
11. NEP		.30 [.26, .34]		1,798 (3)	3,256 (6)		1,798 (3)
12. PBC	.49 [.45, .53]	.49 [.48, .51]	.08 [.03, .12]		3,651 (8)		7,570 (21)
13. Personal norms	.66 [.62, .70]	.63 [.62, .65]	.42 [.39, .45]	.26 [.23, .29]			5,457 (14)
14. Retrospective emotions	.45 [.39, .51]	.37 [.31, .43]					2,571 (4)
15. Social norms	.43 [.40, .47]	.50 [.49, .51]	.23 [.19, .28]	.28 [.26, .30]	.39 [.37, .42]	.29 [.25, .32]	

Note. Lower-left triangle are pooled correlations with lower and upper confidence limits included in brackets. Upper right triangle are the number of contributing participants with the number of discrete contributing participant samples included in parentheses. NEP = new ecological paradigm; PBC = perceived behavioural control.

Results

The section reports on the results of Study 1 analyses, including the comparison of the pooled data against the specified CFM paths, and the results of SEM of comparison models based on the pre-existing TPB, VBN theory, and the comprehensive action determination model (CADM). Gaps in the correlation matrix precluded testing the CFM, however the available data provides useful information for assessing the model's structural appropriateness in preparation for Study 2 testing.

Model-correlation alignment. Comparison of the pooled correlations with the CFM's specified paths provides tentative indications of the likely appropriateness of the specified model, but it is important to acknowledge that bivariate correlations cannot identify mediation paths (i.e., where certain variables act as intermediaries in the relationship of two other variables)—which is why SEM is a useful tool. Particular attention was paid to large correlations that were not well recognised in the model.

There were no CFM correlations with confidence intervals spanning zero, and correlations of moderate or high value (i.e., at least .30) were found for 30 pairs of variables. The majority of these were represented in the CFM by existing specified direct or mediated paths, however six moderate correlations were not represented by model paths. Two of these were not unexpected based on their theoretical processes. The first was identity and social norms, which may correlate due to a common social identity precursor that was excluded from the model for parsimony. Similarly, identity and retrospective emotion may correlate due to both being founded on concern regarding environmental and climate change issues. This concern was also excluded from the model due to its distal nature with respect to behaviour. These variables may require correlation paths to be specified in Study 2.

There were four unexpected moderate correlations. The first two were between anticipated emotion and each of attitude and PBC. This may suggest that anticipated emotions are heightened for individuals with attitudes and PBC that predispose them towards implementing target behaviours (i.e., a lack of excuse for non-adoption). Study 2 should test paths from attitude and PBC to anticipated emotions to test these relationships. The second two unexpected moderate correlations were between PBC and each of attitude and identity. One explanation for these relationships is that previous experiences related to a target behaviour may lead to alignment of these predictors due to behavioural momentum or a need for self-consistency as is posed by the theory of cognitive dissonance (for discussion of the potential negative behavioural effects of these types of cognitions, see Gifford, 2011). As such, further consideration should be given to the adequacy of habit for representing these relationships in the CFM[39].

[39] As discussed in Chapter 4, habit was not included in the dataset acquired for Study 2 and so further testing of the CFM outside the research of this thesis is required to confirm these relationships.

Model fit. While gaps in the correlation matrix precluded testing the fit of the CFM to the Study 1 data, tests were conducted for three pre-existing models of behaviour: TPB, VBN, and CADM. These results offer insight into the ability of these models to predict pro-environmental behaviour from a larger temporal sample than previously tested. The first step in testing models is to confirm that they appropriately represent the data. Model fit was assessed using the RMSEA, SRMR, CFI, and a parsimony measure such as PGFI as recommended by Hooper, Coughlan, and Mullen (2008). Each of these statistics—along with the traditional Chi-square (χ^2) measure of fit—is provided in Table 8 for the tested models[40]. Only the TPB model satisfied all of these criteria, $\chi^2(2) = 3.13$, $p = .209$, RMSEA = .014, SRMR = .008, CFI = 1.00. The CADM achieved the SRMR criteria (.080) but failed the remaining criteria, $\chi^2(25) = 983.419$, $p < .001$, RMSEA = .118, CFI = .907. The VBN model failed all criteria. An examination of the residual covariances provides additional detail for understanding these model fit issues. Part of the modelling process includes the calculation of the amount of covariance between variables that remains unexplained by the model, and this is captured most clearly in the SRMR value.

Table 8
Goodness of Fit Statistics for the Tested Models

Statistic	Fit criteria[a]	TPB model	VBN model	CADM
Chi-square values	$p > .05$	3.13 $df = 2$ $p = .209$	916.224 $df = 14$ $p < .001$	983.419 $df = 25$ $p < .001$
RMSEA[b]	< .06 [.00 - .08]	.014 [.000; .043]	.153 [.145; .161]	.118 [.112; .124]
SRMR[c]	< .08 (preferably < .05)	.008	.150	.080
CFI	≥ .95	1.000	.759	.907
PGFI	-	.200	.506	.344

[a] Fit criteria as specified by Hooper et al. (2008).
[b] 95 percent confidence intervals included in brackets.
[c] SRMR is not a standard calculation within SPSS AMOS software and was manually calculated in Excel as the square root of the mean of the squared residual covariances from each model test.

Residual covariance is the difference between the observed and the model implied covariance, and indicates the variables that have relationships not adequately represented by the model. Table 9, Table 10, and Table 11 present the residual covariances for TPB, VBN, and CADM, respectively. Correlations of .30 are considered moderate (Cohen, 1988), so residual covariances over .25 have been highlighted in bold in the tables to indicate potentially important relationships not sufficiently accounted for by the relevant model.

[40] Chi-square (χ^2) values are also typically reported, but suffer from severe limitations including often rejecting models tested with large sample sizes (Hooper et al., 2008).

Table 9
TPB Model Residual Covariances

Variables	PBC	Social norm	Attitude	Intention
Social norm	.000			
Attitude	.000	.000		
Intention	.000	.000	.000	
Behaviour	.000	.021	.016	.000

Note. No items over .20; PBC = perceived behavioural control.

Table 10
VBN Model Residual Covariances

Variables	Biospheric values	Egoistic values	NEP	AC	AR	Personal norm
Egoistic values	.000					
NEP	.000	.000				
AC	.188	.045	.000			
AR	.205	.014	.171	.000		
Personal norm	**.354**	.006	**.306**	.240	.000	
Behaviour	.216	-.101	.091	.149	.026	.000

Note. Items in boldface are greater than .20; NEP = new ecological paradigm; AC = awareness of consequences; AR = ascription of responsibility.

Table 11
CADM Residual Covariances

Variables	Att	SN	AR	AC	AV	EV	PBC	NEP	PN	Intent	Habit
SN	.000										
AR	.000	.000									
AC	.000	.000	.000								
AV	.000	.000	.000	.000							
EV	.000	.000	.000	.000	.000						
PBC	.000	.000	.000	.000	.000	.000					
NEP	.179	.158	**.298**	**.356**	.000	.000	.089				
PN	.024	.021	.040	.047	.000	.000	.012	.165			
Intent	.007	.006	.104	.044	.090	.046	.004	.184	.025		
Habit	-.005	-.036	-.098	-.026	-.015	-.056	.004	.095	.019	.009	
Beh	.007	.016	.027	.041	.111	-.085	.002	.068	.053	.007	.006

Note. Items in boldface are greater than .20; Att = attitude; SN = social norm; AR = ascription of responsibility; AC = awareness of consequences; AV = altruistic values; EV = egoistic values; PBC = perceived behavioural control; NEP = new ecological paradigm; PN = personal norm; Beh = behaviour.

The residual covariances of interest in both the VBN and CADM were related to variables from Stern's (2000) VBN. In the VBN model the key residuals were for personal norms with biospheric values (cov_{res} = .354) and with NEP (cov_{res} = .306). The relevant residuals for CADM were for NEP with ascription of responsibility (cov_{res} = .298) and with awareness of consequences (cov_{res} = .356). Stern's (2000) acknowledgement that the simplicity of the fully mediating VBN chain may not fully capture the complexities of relationships between variables is supported by these residuals and similar partial mediation effects found by other researchers (e.g., Sahin, 2013; Yeboah & Kaplowitz, 2016). In the case of CADM, adding paths to represent these relationships would require removal of multiple other specified covariances, resulting in further reduction of fit. As the purpose of testing the comparative models was to determine their relative explanatory value, no changes were made to these models. VBN and CADM were each deemed a poor fit for the data and not included in further analyses.

Paths and explained variance. As the VBN and CADM models failed to fit the data, only analysis results from the TPB model are presented. The standardised path coefficients (i.e., beta weights or b^*) and explained variance (R^2) from the TPB model are provided in Figure 25. All the paths predicted by the TPB model were significant. The model explained 44 percent of the variance in intention to implement mitigation behaviours, and 31 percent of the variance in implemented behaviours. Attitudes (b^* = .34) and PBC (b^* = .30) were the strongest predictors of intention, and intention (b^* = .47) was the strongest predictor of behaviour (compared with PBC, b^* = .15). These statistics indicate the proportion of a standard deviation of change in the predicted variable (e.g., .34 standard deviation change in intention) that results from one standard deviation of change in the predictor variable (i.e., attitudes).

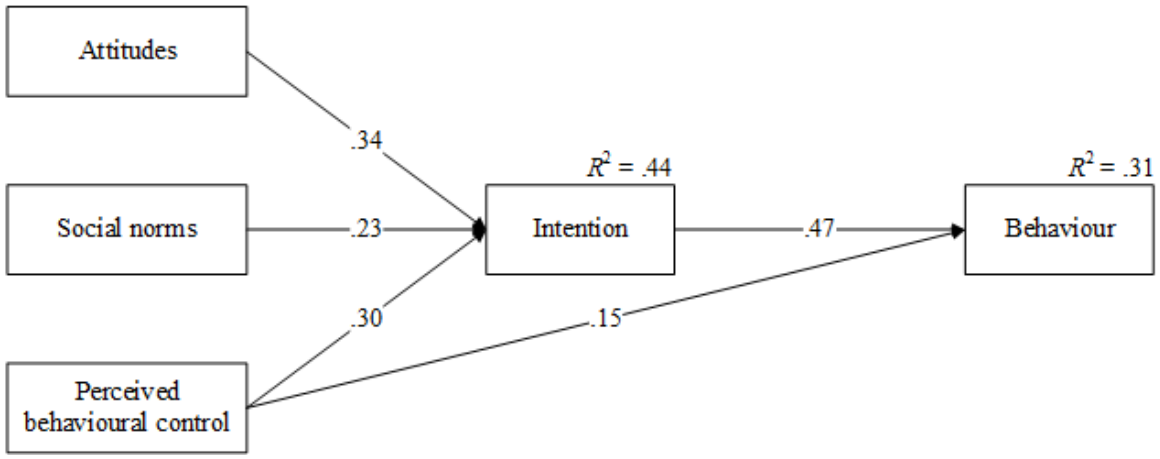

Figure 25. Standardised path coefficients and explained variance from testing Ajzen's (1985) TPB model. All paths were significant at .05 level.

Discussion

This discussion analyses the implications of the findings of this study for answering the first research question. It considers the results relating to the pooled correlations, the fit of the models to the data, and model predictive efficacy and significant paths. Implications for Study 2 are highlighted, with a focus on addressing the issues raised in Study 1.

Gaps in the pooled correlation matrix. Preparation of the correlation matrix identified a subset of the CFM's predictors with no reported correlations in the identified published studies. This resulted in seven CFM correlations missing from the pooled correlation matrix, and precluded testing of the CFM in Study 1. These missing correlations were for combinations of variables not included together in the comparative models (TPB, VBN, and CADM) tested in this study, and included: retrospective emotions with attitudes, habit, personal norms, and anticipated emotion; anticipated emotions with habit and identity; and habit with identity. Each of these factors has been identified as an important predictor of pro-environmental behaviour and this thesis is not the first proposal of the combined importance of these missing predictors for expanding existing models of behaviour. For example, Conner and Armitage (1998) proposed that the TPB be extended by inclusion of a range of variables including personal norms, habit, identity, and anticipated emotion. Various studies have tested the efficacy of these variables in predicting pro-environmental behaviours, however, collectively these studies have insufficient breadth of coverage of diverse predictors to support meta-analytical comparison of relative effects.

Despite the considerable volume of research broadening existing models of mitigation behaviour (refer to *Theoretical bases of the sample* for examples), these efforts have been disjointed in terms of their iterative theory building and testing. Many of the sampled studies tested 'extended' models with one or two predictors added to an existing model but, with limited replication and lack of connection between these extensions over time, these tests fail to build upon each other in a way that truly expands understanding of the predictors of behaviour. Disciplinary diversity may be a contributor to this, as many fields intersect in the context of mitigation behaviour (e.g., transport, marketing, waste management). Such diversity enriches the field but results in challenging conditions in terms of discoverability of past research upon which to build. For example, 42 journals each published a single study relevant for inclusion in this meta-analysis. No single database included all these journals, and the language used to describe the research also varied (e.g., pro-environmental, responsible, sustainable, and mitigation behaviours). Researchers should be encouraged to broaden their analyses and integration across this diversity for more complete understanding these behaviours.

Heterogeneity and model fit. Tests were conducted comparing pre-existing models (TPB, VBN, and CADM) using this study's wider temporal search than previous mitigation research had

used—but with mixed success in terms of model fit. Only the TPB model exhibited adequate fit to the data from this study. The TPB is a volitional model, and explained 31 percent of the variance in behaviour, which leaves almost 70 percent of the variance unexplained. CADM's inclusion of VBNs normative paths, and habit's automatised influence, were attempts to step beyond TPB's volitional cognitive model and capture broader influences on behaviour and improve model prediction (Klöckner, 2013). The poor fit of the VBN model and CADM may be due to (a) the models not appropriately representing the relationships between the constructs; or (b) the impacts of the contributing studies' diverse cultures, contexts, and behaviours were not appropriately represented through pooling of the empirical data; or (c) some combination of (a) and (b).

The pre-pooling data reviews found substantial heterogeneity within the sample data. This heterogeneity may be a result of a number of factors, however the aggregation of different behaviours, and the diversity of cultures from which the samples were taken, are likely to contribute. There was insufficient data to compare models across different behaviours and sampled countries, however the results of several of the individual sample studies support these as likely causes of heterogeneity. Greaves, Zibarras, and Stride (2013) compared TPB predictions of several energy reduction behaviours for a UK sample and found that different variables predicted some behaviours better than others. Contrary to many TPB models, PBC was found to have limited influence on the tested behaviours, and the influence of social norms varied considerably (from $b^* = .10$ to .38). Greaves, Zibarras, and Stride also found differences in the overall explanation of variance in intention (from 46 to 61 percent). Such variability in path importance and overall predictive potential of the model may explain the wide range of correlations within this thesis' meta-analytic sample for some variables, and this suggestion that data aggregation across behaviours is likely to mask the nuanced influences of each predictor was taken forward for testing in Study 2.

In addition to behaviour, the country from which participants are sampled also affected modelled relationships. Several studies have compared predictive models using participant data from different countries (separately and pooled). The results from these studies illustrate the masking of important differences between the samples that can inflate or hide the significance of some variables. Different behaviours can be predicted by different variables for different samples (Ando et al., 2007), and pooling data across samples from different countries can inflate the importance of variables that may be non-significant for both individual samples (e.g., Kim et al., 2012; Yang et al., 2014), or mask the lack of significance for one subsample (e.g., Kim et al., 2012). Such nuanced differences in the predictors of behaviour across samples can provide valuable information for campaign targeting, and may also occur in within-country samples (i.e., different audience segments). Tailoring messages to mistakenly target non-significant predictors due to the adoption of generalised (pooled) model results could considerably reduce the effectiveness and efficiency of campaigns. Consideration of the effects of participant pooling was taken forward for testing in Study 2.

Predictive efficacy and significant paths. The TPB model tested in this study showed similar overall predictive capability and patterns of influence of variables to that found in other meta-analyses. TPB explained 44 percent of the variance in intention and 31 percent of the variance in mitigation behaviour. In comparison, meta-analyses of TPB models across diverse behaviours (e.g., health, education, business, and environmental behaviours) have found it to predict between 35 and 44 percent of the variance in intention, and between 19 and 36 percent of the variance in behaviour (Armitage & Conner, 2001; McEachan et al., 2011; Rise et al., 2010). These meta-analyses also found attitude to be the strongest predictor of intention, although slight differences were found in whether PBC or social norms were the next strongest predictor—with social norms found weaker by two of the studies (Armitage & Conner, 2001; McEachan et al., 2011) and equal or slightly stronger than PBC by one study (Rise et al., 2010).

The efficacy of the TPB for fitting generalised data may be due to its inclusion of intention, which is a relatively consistent predictor across diverse behaviours (Armitage & Conner, 2001; McEachan et al., 2011). In contrast, not all behaviours have moral or habitual components, or these components may not be consistently activated across behavioural contexts (Ouellette & Wood, 1998; Rivis et al., 2009). Once aggregated across behaviours, data used with models incorporating personal norms and habit would be prone to more variability around the influence of these predictors and thus tend towards poorer model fit. It is likely that the prediction of disaggregated behaviours would better identify the influence of these more specialised variables and assist with identifying targets for campaign intervention. For behaviours with moral or habitual components, excluding these variables from models (e.g., using TPB) guiding intervention design could considerably reduce the effectiveness of mitigation campaigns.

Addressing Research Question 1. Study 1 aimed to answer the first research question, which asked: Which predictors of mitigation behaviours does international research indicate are most likely to be suitable and influential for use in behaviour change campaigns? While this study was unable to test the influence of several of the predictors within the CFM due to the gaps in the correlation matrix, it was possible to test a subset of predictors through pre-existing models of behaviour. As TPB was the only model that fit the data, no results are available from this study regarding the influences of identity, habit, emotion, values, or personal norms on mitigation behaviours. Based on the results of the TPB model testing, however, intention was the strongest predictor of mitigation behaviours, and attitudes and PBC were the strongest predictors of intention. These results are supported by the findings of other meta-analyses of the TPB model (see Armitage & Conner, 2001; McEachan et al., 2011; Rise et al., 2010), which have indicated that these overall patterns of influence are relevant for many different types of behaviour (e.g., health, education, business).

There is some evidence, however, that even these few predictors' have more nuanced relationships than aggregated data offers, and this could have important implications for campaign effectiveness and efficiency. Differences have been found in the patterns of influence of TPB predictors across behaviours, with some behaviours registering limited influence of PBC or social norms, and others showing a stronger the influence of these above that of attitudes (McEachan et al., 2011). Thus aggregation of data across behaviours may mask the true influencing factors that campaigns should target, leading to ineffective or inefficient campaigns. Similarly, there is evidence that these patterns of influence can also differ across audiences, with interaction effects between audiences and behaviours (Ando et al., 2007) that suggest modelling at finer scales could offer important advice for campaign interventions. In order for designers to most effectively target campaigns, guidance material must move beyond the rules of thumb developed from generalised modelling results of single category models like the broadly used TPB. Understanding the nuances in behavioural predictors is critical for effective and efficient campaign designs.

The inability to test the influence of several important predictors of behaviour also has implications for campaigns as it is likely that similar trends in nuanced predictor influences exist across behaviours and countries for the CFM predictors unable to be tested in this study. Being able to identify when appeals to a social norms will be more effective than encouraging control beliefs for stimulating behavioural intentions, or when habit is likely to hamper good intentions and may require timely nudges close to behavioural implementation, is of critical importance for campaign designs. In the current context of urgent need for behaviour change coupled with competition for audience attention, campaign organisations (and society more broadly) can ill afford inefficient and ineffective interventions. Understanding the relative importance of predictors beyond the dominant theoretical models and generalised rules of thumb could considerably improve campaigns outcomes, which is crucial for mitigating climate change.

Summary and Implications

Analysis of the studies contributing data to Study 1 highlighted several challenges that hamper the capacity of researchers in the field to iteratively build understanding of behavioural processes. Associated with considerable theoretical and disciplinary diversity is the trend in the published literature for isolated testing of predictors without broader consideration of their relative importance against various other predictors. Along with diverse publication opportunities and indexing/accessibility systems that make discovery of past research problematic, these issues are something that the research field needs to address if we are to effectively support practitioners to achieve real-world outcomes from collectively produced knowledge. These issues may also pose barriers for campaign designers' use of research, and the potential impact of these issues was taken forward for exploration with practitioners in the Study 3 interviews.

The manifestation of these issues facing the research field that was most limiting for Study 1 was gaps in the correlation matrix that precluded testing the CFM. Despite this, three comparative models (TPB, VBN, and CADM) were able to be tested with data from longer temporal searches than in previous meta-analyses. Of these only the TPB model fit the data, producing similar results to that of previous meta-analyses. While TPB offers moderate prediction of general mitigation behaviour, the heterogeneity of the data suggests that pooling the data may mask differences regarding which variables predict which behaviours for which samples. These suggestions were taken forward for testing with raw survey data in Study 2 as raw data offers more flexibility in modelling varying levels of data aggregation. Study 2, therefore, also aimed to determine if differences exist in predictor influences across (a) different behaviours, (b) varying levels of behaviour aggregation, and (b) participants of different characteristics (e.g., audience segmentation as might be used by campaigns).

Despite the possible masking of effects, and gaps in the correlation matrix, the Study 1 data offered a chance for partial review of the structure of the CFM, and highlighted additional paths that may be required for achieving model fit in Study 2. Possible covariance was identified between identity and social norms, and between identity and retrospective emotion, and may be due to these variables' common founding on concern regarding environmental and climate change issues that was not sufficiently proximal to behaviour for inclusion in the model. Similarly, a possible common determinant related to prior behavioural experiences (e.g., habit) may require acknowledgement of covariances between PBC and each of attitudes and identity. The lack of habit data in the Study 2 dataset precludes testing of that variable to account for these covariances, however, and those relationship require further testing with purposely collected data in future studies.

Chapter 6: Study 2 – Model Testing Using an Australian Sample

Where Study 1 used meta-analytic structural equation modelling (MASEM) to identify target variables for campaign interventions from the broader international findings, Study 2 offered the opportunity for a more nuanced structural equation modelling (SEM) investigation comparing these findings with those from the Australian context. Study 2 built upon the findings of Study 1 by testing the campaign focus model (CFM) with Australian survey data to answer Research Question 2, which aimed to determine if the pattern of predictors found in Study 1 also applied in the Australian context. This chapter describes the data and findings of Study 2 (see Chapter 4 for method details), and discusses the implications of the results for future research, campaign design, and the conduct of Study 3.

> *Research Question 2: Does this same pattern of influence of predictors of mitigation behaviours* [as found in Study 1] *apply in the Australian context?*

The Study 2 analysis of the CFM provided an opportunity to determine the efficacy of the model for Australian participants, and to examine the differences in influence of the predictors across behaviours and participant segments—as may have been masked through meta-analytic aggregation of data in Study 1. Few studies have examined the social-psychological predictors of mitigation behaviours with Australian samples, particularly across the breadth of pathways included in the CFM[41]. Those studies that have either did not test mediation pathways to behaviour, or tested only a subset of the variables of importance to campaign designers. White and Hyde (2012) and Yoon, Kyle, van Riper, and Sutton (2013) broadened theory of planned behaviour (TPB) models with one or two additional predictors and tested these using SEM, while Leviston, Greenhill, and Walker (2015) examined the relationship of 16 diverse predictors (e.g., trust, values, belief) of behaviour using multiple regression analyses. Study 2 moves these contributions forward by using SEM to test the path relationships of predictors in the CFM, which integrates diverse pathways to behaviour and focuses on the predictors of maximum relevance for campaign designers. Refer to Chapter 4 for a detailed description and justification of the study methods.

[41] Some studies have investigated the roles of just one or two predictors of behaviour (Lothian, 2002; Margetts & Kashima, 2017); used qualitative approaches (Higham, Reis, & Cohen, 2015; Perera & Hewege, 2013); examined the predictors of behaviour's predictors (Spies-Butcher & Stebbing, 2015); used predictors for audience segmentation rather than the prediction of behaviour (Hine et al., 2016; Morrison, Duncan, & Parton, 2013; van Riper, Kyle, Sutton, Yoon, & Tobin, 2013); or predicted adaptation rather than mitigation behaviours (Akompab et al., 2013; Reser et al., 2012a).

Sample Characteristics

The sample used in Study 2 was taken from a larger survey dataset collected by CSIRO from Australian participants in five sampling events from 2010 to 2014. The Study 2 sample included data from 2,427 participants ("the sample") covering a subset of the survey's collected measures from the 2010, 2013, and 2014 sampling events. The sample included slightly more males than females (51.5 percent and 48.5 percent, respectively). Participants were drawn from all of Australia's major states and territories as shown in Figure 26, with the majority of the sample drawn from New South Wales (30 percent), Victoria (26 percent), and Queensland (21 percent). The oldest participant was born in 1901, the youngest in 1994, and the median participant in 1956. The majority of participants (66 percent) were born in the 1940s to 1960s as illustrated in Figure 27. Participants generally had gross annual household incomes of less than $90,000 (64 percent as per Figure 28), and 70 percent had commenced or completed some form of trade or university qualification (refer to Figure 29). The significance of these characteristics for the analysis methods and generalisability of results, are discussed under Representativeness of the sample.

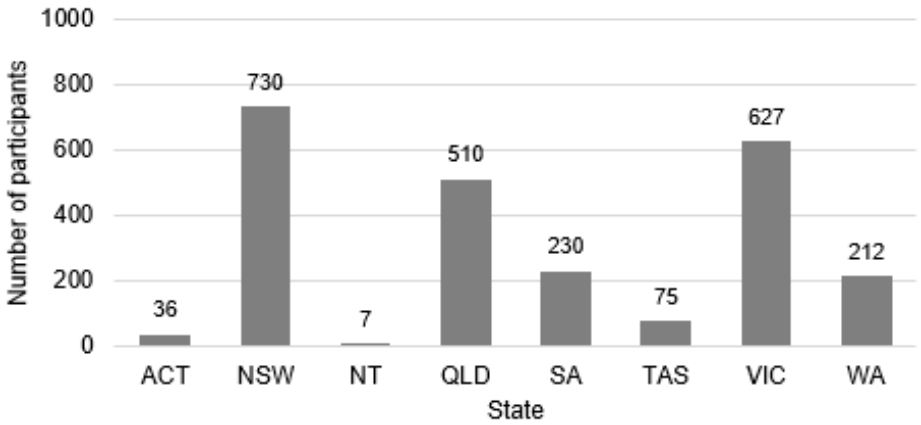

Figure 26. Number of sample participants from the major states and territories of Australia.

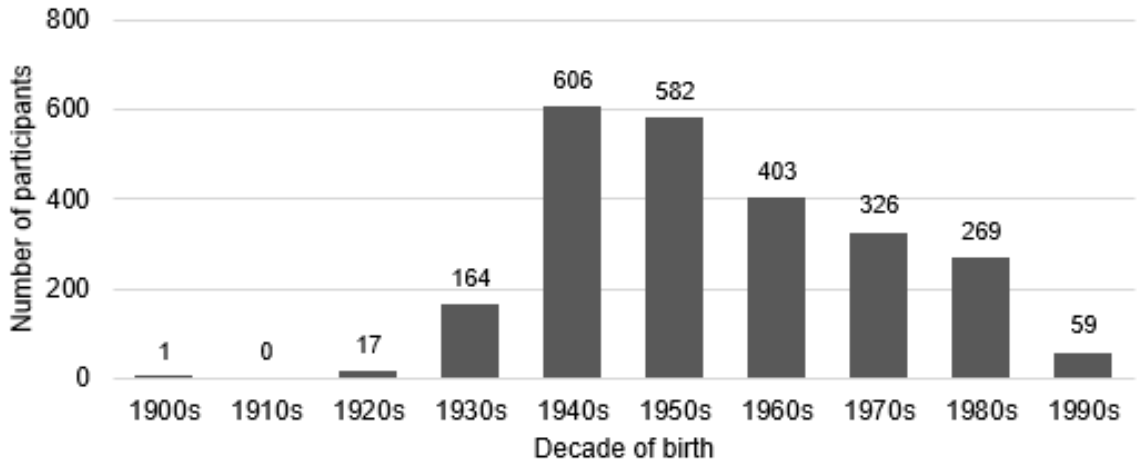

Figure 27. Number of sample participants born in each decade.

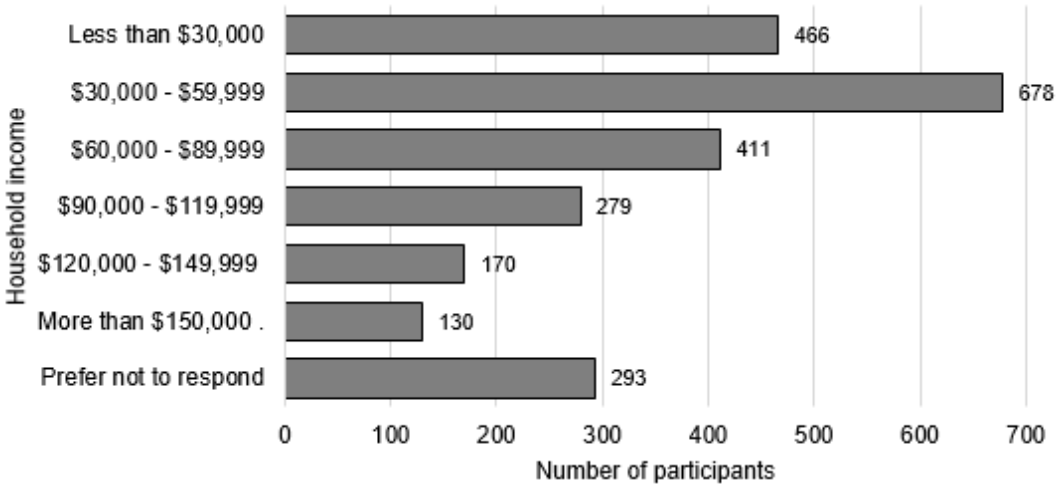

Figure 28. Number of participants reporting each category of gross annual household income.

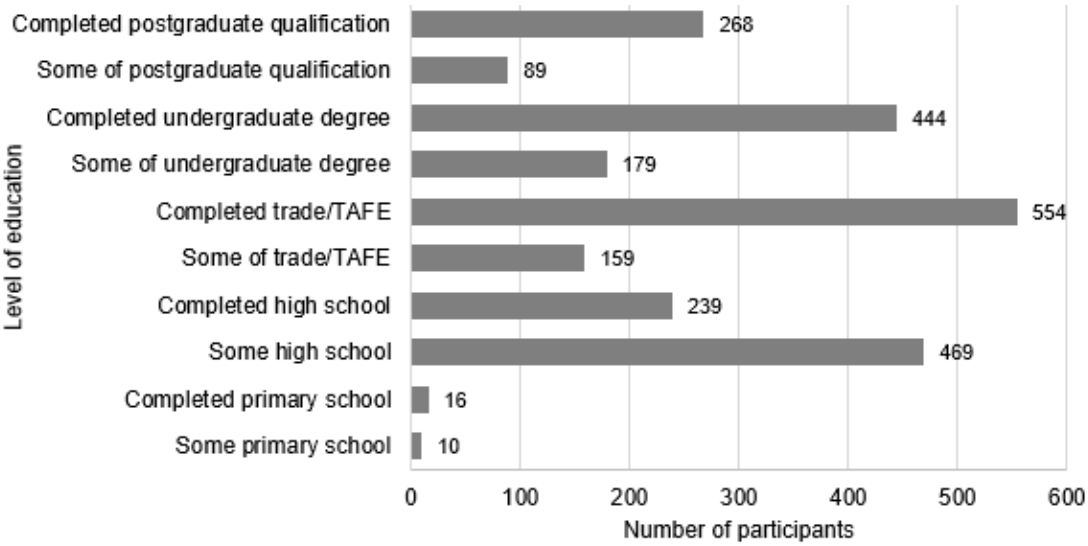

Figure 29. Number of participants reporting each category of highest education level.

Data Screening and Preparation

The appropriateness of analytic techniques depends on the characteristics and format of the data being analysed, so several pretests were undertaken at the outset. These tests included three components: examination of the representativeness of the sample by comparison against census statistics and the broader survey sample; confirmatory factor analysis (CFA) to confirm the appropriateness of selected measures for their respective predictor variables; and exploratory factor analysis (EFA) to identify behaviour groupings (refer to Chapter 4 for details on these approaches). This section outlines the results of these tests.

Representativeness of the sample. The representativeness of the Study 2 sample was assessed in two parts: demographic representativeness, and response representativeness for model variables. Demographic representativeness was assessed by comparison of the distribution of responses to demographic questions against characteristics of the Australian public as represented by Australian census data from 2010—for the full CSIRO sample of each wave, and the Study 2 sample (for the full Study 2 sample, and for those who repeated all three target survey waves). Response representativeness of the Study 2 sample was assessed against the responses of all participants in the relevant survey wave. As the dataset for participants who completed only the final two (but not first) survey waves was large (n = 2076) and was missing data for identity and attitude measures that were only measured in wave one, it was important to evaluate the impact of attrition. Reviews in this section therefore included analysis of the study subsample who completed all three waves (T1-T5 study subsample; n = 351) in comparison with the Study 2 subsample that completed only the final two waves (T4-T5 study subsample), and the full-wave CSIRO samples.

Assessment of the demographic representativeness of the full CSIRO sample and the Study 2 sample showed some differences from the Australian population. For the full CSIRO sample, the distribution of male and female respondents was generally consistent with the population for the 2013 and 2014 sampling events, however the 2010 data indicate an overrepresentation of males at 51.3 percent compared with the population's 49.9 percent[42] (Australian Bureau of Statistics, 2017b). The Study 2 T1-T5 subsample was similarly different from the Australian population, with males overrepresented at 51.5 percent. Males also comprised 63.0 percent of participants in the Study 2 T4-T5 subsample. Respondents across all waves of the full CSIRO sample tended to be older than the general population, with the majority of survey participants born in the 1940s to 1960s compared with the majority of the population born in the 1960s to 1980s (Australian Bureau of Statistics, 2017b)[43]. This skew also translated to the Study 2 sample as illustrated in Figure 30, and was particularly exaggerated in participants in the Study 2 T1-T5 subsample (refer to Appendix B for full listing of statistical test results). The potential effects of this skew on modelling results were mitigated by the adoption of two statistical techniques as described in detail in Chapter 4. The first was the full information maximum likelihood (FIML) approach for handling missing data, which utilises all the available variable data when estimating missing information, thus reducing the effects of bias. The second technique was the specification of full-wave variance for the estimation of identity and attitude, as this ensures the model adopts a spread of estimates to match the wider sample rather than the skewed subsample.

[42] The CSIRO dataset included metadata in the data file regarding interpretation of coding for gender only for the fifth wave, however, it was assumed that the same coding was applied for all waves.
[43] All participant ages were calculated from the Wave 5 responses to ensure comparability of the data.

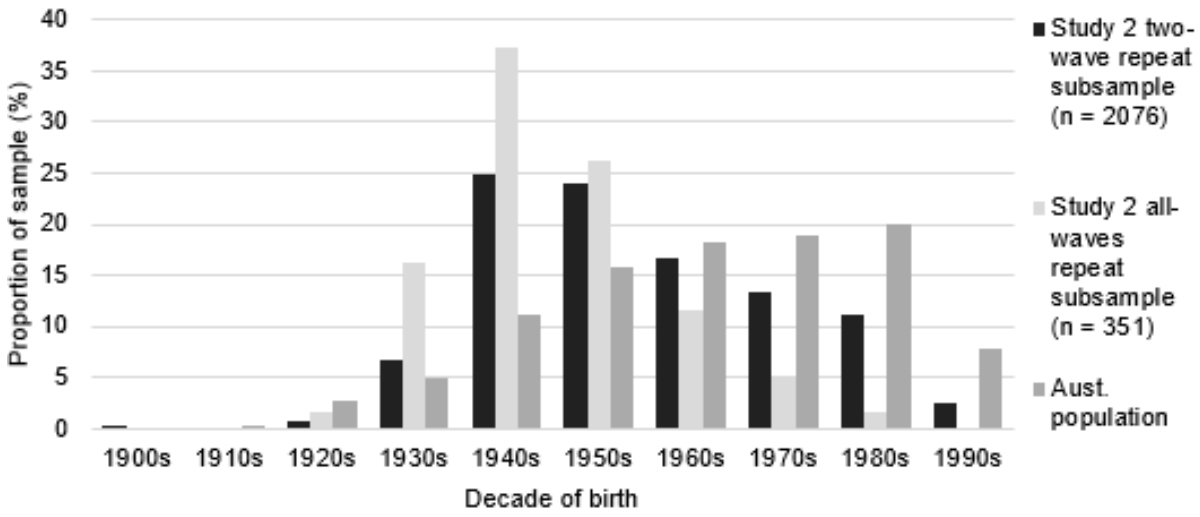

Figure 30. Decade of birth of Study 2 sample subsets in comparison with the distribution within the Australian population (over 18 years of age in 2010). Australian population data from Australian Bureau of Statistics (2017b).

There were varying levels of inconsistency between the full CSIRO sample, the Study 2 sample, and the Australian population regarding geographic distribution and household income. The pattern of distribution of the sample participants across States generally followed that of the general community, with more participants drawn from the states with larger populations (see Figure 31). Respondents in the full CSIRO sample across each survey wave generally reported lower household income than the broader Australian population, which was equally evident in the Study 2 subsample as shown in Figure 32. Education was unable to be assessed due to incompatible categorisations in the ABS and CSIRO surveys. Review of the relationship between income and behaviour was conducted as part of the model demographic analyses, but showed no clear influence so this sample deviation from the population was not deemed likely to have affected the study's results.

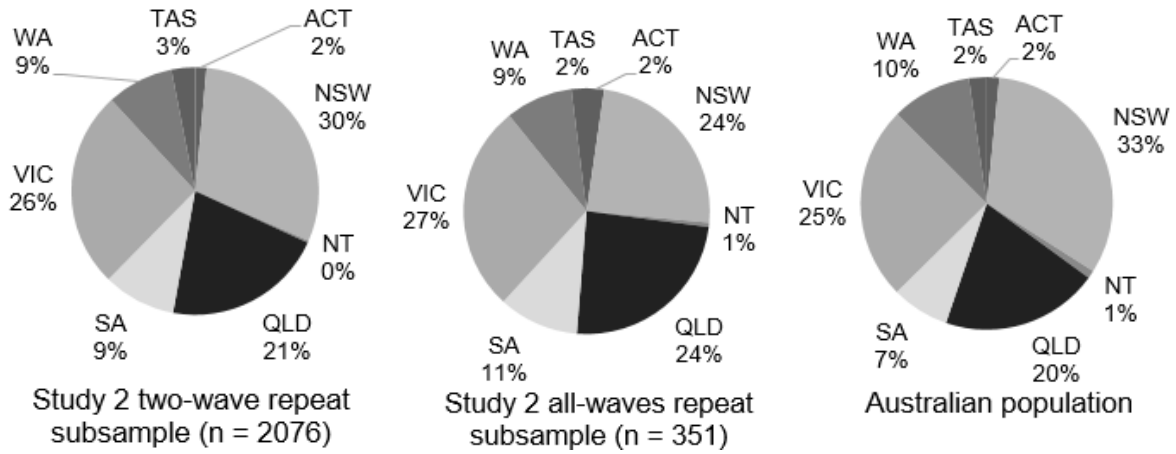

Figure 31. State or territory of residence of Study 2 sample subsets in comparison with the distribution within the Australian population. Australian population data from Australian Bureau of Statistics (2017b).

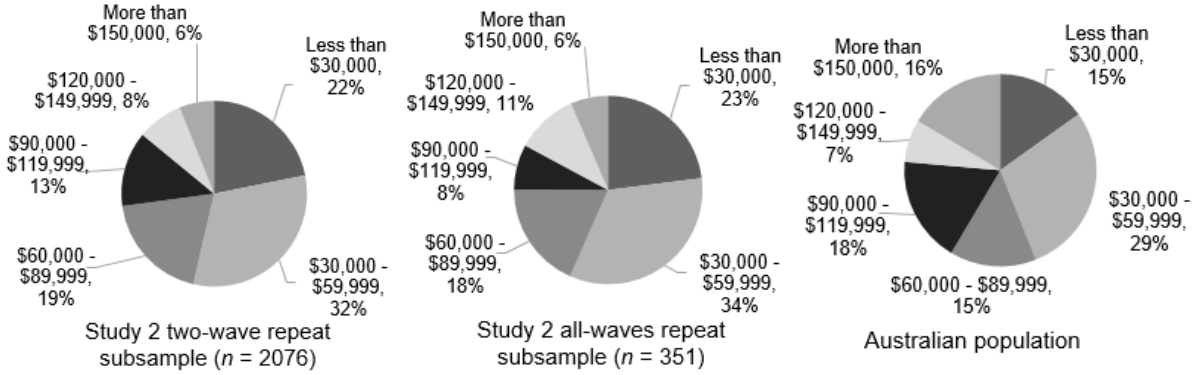

Figure 32. Household income of survey sample in comparison with the distribution within the Australian population. Australian population data from Australian Bureau of Statistics (2017b).

Exploratory factor analysis for mitigation behaviour grouping. EFA was conducted to determine the simplest and most logical categorisation that fit the data (Thompson, 2004) and provided behaviour groupings for SEM. The EFA was specified to test models consisting of 1, 2, 3, and 4 factors, and the recommended combination of both factor analyses and item response theory were used to evaluate the resulting measurement scales (Irwing, Booth, & Hughes, 2018). Factor analysis involved two evaluative tests: assessing model fit, and reviewing factor loadings. Model fit statistics were analysed against the standard criteria as discussed in earlier chapters. Table 12 lists fit statistics for each of the modelled factor sets—from 1 to 4 factors. Factor loadings (refer to Table 13) were also reviewed to identify the best fitting model in which each behaviour loaded onto just one of the factors (i.e., groupings that discriminated behaviours between categories) and had the simplest and most logical behaviour groupings (i.e., interpretable).

Table 12
Goodness of Fit Statistics for EFA of Behaviours

Model	Chi-square values	RMSEA[a]	CFI	SRMR
1 factor	1199.512 (*df* = 65, *p* < *.001*)	.084 [.080, .088]	.927	.106
2 factors	567.065 (*df* = 53, *p* < *.001*)	.062 [.058, .067]	.967	.070
3 factors	116.935 (*df* = 42, *p* < *.001*)	.027 [.021, .033]	.995	.029
4 factors	62.597 (*df* = 32, *p* = .001)	.020 [.012, .027]	.998	.021

Note. Acceptable model fit as specified by Hooper et al. (2008)[44], is indicated by Chi-square values with *p* > .05, RMSEA < .06 with 95 percent confidence interval between .00 and .08, SRMR < .08 (preferably < .05), and CFI ≥ .95. Studies with larger sample sizes, however, often fail the Chi-square criteria, so it is included here for reference only.
[a] 95 percent confidence intervals included in brackets.

[44] The PGFI statistic (as reported in Study 1) is not available from MPlus and so was excluded from reporting in Study 2.

Table 13
Factor Loadings for Categorising Behaviour

	One factor model	Two factor model		Three factor model			Four factor model			
Behaviour	l	1	2	1	2	3	1	2	3	4
Buy locally	.699	.395	.400		.392	.410		.393	.408	
Changed dietary practices	.572		.394	.820			.827			
Changed gardening practices	.680	.403	.370	.575			.600			
Energy conservation	.778	.804			.790			.790		
'Green' power use	.477		.374	.530			.565			
Low-carbon transport mode use	.348	.219		.326			.337			
Recycling	.669	.597			.550			.536		
Reduced petrol use	.661	.596		.324	.538		.329	.523		
Repairing broken items	.702	.725			.713			.706		
Switched to 'green' cleaning products	.905		.935			.940			.910	
Switched to 'green' products	.921		.973			.978			.993	
Switch off lights when leaving room	.900	.986			1.019			1.048		
Water conservation	.804	.904			.904			.922		.303
Scale reliability	.930	.902	.851	.739	.914	.905	As per three factor model			

Note. Loadings less than .300 have been suppressed as convention dictates these have limited contribution (Child, 2006). Scale reliability calculations included each behaviour only in the calculation for their single dominant factor.

Together these evaluative steps identified a three-factor structure as the most appropriate categorisation of the modelled behaviours (refer to Figure 33). The first category included three purchasing behaviours: changing to more environmentally-friendly cleaning products and general products, and buying locally. The second category included six curtailment behaviours relating to: electricity consumption, petrol consumption, car use, water use, switching off lights, and fixing broken items rather than replacing them. The final category—labelled *structural support behaviours*—are behaviours that require infrastructural support (personal or community) and ongoing commitment, and included: changed diet, changed gardening practices, purchase of 'green' power, and changed transport modes to more environmentally-friendly options. The scale reliabilities are listed in Table 13, and were calculated using item response theory. Each factor's scale was appropriately consistent ($\rho_{\text{structural needs}}$ = .739, $\rho_{\text{purchasing}}$ = .905, $\rho_{\text{curtailment}}$ = .914), with curtailment behaviours the most consistent and structural needs behaviours the least consistent.

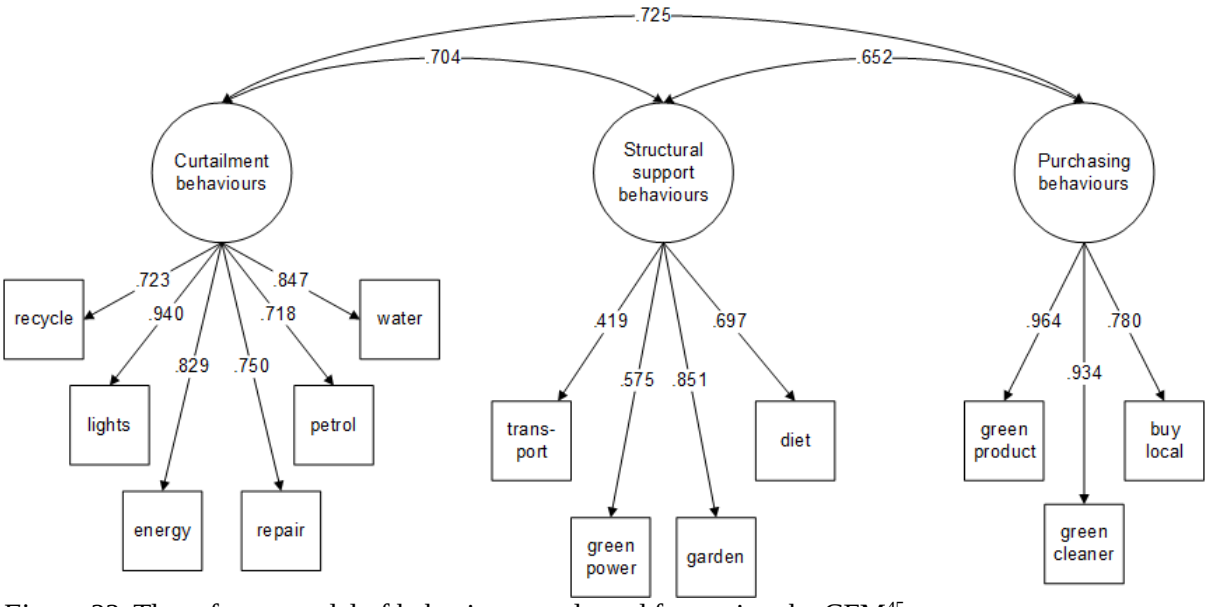

Figure 33. Three factor model of behaviour as adopted for testing the CFM[45].

Once these behaviour groupings were established, each participant's number of adopted behaviours within each category was calculated for use as the dependent variable in modelling. This summation process changed the behaviour data from binary (adoption vs non-adoption) to a count variable (censored at zero) and thus supported the use of the robust maximum likelihood (MLR) estimation method, which offers effective treatment of non-normally distributed data—as is the case for this dataset. A single behaviour index was also calculated, which was the number of all

[45] This diagram is based on the output of a CFA of the three factor model from the EFA (refer to Chapter 4 for details). This CFA was conducted to confirm that data reduction (i.e., removal of low-level cross-loadings) did not negatively influence the fit of the factor structure, χ^2 (62) = 375.384, $p < .001$, RMSEA = .045 [.041, .049], CFI = .980, SRMR = .054.

behaviours adopted by each participant. For models predicting individual behaviours, the binary nature of the dependent variable required the use of logistic regression techniques and so the WLSMV technique was adopted as recommended by the MPlus software developers (Muthén et al., 1997) and detailed in Chapter 4.

Confirmatory factor analysis for predictor variables. CFA was conducted in two parts to confirm the statistical appropriateness of individual survey items as indicators of the (latent) variables in the CFM: separate analyses for each variable, and inclusion of all variables together in a single discriminant analysis. While many studies use specifically designed scales that have undergone their own individual scale evaluation processes prior to combination with other scales, Study 2 utilised measures not previously combined for measurement of the target variables, thus requiring evaluation of scales through separate CFA prior to discriminant analysis. The separate CFA analyses were used to identify and exclude any indicators with low contribution to their assigned variable—i.e., a standardised loading closer to zero than ± .30 (Child, 2006). The combined discriminant analysis was used to confirm that the indicators were statistically relevant to only their own variable (i.e., discriminating between variables), resulting in the removal of indicators with significant cross-loading. A summary of the final model fit characteristics for each CFA is provided in Table 8. Acceptable model fit was separately achieved for all variables except social norms, which failed the RMSEA criteria due to high correlations between indicators. These correlations did not prevent the discriminant model from achieving all fit criteria, however. A visual representation of the final discriminant model is provided in Figure 34, illustrating the correlations between the latent variables, and the path weights for contributing indicators.

Table 14

Goodness of Fit Statistics for CFA of Latent Predictor Variables

Model	Indicators	Chi-square value	RMSEA[a]	CFI	SRMR
Attitudes					
Curtailment	4	21.622 ($df = 2$, $p < .001$)	.061 [.039, .085]	.958	.020
Structural support	3	-	-	-	-
Social norms	4	87.279 ($df = 2$, $p < .001$)	.127 [.105, .150]	.992	.009
PBC	5	22.220 ($df = 3$, $p < .001$)	.049 [.031, .069]	.991	.013
Discriminant		800.306 ($df = 98$, $p < .001$)	.052 [.049, .055]	.954	.040

Note. PBC = perceived behavioural control. The discriminant model included social norms, curtailment and structural support attitudes, and PBC. Acceptable model fit as specified by Hooper et al. (2008) is indicated by Chi-square values with $p > .05$, RMSEA < .06 with 95 percent confidence interval between .00 and .08, SRMR < .08 (preferably < .05), and CFI ≥ .95.

[a] 95 percent confidence intervals included in brackets.

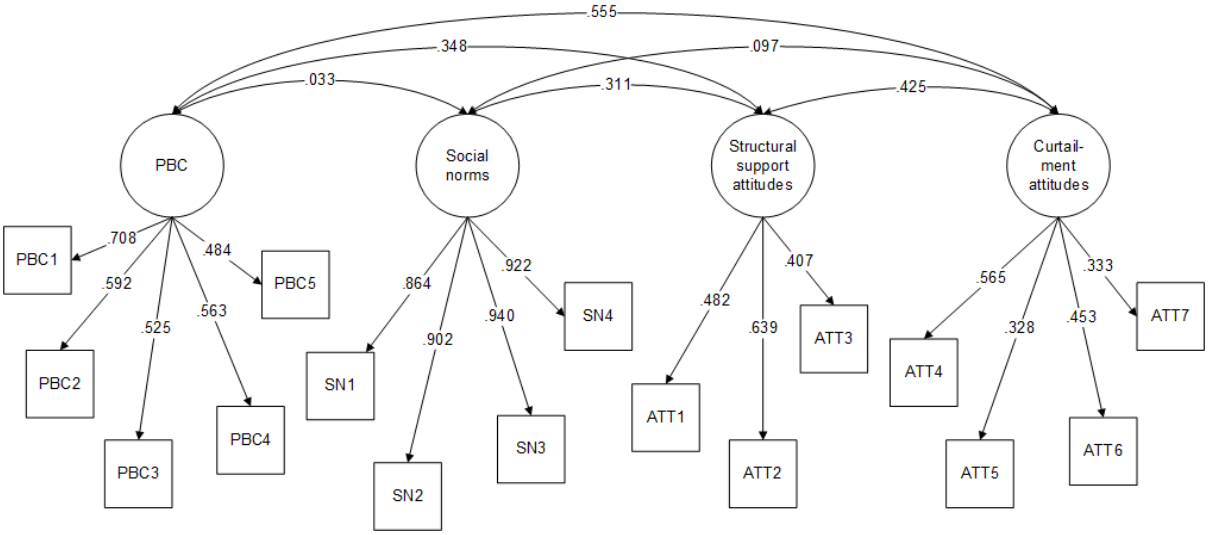

Figure 34. Discriminant model of the CFM predictors showing correlations and path weights.

The number of indicators for each predictor varied from one to five items, which meant not all variables could be tested using CFA, or modelled using latent variable analysis in the SEM. Item parcelling is frequently undertaken to simplify models, usually through the averaging or summing of indicator values (Wang & Wang, 2012). For consistency of treatment of variables, the indicators for each variable were parcelled together into a single measure[46]. As most of the indicators that could be tested, loaded with similar path weights onto their latent variable, averages were used to create single (parcelled) measures for all variables. This included social norms, perceived behavioural control (PBC), a collective measure of all attitudes, five single-behaviour attitude measures, and three categories of attitudes based on the behaviour groupings. Each aggregated attitude measure was labelled after its corresponding behaviour aggregation for ease of interpretation (e.g., curtailment attitudes relating to curtailment category behaviours). When items are parcelled into a single item, specification of the factor loading and the error variance is required to ensure the model is sufficiently specified for analysis (Matsunaga, 2008). Factor loadings must be fixed at 1.0, and the error variance is fixed at one minus the scale's reliability coefficient (i.e., Cronbach's alpha) multiplied by the variance of the composite-score (Matsunaga, 2008). As scale reliabilities are unable to be determined for scales with less than three items, no scale reliabilities were available for over half of the model parameters rendering a latent variable approach unfeasible. The all-item parcelled values were included in the model as observed variables, and path analyses were conducted in place of latent variable SEM. Path analyses are a special case of SEM where SEM accounts for measurement error

[46] A comparison analysis of the CFM with and without item parcelling showed improved fit for the parcelled model. Thus, the more parsimonious (parcelled) model was retained and presented in this chapter. The fit statistics of the unparcelled model, for comparison against the later presented CFM results (all behaviours as single factor), were: χ^2 (275) = 14701.219, $p < .001$, RMSEA = .037 [.034, .039], CFI = .943, SRMR = .134.

through the inclusion of latent variables whereas path analysis assumes that the observations directly represent the variables (Kline, 2011).

Results

This section reports the results of path analysis of the CFM and is separated into three parts: (a) testing the CFM and TPB comparison model using a single index of all behaviours, with modification of the CFM as appropriate; (b) testing the CFM for predicting grouped behaviours (i.e., curtailment, purchasing, and structural support behaviours); and (c) testing the CFM to separately predict four of the target behaviours where one or more attitude measures was available directly related to the specific behaviour (low-carbon transport use, changed dietary behaviour, fixing items rather than replacing, and recycling). This suite of analyses aimed to establish the efficacy of the CFM to predict mitigation behaviours, and to identify the similarities and differences in the patterns of influence of the predictors of different types and groupings of behaviour. Comparisons across participant segments were also undertaken at each level of behaviour grouping to determine predictor path differences such as might relate to different campaign audiences.

CFM and TPB models' prediction of single index of all behaviours. Initial testing of the CFM to predict all behaviours as a single indexed measure, failed to achieve model fit (refer to Table 15), with two unmodelled predictive relationships identified: between anticipated emotion and social norms, and between PBC and personal norms. Anticipated emotions are conceptualised as the result of pre-emptive evaluations of future compliance with, or violation of, expected standards of behaviour (i.e., personal norms; Schwartz, 1977). It therefore makes theoretical sense that social expectations of behaviour (i.e., social norms) may trigger similar anticipatory emotional responses. The CFM was revised to incorporate a path whereby anticipated emotions are predicted by social norms (in addition to the existing path to anticipated emotions from personal norms). Similarly, defensive responses to potential (or previous) implementation failure associated with low PBC may result in re-evaluation of personal norms to maintain a consistent self-image as posed by cognitive dissonance theory (see Festinger, 1957). Thus, a path from PBC to personal norms is theoretically justifiable and was added to the model. The model residual covariances and modification indices were also reviewed for each of the possible additional paths identified in the Study 1 correlation review of the CFM's structure (see Chapter 5): identity-social norms, identity-retrospective emotion, attitude-anticipated emotion, PBC-anticipated emotion, PBC-attitudes, and PBC-identity. There was no evidence to support the need for additional paths between these variables.

Table 15
Model Fit Statistics for CFM and TPB Model Predicting an Index of All Behaviours

Model	Robust χ^2	RMSEA	CFI	SRMR
CFM				
Original	533.157 (*df* = 24, *p* < *.001*)	.093 [.087, .100]	.890	.139
Revised	180.347 (*df* = 22, *p* < *.001*)	.054 [.047, .062]	.966	.125
+ demographics	340.966 (*df* = 42, *p* < *.001*)	.054 [.049, .060]	.942	.116
– identity	269.516 (*df* = 30, *p* < *.001*)	.057 [.051, .064]	.953	.098
TPB	80.922 (*df* = 5, *p* < *.001*)	.068 [.053, .084]	.937	.092

Note. Acceptable model fit as specified by Hooper et al. (2008), is indicated by Chi-square values with *p* > .05, RMSEA < .06 with 95 percent confidence interval between .00 and .08, SRMR < .08 (preferably < .05), and CFI ≥ .95.

Figure 35 illustrates the revised CFM with additional paths from PBC to personal norms and from social norms to anticipated emotions, and the results of testing this model to predict the adoption of all mitigation behaviours as a single group. The revised CFM showed improved model fit above the original CFM, achieving the criteria for RMSEA (.054 < .06) and CFI (.966 > .95), and approaching the SRMR criteria (.125 > .08), but continuing to fail the chi-square value significance criteria [χ^2 (22) = 210.032, *p* < *.001* > .05] as shown in Table 15. The ability of the CFM to predict the single index of behaviour was minimal, explaining only 11 percent of the variance in behaviour. This was surprising as the component theories of the CFM (e.g., TPB) typically offer moderate prediction of behaviour. It is likely that this disparity was due to issues with the data rather than the model, with the results for the comparison TPB model supporting this explanation. In contrast, generalised intention was well predicted by the model (73 percent of variance explained). Generalised intention offered moderate prediction of behaviour, with a path weight of .326. In contrast, PBC was not a significant predictor of behaviour—with a path weight of .033, which was neither statistically significant (i.e., *p* < .05) nor measurable (i.e., more than the .10 effect size threshold identifiable with this study's sample size)[47]. Personal norms were the strongest predictor of intention (*b** = .691), followed by anticipated emotions (*b** = .181), however attitudes and PBC were not significant predictors of intention ($b^*_{\text{attitudes}}$ = .054; b^*_{PBC} = .028). Personal norms also predicted attitudes (*b** = .379). Social norms were the strongest predictor of personal norms (*b** = .423), followed by PBC (*b** = .245), retrospective emotions (*b** = 161), and self-identity (*b** = 139). Anticipated emotions were jointly predicted by social and personal norms ($b^*_{\text{personal norms}}$ = .552, $b^*_{\text{social norms}}$ = .250).

[47] Based on a priori power calculations for minimum sample size determination.

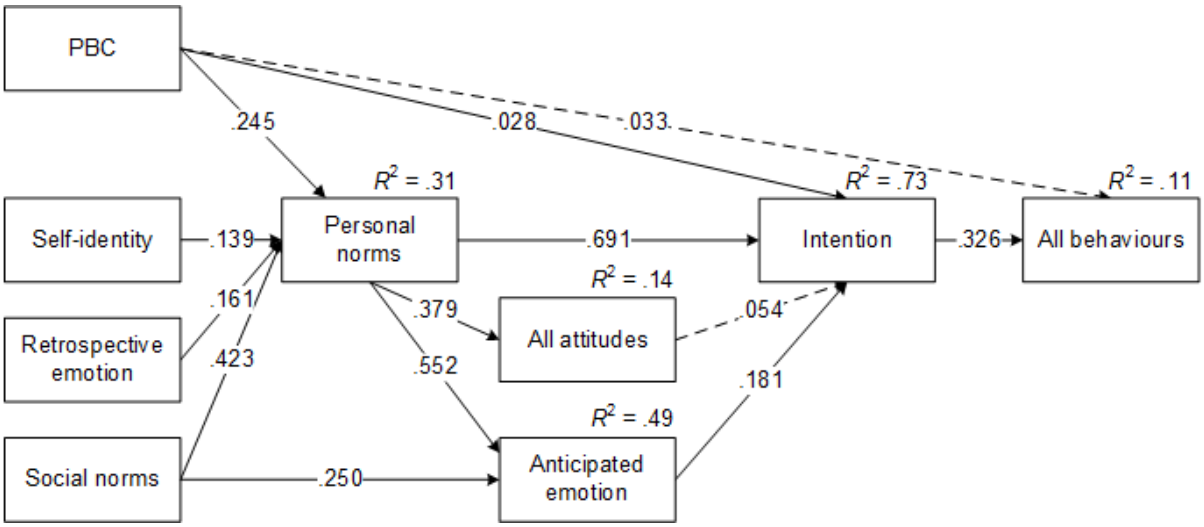

Figure 35. Path weights and explained variance for prediction of all behaviours (as single index) using the revised CFM. Dashed paths were not significant at .05.

The comparison TPB model shown in Figure 36 offered the same level of prediction of behaviour, however it's prediction of intention was substantially reduced. The poor behaviour prediction capability of this model is substantially less than typical for TPB models, which supports the explanation that data issues have reduced the prediction offered by both CFM and TPB models. The TPB model's prediction of intention was less than that of the CFM, with only 33 percent of variance explained in comparison with the CFM's 73 percent. In the TPB model, social norms were the strongest predictor of intention (b^* = .435), followed almost equally by attitudes (b^* = .290) and PBC (b^* = .231). This is in contrast to the typical pattern illustrated in previous meta-analyses such as Study 1, where social norms are typically the least predictive of intention. While this may be due to the generalised nature of the intention measure, the mediation role and high predictive contribution of personal norms in the CFM suggest that normative components may be of high importance for this sample and these behaviours.

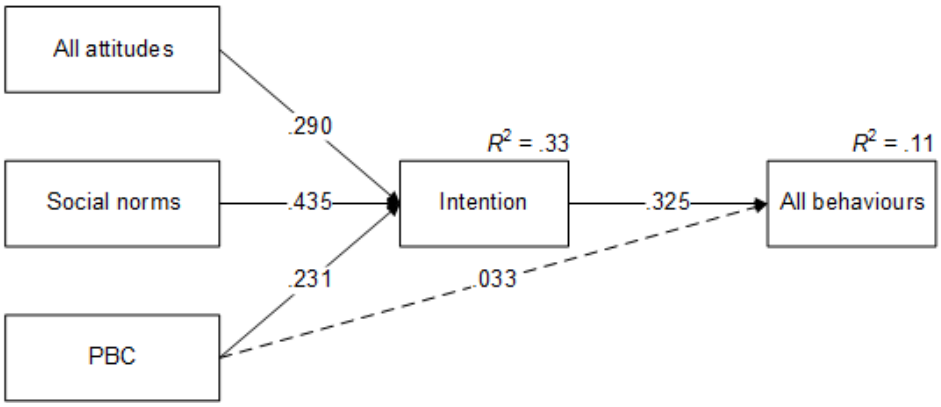

Figure 36. Path weights and explained variance for prediction of all behaviours (as single index) using the comparison TPB model. The dashed path from PBC to behaviour was the only path not significant at .05.

The inclusion of four demographic characteristics as control measures in the CFM (as direct predictors of behaviour) slightly affected the model fit (see Table 15). The included demographic variables were: year of birth, gender, level of education, and household income. They collectively reduced the CFI statistic to just below the relevant criterion, resulting in the model failing all except the RMSEA criterion. A review of the correlation data from this model suggested that only education and age showed relationships greater than .10 with any of the CFM variables, so these variables were used for comparative modelling across participant segments (similar to audience segments as might be used by campaigns for message targeting). While meta-analyses have not found age effects to retain significance across contexts and audiences, individual studies have found age to be related to various mitigation predictors and behaviours in some contexts (Trandafilović, Conić, & Blagojević, 2017; Wiernik, Dilchert, & Ones, 2016; Wiernik, Ones, & Dilchert, 2013). Level of education has also been found to influence behaviour, with meta-analyses indicating slightly more consistency in comparison with age (Hornik, Cherian, Madansky, & Narayana, 1995; Trandafilović et al., 2017).

To reduce the complexity of modelling and maintain analytical power, demographic categorisations were limited to between two and three groups. Two age groups were created based on review of the relationship between behaviour and age: those born before 1958 and those born from 1958 onwards. Three levels of education naturally occurred based on the categorisations in the survey and included at least partial completion of: school, trade/TAFE, and university. Comparative modelling of the CFM across these groups showed slight reductions in model fit such that all fit statistics failed to meet their criterion as listed in Table 16. A review of residual covariance matrix indicated that self-identity had considerable detrimental effect on the fit of these models due to unexplained covariances. This was likely due to the limited coverage of the self-identity concept that was offered by the single item measure. The removal of self-identity, however, did not support the models to achieve model fit so no further examination of the influence of demographic participant segmentation was conducted at this level of behaviour aggregation.

Table 16
Model Fit Statistics for Demographic Comparison Models Predicting Index of All Behaviours

Model	Robust χ^2	RMSEA	CFI	SRMR
Age groups	6321.712 (df = 48, p < .001)	.328 [.321, .335]	.000	2.949
– identity	532.604 (df = 30, p < .001)	.117 [.109, .126]	.889	.276
Education levels	6552.392 (df = 72, p < .001)	.334 [.327, .340]	.000	2.967
– identity	554.092 (df = 45, p < .001)	.118 [.110, .127]	.889	.281

Note. – identity indicates model excluding self-identity.

CFM prediction of behaviour by category. This section reports on testing of the revised CFM to predict mid-level grouping of behaviours: curtailment, purchasing, and structural support behaviour groups. The model fit statistics provided in Table 17 indicate that all three tests achieved model fit criteria for RMSEA and CFI, but failed the SRMR criteria. Examination of the influence of self-identity on model fit showed limited effect at this level of behaviour aggregation. Its removal marginally improved CFI across all models (which had already achieved the fit criterion), but reduced model fit according to SRMR values for all except purchasing behaviours, which were slightly improved. Reported path weights are for the full models including self-identity.

Path weights and explained variance are provided in Figure 37 for curtailment behaviours, Figure 38 for purchasing behaviours, and Figure 39 for structural support behaviours. There was minimal difference in the ability of the model to predict these behaviour groups ($R^2_{\text{curtailment}}$ = .08, $R^2_{\text{purchasing}}$ = .11, and $R^2_{\text{structural support}}$ = .04). The dominant paths identified in the earlier model predicting all behaviours as a single index remained strong for each of these behaviour groups, resulting in the same overall pattern of predictor influence across all groups with slight variations in weight for some paths. Intent remained a small to moderate predictor of behaviour ($b^*_{\text{curtailment}}$ = .272, $b^*_{\text{purchasing}}$ = .312, and $b^*_{\text{structural support}}$ = .200), and PBC remained below the measurable cutoff of .10 across all three models. PBC did not play a significant role in predicting intention or behaviour across these categories, with the normative pathways the only measurable contributors to intention. There was no change in the prediction of personal norms or anticipated emotion due to the lack of behaviour-specific measurement of those variables and all their predictors. The paths predicting intention also varied little, with personal norm path weights ranging from .689 to .707, and anticipated emotions path weights ranging from .181 and .182. The only variation in path weight that achieved the minimum .10 measurable difference across the three behaviour groupings was for attitudes predicted by personal norms, where personal norms best predicted curtailment attitudes and least predicted purchasing attitudes ($b^*_{\text{curtailment}}$ = .344, $b^*_{\text{purchasing}}$ = .233, and $b^*_{\text{structural support}}$ = .274). The inability of attitudes to predict intention was likely due to the mismatch in levels of behaviour-specificity of these two measures.

Table 17
SEM Model Fit Statistics for Separate CFM Prediction of Behaviour by Category

Behaviour category	Model	Robust χ^2	RMSEA	CFI	SRMR
Curtailment	CFM	178.322 (df = 22, p < .001)	.049 [.042, .057]	.972	.227
	– identity	94.529 (df = 14, p < .001)	.049 [.040, .058]	.982	.239
	Age groups	163.629 (df = 44, p < .001)	.047 [.040, .055]	.974	.238
	Education levels	183.867 (df = 66, p < .001)	.047 [.039, .055]	.975	.244
Purchasing	CFM	164.190 (df = 22, p < .001)	.049 [.042, .057]	.972	.105
	– identity	94.565 (df = 14, p < .001)	.049 [.040, .058]	.982	.076
	Age groups	173.743 (df = 44, p < .001)	.049 [.042, .057]	.973	.114
	Education levels	207.657 (df = 66, p < .001)	.052 [.044, .059]	.971	.128
Structural support	CFM	265.688 (df = 22, p < .001)	.062 [.054, .069]	.955	.195
	– identity	164.913 (df = 14, p < .001)	.067 [.058, .076]	.965	.201
	Age groups	238.120 (df = 44, p < .001)	.060 [.053, .068]	.957	.214
	Education levels	265.443 (df = 66, p < .001)	.061 [.054, .069]	.957	.226

Note. – identity indicates model excluding self-identity.

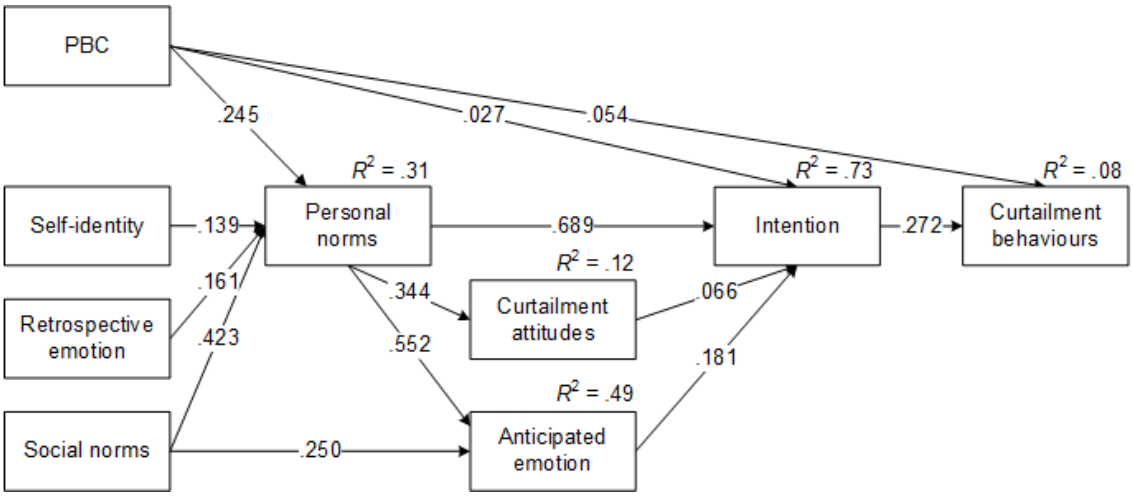

Figure 37. CFM path weights and explained variance for curtailment behaviours. All paths were significant at .05.

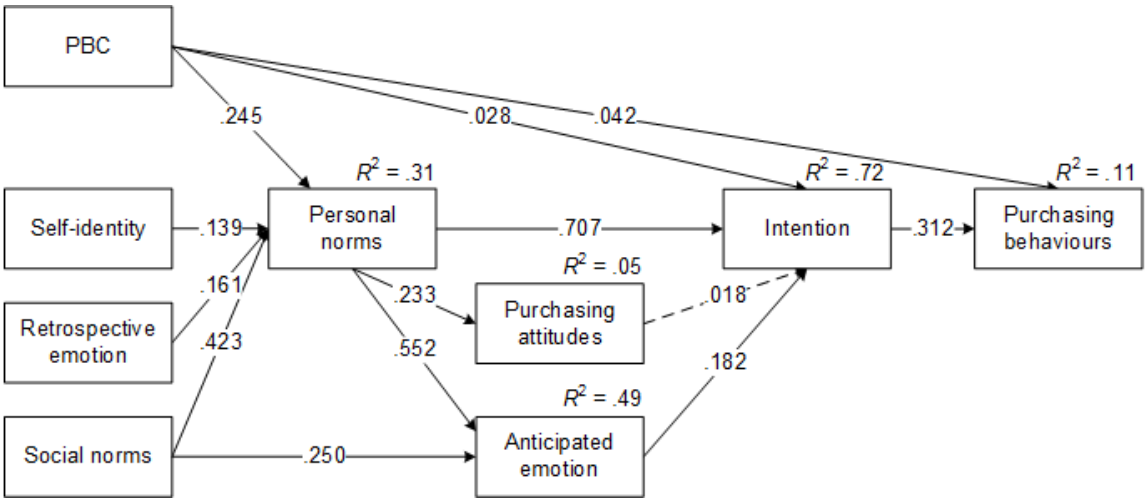

Figure 38. CFM path weights and explained variance for purchasing behaviours. The dashed path from attitude to intent was non-significant at .05.

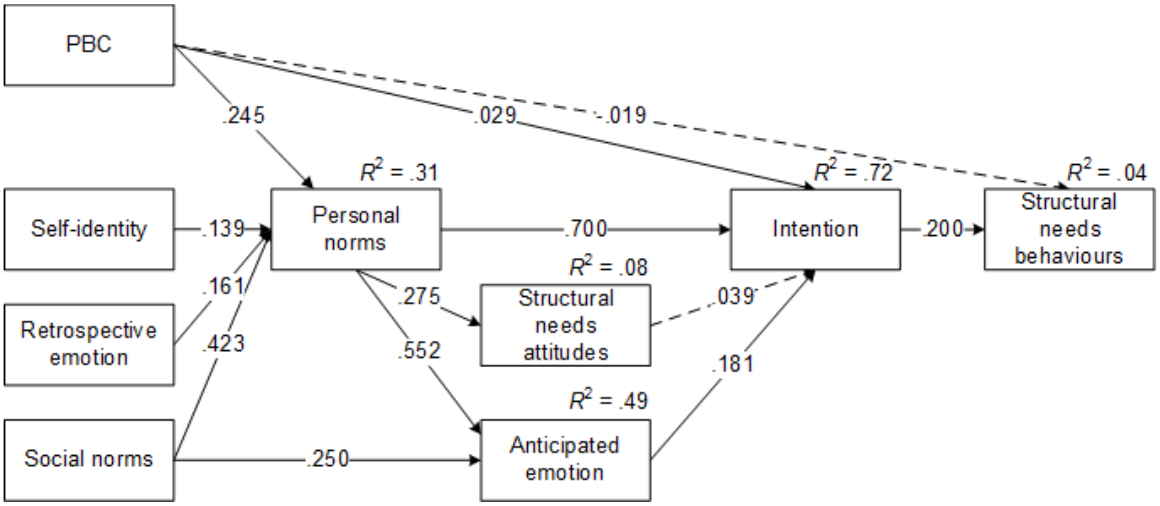

Figure 39. CFM path weights and explained variance for structural support behaviours. Dashed paths were non-significant at .05

For this level of behaviour aggregation, there was greater variation in the paths to behaviour between participant segments than there was across behaviour groups. The curtailment behaviours results from demographic segmentation comparison modelling are included in Table 18 for discussion, with model outputs for purchasing and structural support behaviours included in Appendix B. Measureable path differences were evident for curtailment behaviours across age groups for the paths for: (a) personal norms predicted by self-identity and by retrospective emotions, (b) attitudes predicted by personal norms, and (c) intent predicted by personal norms and anticipated emotions. Younger participants' personal norms were more strongly influenced by emotion and identity than were older participants. Personal norms then showed stronger prediction of attitudes, but lower prediction of intent for younger participants. Younger participants' intentions were also more strongly influenced by anticipated emotion than were those of older participants.

Table 18
Model Outputs for Education and Age Comparative CFMs for Curtailment Behaviours

	Age group		Education level		
Path	Younger	Older	School	Trade	University
Personal norms ← PBC	.244	.257	.186 [b]	.318 [bc]	.244 [c]
	[.215, .273]	[.231, .283]	[.149, .223]	[.283, .353]	[.215, .273]
Personal norms ← social norms	.452	.400	.388	.403	.452
	[.420, .484]	[.372, .428]	[.348, .428]	[.365, .441]	[.420, .484]
Personal norms ← retrospective emotion	.221 [a]	.114 [a]	.144 [b]	.086 [c]	.221 [b c]
	[.189, .253]	[.086, .142]	[.105, .183]	[.048, .124]	[.189, .253]
Personal norms ← self-identity	.172	.113	.277 [b]	.010 [bc]	.172 [c]
	[.110, .234]	[.044, .182]	[.186, .368]	[-.077, .097]	[.110, .234]
Anticipated emotion ← personal norms	.530	.565	.572	.557	.530
	[.500, .560]	[.540, .590]	[.537, .607]	[.522, .592]	[.500, .560]
Anticipated emotion ← social norms	.279	.231	.205 [b]	.256	.279 [b]
	[.249, .309]	[.204, .258]	[.168, .242]	[.218, .294]	[.249, .309]
Attitudes ← personal norms	.398	.292	.304	.279	.398
	[.340, .456]	[.238, .346]	[.231, .377]	[.202, .356]	[.340, .456]
Intent ← PBC	.034	.019	.026	.009	.034
	[.013, .055]	[.004, .034]	[.004, .048]	[-.011, .029]	[.013, .055]
Intent ← personal norms	.621 [a]	.736 [a]	.689 [b]	.776 [bc]	.621 [c]
	[.575, .667]	[.711, .761]	[.650, .728]	[.742, .810]	[.575, .667]
Intent ← anticipated emotion	.222 [a]	.152 [a]	.205 [b]	.105 [bc]	.222 [c]
	[.188, .256]	[.129, .175]	[.173, .237]	[.074, .136]	[.188, .256]
Intent ← attitudes	.112	.030	.025	.054	.112
	[.045, .179]	[-.003, .063]	[-.022, .072]	[-.001, .109]	[.045, .179]
Behaviour ← intent	.255	.284	.258	.305	.255
	[.222, .288]	[.260, .308]	[.224, .292]	[.271, .339]	[.222, .288]
Behaviour ← PBC	.079	.037	-.005 [bc]	.074 [b]	.079 [c]
	[.047, .111]	[.014, .060]	[-.037, .027]	[.042, .106]	[.047, .111]
R^2 (intent)	.712	.739	.725	.756	.712
	[.688, .736]	[.720, .758]	[.694, .756]	[.731, .781]	[.688, .736]
R^2 (behaviour)	.079	.087	.066	.113	.079
	[.063, .095]	[.074, .100]	[.050, .082]	[.093, .133]	[.063, .095]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences.

Differences in the paths across the three levels of education for curtailment behaviours showed variation across the same paths as for the age comparison, but with the addition of deviations in the influence of PBC on personal norms. The personal norms of those who had completed some level of school education were more strongly influenced by identity than were either the trade or university educated participants whose personal norms were more influenced by PBC (for trade trained) or PBC and retrospective emotion (for university trained). Anticipated emotion had less influence on intent for trade trained individuals than for either school or university trained participants. Comparison of age and education outputs also identified that the results for university trained participants were almost identical to the results for younger participants across all groups of behaviours. This may indicate cohort effects behind education levels such that some level of university training is more common for, and more representative of, the younger group.

Despite measurable differences in path weights across participant segments for these behaviour groups, the overall importance of paths (i.e., the relative dominance of each predictor) remained generally consistent. This may be due to the generalised nature of many measures and high concordance between some predictors (e.g., generalised personal norms and generalised intention), which may suggest confounding in the measures. While recognising this overarching measurement issue and it's likely impact on paths, improved understanding of nuances like these variations in the influence of the predictors of behaviour could provide substantial insight for campaign design. For example, knowing that appeals to environmental self-identities would likely be more effective for activating personal norms for younger individuals and less effective than PBC-related messages for trade-trained audiences could substantially change campaign messaging for more effective outcomes.

CFM prediction of specific behaviours. Specific attitude measures were available to support the prediction of four behaviours: changed dietary behaviour, recycling, repairing items rather than replacing them, and using low-carbon transport. Model fit was achieved for RMSEA and CFI across all base and demographic comparison models (refer to Appendix A for full list of these statistics), but the SRMR was substantially inflated due to residual covariance for self-identity hence the models reported in this section are for the CFM without self-identity[48]. The ability of the CFM to predict these four behaviours was low, explaining less than 7 percent of the variance in behaviour (see Table 19), however generalised personal norms continued to offer strong prediction of generalised intent (b^* = .718 to .771; R^2_{intent} = .743 to .751). Paths varied only marginally across behaviours in this testing using the full sample (i.e., unsegmented), with only the intent-behaviour path exhibiting measurable deviation. Generalised intent was least predictive of low-carbon transport use (b^* = .092, p = .001), and most predictive of recycling (b^* = .255, $p < .001$), with changed diet and repairing items falling between these (b^*_{diet} = .172, $p < .001$; and b^*_{repair} = .173, $p < .001$). The overall pattern of predictor dominance for these behaviours was similar to that of the grouped behaviours for the full sample (i.e. unsegmented).

[48] The removal of self-identity from these models typically reduced the SRMR values to less than half their original value, bringing all models' SRMR values to between .073 and .178.

Table 19
Model Outputs for CFMs for Specific Behaviours Using Unsegmented Data

	Behaviour			
Path	Changed diet	Low-carbon transport use	Recycling	Repairing items
Personal norms ← PBC	.391	.396	.398	.399
	[.369, .413]	[.374, .418]	[.376, .420]	[.377, .421]
Personal norms ← social norms	.547	.545	.543	.543
	[.532, .562]	[.530, .560]	[.528, .558]	[.528, .558]
Personal norms ← retrospective emotion	.175	.172	.172	.172
	[.161, .189]	[.158, .186]	[.158, .186]	[.158, .186]
Anticipated emotion ← personal norms	.586	.582	.579	.581
	[.574, .598]	[.570, .594]	[.567, .591]	[.569, .593]
Anticipated emotion ← social norms	.280	.284	.286	.284
	[.265, .295]	[.269, .299]	[.271, .301]	[.269, .299]
Attitudes ← personal norms	.333	.274	.283	.324
	[.290, .376]	[.227, .321]	[.241, .325]	[.269, .379]
Intent ← PBC	.031	.028	.027	.025
	[.017, .045]	[.014, .042]	[.013, .041]	[.011, .039]
Intent ← personal norms	.740	.740	.718	.771
	[.724, .756]	[.726, .754]	[.704, .732]	[.752, .790]
Intent ← anticipated emotion	.145	.146	.153	.143
	[.132, .158]	[.134, .158]	[.140, .166]	[.130, .156]
Intent ← attitudes	.036 [a]	.032 [b]	.092 [ab]	-.062 [ab]
	[.006, .066]	[.003, .061]	[.067, .117]	[-.101, -.023]
Behaviour ← intent	.172 [a]	.092 [ab]	.255 [ab]	.173 [b]
	[.143, .201]	[.063, .121]	[.224, .286]	[.137, .209]
Behaviour ← PBC	-.039 [ab]	-.034 [c]	.089 [ac]	.065 [bc]
	[-.078, .000]	[-.075, .007]	[.042, .136]	[.011, .119]
R^2 (intent)	.749	.743	.751	.745
	[.740, .758]	[.734, .752]	[.752, .760]	[.735, .755]
R^2 (behaviour)	.028	.008	.076	.036
	[.018, .038]	[.003, .013]	[.060, .092]	[.023, .049]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences.

Segmentation of participants by age and by education again showed measurable differences across a selection of paths, and nearly identical results for the younger age group and the university level education category. The same overarching patterns of predictor dominance also applied across theses comparison groups, however more paths showed measurable differences than was found for grouped behaviours. Results from predicting changed dietary practices are presented in Table 20, with the model results for the remaining three behaviours included in Appendix B.

The most substantial deviations in path weights for changed diet practices occurred for the relationships between (a) intent and behaviour, (b) anticipated emotions and intention, and (c) personal norms and attitudes. The intent-behaviour path did not reach measurable level for school trained individuals, but had path weights of .237 and .223 for trade and university trained participants, respectively. Anticipated emotions were more influential predictors of intentions for university trained participants (b^* = .200) than for school trained individuals (b^* = .144), and least predictive for those who were trade trained (b^* = .058). University trained individuals showed a considerably

stronger influence of personal norms on attitudes ($b^* = .430$) compared with those of the other participant segments ($b^*_{school} = .218$, $b^*_{trade} = .239$). These results suggest that nuanced differences in paths do exist across behaviours and audiences, although the lack of behaviour-specificity of many measures restricted the potential of the model for identifying these.

Table 20
Model Outputs for Education and Age Comparative CFMs for Changed Diet Behaviours

	Age group		Education level		
Path	Younger	Older	School	Trade	University
Personal norms ← PBC	.357 [a] [.322, .392]	.440 [a] [.410, .470]	.384 [b] [.338, .430]	.486 [bc] [.447, .525]	.357 [c] [.322, .392]
Personal norms ← social norms	.576 [a] [.553, .599]	.526 [a] [.506, .546]	.534 [.503, .565]	.515 [b] [.488, .542]	.576 [b] [.553, .599]
Personal norms ← retrospective emotion	.227 [a] [.206, .248]	.135 [a] [.116, .154]	.166 [b] [.138, .194]	.106 [b] [.081, .131]	.227 [b] [.206, .248]
Anticipated emotion ← personal norms	.563 [a] [.544, .582]	.605 [a] [.590, .620]	.617 [b] [.595, .639]	.590 [.568, .612]	.563 [b] [.544, .582]
Anticipated emotion ← social norms	.321 [a] [.296, .346]	.247 [a] [.228, .266]	.223 [b] [.196, .250]	.273 [.245, .301]	.321 [b] [.296, .346]
Attitudes ← personal norms	.430 [a] [.369, .491]	.243 [a] [.181, .305]	.218 [b] [.129, .307]	.239 [c] [.156, .322]	.430 [bc] [.369, .491]
Intent ← PBC	.050 [a] [.026, .074]	.003 [a] [-.015, .021]	.011 [-.016, .038]	-.005 [b] [-.030, .020]	.050 [b] [.026, .074]
Intent ← personal norms	.682 [a] [.649, .715]	.798 [a] [.780, .816]	.742 [b] [.717, .767]	.840 [b] [.813, .867]	.682 [b] [.649, .715]
Intent ← anticipated emotion	.200 [a] [.178, .222]	.093 [a] [.077, .109]	.144 [b] [.121, .167]	.058 [b] [.034, .082]	.200 [b] [.178, .222]
Intent ← attitudes	.016 [-.040, .072]	.057 [.021, .093]	.099 [.038, .160]	.026 [-.017, .069]	.016 [-.040, .072]
Behaviour ← intent	.222 [a] [.178, .266]	.132 [a] [.092, .172]	.016 [bc] [-.041, .073]	.237 [b] [.184, .290]	.223 [c] [.179, .267]
Behaviour ← PBC	-.104 [-.162, -.046]	-.012 [-.066, .042]	.055 [b] [-.023, .133]	-.081 [-.156, -.006]	-.104 [b] [-.162, -.046]
R^2 (intent)	.719 [.704, .734]	.777 [.766, .788]	.768 [.748, .788]	.786 [.771, .801]	.719 [.704, .734]
R^2 (behaviour)	.048 [.029, .067]	.017 [.007, .027]	.002 [-.002, .006]	.051 [.028, .074]	.048 [.029, .067]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences.

Discussion

This study aimed to answer the second research question by building upon the findings of Study 1 through testing the CFM with data from Australian participants. While Study 1 was unable to test the CFM using its sample of published international research, the heterogeneity of the Study 1 data combined with examples from the literature, suggested that data aggregation may mask important differences in the influence of the predictors of behaviour. Such deviations in predictor influence may provide behaviour change campaign designers with more refined target variables for campaign messages. Study 2 thus applied the CFM across varying levels of behaviour aggregation, and

compared audiences segmented by age and by level of education. Study 2 used data from the most comprehensive climate change psycho-social survey dataset available for Australia. Substantial limitations in the data, however, negatively impacted on the ability to effectively model behaviour and thus identify the most influential predictors for campaign targeting to accelerate climate change mitigation.

Data issues and assessing the CFM. The CSIRO surveys were originally designed to explore "the ways in which Australians think about climate change, and the activities they are undertaking to mitigate or adapt to its impacts" (Leviston et al., 2015, p. 1), and while many of the variables of the CFM were collected as part of these surveys, this collection was not necessarily with the intent of predicting mitigation behaviour. Thus, despite the CSIRO survey data being the most comprehensive and extensive dataset available on the psycho-social predictors of Australians' mitigation behaviour, issues arose relating to the dataset's coverage and conceptualisation of measures.

The lack of a measure for habit within the CSIRO dataset required the omission of this key variable from the tested model. Habit has been shown to be a moderate predictor of behaviour due to its ability to override intentions at the point of implementation (Klöckner, 2013), and can lead to feedback loops through other predictors that effectively reduce the likelihood of intentions forming (Klöckner & Matthies, 2004). The absence of habit in the tested CFM likely reduced the model's ability to predict not only behaviour, but also personal norms, PBC, and intention. The full CFM should be tested in future research to better determine the model's efficacy and the relative influence of habit for different behaviours and audiences.

The fit and predictive ability of the tested CFM (excluding habit) were both less than ideal, likely due to issues regarding the correspondence of measures with the CFM variables' conceptualisations. While the measure adopted for intentions was more abstract than is typically used, only generalised rather than the usual behaviour-specific measures were available for intentions, personal and social norms, PBC, and anticipated emotion. Ideal measures of intention as intended in the CFM stem from TPB and involve both behavioural and temporal specificity, for example, "I intend to engage in household recycling during the next fortnight" (White & Hyde, 2012, p. 790). The adopted intention measure, however, was substantially more abstract and generalised, using the language of 'willingness'. While willingness has been used by several researchers as surrogates for intention in TPB studies (e.g., Chan & Bishop, 2013; Kim et al., 2012; Minton & Rose, 1997), this is not an ideal match with the theory's conceptualisation.

The intention measure was also generalised (rather than behaviour-specific) and temporally removed from the measurement of behaviour, as were the measures of several other variables. The use of generalised measures has been raised previously as an explanation for poor prediction of

specific behaviours (Ajzen, 1991). Delays between the measurement of intention and behaviour have also been shown to weaken their predictive relationship (Ajzen, 1985). The tested CFM explained only 11 percent of the variance in the fully aggregated behaviours and up to seven percent of the variance for specific behaviours. Comparative testing of a TPB model—which is typically offers acceptable fit and moderate prediction of behaviour (e.g., Armitage & Conner, 2001; McEachan et al., 2011)—showed similarly poor fit and low predictive capacity to that of the CFM when tested with the Study 2 data. The impact of these generalised measures was also more pronounced at the level of specific behaviours where a combination of aggregated and specific measures were included in each model. This provides support for the detrimental effect of generalised measures and suggests that the Study 2 tests do not fully represent the potential of the CFM for predicting mitigation behaviour. There is still the possibility that the CFM is simply not a good representation of the relationships between the predictors of mitigation behaviours, however, and further testing of the CFM with conceptually congruent measures for each variable would enhance understanding of the efficacy of the model, and the relative influences of each predictor across behaviours.

Behaviour groupings. The grouping of behaviours is not commonly undertaken within research on mitigation behaviours (Dono et al., 2010), especially within the frequent, household behaviours upon which this thesis focuses. In the sample articles used in Study 1, 79 percent of articles tested specific behaviours (e.g., recycling or public transport use), and 25 percent used an index of multiple general behaviours similar to the single index of all behaviours in this study[49]. Three categories of behaviour were identified and utilised in Study 2: curtailment behaviours, purchasing behaviours, and behaviours requiring structural support and commitment. Few other studies were identified that conducted categorisations of behaviour, although categorisations are frequently applied at broader scales that would place all of this thesis' focal behaviours in a single category (for example, see Kneebone, Fielding, & Smith, 2018). Similar to Study 2, Barr, Gilg, and Ford (2005) also found three behaviour categories, although these were slightly different to those found in Study 2. Barr, Gilg, and Ford did not study quite the same suite of behaviours as Study 2[50], however they identified purchasing behaviours as one group and included curtailment behaviours in a second group (labelled 'habit'). In contrast to Study 2, their third factor was composed solely of recycling behaviours.

[49] Some studies analysed both separate behaviours and aggregated behaviours (uncategorised), so the sum of the two categories is more than 100 percent.

[50] Barr, Gilg, and Ford (2005) did not study transport or dietary behaviours as were included in Study 2's structural support behaviour category.

From a theoretical perspective, Study 2's behaviour categories can be explained with reference to psychological and structural barriers. Stern (2011) rationalises the separation of energy related curtailment and efficiency behaviours through explanation of the psychological differences between them, whereby reduced energy consumption due to curtailment behaviours is perceived as sacrifice, while reduced energy consumption due to more energy efficient appliances is not perceived as sacrifice. Similar justification can be used to support the separate categorisations of curtailment and purchasing behaviours found in Study 2. The structural support behaviours identified in Study 2 have the lowest adoption rate of all the behaviour categories—at just over half the rate of adoption of curtailment behaviours. The importance of practical barriers to adoption such as the availability of resources and necessary infrastructure, has been raised by many scholars (e.g., Ajzen, 1991; Chen & Tung, 2010; Klöckner 2011; Kollmuss & Agyeman, 2002; Stern, 2000; Triandis, 1977). Less commonly performed behaviours—including those found in the structural support group—may have common barriers and effort requirements rather than common adoption. This category, however, also has the lowest scale reliability, which suggests there is more variability among these behaviours than exists among behaviours within the other two categories.

In predicting the adoption of these different behaviour categories and specific behaviours, Study 2 found some support for the Study 1 suggestion that grouping behaviours may be mask valuable nuances in which predictors are effective targets for campaign interventions. This will be discussed along with audience characteristic implications in the following section.

Addressing Research Question 2.

Research Question 2 focused on the patterns of influence of behaviour's predictors in the Australian context and, despite its various challenges, Study 2 provided initial indications of important relationships and differences in predictor influence across behaviours. Study 1 and Study 2 both provided TPB model results that support a basic level of comparison across a subset of CFM pathways, and Study 2 provided results for a broader range of paths for the Australian context.

The TPB models from Study 1 and Study 2 showed only slightly different patterns of influence for the included predictors, with the overall magnitude of path weights typically remaining within the same band (i.e., moderately large paths tended to remain so, while small paths remained small). The only TPB path that substantially varied across studies, was that for intention predicted by social norms. The international meta-analytic data from Study 1 highlighted social norms as the least predictive of intentions' contributing variables (below that of attitudes and PBC), which is common in TPB meta-analyses (e.g., Armitage & Conner, 2001; McEachan et al., 2011; Rivis et al., 2009). In contrast, Study 2's TPB model showed social norms as being the most predictive of intentions. Individual TPB studies have rarely found this to be the case, although the influence of social norms does vary (e.g., Harland et al., 1999; Heeren et al., 2016). The pattern of dominance between

intention and PBC as predictors of behaviour remained constant between Study 1 and Study 2. Intention was more predictive than PBC as is typically the case in TPB models (e.g., McEachan et al., 2011; Rivis et al., 2009) and both path weights reduced by about .10 between studies. PBC often has a stronger contribution to behaviour than evidenced in Study 2, but does vary in strength (e.g., McEachan et al., 2011; Rivis et al., 2009), particularly at the level of specific behaviours (e.g., Heeren et al., 2016).

The CFM's additional normative pathways were the most predictive of intentions in Study 2, dominated by personal norms. Testing across three different levels of aggregation of behaviours, and participant segmentations based on two separate demographic characteristics, showed very similar patterns of predictor dominance. Path weights did vary across the less aggregated behaviours, and across participant segments, however these tended to be insufficient to overshadow the dominant paths (although some almost reached equal influence). Similar to the stronger normative path identified in the Study 2 TPB model, social norms were typically the strongest predictor of personal norms in the CFM. Personal norms were then the strongest predictor of intention, and intention was the dominant predictor of behaviour. The strength of intention's influence on behaviour varied, however, with the most pronounced deviation at the level of specific behaviours. The data challenges faced in this study likely contributed to the seemingly static pattern of predictor influences, as the preponderance of generalised measures reduced the potential for variability across behaviours. This also explains why more pronounced changes in path weights were evident with participant segmentation rather than across behaviours.

These relationships also tend to be slightly different than that found in meta-analyses, but are not without precedent in individual population studies. The dominance of personal norms as predictors of intention has varied considerably across studies, but may be an indication of measurement confounding. A meta-analysis by Rivis, Sheeran, and Armitage (2009) found the influence of personal norms on intention to be stronger for behaviours that could be considered moral in nature, but to be a lower predictor on average than either PBC or attitudes. Individual studies, however, have shown the influence of personal norms as ranging from having dominant to low influence on intention in comparison to TPB predictors (Harland et al., 1999; Sparks et al., 2014). Similarly, the relationship between intention and behaviour also tends to vary to some extent across behaviours (McEachan et al., 2011), although typically showing stronger influence than that found in Study 2. The more specific are intentions, the more predictive they are of behaviour (van Osch, Lechner, Reubsaet, & De Vries, 2010), and the closer they are measured to behaviour, the more predictive they are (Ajzen, 1985). Thus, the lack of behavioural specificity, the temporal delays, and the level of abstraction (as 'willingness') are the likely explanations for the reduced predictive relationship between intention and behaviour in Study 2.

Campaigns aiming to influence the mitigation behaviours of Australians would benefit from understanding the potential importance of normative pathways (e.g., through personal norms), and that generalised intentions are not good indicators of behaviour implementation—neither specific behaviours, nor in aggregate. This is particularly the case for the less commonly implemented and more structurally reliant behaviours such as changing transport modes. Beyond understanding the power of the identified dominant pathways to behaviour adoption, appreciating the nuances in the strength of other paths for different audiences offers valuable support for campaign targeting. For example, the influence of PBC on personal norms was almost as high as that of social norms for trade trained individuals in the context of changing dietary practices. Such knowledge offers additional message tailoring opportunities that could increase campaign effectiveness.

Summary and Implications

The data limitations of this study reduced the depth and complexity of its knowledge outcomes, but Study 2 offered tentative support for the CFM and further evidence of the valuable role of normative pathways in addition to rational choice pathways for predicting mitigation behaviours. This study tested the CFM using data from an Australian sample, identifying variability in the influences of some predictors across the different levels of behaviour aggregation. It also confirmed that participant/audience segmentation can highlight deviations in the influence of predictors that are of value for campaign targeting. The variability in the influences of some predictors across the different levels of behaviour aggregation suggest that even aggregation to category levels may mask nuances in predictor influence that may be of importance for effective behaviour change campaigns. As aggregation is common in research on environmental and climate change mitigation behaviour, this finding also raises important considerations for the design of future research, which should further examine if any form of behaviour grouping can be effective without masking valuable insights for behaviour change. The importance of audience characteristics, while of significance to campaign designers in terms of targeting campaigns, may also be of considerable importance to policy and infrastructure decision-makers to identify and address structural and societal barriers to adoption that may be outside campaign capacity to influence (e.g., income or home ownership). Future research should examine the level of grouping of behaviours and audiences that can be effectively adopted in predictive models that aim to support campaign designs. The lack of behaviour-specific and temporally proximal measures reduced the ability of the tests to confirm the value of the CFM as an integrated theoretical model of behaviour, however there was tentative evidence of its efficacy through positive comparison against a TPB model. Further research on the CFM is recommended with behaviour-specific data to evaluate the efficacy of the model for explaining mitigation behaviour, to confirm the patterns of influence of predictors for different behaviours, and to investigate the practical significance of a range of audience characteristics.

The implications of Study 2 for Study 3 were incorporated into Research Question 4, which focused on investigating campaign design processes relating to the findings of Study 1 and Study 2. Two specific subquestions were created that were also incorporated in the Study 3 interview questions. Research Question 4a asked: To what extent does audience targeting include demographic considerations with respect to current adoption of behaviours, and structural and societal barriers to adoption? Research Question 4b inquired: If practitioners target a range of behaviours (either within or across campaigns), to what extent are their theoretical frameworks (if any) and audience targeting applied differentially across behaviours?

Chapter 7: Study 3 – Campaign Designer Perspectives and Processes

Study 3 builds upon the findings from Study 1 and Study 2 to address the third and fourth research questions by establishing: (a) the level of use, and barriers to use, of behaviour research in campaign design; and (b) the extent to which campaign processes reflect the findings of Study 1 and Study 2. This chapter provides an overview of the Study 3 interview sample, and analyses the interview findings in the context of the campaign and behaviour research literature covered in Chapters 2 and 3.

Research Question 3: What barriers prevent or limit campaign designers' use of behaviour research to inform campaign design and why might this be the case?

Research Question 4: To what extent do campaign processes reflect the findings of the quantitative analyses of this thesis?

Considerable research has yielded valuable knowledge regarding the psychology of mitigation behaviour, and campaign media effects, however effective campaign application of this knowledge rests with practitioners. Translating the knowledge gained through research relevant to climate change mitigation campaigns, and making it accessible for practitioner learning, are challenging processes. Learning is a social process, and can occur through a variety of mechanisms (Bandura, 1986). There is considerable volume of mitigation psychology and climate change communication research knowledge available, some of which has been synthesised into guidance material for practitioners. A review of the guidance literature (see Chapter 2) found such guidance is typically provided as highly generalised rules of thumb, usually without clear advice on how to distinguish which factors are appropriate to target, using which strategies, in any specific campaign instance. Study 1 and Study 2 findings also suggested that the generalised nature of campaign guidance material, and the complexities of the mitigation psychology academic literature may not provide advice in forms and with the level of specificity that meets the needs of campaign practitioners. Study 3, therefore, examined practitioners' perceptions of, and engagement with, campaign guidance material and academic literature, as well as the design and evaluation processes used. This hoped to identify any issues with knowledge uptake and the ways in which researchers could improve support for practitioner learning. Refer to Chapter 4 for a detailed description and justification of the study methods.

Following a brief overview of the interview sample, this chapter discusses the results of the interview analysis in the context of the campaign and behaviour research literature covered in Chapters 2 and 3. Beginning with the contextual barriers and enablers influencing campaigns, the chapter then examines campaign evaluation processes, practitioner access and use of research

(answering Research Question 3), and finally the differential targeting of audiences and behaviours in response to Research Questions 4a and 4b.

Interview Sample

Interviews were conducted with representatives of the ten organisations in September and October of 2018. Participating organisations all conducted campaigns to promote the adoption of mitigation behaviours. Organisations included one state government department, three local governments, three national not-for-profit organisations, and three local not-for-profit organisations. Campaign teams included volunteers and paid individuals with diverse areas of expertise. Some teams were highly stable, while others had recently experienced the loss of key staff members, which affected organisational retention of knowledge and networks. These diverse mandates and levels of resourcing resulted in a broad range of approaches to campaigning, and offered a variety of perspectives on the issues faced by campaign designers. A summary of the key themes identified during analysis of the interview data is provided in Appendix C.

Contextual Issues Facing Campaigns

A range of contextual issues were raised as barriers to, and enablers of campaign effectiveness. While all the interviewed organisations operate within the overarching socio-political context of climate change in Australia, specific contextual barriers and enablers also existed relevant to the size, resourcing, and associated collaborative approaches of each organisation. This section will outline these contextual issues, leaving the barriers and enablers related to research access and use for discussion later in this chapter.

Four aspects of the socio-political context of climate change in Australian are challenging for campaigns: (a) the lack of a stable, national climate change policy; (b) Australians' political disengagement on climate change; (c) the prevalence of misinformation; and (d) differential behavioural demand. The lack of a stable, national climate change policy was raised as problematic with regard to both structural barriers to behavioural implementation, and for ongoing research relevant to mitigation. Climate change is a highly politicised topic in Australia (Bliuc et al., 2015; Chubb & Nash, 2012), and has been the platform for the rise and fall of several Prime Ministers and governments (Kousser & Tranter, 2018). Australia has seen the proposal and removal of numerous climate change policies over recent decades (Crowley, 2017; Kousser & Tranter, 2018), which has led to detrimental uncertainty for business and industry (Leary, 2016; Simpson & Clifton, 2014) and flow-on effects for research funding (CSIRO, 2017; Torok, Griggs, & Voice, 2016). This policy volatility was raised by some interviewees as an issue because it meant a lack of support for critical structural changes. One interviewee raised the limits of individual behaviour change, commenting that "very quickly that changed to realising that a lot of the decisions that you make about how you

live, relate to decisions that are made outside of your own power" (CI, local community group). Another raised the roles of the Australian and state governments as critical to mitigation stating that "at the end of the day, a lot of the changes that need to be made to genuinely address the climate emergency are at the State and Federal level" (SG, local government). Government-based campaign teams, however, faced more direct impacts from this political volatility, with one such group explaining, "That's just the reality of something that we navigate and you try and keep things moving dependent on who's in power, but I can see that that's something that has changed over the time that [this department has] run" (ED, state government).

Despite the negative impacts of this lack of national leadership, some of the interviewed organisations mentioned positive perceptions that implied it had stimulated (or at least not completely stifled) activity by industry and sub-national governments, which was somewhat countering this national gap.

> [There is] a real need for every Australian to ... maybe not every ... but for a lot broader spectrum of Australians to understand what's currently happening, and that there is a lot currently happening—that businesses are choosing to transition, even without political stability or policy stability in the space (CC, national nonprofit group).

Business, industry, and sub-national governments in many countries have implemented climate change initiatives and participated in climate change governance (Dunn, 2002; Johnson, 2017). This is illustrated by networks including the international C40 Cities (involving more than 90 cities including Melbourne and Sydney; see www.c40.org), and the Climate Business Network (see www.climatebusiness.net).

While considerable activity is occurring through non-State actors, however, the Australian public's growing general dissatisfaction with politics was raised by one interviewee as affecting community understanding of what's actually being implemented with regard to mitigation.

> While [Australians] care, we have switched [off] from the political—I wouldn't call it a debate, cos it's not one—from the political situation, which means that we've kind of switched off from everything, which does mean we don't know that other people are doing stuff (CC, national nonprofit group).

Australians' have shown evidence of climate change issue fatigue (Morrison et al., 2018), which is perhaps unsurprising with the country's history of political and climate change policy instability. Australian voters have become increasingly dissatisfied with democracy and distrustful of government (Cameron & McAllister, 2016). Despite growing acceptance of the seriousness of the threat of climate change (Oliver, 2018), there remains limited political priority placed on climate change by voters in comparison with traditional policy issues including health and the economy (Cameron & McAllister, 2016). People tend to believe there is less agreement over climate change

than is really the case, and also to overestimate their own mitigation behaviour compared with that of others (Leviston et al., 2015). It's unclear how aware the public is regarding the action of non-State actors, but the above trends suggest that perceptions are likely to be underestimates. For example, one organisation indicated:

> It was something that came out of our ... surveys, that we can see that they think we should be doing more. We actually know that we're doing a lot of that stuff—that they just don't see it and they're not looking for it. So it is our endless struggle ... how do we engage our community? (JS, local government)

Social expectations and leadership have both been found to influence individuals' intentions to act on climate change (Gifford, 2011; Kousser & Tranter, 2018; Rees & Bamberg, 2014), so underestimating the actions of others (individuals or organisations) is likely to negatively affect adoption of critical behaviours.

In addition to this lack of awareness of the extent of climate change actions being implemented, the demand for different mitigation behaviours varied considerably—although it's unclear how connected are these two issues. Changing social expectations have led some target behaviours to increase in demand.

> We're in a good and balanced position and, as you probably noticed ... well, the world is changing, I think, and more [of the target audience] are taking more climate action. So I think, you know, that we're in a good place at the moment (AM, national nonprofit group).

A lack of understanding of climate change—potentially due to the prevalence of misinformation and politicisation of the issue—has also resulted in the public's failure to recognise the connection of other behaviours with climate change. A lack of audience understanding of the climate change's causes, effects, and solutions requires campaign designers to carefully consider their amount of educational material required to be integrated in campaign messaging.

> People were surprised by the amount of emissions caused by food waste ... in terms of climate change awareness ... Like, people connect the idea that transport has emissions, that turning on your light bulb has emissions, but they don't necessarily think about food emissions (MV, local government).

Provision of information is not sufficient to change behaviour (Bauer, Allum, & Miller, 2007), but a certain level of knowledge is important to the motivation and implementation of behaviour (Gifford, 2011). Australians' objective knowledge of climate change is moderate at best, with accurate question responses given by only between 30 and 60 percent of survey respondents in 2010 and 2011 (Reser et al., 2012a). Despite relatively high levels of national concern about climate change (Oliver, 2018), campaigns become more expensive if they must raise knowledge levels as well as motivation. One participant suggested that "[it] doesn't mean I don't want to do the education and information-

based stuff, but there are other organisations probably better resourced to" (AM, national nonprofit group). This is not to say that it makes the harder task less attractive to campaign designers—as these may, in fact, be perceived the worthier cause—but the challenge of engaging audiences on behaviours that are in less demand and less clearly connected with climate change, should not be underestimated.

In addition to societal demand barriers, organisational size and associated resourcing were barriers for some but enablers for others. The smaller organisations found advantage in their ability to rapidly change direction and take on risks, however their limited resources reduced capacity. This contrasted with the risk aversion and slow change processes limiting some of the larger organisations, but who had greater resources on which to draw. One participant raised uncertain campaign outcomes as limiting their organisation's risk-taking, stating that: "Many [organisations like ours] can be quite conservative and risk averse. And so, if they don't know if something's going to work, it will be hard to take that step" (MV, local government). Larger organisations that had recently completed strategic planning, however, found those pre-approved strategic approaches to be highly effective, ameliorating some of these organisational barriers to effective campaign design. One participant stated, "our environmental sustainability strategy, which was finalised in 2016, [gives] that, kind of, high level commitment ... and then we had the project plan, and then it was just rolled out" (MV, local government). Thus, each campaigning organisations faced challenges relating to size and resourcing, however they had also developed a range of coping strategies to deal with these.

In addition to strategic planning as a coping mechanism, every interviewed organisation raised networks as integral to their activities—although for a range of reasons. Some found their networks provided reassurance that others were also concerned about climate change, while others indicated these provided opportunity for joint activities. One participant indicated they were "... looking for contacts, I mean ... organisations ... people that shared the same feelings and passion, and would try to work together" (AI, national nonprofit group). Another interviewee added, "People like to come to a big event. That is where everybody of like mind gets together" (CI, local nonprofit group). Others found networks critical for their campaign processes. For example, "We are national and the way we achieve that is we actually work through a whole series of partners" (AM, national nonprofit group). Organisational networks also shared information regarding events and research of possible interest:

> There's the overarching group called CANA—Climate Action Network Australia—that links everybody ... everybody with a climate type interest ... CANA is the group that will let everybody know that it's happening and then we'll let other people know (CI, local nonprofit group).

Collaborative activities within these networks were also raised as important enablers. These were often raised as integral to the organisation's approach, for example: "We utilise the relationships we have ... We always try to work in collaboration" (SG, local government). For organisations that

were not social enterprises with competitive markets, collaboration was also about recognising that there were others better placed to undertake some tasks. One participant recognised that, "There are a number of those groups in existence already ... [and] there's no need for us to compete if something's working" (CC, national nonprofit group). Selsky (1991) describes fractionated organisational communities as those with many small groups working in loosely organised clusters with some interdependence associated with resources, goals, and contextual influences, but facing shortages of resources that require creative problem-solving. Organisations in these communities sometimes use strategic alliances and joint actions to address resourcing shortfalls, or use more integrated collective approaches (Selsky, 1991; Takahashi & Smutny, 2001). Such approaches can increase efficiency, lead to a "spiral of rising trust" (Fox 1974, as cited in Selsky, 1991) that further encourages collaboration, and can influence the contextual operating environments, but can also be challenging to navigate (Selsky, 1991; Takahashi & Smutny, 2001). Interviewed organisations exhibited both of these coping strategies to varying degrees and recognised these collaborations as important for impact and efficiency. Monthly meetings are one example of this.

For local activities by not-for-profit groups, the social aspects of collaborative interactions were also highly valued, leading to many of these groups including face-to-face collaborative activities in their behaviour change approaches.

> [We have] monthly meetings for our community, and we get between 50 and 60 members each month who will meet ... not the same group ... but at least that number who come and meet in a little local hall. And we have a speaker, and we talk to each other, and we have food and wine, and we have a social interaction as well. So, that's a regular solid part of what we do (CI, local nonprofit group).

These social interactions fit well within relational models of collective action, with van Zomeren (2015) suggesting that activism[51] can be explained by acceptance of a communal sharing model of ingroup relations, and a rejection of authority ranking models. The communal sharing model explains involvement in activist groups through collectivism and group unity (van Zomeren, 2015), which aligns with Study 3 interview findings that individuals sought out like-minded others and thus joined climate action organisations. Authority ranking models prioritise existing hierarchies of power and system justification (van Zomeren, 2015), and thus activist groups' rejection of authority ranking explains attempts to shift the existing system through campaigning.

In summary, several socio-political and organisational contextual factors were raised by interviewees as affecting campaign processes. While the lack of a stable, national climate change policy was seen as failing to address the structural changes needed, there was acknowledgement of the

[51] Van Zomeren (2015, p. 1) used the term activist to indicate "members of social movements or action groups". As such, activism in this chapter includes any group or organisation that actively encourages behaviour change through campaigns.

considerable efforts of industry and sub-national governments. The politicised nature of climate change in Australia was seen as affecting community understanding of climate change, and thus making campaign messaging more complex. Behavioural demand was also seen as influenced by community knowledge, especially through a failure to recognise some mitigation behaviours as relevant for addressing climate change. Campaigns may not have the capacity to address the politicisation of climate change in Australia, but a strong understanding of current community knowledge and attitudes to target behaviours would certainly be valuable. The interacting contexts of organisation size and resourcing affected group agility, acceptance of risk, and skills access for more complex approaches. Collaboration and networking were consistently adopted approaches, and offered particularly valuable coping mechanisms for groups with limited resources or expertise. The intrinsic benefits and efficiencies of these networks should not be underestimated in such an challenging field as climate change mitigation campaigning.

Perceived Campaign Effectiveness

All of the interviewed organisations had approaches for evaluating their campaign effectiveness, but the nature and extent of these evaluations varied considerably. Approaches varied from simple assessments of whether or not people remained on mailing lists, to more complex and formalised processes involving pre- and post-campaign surveys, social media and website statistics, and objective data (e.g., volume of waste disposed). This variability was linked with capacity, in terms of both skills and resources. Larger, better resourced organisations with professionally trained teams were more likely to be content with their evaluation processes (or with their planned changes to these), which were typically more comprehensive—involving multiple lines of evidence. For example, “There might be other things like the increased membership of a group, increased traffic to our website, the number of likes on a social media post. You know, there’ll be all kinds of readings” (SG, local government). Organisations with less formal training and fewer resources tended to have simple approaches and often raised complexity as an issue limiting the evaluation of campaign impact.

> We’re not very good at this. We run a strategic planning day every year where we look back at the things that we’ve done well and things we haven’t done well. Sort of throw those around and talk to each other ... And that process is quite useful in identifying some of the things we think we do well. But we’re not really very good at judging, largely because it’s such a difficult thing (CI, local nonprofit group).

Thus, similar to other topics already discussed, the inability to formulate criteria and approaches for the monitoring and evaluation of campaign effectiveness appeared to be strongly connected to the skills of the campaign teams. Where teams had these skills there was more discussion of resourcing issues, but when skills were low there was more discussion of the difficulty of evaluation.

Despite, or perhaps due to, these challenges, interviewees expressed an overriding need to know what works and why, to increase campaign effectiveness and efficiency. Many interviewees raised their desire for more sharing of campaign evaluation knowledge. Campaign designers wanted to better understanding what has worked (or not) for other campaigns, as well as the collateral, beneficial impacts of the behavioural changes achieved through their organisation's own campaigns (e.g., the biodiversity outcomes from trees planted as carbon offsets). Consistent with issues raised in Chapter 2 regarding the considerable gaps that exist in the design and practice of campaign evaluations (Coffman, 2002), it falls to campaign designers to rely on their networks and individual relationships to gain informal program insights from other practitioners. This has been an effective approach for some groups. One interviewee explained that there had been:

> ... quite a few [similar organisations] that had done this, and I contacted lots of different [groups] to find out what their experience was. And it would have been really helpful to have a report of, "Ok. This is what has worked here. This is what happened over here." ... Not reinventing the wheel (MV, local government).

The time-consuming investigation of other groups' experiences is also heavily reliant on relational networks that can be lost when individual employees (or volunteers) leave the organisation. Staff turnover was raised as considerably hampering this process for some groups, although other groups indicated they have highly stable membership. Once other groups' learnings are accessed, however, organisations face the complex task of translating these learnings into the context of a new campaign, in a new context, with a new target audience. One participant raised learning from others as important for efficiency, stating that:

> We're all trying to do the same kind of thing, with varying levels of success. But also, our communities are so different, so it makes it hard to just blanket anything [that others have done] ... It's just trying to see what others are doing and how we don't have to reinvent the wheel, but can adjust for what we need to do (JS, local government).

Team turnover—and the associated loss of skills, experience, and networks—can be a significant concern in such informal information-sharing networks, and support for more formalised evaluation, sharing, and translation of learnings, could provide substantial efficiencies and increases in campaign effectiveness.

In addition to this need for access to others' campaign evaluation learnings, some interviewees also raised desires to better understand collateral outcomes of their own campaigns. The collateral benefits of campaigns are less commonly measured than target outcomes, due to insufficient resourcing. For example, one participant indicated that they "... would love to be able to report ... more on the longer term impacts of our forest on, you know, the status of endangered species and ... wildlife returning etc. etc." (AM, national nonprofit group). The ability to highlight the realised

collateral benefits of behaviours promoted by a campaign organisation would provide additional motivational messaging opportunities. Such knowledge could also benefit these organisations' ongoing improvement processes, and would be of particular value for promotional purposes (for public funds, grants, and market income). The collateral benefits of climate action for society—for example, economic and social outcomes—have been found to provide useful messaging foci to promote mitigation behaviours to those unconvinced of the veracity or urgency of climate change (Bain et al., 2012; Bain et al., 2016). These collateral benefits can tap into the self-transcendent values to support message reception. So in addition to being able to highlight how campaigns have contributed to climate change mitigation, being able to report on these collateral benefits from campaigns would offer organisations opportunities to engage with and motivate wider audiences.

Accessing and Utilising Research

Similar effects related to organisational and team characteristics were found for the uptake of research knowledge, which was highly variable. While the third research question focused specifically on the use of behavioural science, this section will also include discussion on the use of communications research, as interviews highlighted critical barriers to the use of knowledge from both these fields in campaign designs. This section will address the third research question by first describing the research topics accessed by campaign designers, and the research channels used to access this research. It will then examine the barriers to access, how the research was used, and the research needs of the interviewed organisations.

All of the interviewed organisations make use of research to inform their approaches, however the topics and methods of access varied considerably. Research on one or more topics across the science of climate change, technological solutions, behaviour change, and campaign design guidance were accessed by all organisations, although only the larger, more well-resourced organisations tapped into research across all these topics. Climate science and technological solutions were the most commonly sourced research areas, while behavioural science research was the least commonly accessed—particularly for volunteer groups. Many of the groups included members with formal training in one or more of these areas. Groups without formal training in these key areas were typically smaller nonprofit groups that often had direct relationships with researchers through research institutes like the Monash Sustainable Development Institute and the Centre for Social Impact Swinburne. Some of the interviewees also accessed research through funded places in training similar to that provided by Climate for Change or The Change Agency, or through various fellowships. Other research access points included: podcasts, documentaries, published books, research reports, case studies, public lectures, conferences, and academic journals. One interviewee stated, "I'm just like a magpie, really. You know? I'm always just playing podcasts and reading articles, and books, and stuff" (CE, local nonprofit group). The better resourced organisations also undertook their own

research or contracted consultants to complete it on their behalf. Thus, the research topics and methods of access by interviewees were diverse, although limited accessing of behavioural and communications research was common for smaller organisations that did not include team members with formal qualifications in these areas.

Despite this breadth of access points and topics available to campaign organisations, groups with less formal training relevant to behaviour change campaigns often did not recognise that research existed on some of these key topics or that accessing it might improve their campaign successes. For example, one participant stated, "I didn't even know people were doing research on this" (AI, local nonprofit group). This was most evident regarding behaviour change research and communication research, as information on climate change science and solutions was accessed by every group. Having some knowledge on a topic tends to hinder recognition of knowledge gaps (Glucksberg & McCloskey, 1981), with perceptions of personal ignorance comparatively underestimated for fields outside one's area of expertise (Hansson, Buratti, & Allwood, 2017). Thus personal experience of daily communication and independent action, and lack of relevant topic expertise to enable accurate estimation of knowledge gaps, can hinder recognition that there might be important knowledge on behaviour change and effective communication that could be accessed.

The cross-disciplinary nature of mitigation campaigns also leads to the inverse issue of too much information. Multiple interviewees identified the availability of excess information as a barrier to identifying what were the most important pieces, with one stating: "How much should I know? I mean there's lots of stuff out there. It'll kill you" (AI, local nonprofit group). The diversity of research sources and the topics accessed by the interviewees have the potential to be both enabler and barrier. If research is not presented through channels that are likely to be accessed by these organisations, and in ways that clearly indicate the information's relevance and offered benefits, such research is unlikely to have an impact on campaign effectiveness. With more people generating information and more ways to disseminate it, it becomes increasingly difficult to identify the information that is of most relevance and highest reliability for decision making contexts (Eppler, 2015). The concept of information overload captures the relationship between the quantity of accessed information and decision performance, whereby increasing information leads to improved performance up to a tipping point after which more information leads to declining performance (Eppler, 2015; Eppler & Mengis, 2004). Such overload can lead to feelings of stress and confusion, and can reduce motivation (Eppler, 2015; Eppler & Mengis, 2004). Perceptions of overload can be influenced by the nature of the information (e.g., complexity), the person receiving the information (e.g., attitudes), the technology used to access the information, as well as task pressures like interdisciplinarity and time pressures (Eppler, 2015; Eppler & Mengis, 2004). Facilitated filtering processes as in the dissemination of information through trusted networks, as well as collaboration with specialists, are approaches that can assist in reducing information overload (Eppler & Mengis,

2004), both of which were utilised by interviewees for accessing relevant information. Researchers can also use the principles of information quality to help reduce information overload (Eppler, 2015). These principles state that the provided information should be highly integrated (i.e., aggregated and pertinent) and contextualised (i.e., linked and targeted; Eppler, 2015).

Raising awareness of the existence of relevant research and ensuring the research is provided in channels and formats likely to be accessed by practitioners, pose challenges for researchers. With academic prestige still strongly tied to the traditional publication of research in academic journals (Fyfe et al., 2017), there is insufficient encouragement of dissemination of research to practitioners in fields relevant to mitigation campaigns (Anderson, 2015; Moser, 2016). Traditionally research impact was measured using bibliometrics such as numbers of journal publications (Moed & Halevi, 2015), which reflect the dissemination of research to, and use by, other researchers. Increasing pressure attached to competitive funding has raised the profile of societal research impact, and expanded the metrics available to assess research performance (see Moed & Halevi, 2015). While the available metrics are becoming more diverse, the level of priority given to different categories of metric by academia remains skewed towards traditional metrics (Fyfe et al., 2017), which inadvertently discourages time-poor researchers from expending effort towards dissemination of research to practitioners for disciplines relevant to mitigation campaigns. As discussed in Chapter 2, environmental communication scholars have historically failed to translate research for wider accessibility outside academia (Anderson, 2015), where this research could have considerable societal benefit. In addition, one participant who had conducted research in previous employment, raised the issue that not all useful research gets published in journals.

> And then we pulled this thing together, and we wrote it all up ... and then we submitted it to a journal, and the journal said “Oh! This is most interesting. Now all we need you to do is to ...” and then they set out all this sort of stuff! We all just looked at each other and said, “Nah! Nah! I’m not doing that.” And so it just sat, and it never went anywhere (CI, local nonprofit group).

With reduced incentive to publish outside journals, and higher ranked journals forming highly competitive publishing environments, some research that may be highly useful to practitioners and researchers alike, may never be made accessible by those who might benefit from it.

The use of accessed communication research knowledge also varied across organisations. Better resourced organisations with larger target audiences tended to have team members or advisors (e.g., consultants or other teams within their organisation) with professional training and experience in behaviour change and communication, and thus drew more heavily on models and research from these fields. From a communications theory perspective, audience targeting and segmentation were the most commonly mentioned applications of theory across all interviewees, along with aspects of message construction including the use of emotional (fear and hope) appeals, promotion of self-

efficacy (PBC), and dissemination of information (knowledge). As discussed above, however, there were some groups that did not appear to recognise that communications theory existed that could assist them in designing more effective campaigns (outside of the idea of reaching target audiences).

Recognition of target audiences, and of a need for appropriate language choices and resonating messages, were the most commonly referenced communications concepts. One participant acknowledged the mismatch between the audience they reached, and the audience they hoped to reach by joking, "We have an audience, and we have a target audience" (CE, local nonprofit group). Target audiences varied across the organisations and their campaigns, including focus on maintaining action by those already highly concerned about climate change, or encouraging action and engagement by those who are curious but unconvinced about climate change. All interviewees could describe their target audiences, although these targets and the level of detail known about them varied. As might be expected, the organisational scale tended to dictate the audience scale where the local community was targeted by local scale organisations, and broader national communities were targeted by national organisations. Only the larger, more well-resourced organisations targeted whole communities.

> I would like to do [more], but because we're a small organisation, ... well we just can't really do that. So what we need to do is target those people who are actually already more likely to commit to action, but may not necessarily be acting ... or maybe doing a bit ... you know, not doing the full suite of things (AM, national nonprofit group).

The ability to reach these target audiences was recognised by most interviewees as an ongoing challenge. This was linked by several groups with information overload, as evidenced by one interviewee questioning, "How are we going to achieve reach when everyone else is trying to achieve reach?" (AM, national nonprofit group). This issue of cutting through to audiences was similar to interviewees' own issues of finding the most important research in an information-rich world. For example:

> [It's] that challenge of reaching the people that are so hard to reach. Like, we've had people contact us and say, "Why haven't I heard about this?" ... It was in [the newsletter], it was in the [newspaper], we had a guide that was delivered to [them], it's been on Facebook, it's been on Twitter, it's been on Instagram, it's on the website, we've been at events ... we've got posters ... how do we reach you? And I think that's a real challenge. We're in a society where there's so much information coming at us from so many avenues, and getting the cut-through of your message [is hard] (MV, local government).

While some organisations mentioned using paid social media advertisements to reach their target audiences, groups with more limited resources were not able to follow such an approach.

Lack of knowledge about campaign audiences was also raised by several of the professionally trained communicators as an ongoing issue limiting repeated engagement of audiences with campaign messages. For example, one participant stated that "hearing it once is not necessarily going to create the behaviour change that we need. You know ... you need to hear it again and again and again. And that's a challenge" (MV, local government). Acknowledgement of the value of repeated engagement evidences practitioners' understanding of concepts raised in theories such as elaboration likelihood (see Chapter 2), but was rarely acknowledged in the processes of groups without professionally trained communicators. Understanding individuals' preferred communication channels along with their reasons for preference, is a useful tool for improving reach and message effectiveness (Hardy, 1982; Ruppel & Rains, 2012). The use of multiple, complementary channels for message delivery can also increase message effects by tapping into the different qualities of each channel and the associated purposes for channel use (Ruppel & Rains, 2012). The use of multiple channels was often built into campaign delivery approaches, with one participant stating that they had used nine different channels to reach their community: "It was in [newsletter], it was in the Leader [newspaper], we had a ... guide that was delivered ... it's been on Facebook, it's been on Twitter, it's been on Instagram, it's on the website, we've been at events ... we've got posters ..." (MV, local government).

Individuals' preferred media channels for communication vary based on their purposes for engagement. Communications theories like uses and gratifications (see Chapter 2) suggest that motivations for media interaction can be social, cognitive (informational), or emotional (Ruggiero, 2000). Each media channel is characterised by unique combinations of levels of reach, information specificity to an individual's context, emotional arousal, and level of involvement (Schooler, Chaffee, Flora, & Roser, 1998). As such, the use of multiple, complementary channels in campaigns tends to increase impact by countering the limitations of any single channel (Ruppel & Rains, 2012; Schooler et al., 1998). Some studies have investigated the preferred channels of some audience segments (e.g., Alcorn & Buchanan, 2017; Morrison, Duncan, & Parton, 2013). These segments may not necessarily easily translate to segmentations relevant for individual campaigns, but offer some guidance for selection of campaigns channels. A better understanding of channel preferences and associated user characteristics could assist campaign teams to design efficient multi-channel approaches to effectively improve reach and repetition of engagement with campaign messages.

The lack of information on target audiences was also raised by several interviewees as a barrier to tailoring messages for optimal reception and uptake, although there was considerable variability in the extent and timing of plans for filling these gaps. For example, one participant indicated they'd done extensive audience research for message reception for a recent campaign: "We did two different sets of research. One was ... focus groups ... but then also through Facebook ... And I think that reached 500,000 people. So it's quite extensive Facebook testing of just the messages" (ED, state government). In contrast, another organisation was hoping to grow their audience before

conducting audience segmentation, relying on knowledge of existing clients in the interim: “We haven’t done a full customer segmentation, which is also something I would normally have, but ... I’m not ... intending to do that ... until we grow a bit more first” (AM, national nonprofit).

Chapter 2 provided an outline of the value that audience targeting can offer, with communication theory and research suggesting that tailoring messages to resonate with audience attitudes can substantially improve message reception (Corner & Randall, 2011). Some care must be taken with the particular approaches selected for message tailoring to avoid negative side effects like the promotion of materialistic concerns and behaviours, but social marketing approaches have been shown to be highly effective at achieving behaviour change (Corner & Randall, 2011). National scale investment in attitudinal and behavioural surveys occurred between 2010 and 2014 (e.g., Leviston et al., 2015; Reser et al., 2012b). More recent surveys conducted with smaller samples have suggested temporal shifts in both attitudes and behaviours (Morrison et al., 2018; Oliver, 2018). Most interviewees appeared unaware of studies more recent than CSIRO’s 2014 survey (i.e., Leviston et al., 2015), with one participant raising a need for current information: “I would love to be exposed to more research ... on Australian audiences, and their likelihood to act on environmental issues themselves ... [The older research is] all I’ve turned up” (AM, national nonprofit group). Regular updates regarding changing community perceptions and action, with sufficient detail to assist with appropriate audience segmentation, would be highly beneficial for campaign designers—particular those with fewer resources. Some of the larger organisations were able to conduct some form of audience analyses within the formative evaluations of their campaigns, however the majority of the interviewed organisations did not have the skills or resources to do so.

Similar to the variable uptake of communications research, behavioural science knowledge also differed across groups—often related to practitioners’ level of related training. Interviewees mentioned several theoretical behavioural science concepts as contributing to their campaign designs, although identifying the most appropriate of these was highlighted as problematic by some interviewees. One participant stated: “I think the challenge around picking an approach and saying that this is our approach, this is why ... and we believe we’ll be successful for these reasons, in the space of behaviour change, can be really difficult” (CC, national nonprofit). Only one behavioural theory was mentioned by name—TPB was listed by one interviewee—but there was unnamed (indirect) acknowledgement of other theories including VBN theory and information deficit theory (refer to Chapters 2 and 3 for descriptions of these theories). The most commonly mentioned influencers of behaviour were individuals’ values, structural barriers, self-efficacy (PBC), emotions, and knowledge (of climate change and of mitigation behaviours). Values theory—and its application via the Common Cause approach (see Crompton & Weinstein, 2015)—was the most frequently listed behavioural science theory applied by interviewees. The Common Cause’s approach focuses on designing messages that promote self-transcendent values and thus addresses some of the flaws of the

social marketing approach as discussed by Corner and colleagues (Corner et al., 2014; Corner & Randall, 2011; see Chapter 2). However the efficacy of values-based messaging may not be universal (Chai, Bradley, Lo, & Reser, 2015), as an individual's values take on a filtering role with regard to acceptance of messages and are likely contributors to the politicisation of climate change and associated community polarisation seen in Western countries (Corner et al., 2014). Values are not consistent in their influence on behaviour (Chai et al., 2015) and that influence is often mediated by other factors such as identity and norms (Barbarossa, De Pelsmacker, & Moons, 2017; Cheung, Luke, & Maio, 2014). As no specific factor consistently influences all behaviours for all audiences, improved understanding of which factors to target for which behaviours and audiences would enhance campaign targeting for most groups.

The few interviewees aware of conflicting research regarding the efficacy of different theoretical approaches were typically professionally trained communicators, one of which raised the issue as a barrier to choosing (and promoting to decision-makers) a behaviour model for messaging.

> I read Common Cause and I was like, "Oh! That's the world I want to live in. They do have research to back it up, so I'm on board." But then someone else has written the exact same thing ... and come up with the exact opposite. So I think the challenge around picking an approach and saying that, "This is our approach, this is why, and we believe we'll be successful for these reasons" in the space of behaviour change, can be really difficult (CC, national nonprofit group).

The review of behavioural theories in Chapter 3, and the meta-analysis in Study 1, both highlighted conflicting research on the influencers of behaviour. The testing and retesting of theory-based hypotheses is a critical component of scientific methods that leads to improvement in understanding over time, however it is critical that these progressive findings be integrated and translated into accessible updates for practitioners. Coupled with the vast quantity of research being undertaken and published across a wide range of disciplines and journals as found in Study 1, the conflicting findings and evolving theories around climate change behaviours requires a dedicated effort from researchers to assist practitioners in their efforts to design evidence-based practices.

The conflict between experiential learning and research findings was also raised as an issue for justifying a behavioural messaging approach. One participant used the following example of responses from within their team:

> In trying to bring [colleagues] along on that journey, you know, you just kind of constantly get pulled down. Like [with] Queensland going off the charts in solar, but it's not [self-transcendent] values based at all—it's the complete economic argument. So ... "Are you saying that's not actually a good way to get [adoption]?" You know ... so that sort of stuff (CC, national nonprofit group).

Individuals learn through a mixture of observation (i.e., vicarious experience) and enactive (i.e., personal) experience, and knowledge from these different sources must be reconciled and integrated over time (Bandura, 1977b, 1986). Human conceptual and inferential capabilities allow learning from observation, which is then reconciled with enacted experiences (Bandura, 1977b). However, biased perspectives and insufficient data can lead to inaccurate judgements regarding behaviour (Bandura, 1977b). The effect of various biases on the reception of new information can also make these preconceptions difficult to shift (Gifford, 2011; Kraft, Lodge, & Taber, 2015). This difficulty shifting perspectives was also felt by some practitioners in larger organisations where information deficit models were preferred by decision-makers in other teams that were required to collaborate. For example:

> A lot of people still have this idea that more information equals change, and so that's something that we deal with quite regularly here too. Where, because the arguments that have worked for them to get to this point are often kind of rational ones, they think that a rational, educational campaign will be the thing that will switch behaviour (ED, state government).

In these situations, campaign designers may struggle to convince other decision-makers of the appropriateness of selected behavioural models. Some campaign designers found that strategic planning helped cement campaigns within broader organisational systems in such a way that reduced the need for re-engagement with higher decision-makers regarding campaign details. This resulted in higher autonomy over campaign approaches within the agreed strategic framework. Some of the better resourced organisations were also able to use formative evaluations to tested messaging options with their target audiences, which helped justify the approaches selected, however not all groups were in a position to undertake such research.

Structural barriers to behaviour implementation were raised by several interviewed organisations as critical factors in determining the focus of their campaigns. This recognition of individuals' lack of control over implementation of some behaviours in some situations, matches behavioural theories as discussed in Chapter 3. Individuals' perceptions of control and the difference between actual and perceived control, are critical factors in determining the development of intentions to implement mitigation behaviours and the successful implementation of those intentions (Carrington, Neville, & Whitwell, 2010). While some organisations were able to directly impact structural barriers prior to campaign roll-out (e.g., local government waste management campaigns), others refocused their efforts on approaches designed to influence political audiences to effect structural change. For example, one participant explained:

> We focused on our own footprint, and wanted to try to understand it ... but very quickly that changed to realising that a lot of the decisions that you make about how

> you live, relate to decisions that are made outside of your own power (CI, local nonprofit group).

This recognition of structural barriers was also paired for some, with an understanding that such barriers did not just prevent implementation, but can also result in cognitive effects that reduce motivation and engagement. For example, an interviewee explained, "It's all good and well to say to people, 'You've got to do the right thing', but if we're not actually doing the big structural changes to enable them to do the right thing, it's disempowering" (MV, local government). In light of the volatile socio-political context of climate change in Australia, policies to address structural change are highly contested. Without such support, changing individual behaviour becomes considerably more difficult.

In summary, research access and use varied considerably across the interviewed organisations and across topic areas. While research was accessed by interviewed organisations across diverse topics and through a broad range of mechanisms, limited recognition by smaller groups of the opportunities offered by behavioural and communications research reduced accessing of research on these topics. This was coupled with issues identifying the most relevant and useful research in an information-rich world. The use of communications and behavioural science research was highly variable, however all groups applied concepts from these fields to some extent. The most commonly used aspects taken from communication research were consideration of target audiences, although limited understanding of these audiences was a barrier for many groups. This knowledge gap was acknowledged by several groups as negatively influencing message design and campaign reach. The use of behavioural science was often less than that of communications research, although concepts from a range of behaviour theories were used. There was limited acknowledgement by interviewees of conflicting behavioural research findings although, where this was raised, it was described as hampering the selection and justification of behaviour change models for campaigns. Groups have developed a range of coping mechanisms to overcome these barriers, including collaboration and networking, and the use of strategic planning. Three key actions that could further improve campaign effectiveness, are: regular, integrated updates on Australian audiences' attitudes, behaviours, and media use to improve reach; and support for the evaluation of campaigns and sharing of findings to increase campaigns' effectiveness and efficiency.

Differential Audience and Behaviour Targeting

Whilst all interviewed organisations undertook some level of audience targeting and focused campaigns on behaviour change, Research Questions 4a and 4b considered if this targeting matched the findings of the first two studies, which suggested differential influences on behaviour across audiences and behaviours. This section will examine practitioner application of such

contextualisation of targeting approaches, beginning with audience targeting then followed by behaviour targeting.

> *Research Question 4a: To what extent does audience targeting include demographic considerations with respect to current adoption of behaviours, and structural and societal barriers to adoption?*

> *Research Question 4b: If practitioners target a range of behaviours (either within or across campaigns), to what extent are their theoretical frameworks (if any) and audience targeting applied differentially across behaviours?*

The level of detailed knowledge of audiences, and ability to differentially targeted these, was highly variable across the groups interviewed. Larger organisations with professional communicators tended to invest resources in some level of audience research—including the use of paid consultants. These groups also typically targeted larger populations and considered segmentation of audiences. For example, one interviewee explained their use of formative evaluation to inform audience targeting:

> We paid to test it ... and out of that, also came up with the people who are most likely to respond to this stuff ... They called it 'young mums and tradies'. So it was like, 25-35 year old women, and probably similar aged men, I guess (CC, national nonprofit group).

Segmentation was not always utilised to deliver alternative messages to different audience segments, however, but rather was sometimes used as a narrowing process where alternative segments were thereafter considered non-target. For example, one participant asks their team: "Well, who do you want, and why do you want them, and who are you excluding, and if you had to preference this one over that one ...?" (ED, state government). In some instances, this narrowing resulted in more focus on what might be considered low-hanging fruit—those who were curious or already concerned about climate change, and thus more easily convinced to take action. This audience was a common target, particularly among campaign organisations that could not afford formal audience analysis. For example, one interviewee stated that, "We've really tried to be the information source for people who want to make changes" (KD, national nonprofit group). In terms of climate change, researchers have categorised this audience as *Alarmed, Concerned,* or *Cautious* and found that these segments comprise, respectively, 15 percent, 31 percent, and 18 percent of the Australian population (Morrison et al., 2018). While *Alarmed* and *Concerned* individuals are already apprehensive about climate change and inclined to act in line with this concern, *Cautious* individuals are undecided and open to change towards action (Hine et al., 2014), making them a good target for campaigns. The adoption of

specific behaviours by these individuals varies considerably across behaviours and is not always substantially different across segments (Morrison et al., 2018). This suggests that this particular target audience may require additional segmentation and information on behaviour-specific adoption and barriers to adoption, for accurate estimation of the potential for change and for effective targeting.

Structural barriers to adoption were typically considered as affecting the community as a whole rather than differentially across segments, however there some were instances of targeting specific audiences in relation to these barriers. One example was the use by some campaigns of housing characteristics as segmentation tools. The influences of housing on behaviour were recognised on two fronts: as influencing the relevance of behaviours and the psychology of residents. Behaviours that rely on the approval of housing owners or body corporates are less frequently adopted in rental contexts (Instone, Mee, Palmer, Williams, & Vaughan, 2014). Shared responsibility is known to influence behaviour, through both behavioural interdependence (Ajzen, 1985) and bystander effects (Anker & Feeley, 2011).

> This is targeted at residents, and particularly standalone homes. Large developments are trickier, because ... you know ... there's often shared bins. And ... wherever a bin is shared, the sorting is worse ... People just don't recycle as well when it's a shared bin (MV, local government).

Segmentation based on these audience characteristics recognises the underlying behavioural theories regarding the role of actual behavioural control as per TPB, as well as VBN theory's issue awareness and acceptance of responsibility. Each of these theories were discussed in Chapter 3, and their key components integrated into the predictive model (CFM) analysed in Study 1 and Study 2.

In addition to housing characteristics, interviewees mentioned audience profession, geography, age, and cultural backgrounds as differentiating audiences. Sometimes these distinctions led to different message framing such as the use of emotional appeals versus non-persuasive communication. More often, however, these distinctions were made in the context of engagement platforms (access channels) whereby campaigns reached these audiences through existing structures. In some cases these were external to the campaigning organisation, for example an external network accessed by one interviewee: "... [through] a very close relationship with the Australian-Vietnamese Women's Association, so it was the Vietnamese community with which the [organisation] partnered for that" (SG, local government). In other cases reach was via internal organisational networks with the community, as raised by the same practitioner for other campaign instances:

> I guess we're kind of lucky in that. Because our business is so broad, there's these ... interest groups here ... We utilise the relationships we have across [the organisation]. So we use our colleagues in other teams to access the ... people in the community who they work with (SG, local government).

Accessing audiences through established networks supports the use of trusted speakers to present campaign material to these segments. The effect of a range of source characteristics on message reception was discussed in Chapter 2. By using trusted sources, campaigns can capitalise on perceptions of source similarity and reliability, thus increasing positive message reception. Australia is a culturally diverse nation, with around half the population being first or second generation Australians and over 20 percent of the population speaking a language other than English at home (Australian Bureau of Statistics, 2017a). Targeting cultural communities also allows for audience-specific channel selection and message tailoring that addresses cultural contexts. The meta-analysis in Study 1 found that culture (represented by country) affected which factors influenced behaviour, suggesting that cultural audience targeting is a sound segmentation approach.

Each of these considerations of socio-demographic characteristics matched Hine and colleagues' (2014) proposal that segmentation should consider theoretical and practical implications, however this segmentation occurred for groups that targeted larger populations and was not common among other interviewed organisations. This highlights possible issues for campaigns run by smaller organisations where lack of awareness of differential barriers or other relevant audience characteristics—for example, age or education as found in Study 2—may reduce the effectiveness of campaigns. As smaller campaign organisations tended to focus on more engaged audiences this may counter some of these issues, however it raises the possibility that there are gaps in audience targeting such that some segments of the population are overlooked by campaigns.

In contrast to tailoring messages to audiences, tailoring campaign approaches to behaviours was less frequently supported. There was recognition by some interviewees that different behaviours would require different campaign approaches, although this also intersected with audiences as evident in one interviewee's explanation that:

> There's not one particular model which we use, although a lot of us have done various training, like I said, including Douglas McKenzie-Mohr and others at Behaviour Works ... I think probably what is more standard across projects than a particular approach is ... that we always try to work in collaboration and alongside the community ... and the approach is often dictated by the community of what works for them (SG, local government).

Groups with less training in behavioural science often used a consistent approach across behaviours but differentiated across audiences. Organisations with more formal campaign training (and more resources), however, were more likely to adopt different approaches across behaviours—whether overtly acknowledged or built into the testing of messages during formative evaluations. The use of formative evaluations allows for testing messages at the intersection of audience and behaviour, which was an area identified in Study 1 as insufficiently integrated across behavioural research in this field. Providing organisations with stronger frameworks for decisions on where to target behaviour

change campaigns for different behaviours, and the likely differences in behaviour pathways across audiences, could benefit practitioners in both small and large organisations. For smaller organisations, such knowledge could improve capacity to tailor campaign messages without needing to expend resources on formative evaluations. For larger organisations, this information could inform the design of formative evaluations and potentially reduce costs by requiring pre-testing with a smaller number of participants. Such clear guidance would also strengthen the justification of selected models where it is required.

Conclusion

This study examined the design processes, context, and engagement with research, of ten Melbourne-based, campaign organisations. These groups have diverse structures, resourcing, skill bases, and mandates, which interact with Australia's socio-political context in ways that create unique constellations of barriers and enablers for campaign design and the use of research. Key challenges identified by interviewed organisations often stemmed from the organisation's size and resources, although issues typically related to one or the other. Larger organisations were better resourced and had teams with stronger skills in communication and behavioural science, but faced issues of mandates covering large audiences and showed tendencies towards bureaucracy. Smaller organisations, however, could be more flexible in their approaches but had fewer resources and teams with fewer skills in communication and behavioural science.

Despite these challenges, practitioners had developed a range of coping strategies to support campaigns within their organisational limitations. Collaboration and networking are common approaches that support these organisations to access ideas, learn from other practitioners, and support each other's actions. The better resourced groups also tend to conduct research through in-house teams or via consultants, to better understand their audiences and to test message reception. Strategic planning has also been implemented by larger organisations to ensure high level support and manage the complexities associated with projects in organisations that tend towards bureaucracy.

The tailoring of campaign approaches for different audience segments and behaviours was variable, and also appeared to be related to organisational characteristics (resourcing, skills, and mandates). The use of demographic characteristics (e.g., age, cultural background, and housing situation) for audience segmentation, was adopted by organisations with professionally trained campaign teams with more resources and mandates that required the coverage of broader audiences. Tailoring behaviour change models for different behaviours was also more common in these organisations, and often involved message testing in formative evaluations. Organisations with fewer resources and involving teams with less formal training in the behavioural sciences, were more likely to adopt a similar suite of approaches across diverse behaviours, but did tailor approaches where audiences were segmented.

Researchers could support campaign designers to increase campaign effectiveness and efficiency by providing regular research updates that integrate the findings of diverse research and are presented in formats and through channels accessed by campaign practitioners. Campaigning organisations would also benefit from the increased sharing of the results of well-designed campaign evaluations, as practitioners are keen to learn from the work of others. In addition, access to regular assessments of Australians' attitudes, behaviours, and media channel preferences (and how those intersect) would strengthen campaign designs and support the ongoing evaluation of the Australian public's progress on climate change.

These findings suggest that larger organisations with more formalised skills and greater resourcing, are more likely to access and use behavioural and communications research, although this information is not sufficient in its current forms. Issues regarding the limited integration of climate change behavioural research as found in Study 1, and the value of certain demographic segmentations similar to that found in Study 2, were illustrated in practitioners' approaches and perspectives. Researchers can offer support to campaign designers, but to do so requires a shift from current coverage and integration. Funding organisations should consider how best to support such research.

Chapter 8: Discussion and Conclusions

Despite the vast accumulation of information regarding the significance of climate change, the uptake of actions necessary to mitigate global warming has been insufficient to prevent the increasing atmospheric greenhouse gas levels that are impacting both human and natural systems across the globe. As many mitigation behaviours are voluntary, communication campaigns offer cost effective interventions for encouraging adoption of these behaviours (Klöckner, 2015). The success of communication campaigns can be difficult to ascertain (Coffman, 2002), but evidence indicates substantial potential for behaviour change, particularly through social marketing approaches (Corner & Randall, 2011; McKenzie-Mohr et al., 2012). Behavioural science research has been raised as offering strong value for affecting changes in behaviour to address climate change (Gifford, 2008; Swim et al., 2011; van der Linden, Maibach, & Leiserowitz, 2015), however the psychology literature lacks sufficiently comprehensive behaviour models targeted for campaign interventions and the research syntheses necessary to provide guidance of appropriate specificity for campaign targeting. This thesis aimed to improve understanding of (a) the factors that influence the mitigation behaviours of individuals, and (b) how communication campaigns can be improved to better target these factors. This research focused on addressing four research questions:

- Research Question 1—Which predictors of mitigation behaviour does international research indicate are most likely to be influential for use in behaviour change campaign targeting?
- Research Question 2—Does this same pattern of influence of predictors of mitigation behaviour [as per Study 1's findings] apply in the Australian context?
- Research Question 3—What barriers prevent or limit campaign designers' use of behaviour research to inform campaign design and why might this be the case?
- Research Question 4—To what extent do campaign processes reflect the findings of the quantitative analyses of this thesis?

Three sequential studies were conducted using qualitative and quantitative methods to answer these four research questions. Study 1 involved quantitative meta-analysis applying meta-analytic structural equation modelling to test the campaign focus model (CFM) using data from internationally published climate change mitigation behaviour prediction research to answer Research Question 1. The quantitative analysis in Study 2 applied structural equation modelling techniques (path analysis) to test the CFM using survey data collected by CSIRO from an Australian sample to answer the second research question. Study 3 applied qualitative content analysis techniques to analyse data from interviews with Australian climate change mitigation behaviour change campaign designers, to answer Research Questions 3 and 4. Details of these methods, including justifications for method choices, data collection and analysis, and assumption testing, are provided in Chapter 4. The findings and implications of these studies were presented in Chapters 5 (Study 1), 6 (Study 2), and 7 (Study 3).

This discussion chapter examines the collective findings across these three studies, how they relate to the existing literature, and their implications for campaign design and for future research. A summary of the theoretical and practical contributions of this research is also provided, along with acknowledgement of the research limitations.

Climate Change Communication and Mitigation Behaviour Research

The effective design of campaigns for behaviour change requires understanding of both communication and behaviour. As such, both climate change communication research and mitigation behaviour research offer valuable insights for climate change mitigation campaign interventions. Substantial research has been undertaken in each of these fields, however limitations exist within each discipline with regard to their strategic progression in understanding, and their presentation of findings for use by campaign designers. Previous researchers have highlighted considerable challenges for climate change communication research, specifically: a lack of theoretical cohesion in the evolving research corpus, insufficient incorporation of the progress made in broader communication research, and poor dissemination of research findings for practitioner uptake (Anderson, 2015; Ballantyne, 2016; Moser, 2010). The mitigation psychology literature review and meta-analysis of this thesis faced similar challenges, particularly with respect to limited theoretical cohesion and insufficient specificity in research syntheses, although this branch of psychology has stronger theoretical connection with the broader psychology discipline.

Internal and external theoretical cohesion. Both communication and psychology research regarding climate change face challenges in strategic progression of understanding due to poor theoretical cohesion, although linkage with the broader, parent discipline is stronger for mitigation psychology than for climate change communication. The complex and systemic nature of climate change has led to research engagement by a broad range of disciplines, and this has produced rich and diverse research that offers many benefits in understanding different aspects of belief and behaviour. With respect to internal theoretical cohesion, however, neither climate change communication nor mitigation psychology research has yet managed to reconcile the multiple paradigms associated with diversity into a cohesive whole. The field of climate change communication is based on multiple ontological assumptions, which has led to fundamentally different and dissonant ways of understanding communication and conducting research (Ballantyne, 2016). Mitigation psychology shows similar dissonance, evident in its limited integration of theories across the diverse pathways to behaviour (Klöckner, 2013; Whitmarsh, O'Neill, & Lorenzoni, 2013). The increasing recognition of these issues in reviews and model integration studies suggests room for hope, but concerted effort is required.

While mitigation psychology research typically draws upon theories from the broader psychology discipline, climate change communication has not followed the same approach. The interactive and constitutive nature of communication and meaning-making is well accepted in theories of the broader communications research discipline, but has not been well integrated into climate change communication research (Ballantyne, 2016; Moser, 2010). This may be due to climate change communication initially being undertaken by scientists rather than communications experts (Ballantyne, 2016). The Dunning Kruger effect's overestimation of competence by those with lower levels of expertise (Glucksberg & McCloskey, 1981; Hansson et al., 2017; Pennycook, Ross, Koehler, & Fugelsang, 2017) may reduce the potential for information-seeking and self-improvement (Pennycook et al., 2017). Thus personal experience of daily communication, and lack of communication training to support accurate estimation of knowledge gaps, hinders recognition that there may be considerable research available on communication processes that could be accessed and built upon. Behaviour change campaigns exist within, and contribute to, society's evolving meaning-making. Theoretical progression within climate change communication research commensurate with general communications research could offer valuable support to help campaigns navigate and influence these meanings and associated behavioural responses.

Dissemination to practitioners. In addition to a need for improved internal and external theoretical cohesion, climate change communication and mitigation psychology researchers must improve outreach to practitioners if the results of their research are to effect real world change. Previous researchers have identified environmental communications scholars as having historically failed to translate their research for wider accessibility outside academia (Anderson, 2015), while this thesis' literature review identified issues with dissemination approaches used by mitigation psychology researchers. Both these fields have valuable insights that could be used by practitioners to improve campaign designs, but current approaches to research synthesis typically fail to offer the necessary levels of specificity for application to individual campaigns.

Research synthesis aims to integrate and translate diverse (and sometimes contradictory) findings from the breadth of climate change communication research, but a key challenge of this process is to avoid oversimplification (Moser, 2016). Syntheses published as guidance relevant for climate change campaigns have typically offered somewhat generalised findings to support diverse pro-environmental campaigns or communication agendas (e.g., Klöckner, 2015; McKenzie-Mohr et al., 2012). While broader campaign guidance material (not climate change or pro-environmentally focused) tends to be even less specific (e.g., National Council for Voluntary Organisations, 2017; Pike et al., 2010). Resources offering such generalised advice often suggest the use of diverse campaign strategies and channels, and the application of formative evaluations to test campaign approaches (e.g., Rice & Atkin, 2011) as means to address the lack of specificity of guidance within the

complexity of the contexts surrounding campaigns. Not all campaign organisations have the resourcing to implement such advice, however, and could benefit greatly from additional specificity providing insights on nuances of messaging approaches across audiences and behaviours. Achieving the necessary balance of specificity and generalisability is highly challenging (Frederiks et al., 2015; Moser, 2016) and requires adjusted approaches to research synthesis that reconcile theoretical approaches and empirical results to retain additional nuance that can guide campaign targeting for diverse audiences and behaviours.

Addressing the challenges. These reviews identified both strengths and weaknesses within the existing climate change communication and mitigation behaviour research, and established the research focus for this thesis. The need for improved model integration and nuanced understanding in predicting mitigation behaviour was addressed by Study 1 and Study 2 in response to Research Question 1 and Research Question 2, while the need to understand how to improve the dissemination of this research to practitioners was addressed by Study 3 in response to Research Question 3 and Research Question 4.

Modelling Mitigation Behaviour

In addition to developing an integrated model of behaviour specifically relevant to campaign interventions, this research's modelling in Study 1 and Study 2 supported the identification of important differences in the influence of predictors that related to levels of data aggregation and the nature of the behaviours and community segments modelled. Despite a series of data issues, comparative model testing provided insights on the predictors of mitigation behaviour in response to Research Question 1 (through Study 1) and Research Question 2 (via Study 2).

> *Research Question 1: Which predictors of mitigation behaviours does international research indicate are most likely to be suitable and influential for use in behaviour change campaigns?*
>
> *Research Question 2: Does this same pattern of influence of predictors of mitigation behaviour apply in the Australian context?*

The value of an integrated model. The CFM was developed to address the need for a model of behaviour that integrated key concepts from all three categories of pathways to behaviour, focusing specifically on the predictors of behaviour that are most relevant for campaign interventions. Together, these pathways offer various opportunities for campaigns to influence behaviour, both through triggering the enablers of behaviour and through addressing the barriers to implementation.

Comparison between the theory of planned behaviour (TPB) and CFM models in Study 2 provided corroborating evidence of the value of integrating multiple pathways to behaviour. With the inclusion of normative pathways leading to intention improving model performance above that of rational choice pathways alone.

The specific value of the CFM above existing models was tested across Study 1 and Study 2 and, despite a range of data issues that limited the modelling, the results of this initial testing suggest that the CFM may offer valuable support for campaign design above that offered by existing models. Study 1 tested three comparison models from previous literature: TPB (Ajzen, 1991), value-belief-norm theory (VBN; Stern, 2000), and the comprehensive action determination model (CADM; Klöckner, 2013). The meta-analytic data in Study 1 did not fit either VBN or CADM, but fit the TPB model, which offered a moderate level of prediction comparable with that of previous meta-analyses of TPB across diverse behaviours (Armitage & Conner, 2001; McEachan et al., 2011; Rise et al., 2010). A lack of published correlation data for various predictors' relationships with self-identity, emotions, and habit prevented testing the CFM in Study 1. These three predictors (self-identity, emotion, and habit) have been raised by various researchers as important for more complete models of behaviour (e.g., Bamberg & Möser, 2007; Conner & Armitage, 1998; Klöckner, 2013). Despite being raised 20 years prior to the publication of this thesis, however, insufficient coverage within research on mitigation behaviours has restricted the ability for meta-analytic reviews like that of Study 1 to successfully test the integration of these predictors. This gap is indicative of issues associated with the theoretical diversity and cohesion challenges already discussed, and requires a strategic approach to the examination of the many known predictors of behaviour if their relative influence is to be determined.

Tests of the CFM and TPB in Study 2 found the CFM to have slightly better fit to the data than the TPB, however data issues also affected these analyses and resulted in low overall predictive capacity. The data sufficiency issues in Study 2 were slightly different to those of Study 1, involving some similar gaps in the coverage of model variables, but also including the use of measures for some variables that were not sufficiently behaviour-specific or temporally proximal. Study 2 used data from Australia's largest national climate change attitudinal dataset, which was collected by CSIRO between 2010 and 2014, and included measures for all CFM variables except habit—although no single survey event measured all variables. In addition, many variables were captured as generalised rather than behaviour-specific measures, which also affected modelling results. Measurement specificity, correspondence between levels of specificity across variables, and the temporal proximity of intent and behaviour measures, have been posed as an explanation for some studies' poor ability to predict behaviour (Ajzen, 1985; Davies, Foxall, & Pallister, 2002; Kaiser, Wölfing, & Fuhrer, 1999), and this was evident in the lower than expected prediction of both TPB and CFM in Study 2, although the CFM offered slightly better model fit than TPB.

Considered together, the modelling results and data issues illustrate important considerations for the design of future research, but offer initial support for the value of the CFM. There is a critical need to strategically test the known predictors of behaviour for comparative evaluation and integration, and surveys supporting mitigation behaviour research must adopt measures with appropriate levels of behaviour-specificity. Further testing of the CFM with complete data of appropriate specificity, would provide stronger evidence of the efficacy of the model.

Patterns of influence and the predictors of mitigation behaviour. Comparison of results across Study 1 and Study 2 support the notion that the relative importance of predictors varies across behaviours and audiences. The TPB model in Study 1 showed intention to implement as the strongest direct predictor of behaviour, with perceived behavioural control (PBC) and attitudes offering the strongest (similar) prediction of intention, followed by social norms. This pattern is consistent with the findings of other meta-analyses (Armitage & Conner, 2001; McEachan et al., 2011), however evidence from review of the heterogeneity of the data and from individual comparative studies (e.g., Greaves et al., 2013; Kim et al., 2012; Yang et al., 2014) suggested that aggregation of the data may mask nuanced differences in pathway importance across behaviours and communities (or segments). The analysis of the CFM in Study 2 offered further support for such nuances across behaviours and masking by aggregation, with some predictors showing higher or lower value across different levels of aggregation and different behaviours.

In addition to testing the CFM with data aggregated across all behaviours, modelling was completed for three groups of behaviours and five individual behaviours, with varying efficacy. All of the included variables influenced behaviour in some way when predicting aggregated behaviour data, however the relative predictive contribution of some variables changed at other levels of behaviour aggregation. The inclusion of demographic data as predictors of fully aggregated behaviour failed to identify statistically significant roles for these audience segment characteristics, however disaggregated analyses found that characteristics including gender, age, and education predicted the adoption of some behaviours, suggesting masking of these segment effects under aggregated conditions. Of the three behaviour categories tested, the CFM best explained purchasing behaviours (11 percent explained), then curtailment behaviours (8 percent explained), and least explained were structural support behaviours (4 percent). There were few differences in paths across these behaviour groups due to the generalised measures for most variables, however the paths involving the two behaviour-specific measures (attitudes and behaviour) did vary across behaviour groups. As attitude and behaviour were the only two variables measured with behaviour-specificity, these findings support the expectation that different behaviours are predicted by different pathways (patterns of variables).

The ability of the CFM to predict behaviour increased with the level of aggregation, with specific behaviours predicted with the least efficacy. This may be due to the influence of the generalised measures, which may be more relevant with aggregated (generalised) behaviour, however it may also suggest that even statistically valid grouping of behaviours may mask details of relevance to campaigns. Generalised intent offered the strongest prediction of the more commonly adopted specific behaviours such as reduced petrol consumption and recycling, with less effective prediction of behaviours with lower adoption, including the use of low carbon transport modes.

Collectively, these findings support expectations of varying paths to behaviour adoption for different behaviours and audience segments, and suggest that researchers should be wary of aggregating data or adopting generalised measures for behaviour-specific variables. While the data was not ideal for testing the CFM, this model shows potential for supporting these nuanced analyses, and further testing should be undertaking to confirm the model's value, and nuances in the patterns of influence of CFM predictors across behaviours and community segments. By tailoring the model to include variables of most influence, this thesis offers a potentially valuable tool for campaign design. The identification of model nuances, however, should be paired with reconciling findings with previous studies if they are to assist practitioners in identifying and justifying the choice of target variables and thus achieving more efficient and effective campaign designs.

The analysis of Study 3 interview data (see Chapter 7) identified a recurrent theme of knowledge as a barrier to effective campaign designs and use of research by campaign designers, and knowledge may also be a barrier to the adoption of new mitigation behaviours. While knowledge is typically found to be a distal predictor of behaviour that is mediated by other variables such as attitudes, for unfamiliar behaviours (e.g., associated with new technologies) it could be a substantial barrier. Future studies testing the CFM should examine the possibility that knowledge may be a more proximal predictor for unfamiliar behaviours.

Campaign Engagement with Research

A strategic and informative research base is not sufficient to ensure effective campaign designs, however, but must be paired with research dissemination to, and uptake by, practitioners if it is to inform campaign designs. Understanding current research-practice engagement was the focus of interviews with campaign designers in Study 3 (see Chapter 7) to address Research Question 3, which focused on campaign organisations' research access, use, and needs. McKenzie-Mohr (2000) suggested that practitioners have yet to widely access or utilise available psychology research for design of interventions. Study 3's interview findings support this to some extent, with varying levels of awareness and use of research across campaign organisations for both climate change communication and mitigation behaviour research. These interviews identified diverse sources and

types of research accessed (and sometimes created) by practitioners, but with gaps in access and unmet research needs that have implications for campaign effectiveness.

Research Question 3: What barriers prevent or limit campaign designers' use of behaviour research to inform campaign design and why might this be the case?

Barriers to research use. Climate change communication research was used by practitioners more extensively than was behaviour research, but a series of barriers influenced this uptake and resulted in varying levels of engagement with the available research. Communication and behaviour research was used by all groups to some extent, but typically to a lesser extent than was climate change science and technology research. Many different channels were used to access research, ranging from books and podcasts designed for general consumption, to academic journals and direct relationships with researchers. Different levels of expertise in communication and behavioural science in campaign teams appeared to be a key factor in research uptake, affecting recognition that research might exist (and should be sought), capacity to identify and engage with the depth and breadth of research available, and the complexity of the research insights that were utilised. Larger organisations with team members trained in communications or behavioural science generally accessed and applied more complex insights from research than did smaller organisations without members trained in these fields. This differential use of research by practitioners may, in part, be due to the Dunning-Kruger effect whereby individuals with lower levels of competence tend to overestimate their competence and fail to recognise their knowledge gaps (Glucksberg & McCloskey, 1981; Hansson et al., 2017). By underestimating knowledge gaps, information seeking is reduced and the considerable volume of climate change communication and behaviour research remains untapped by many practitioners.

Difficulty identifying relevant information from amid the plethora available was another contributor to lack of research use raised by many practitioners—although more commonly by those with less training in the communication and behavioural sciences—and was often raised in terms of an overload of information. With more researchers and others generating information and resources, and more ways to disseminate these, it becomes increasingly difficult to identify the information that is of most relevance and highest reliability for decision making contexts (Eppler, 2015). Some groups relied on their networks of peers for identifying relevant information, and also for sharing learnings from campaign practice. Some organisations also had ongoing relationships with researchers that also provided links to research findings. Tapping into existing knowledge-sharing networks and increasing research-practice collaboration could offer valuable pathways for increasing the discoverability of research for practitioners.

Practitioners with deeper engagement also encountered barriers not felt by those with more superficial research uptake. Campaign designers without relevant training tended to use simpler concepts of intuitive appeal (e.g., designing campaign messages to appeal to self-transcendent values, or limiting their chosen audience based on structural barriers to behaviour). This was in contrast to the more complex application of theories and insights applied by teams that included members with some form of relevant training. Practitioners more engaged with the psychology literature in particular, however, raised inconsistencies in research findings and lack of clarity on how to select and justify behaviour theories as barriers to effective research application. Changes to the way research syntheses are conducted could assist with simplifying these types of decisions. Research syntheses typically focus on one of two outcomes: (a) summarising the breadth of theoretical approaches used in the field (e.g., Gifford & Nilsson, 2014; Jackson, 2005); and (b) meta-analytical analyses of a specific theoretical model (e.g., Bamberg & Möser, 2007; Conner & Armitage, 1998; Klöckner, 2013). Stronger integration of these two approaches is critical for identifying the contexts that explain seemingly conflicting research findings while integrating and reconciling the different theoretical approaches that can inform campaign designs. By providing research syntheses that draw out these contextual differences, behavioural science research could be more effectively applied in individual campaign designs.

From the perspective of communication theory, more limited engagement did not prevent practitioners with less training from rejecting information deficit approaches in favour of dialogic models. Few interviewees overtly acknowledged this as related to engagement with research, instead appearing to have developed this insight through more intuitive means. Practitioners tended to connected with their audiences through multiple platforms that included a range of dialogic approaches such as to social media engagement and direct interpersonal engagement (e.g., face-to-face events). The inclusion of face-to-face engagement alongside mediated campaigns has been shown to improve outcomes for campaigns (Davies, 2012; Scott & Maryman, 2016), and was seen by some Study 3 organisations as integral to their group's identity (particularly volunteer groups). In several instances, recognition of the importance of engagement and dialogue seemed to lead practitioners to limit their audiences (or target behaviours) to allow for such engagement within their available resources rather than removing this type of engagement in an effort to reach more people but with less depth.

In summary, this research identified varying levels of engagement with climate change communication and behaviour research, with apparent links to practitioners' training. While some groups have relatively simplistic engagement with theory and research insights, others with deeper engagement were challenged by the complexities within the research field. The rejection of deficit models of communication was strong across campaigners, with dialogic engagement often integral to

organisations' approaches. This depth of understanding of the barriers to engagement was not apparent within current literature, despite some researchers suggesting that engagement was low.

Research application through audience targeting. The targeting of the campaigns to audiences, whether through dialogic approaches or otherwise, was adopted by all interviewed organisations, although they rarely adopted segmentation approaches within that target (i.e., where different segments are targeted with different messages or through disparate channels). Audience targeting is a particularly effective approach for behaviour change (Corner & Randall, 2011). Study 2 (see Chapter 6) identified that certain community segments' demographic characteristics could relate differentially with some behaviours, hence Research Question 4a focused on audience targeting based on demographic characteristics that could be associated with barriers to adoption. This question was answered by Study 3's interviews, which identified highly variable levels of audience segmentation and targeting (see Chapter 7).

Research Question 4a: To what extent does audience targeting include demographic considerations with respect to current adoption of behaviours, and structural and societal barriers to adoption?

Audience segmentation that includes consideration of socio-demographic characteristics matches Hine and colleagues' (2014) proposal that segmentation should consider theoretical and practical implications, however such consideration was not regularly or comprehensively applied across all the interviewed organisations. Campaign organisations have diverse mandates and associated target audiences, as well as variable resources to support campaign design and delivery, and this results in considerable variation in their levels of audience segmentation and targeting. Smaller campaign organisations typically avoided audience segmentation, instead choosing an undifferentiated level of audience (e.g., the local community) to target without further segmentation, and often limited their targeting to individuals already predisposed to mitigation behaviours. Larger campaign organisations typically had more formalised mandates (e.g., local governments) and focused on wider audiences. These groups were more likely to apply segmentation and targeting at finer scales that utilised a range of factors including demographic characteristics such as gender, age, culture etc. With more resources, these larger organisations were also more likely to conduct market research on audiences, and formative testing of campaign messages and channels with these audiences. A similar mix of focus on persuading the already alarmed/concerned public, or the less concerned, or both, was found in climate change advocacy NGOs in the US (Hestres, 2015). Analysis of organisations campaigning for low carbon transport behaviours in Europe also found a similar mix

of audience limiting (e.g., school children) and segmenting, with segmentation based on criteria other than climate change engagement per se (Davies, 2012).

While focusing on already engaged individuals is attractive in terms of requiring less persuasive effort and ensuring positive message reception, it may result in the exclusion of large segments of the population, and overlooks segments of the public where larger gains might be made. For example, Morrison and colleagues (2018) found a growing proportion of the Australian population falling into the more *Cautious* and *Disengaged* categories (primarily due to shifts away from the *Doubtful* and *Dismissive* categories). These *Cautious* and *Disengaged* individuals are where larger gains could be made, as they tend to be less engaged in mitigation behaviours (Morrison et al., 2018) but their opinions on climate change issues can be easily changed (Morrison, Duncan, Sherley, & Parton, 2013). Better understanding of community attitudes and behaviours could allow campaign organisations to identify alternative audiences for expanding their campaign focus and achieving greater changes in behaviour.

Certain audiences are also more likely to be challenged with the societal or structural barriers that relate to some behaviours (e.g., reliant upon home ownership), however, these barriers were more commonly recognised at levels applicable to the general population (e.g., government policies). Where these barriers were recognised, it was typically not specific to any particular target behaviour but appeared to be more related to the campaign organisations' behavioural science skills and general mandate. Most organisations recognised general societal or structural barriers that affect the community as a whole (e.g., national policy barriers), while larger organisations more often also acknowledged societal and structural barriers that affect different segments of their target audiences differentially (e.g., language and cultural barriers, or home ownership). These larger organisations, where appropriate, tailored campaign delivery channels and messages to reach specific audience segments affected by these barriers (e.g., via language communities using translated material), and also addressed the structural barriers directly where this was within their mandate (e.g., development of food waste disposal infrastructure by local governments in charge of waste management infrastructure). Targeting of audiences already engaged in climate change mitigation, and potentially overlooking the differential impact of social and structural barriers to behaviour, raises the potential that there are gaps in audience targeting such that some segments of the population are overlooked or poorly targeted by campaigns.

The interviews thus add to the existing literature by highlighting the potential for improved campaign effectiveness and efficiency through enhanced audience targeting, particularly for smaller campaign organisations. This would require increased understanding of campaign audiences and capacity to target, which could be achieved through the mechanisms already discussed in this section, namely research-practice collaboration with associated new knowledge shared through industry networks, and regular audience surveys.

Research application through behaviour targeting. With psychology literature and this thesis' modelling suggesting that different behaviours may be better predicted by different pathways, the interviews in Study 3 were used to answer Research Question 4b. This question focused on the extent of behaviour-specific campaign targeting, and interviews found considerable variation in the application of such approaches.

> *Research Question 4b: If practitioners target a range of behaviours (either within or across campaigns), to what extent are their theoretical frameworks (if any) and audience targeting applied differentially across behaviours?*

The selection of target behaviours by the Study 3 sample was often driven by their engagement with climate change science and technology resources (e.g., several groups mentioned Hawken, 2017). Each group's mandate and resourcing also affected their choice of target behaviours. Most groups targeted multiple behaviours, often at the same time. An analysis of climate change and animal rights NGOs in the US also raised the desire to avoid alienating members and supporters as potentially restricting campaign foci for contentious issues (Laestadius, Neff, Barry, & Frattaroli, 2014), which suggests that certain behaviours may be less well covered by campaigns. The development of NGOs to fit niche markets has also been raised by several researchers as an adaptation for achieving differentiation and competing for members and support (Laestadius et al., 2014). Such a process reduces duplication of effort, however care must be taken to identify potential gaps in audience or behaviour coverage where substantial mitigation gains might be achieved. Research-practice collaborations could assist with assessing for the presence of such gaps, and identification of approaches to address these.

Continuing the general trend of lower engagement with behavioural science, the interviewed organisations less frequently acknowledged tailoring campaign approaches to behaviours in comparison with tailoring messages to audiences. Groups with less training in behavioural science rarely distinguished approaches across behaviours in comparison with organisations with more formal campaign training (and more resources). This differentiation may be overtly acknowledged and integrated into campaign designs, or consequentially derived through the testing of messages during formative evaluations. Providing stronger frameworks for understanding the nuances required for behaviour targeting, would offer campaign organisations improved ability for tailoring their approaches, particularly when limited resources preclude formative evaluation of messaging approaches

The interviews therefore offer new insights into the behaviour-specific application of behavioural science research by Australian climate change mitigation campaign designers, suggesting barriers that vary across organisations. Also highlighted, is the potential for gaps in the coverage of

behaviours, in terms of both target behaviour selection and audience reach. While raising awareness of behavioural science research in general could help improve campaign designs, there is also a distinct need to accompany this with improved research syntheses and theoretical frameworks that can provide clearer explanation of the differences in drivers and barriers across behaviours (and audiences). Research-practice collaboration could also assist with the identification of targeting gaps and ways to address these.

Research needs. In addition to a need for improved accessibility and useability of research, campaign organisations raised two specific research gaps that groups with the resources to do so filled through internal organisational research. These knowledge gaps included a (a) information on target audiences' beliefs, behaviours, and media use; and (b) findings from evaluations of other campaigns. In both cases, these gaps acknowledged a desire for more efficient and effective campaign designs, which is particularly relevant as most campaign organisations acknowledged feeling resourcing pressures.

Better funded campaign organisations typically conducted their own audience research during planning (or as part of formative or summative evaluations), however previous research has collected datasets that provide important insights that could be expanded upon. Campaign organisations' internal research was not often published, but tended to include one or more of: the identification of audience characteristics, benchmarking of behaviour adoption and beliefs, testing messages and media channels with target audiences, and assessments of reach and audience responses/uptake. Various studies conducted by researchers have investigated similar topics, however connections between these different variables are rarely included in the same study.

Various national surveys of the Australian public's beliefs and behaviours relevant to climate change have been conducted (e.g., Leviston et al., 2015; Morrison et al., 2018; Reser et al., 2012a). Similarly, media channel use has also been investigated through national surveys (e.g., Alcorn & Buchanan, 2017). These two sets of surveys, however, do not intersect in ways that support the intersection of beliefs, behaviours, and media engagement to effectively assist climate change mitigation campaigns. In the complex cultural circuits of media and society, the public's beliefs, behaviours, and media use all change over time (Alcorn & Buchanan, 2017; Morrison et al., 2018), and regular updates spanning all of these topics could assist with both campaign targeting and the tracking of societal changes before their effects might be evident in terms of atmospheric carbon. Such comprehensive datasets and analyses would require considerable resourcing, but could greatly improve the outcomes of campaigns in conjunction with the model improvements already discussed.

Improving engagement with research. The barriers and research needs identified by this research, suggest a need for better integration of research and practice. Several researchers have

offered advice on how the behavioural sciences can help address climate change (e.g., Gifford, 2008; Stern, 2011; Swim et al., 2011; Task Force on the Interface between Psychology and Global Climate Change, 2009), but these typically focus on specific psychological phenomena for study and the need for interdisciplinary research. Few of them directly discuss processes for promoting the practical application of psychological research's findings, although some do highlight the importance of engagement with policymakers (e.g., Clayton & Brook, 2005; Gifford, 2008). Improvements to both the focus research and dissemination of findings offer important avenues for improving practical outcomes. These two aspects of focus and dissemination are reciprocally connected, and both require active engagement with industry. Engagement with industry either indirectly through non-academic publication channels or directly through research collaborations, is not consistently required or implemented (Department of the Prime Minister and Cabinet, 2015; Fyfe et al., 2017). This disjoint presents a critical challenge for both industry and researchers, as each offer important contributions for addressing societal issues such as climate change.

Improving research focus would involve consistent, strategic efforts to replicate and build upon past research, as well as ongoing industry engagement to integrate practitioners' perceived research needs. While researchers should consolidate their own understanding of mitigation behaviour (e.g., through research syntheses and strategic examination of the predictors of behaviour), understanding practitioners' perceived research needs is another critical aspect for effective research and practice. Direct engagement would raise practitioners' awareness of existing research as well as allowing for practice-driven research foci. The associated mutual sharing of knowledge would improve both parties' understanding of campaign and behavioural processes, and improve the dissemination of research. Such collaborations offer valuable opportunities to move beyond laboratories and correlational data into real world campaign evaluations for testing theories of behaviour change. Indirect engagement could also be improved through increasing publication in non-academic formats and through non-traditional dissemination channels such as industry networks and open access journals. There is growing impetus across many fields of research—including psychology (e.g., Bullock, 2004; Dingfelder, 2012)—for open access to research articles (Tennant et al., 2016), however non-academic publication is less frequently supported (Fyfe et al., 2017) but considerably more commonly accessed and shared by the practitioners interviewed in Study 3.

The combination of literature analysis and interviews in this thesis thus provides corroborating evidence to support the current trends towards promoting research-practice collaboration and open access to research. This analysis further expands on past proposals for psychology research's contributions to addressing climate change by highlighting two important areas for improvement in research practice. Improving the strategic progression of the field could be achieved through (a) broader comparative modelling across a range of theories and concepts to support theoretical integration, and (b) stronger integration of research synthesis approaches to

identify contextual differences in the predictors of behaviour and to reconcile seemingly conflicting findings. Together, these two approaches could provide campaign designers with a better understanding of the most influential predictors to target for specific campaigns, and increase both research and practice effectiveness and efficiency.

Institutions funding and publishing research can support researchers' efforts in these areas through a range of strategies in furtherance of current trends towards ensuring research impact. Specifically, academic and funding institutions should place high value on: (a) deeper engagement and collaboration with practitioners for identifying research needs and in conducting applied research; (b) strategic and integrative theoretical development; (c) the synthesis of research findings at more nuanced scales; and (d) dissemination of results through channels more likely to reach practitioners. Such encouragement is necessary within academic evaluation and promotion processes, and grant allocations. Similarly, publishing and research institutions should also continue to pursue options for effective open access research publication.

Practitioners and practitioner networks could also take active approaches to improve connections with researchers by reaching out to relevant research organisations. Practitioners could offer researchers insight into knowledge gaps, opportunities for collaborative applied research through proposed campaigns, and networks for sharing research findings. By taking a proactive approach, practitioners could help focus research on their own practice needs and encourage mutually beneficial relationships between research and practice.

Conclusion and Implications

This thesis aimed to improve our understanding of the factors that influence the mitigation behaviours of individuals, and how communication campaigns can be improved to better target these factors. It examined existing climate change communication and behavioural science research, and provided an integrated model of climate change mitigation behaviour. Comparative testing of this model provided initial indications of efficacy, and corroborating evidence that the paths to behaviour vary across behaviours and potentially across community segments. Interviews with campaign designers identified critical barriers to their use of research, as well as some consistent research needs. Campaign designers have adopted various coping strategies to deal with the barriers they face, but researchers can offer valuable support. This section acknowledges the research's limitations and provides an overview of the unique contributions of this thesis to theory and practice.

Research limitations. Data limitations impacted on the ability to test the CFM developed as part of this research. The literature search criteria for Study 1 aimed to provide the most comprehensive dataset, however restricting to relevant behaviours and measures considerably limited the available data. Similarly, the decision to use Australia's most comprehensive, but already

collected climate change attitudinal dataset meant that some variables were either not measured or were measured with generalised rather than behaviour-specific focus. These unexpected issues highlight critical challenges facing researchers in this field, and which must be strategically addressed if understanding of mitigation behaviour is to advance. Further testing of the CFM with data specifically collected for that purpose would contribute to this necessary strategic progression. It would also provide stronger evidence on the model's efficacy at predicting mitigation behaviours, and of differences in the relevance of certain paths to behaviour that might exist across behaviours and audiences.

Decisions regarding the choice of interviewees for Study 3 limits the generalisability of results from that component of the research. The exploratory approach targeting diversity in practitioner participants provided valuable insights on the breadth and differences across these groups, however further research to verify the extent and representativeness of these findings would be valuable. Similarly, expanding the pool beyond the geographic boundaries of Melbourne would allow for broader perspectives across different cultural systems.

Contributions to the field. Despite these limitations, this thesis offers unique contributions to theory and practice relevant to climate change mitigation. From a theoretical perspective, this research integrated diverse theories of mitigation behaviour to provide a model with targeted, practical relevance for campaigns. Through literature reviews and personal issues faced in conducting this research, also identified critical theoretical and methodological issues that are limiting strategic theoretical progression in the field of mitigation behaviour research. This research has also provided initial understanding of the diversity of campaign organisations in Australia, including their barriers and enablers with regard to the use of communication and behavioural science research in campaign design, as well as their research needs. This thesis also includes several recommendations relating to collaboration and engagement relevant to all stakeholders, as well as specific recommendations relevant to climate change communication and behavioural sciences researchers and to institutions funding and publishing research.

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Appendix A: Study 1 MASEM – Supporting Tables and Charts

Information presented in this appendix relates to Chapter 5 regarding Study 1.

Source Article Contributions

Table 21 provides a list of the articles included in the Study 1 sample, along with details of the number of contributing participants and correlations.

Table 21
Source Study Citations with Number of Contributed Correlations and Participants

Source	Participants (*N*)	Correlations
(Abrahamse & Steg, 2009)	189	10
(Abrahamse, Steg, Gifford & Vlek, 2009)	241	18
(Aguilar-Luzón, García-Martínez, Calvo-Salguero & Salinas, 2012)	120	19
(Aman, Harun, & Hussein, 2012)	384	1
(Ando, Ohnuma, & Chang, 2007)	274	6
(Arvola et al., 2008)	672	8
(Bamberg, Hunecke, Blöbaum, 2007)	954	29
(Bamberg, Rees, & Seebauer, 2015)	652	8
(Bratt, 1999)	423	3
(Carrus, Passafaro, & Bonnes, 2008)	334	16
(Chan, 1998)	173	6
(Chan & Bishop, 2013)	271	6
(Chao, 2012)	180	14
(Chao & Lam, 2011)	172	1
(Chen, 2015a)	757	10
(Chen, 2015b)	937	1
(Chen & Chao, 2011)	442	6
(Chen & Tung, 2010)	541	3
(Cordano, Welcomer, Scherer, Pradenas & Parada, 2010)	566	8
(Davies, Foxall, & Pallister, 2002)	317	21
(De Groot & Steg, 2007)	218	6
(De Groot & Steg, 2010)	304	3
(Dono, Webb, & Richardson, 2010)	131	1
(Eriksson & Forward, 2011)	620	6
(Estrada, Schultz, Silva-Send, & Boudrias, 2017)	1000	2
(Fielding, McDonald, & Louis, 2008)	169	13
(Fornara, Carrus, Passafaro, & Bonnes, 2011)	452	3
(Gardner & Abraham, 2010)	190	20
(Graham-Rowe, Jessop, & Sparks, 2015)	279	13
(Greaves, Zibarras, & Stride, 2013)	449	4
(Gregory & Di Leo, 2003)	471	1
(Grendstad & Wollebaek, 1998)	751	1
(Grimmer, Kilburn & Miles, 2016)	772	1
(Guido, et al., 2010)	207	2

Table 21 continued.

Source	Participants (*N*)	Correlations
(Ha & Janda, 2012)	202	6
(Harland, Staats, & Wilke, 1999)	258	10
(Harth, Leach, & Kessler, 2013)	88	1
(Haustein & Hunecke, 2007)	1275	4
(Heeren, Singh, Zwickle, Koontz, Slagle & McCreery, 2016)	580	3
(Ho, Liao & Rosenthal, 2015)	1168	2
(Hoang-Tung, Kojima, & Kubota, 2016)	333	2
(Honkanen, Verplanken, & Ottar Olsen, 2006)	1603	3
(Hsu & Roth, 1999)	226	6
(Huffman, Van Der Werff, Henning, & Watrous-Rodriguez, 2014)	118	3
(Jansson, Marell & Nordlund, 2011)	474	15
(Joireman, Lasane, Bennett, Richards, & Solaimani, 2001)	192	3
(Kaiser, 2006)	1394	3
(Kaiser & Gutscher, 2003)	895	6
(Kaiser, Hübner, & Bogner, 2005)	468	14
(Kaiser, Ranney, Hartig, & Bowler, 1999)	754	5
(Kaiser & Scheuthle, 2003)	895	2
(Kaiser, Schultz, Berenguer, Corral-Verdugo, & Tankha 2008)	801	1
(Kaiser, Wölfing, & Fuhrer, 1999)	391	1
(Kerr, Lennon, & Watson, 2010)	186	10
(Kim, Jeong, & Hwang, 2013)	333	2
(Klöckner & Blöbaum, 2010)	389	16
(Klöckner & Matthies, 2004)	167	18
(Klöckner & Matthies, 2009)	428	28
(Klöckner, Matthies, & Hunecke, 2003)	158	3
(Klöckner, Nayum, & Mehmetoglu, 2013)	1283	49
(Klöckner & Oppedal, 2011)	697	15
(Knussen, Yule, MacKenzie, & Wells, 2004)	252	10
(Largo-Wight, Bian, & Lange, 2012)	189	6
(Lin, 2015)	235	3
(Lindsay & Strathman, 1997)	317	3
(Mannetti, Pierro, & Livi, 2004)	230	3
(Milfont, Sibley, & Duckitt, 2010)	468	1
(Milkovic & Štambuk, 2015)	712	9
(Minton & Rose, 1997)	144	1
(Nguyen, Lobo, & Greenland, 2017)	682	3
(Nigbur, Lyons, & Uzzell, 2010)	791	24
(Nordlund & Garvill, 2002)	1429	10
(Nordlund & Garvill, 2003)	1467	1
(Onwezen, Antonides, & Bartels, 2013)	617	25
(Park & Yang, 2012)	211	14
(Pino, Peluso, & Guido, 2012)	291	2
(Ramayah, Lee, & Mohamad, 2010)	257	2

Table 21 continued.

Source	Participants (*N*)	Correlations
(Rees & Bamberg, 2014)	538	2
(Rees, Klug, & Bamberg, 2015)	114	1
(Rex, Lobo, & Leckie, 2015)	511	2
(Scherbaum, Popovich, & Finlinson, 2008)	154	6
(Sparks, Hinds, Curnock, & Pavey, 2014)	163	6
(Stefan, van Herpen, Tudoran, & Lähteenmäki, 2013)	244	2
(Steg, Perlaviciute, van der Werff, & Lurvink, 2014)	773	6
(Stern, Dietz, & Guagnano, 1995)	139	6
(Tanner, 1999)	135	3
(Terry, Hogg, & White, 1999)	143	15
(Thøgersen, 1999)	633	5
(Tonglet, Phillips, & Bates, 2004)	191	3
(Tonglet, Phillips, & Read, 2004)	20	5
(van Birgelen, Semeijn, & Keicher, 2009)	176	5
(van Zomeren, Spears, & Leach, 2010)	183	2
(Verplanken, Aarts, Van Knippenberg, & Moonen, 1998)	200	13
(Wang, Tu, Yang, Guo, Yuan, & Liu, 2016)	972	2
(Webb, Benn, & Chang, 2014)	346	13
(White & Hyde, 2012)	148	14
(Widegren, 1998)	819	2
(Yang, Kahlor, & Griffin, 2014)	1381	6
(Yang, Seo, Rickard, & Harrison, 2015)	572	1
(Zhang, Wanga, & Zhou, 2013)	273	4

Funnel Plots Testing for Publication Bias

Figure 40 to Figure 55 are funnel plots illustrating the distribution of contributing correlations around the pooled correlation for different sample sizes. Plots were prepared for pairs of variables with at least 10 contributing correlations. Pooled correlations are marked with a solid line.

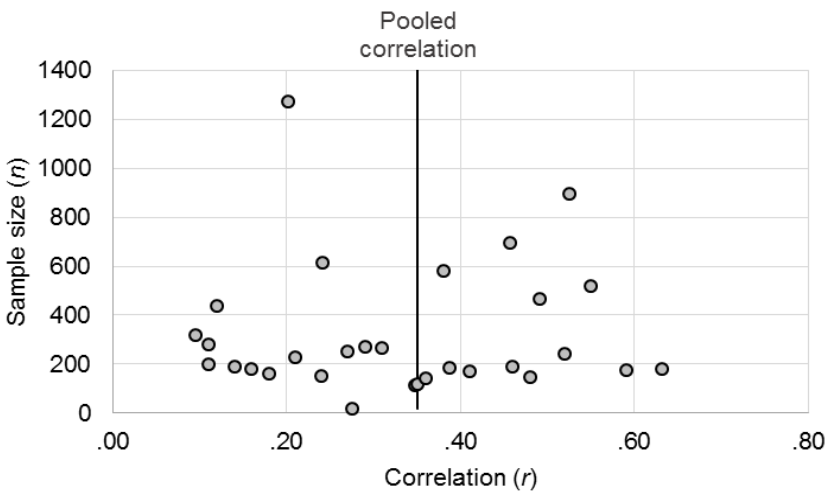

Figure 40. Attitude-behaviour funnel plot testing for publication bias.

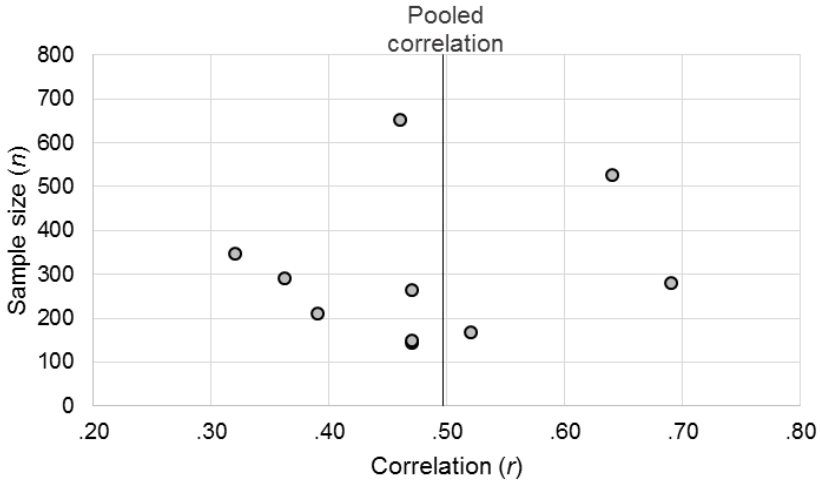

Figure 41. Attitude-identity funnel plot testing for publication bias.

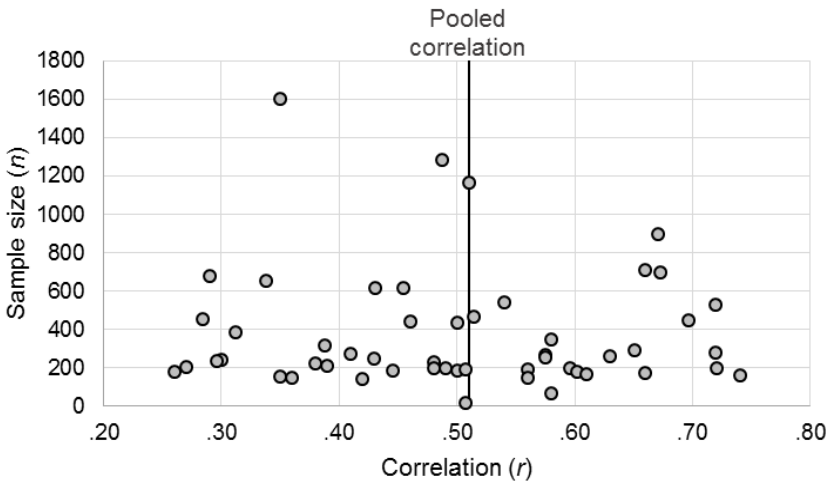

Figure 42. Attitude-intention funnel plot testing for publication bias.

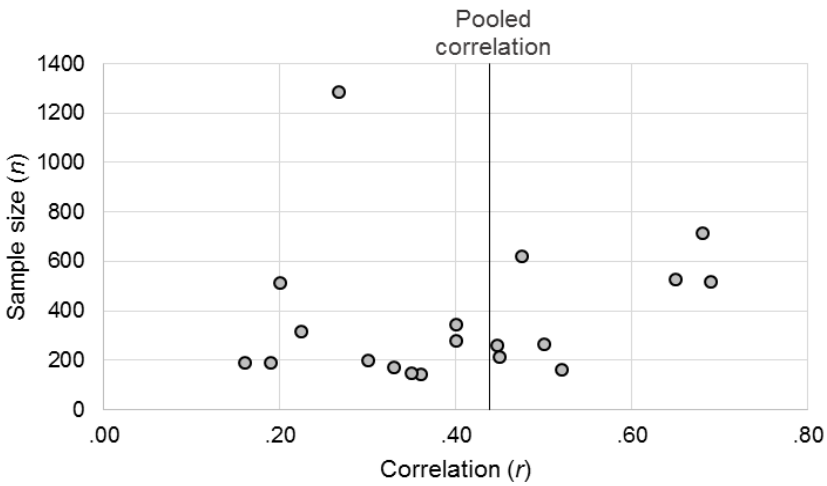

Figure 43. Attitude-PBC funnel plot testing for publication bias.

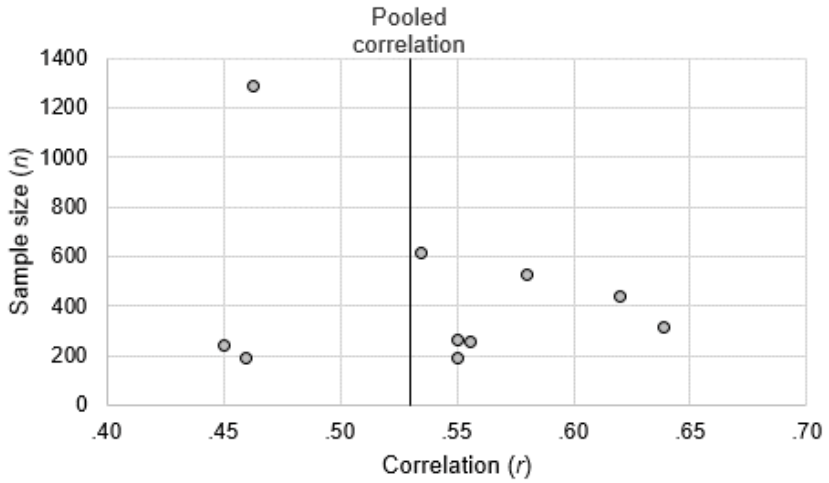

Figure 44. Attitude-personal norm funnel plot testing for publication bias.

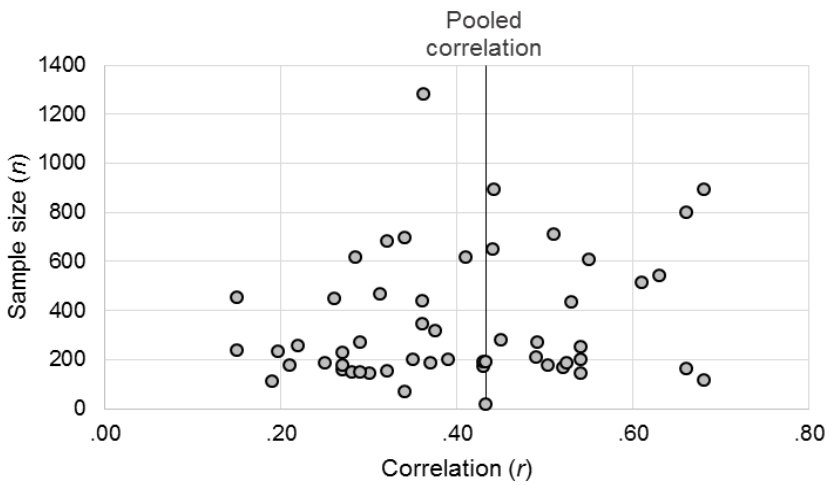

Figure 45. Attitude-social norm funnel plot testing for publication bias.

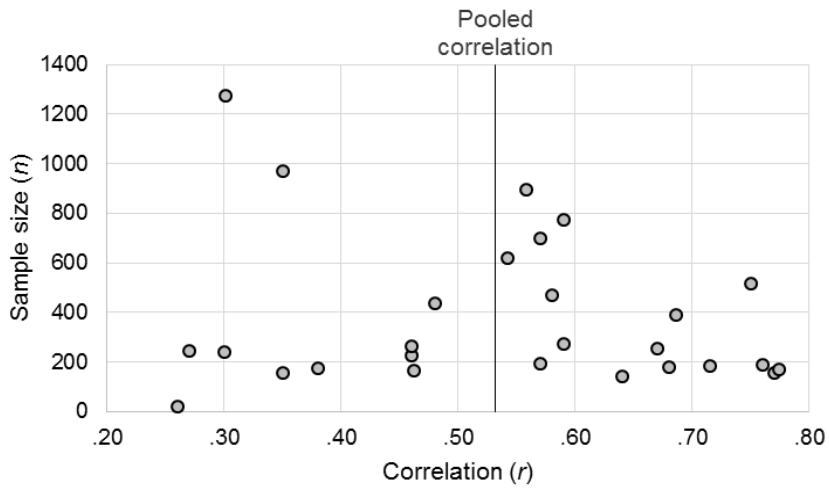

Figure 46. Behaviour-intention funnel plot testing for publication bias.

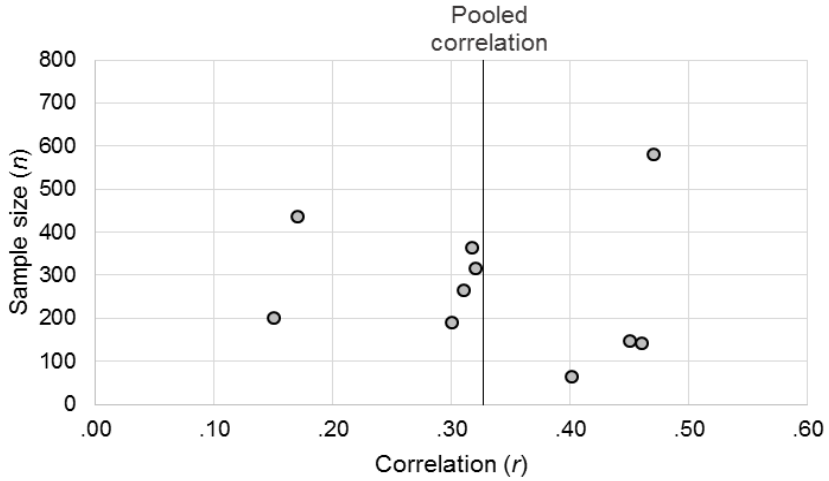

Figure 47. Behaviour-PBC funnel plot testing for publication bias.

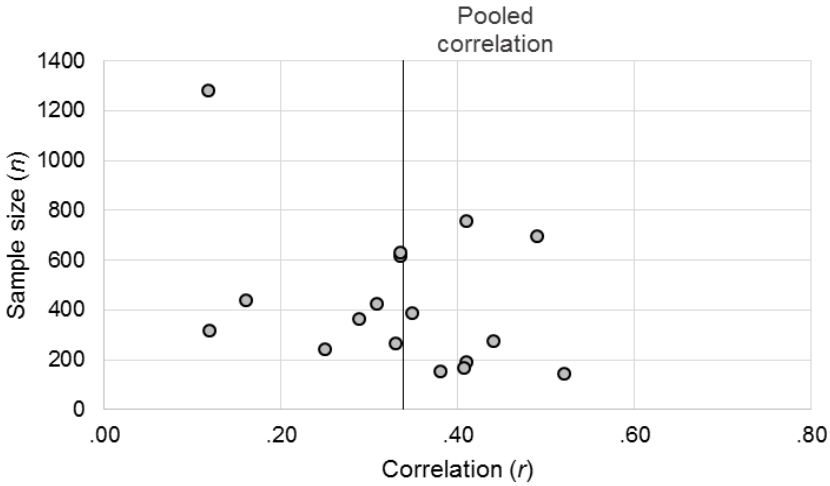

Figure 48. Behaviour-personal norm funnel plot testing for publication bias.

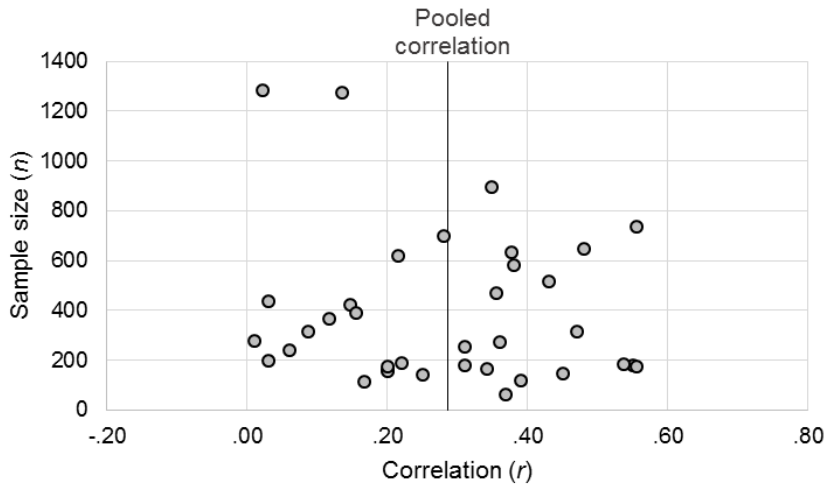

Figure 49. Behaviour-social norm funnel plot testing for publication bias.

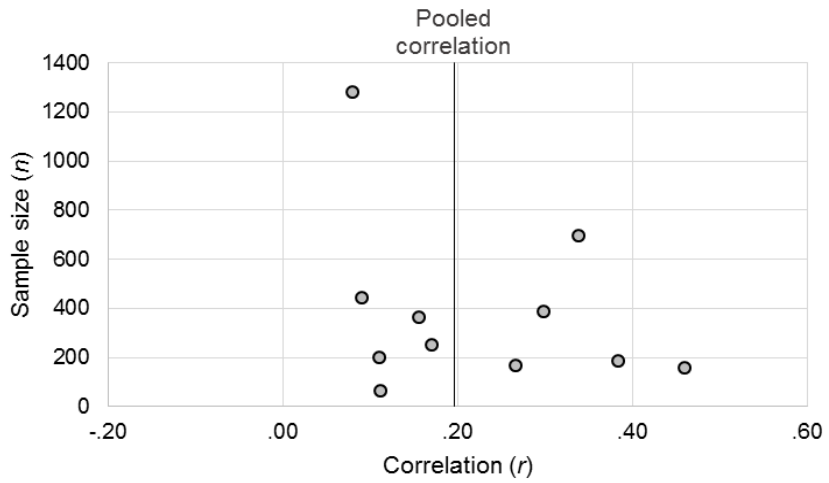

Figure 50. Habit-social norm funnel plot testing for publication bias.

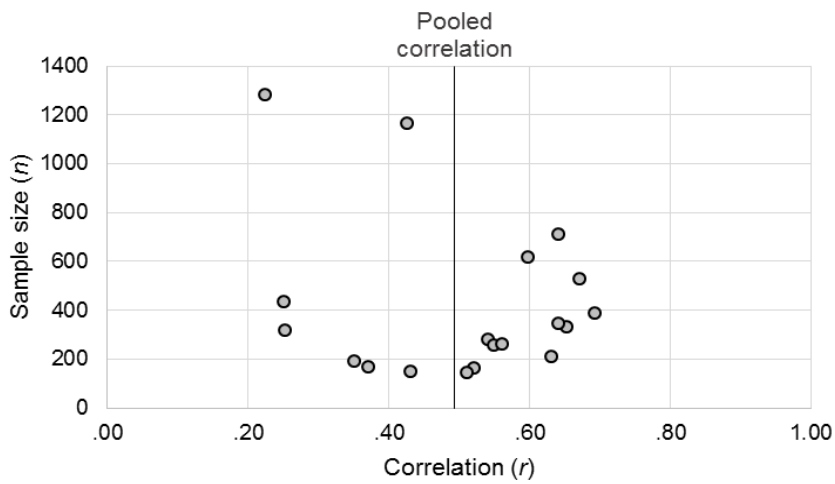

Figure 51. Intention-PBC funnel plot testing for publication bias.

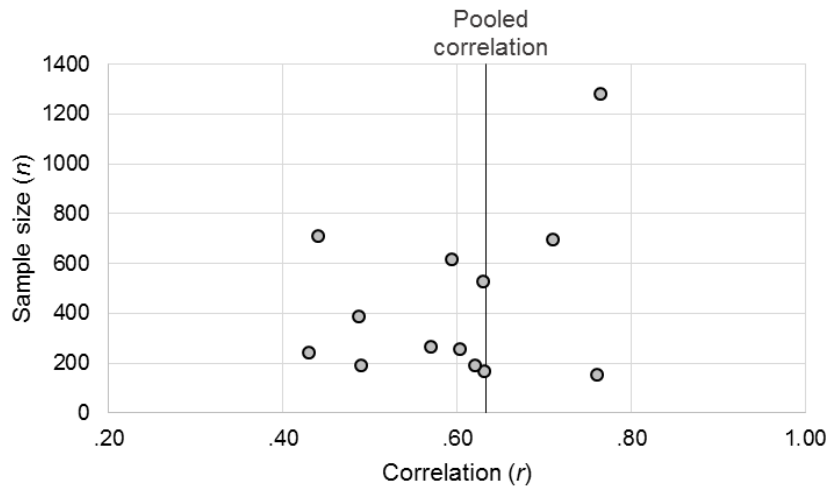

Figure 52. Intention-personal norm funnel plot testing for publication bias.

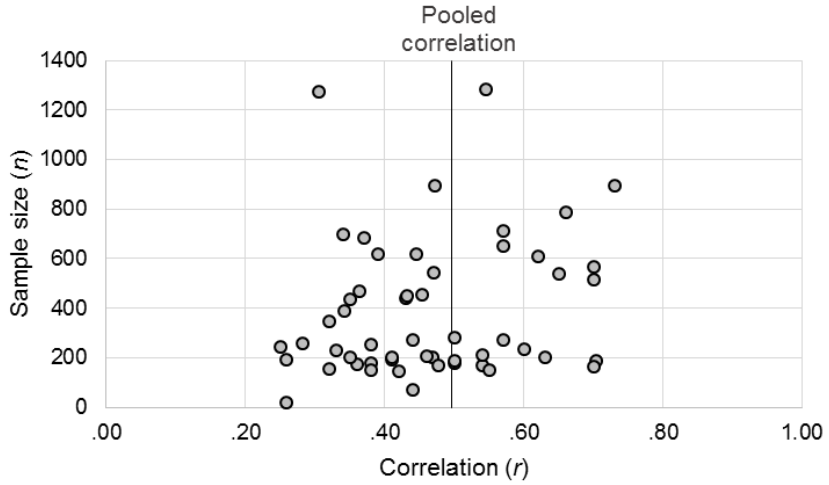

Figure 53. Intention-social norm funnel plot testing for publication bias.

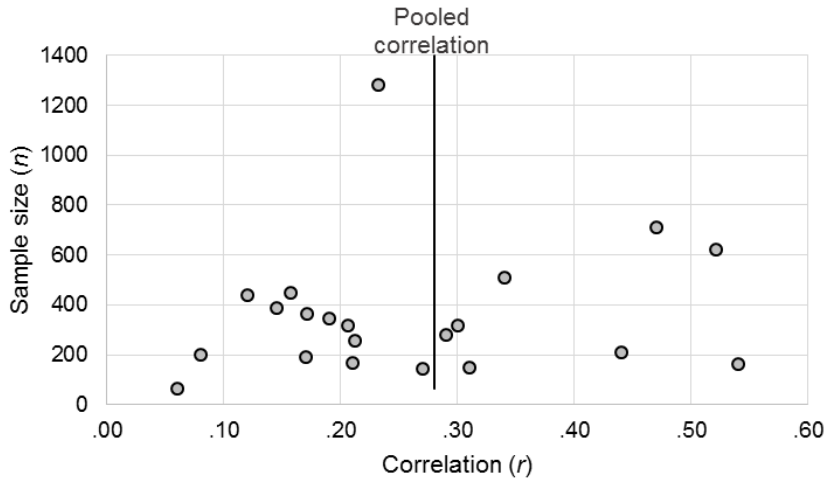

Figure 54. PBC-social norm funnel plot testing for publication bias.

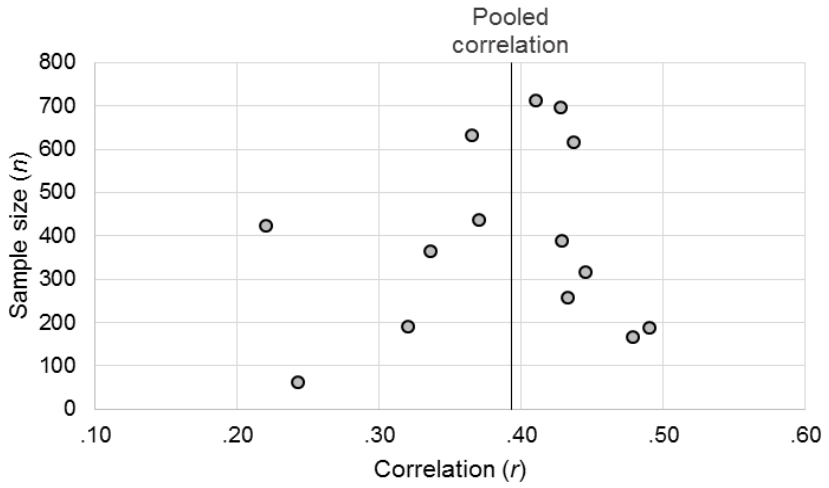

Figure 55. Personal norm-social norm funnel plot testing for publication bias.

Appendix B: Study 2 SEM – Supporting Tables and Charts

Information presented in this appendix relates to Chapter 6 regarding Study 2.

Data Coding and Preparation

Table 22 details the individual survey items associated with each model variable, along with the relevant scales and processing approaches.

Table 22
Survey Items, Scales, and Data Processing for Model Variables

Variable	Wave	Items	Scale	Processing
Anticipated emotion	4	Still thinking about these behaviours overall, please indicate how much you agree or disagree with the following statements One item: • I would feel guilty if I didn't do these behaviours	1 *Strongly disagree* to 5 *Strongly agree*	Unweighted value
Attitudes	1	Using the scale below, please indicate how much you agree or disagree with the following statements Nine items: • Having a car gives someone more freedom than not having a car (reverse coded) • I enjoy buying things (reverse coded) • It gives me more satisfaction to try and make things last than to buy new things • Eating less meat would save me money • Using a car less often would be better for my health • For most of the things I do, it would be more convenient for me to drive than to walk, ride, or take public transport (reverse coded) • People should stop and ask themselves "do I really need this?" before they buy new things • Meat is an important part of my diet (reverse coded) • I would save money if I used my car less	1 *Strongly disagree* to 5 *Strongly agree*	Reverse coded four items; unweighted sum
Habit	-	None included		
Intention	4	Still thinking about these behaviours overall, please indicate how much you agree or disagree with the following statements One item: • I am willing to put in extra effort to do as many of these behaviours on as possible on a regular basis	1 *Strongly disagree* to 5 *Strongly agree*	Unweighted value

Table 22 continued.

Variable	Wave	Items	Scale	Processing
Perceived behavioural control	4	Please indicate how much you agree or disagree with the following statements Three items: • I don't have the information I need to reduce the impact of climate change (reverse coded) • I don't have enough money to do things that would reduce the impact of climate change (reverse coded) • I don't have enough time to do things that would reduce the impact of climate change (reverse coded)	1 *Strongly disagree* to 5 *Strongly agree*	Reverse coded three items; unweighted sum
Personal norms	4	Still thinking about these behaviours overall, please indicate how much you agree or disagree with the following statements... One item: • I feel a strong personal obligation to do as many of these behaviour as possible	1 *Strongly disagree* to 5 *Strongly agree*	Unweighted value
Retrospective emotion	4	How does the issue of climate change make you feel? Two items: • Angry • Guilty	1 *Strongly disagree* to 5 *Strongly agree*	Unweighted sum
Self-identity	1	Rate how much each word or phrase reflects your view on climate change? Two items: • Sceptical (reverse coded) • Denying (reverse coded)	-5 *Not at all like my view* to + 5 *Exactly like my view*	Reverse coded two items; re-coded 0-11; unweighted sum
Social norms	4	Still thinking about these behaviours overall, please indicate how much you agree or disagree with the following statements... Four items: • Most people who are important to me do many of these behaviours • Most people in my social network do many of these behaviours • Most of my family do many of these behaviours • Most people in my community do many of these behaviours	1 *Strongly disagree* to 5 *Strongly agree*	Unweighted sum
Behaviour		For each of the activities below, we would like to know if you take the action mainly for environmental reasons, or mainly for other reasons such as convenience, time, money, and so on. If you do an action for both environmental and other reasons, please select the strongest reason.	0 *I don't do this*, 1 *Mostly for other reasons*, 2 *Mostly for environmental reasons*	Recoded to binary adoption/ non-adoption; unweighted values and sum
• Changed diet	5	I have changed my diet (vegetarian/ vegan/ less meat/ seasonal produce/ organic food)		
• Eco cleaning	5	Most of my cleaning products are environmentally friendly		
• Fix things	5	I will usually try to fix things rather than replace them		

Table 22 continued.

Variable	Wave	Items	Scale	Processing
• Gardening practices	5	I have changed my gardening practices (growing food/ planting times/ hardy plants/ pruning/ shade etc.)		
• Local products	5	Where possible, I buy products that are made locally		
• Recycle waste	5	I recycle/ compost as much household waste as possible		
• Reduced petrol	5	I have reduced the amount of petrol I use (drive less/ bought smaller or fuel efficient car)		
• Reduced power	5	I have reduced the amount of gas and/ or electricity I use around the house		
• Switch lights off	5	I switch lights off around the house whenever possible		
• Switched products	5	I have switched to products that are more environmentally friendly		
• Low carbon transport	5	I usually walk/cycle/carpool/take public transport		
Controls				
• Year of birth	5	What is your year of birth?	Year	Unweighted value
• Education	5	What is the highest level of education you have attained? Ten options: 1. Some of primary school 2. Completed primary school 3. Some of high school / tertiary school 4. Completed tertiary school 5. Some of trade / TAFE qualification 6. Completed trade / TAFE qualification 7. Some of undergraduate degree 8. Completed undergraduate degree 9. Some of postgraduate qualification 10. Completed postgraduate qualification	Ordered categorical coded 1-10	Unweighted value
• Gender	5	What is your gender? Two options: • Male • Female	Nominal	Unweighted value
• House-hold income	5	What is your household's gross annual income before tax? Seven options: 1. Less than $30,000 2. $30,000 - $59,999 3. $60,000 - $89,999 4. $90,000 - $119,999 5. $120,000 - $149,999 6. More than $150,000 7. Prefer not to respond	Ordered categorical coded 1-6 and missing	Unweighted value

Note. Wave indicates the source wave (i.e., from the first to the fifth survey) for the variable, as not all items were offered in all years and only one wave was used as the source for data for each variable.

Sample Representativeness Tests

This section provides the results of Chi-squared tests comparing the distribution of sample responses against comparison data. Table 23 lists the results of comparison demographic characteristics against those of the Australian population, while Table 24 details results for responses on self-identity and attitude questions compared against those of the full 2010 survey wave.

Table 23
Sample Demographic Representativeness in Comparison with the Australian Population

Demographic characteristic	Sample	*N*	χ^2	*df*	*p*
Gender	CSIRO				
	2010	5,036	17,378	1	.009
	2013	5,219	3,559	1	.243
	2014	5,163	3,956	1	.216
	Study 2				
	Full	2,427	5,012	1	.042
	2010-2014	351	4,532	1	.000
Decade of birth	CSIRO				
	2010	5,036	634,616	9	.000
	2013	5,219	382,779	9	.000
	2014	5,163	198,288	9	.000
	Study 2				
	Full	2,427	239,027	9	.000
	2010-2014	351	19,088	9	.000
State or territory	CSIRO				
	2010	5,036	37,540	7	.000
	2013	5,219	36,548	7	.000
	2014	5,163	35,687	7	.000
	Study 2				
	Full	2,427	8,857	7	.000
	2010-2014	351	1,258	7	.011
Household income	CSIRO				
	2010	5,036	338,847	5	.000
	2013	5,219	444,252	5	.000
	2014	5,163	434,654	5	.000
	Study 2				
	Full	2,427	109,810	5	.000
	2010-2014	351	3,347	5	.000

Note. Comparison Australian population statistics from 2011 census data (Australian Bureau of Statistics, 2016).

Table 24
Comparison of the Study 2 Sample Responses Against Those of the Full 2010 Wave

Variable	Description	χ^2	*df*	*p*
Self-identity	Activist	606.432	10	.065
	Sceptical	431.044	10	.147
	Denying	598.506	10	.006
Attitudes	Meat consumption – positive	1112.344	4	.016
	Meat consumption – negative	824.826	4	.101
	Purchasing – positive	164.675	4	.175
	Purchasing – negative	3394.365	4	.000
	Changed transport – positive	1475.183	4	.000
	Changed transport – negative	463.322	4	.124
	Car use – positive	257.515	4	.554
	Car use – negative	621.160	4	.128
	Recycling – positive	16.056	4	.833

CFM Variable Correlations

Table 25 lists the correlations between model variables calculated from the Study 2 sample across all behaviours.

Table 25
Correlations for CFM Variables (Including All Behaviours) for the Study 2 Sample

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Attitudes	-								
2. Behaviour	.122	-							
3. Habit	-	-	-						
4. Self-identity	.053	.037	-	-					
5. Intent	.364	.334	-	.113	-				
6. Retrospective emotions	.092	.068	-	.000	.206	-			
7. Perceived behavioural control	.096	.109	-	.000	.234	.018	-		
8. Personal norms	.379	.282	-	.139	.839	.243	.253	-	
9. Anticipated emotions	.252	.219	-	.077	.658	.180	.143	.666	-
10. Social norms	.172	.136	-	.000	.415	.184	.018	.455	.502

Note. No data was available for habit.

Modelling Results for Grouped and Specific Behaviours

This section lists model results for models of specific behaviours. Table 26 details the model fit statistics for each model (with and without self-identity) and for the comparison demographic models (split by either age or level of education). Table 27 to Table 31 provide the model path weights associated with the comparison models for each of the three behaviour groups, and for each of the modelled specific behaviours.

Table 26
Model Fit Statistics for CFMs for Specific Behaviours with Demographic Comparisons

Behaviour category	Model comparisons	Robust χ^2	RMSEA	CFI	SRMR
Changed diet		195.690 (df = 22, p < .001)	.057 [.050, .065]	.961	.331
– identity		126.796 (df = 14, p < .001)	.058 [.049, .067]	.974	.104
	Age	141.793 (df = 28, p < .001)	.058 [.049, .068]	.974	.120
	Education	162.247 (df = 42, p < .001)	.059 [.050, .069]	.972	.126
Fixing items		167.341 (df = 22, p < .001)	.052 [.045, .060]	.967	.339
– identity		104.103 (df = 14, p < .001)	.051 [.042, .061]	.979	.146
	Age	108.458 (df = 28, p < .001)	.049 [.039, .059]	.981	.160
	Education	119.763 (df = 42, p < .001)	.049 [.038, .058]	.982	.178
Recycling		146.656 (df = 22, p < .001)	.048 [.041, .056]	.972	.323
– identity		82.139 (df = 14, p < .001)	.045 [.036, .054]	.985	.073
	Age	97.694 (df = 28, p < .001)	.045 [.036, .055]	.984	.119
	Education	108.034 (df = 42, p < .001)	.044 [.034, .054]	.985	.126
Low carbon transport		181.419 (df = 22, p < .001)	.055 [.047, .062]	.964	.326
– identity		119.552 (df = 14, p < .001)	.056 [.047, .065]	.976	.094
	Age	126.361 (df = 28, p < .001)	.054 [.044, .064]	.977	.103
	Education	153.446 (df = 42, p < .001)	.057 [.048, .067]	.974	.121

Note. – identity indicates the unsplit model without self-identity. All demographic comparison models are reported with self-identity excluded from the model due to its problematic effect on SRMR at this level of individual behaviours.

Table 27
Model Outputs for Education and Age Comparative CFMs for Purchasing Behaviours

	Age group		Education level		
Path	Younger	Older	School	Trade	University
Personal norms ← PBC	.244 [.215, .273]	.257 [.231, .283]	.186 [b] [.149, .223]	.318 [bc] [.283, .353]	.244 [c] [.215, .273]
Personal norms ← social norms	.452 [a] [.420, .484]	.400 [a] [.372, .428]	.388 [.348, .428]	.403 [.365, .441]	.452 [.420, .484]
Personal norms ← retrospective emotion	.221 [a] [.189, .253]	.114 [a] [.086, .142]	.144 [b] [.105, .183]	.086 [c] [.048, .124]	.221 [bc] [.189, .253]
Personal norms ← self-identity	.172 [.110, .234]	.113 [.044, .182]	.277 [b] [.186, .368]	.010 [bc] [-.077, .097]	.172 [c] [.110, .234]
Anticipated emotion ← personal norms	.530 [a] [.500, .560]	.565 [a] [.540, .590]	.572 [.537, .607]	.557 [.522, .592]	.530 [.500, .560]
Anticipated emotion ← social norms	.279 [a] [.249, .309]	.231 [a] [.204, .258]	.205 [b] [.168, .242]	.256 [.218, .294]	.279 [b] [.249, .309]
Attitudes ← personal norms	.220 [.133, .307]	.240 [.170, .310]	.222 [.132, .312]	.257 [.154, .360]	.220 [.133, .307]
Intent ← PBC	.036 [.015, .057]	.020 [.005, .035]	.027 [.005, .049]	.011 [-.009, .031]	.037 [-.016, .090]
Intent ← personal norms	.657 [a] [.620, .694]	.745 [a] [.722, .768]	.697 [b] [.663, .731]	.793 [bc] [.761, .825]	.657 [c] [.620, .694]
Intent ← anticipated emotion	.223 [a] [.189, .257]	.153 [a] [.130, .176]	.206 [b] [.174, .238]	.106 [bc] [.075, .137]	.223 [c] [.189, .257]
Intent ← attitudes	.037 [-.016, .090]	-.005 [-.033, .023]	-.004 [-.041, .033]	-.012 [-.055, .031]	.036 [.015, .057]
Behaviour ← intent	.297 [.266, .328]	.324 [.300, .348]	.283 [b] [.248, .318]	.369 [bc] [.335, .403]	.297 [c] [.266, .328]
Behaviour ← PBC	.061 [.031, .091]	.031 [.008, .054]	.031 [-.002, .064]	.025 [-.007, .057]	.061 [.031, .091]
R^2 (intent)	.738 [.718, .758]	.703 [.678, .728]	.726 [.694, .758]	.753 [.729, .777]	.707 [.682, .732]
R^2 (behaviour)	.111 [.096, .126]	.099 [.080, .118]	.085 [.066, .104]	.142 [.118, .166]	.100 [.081, .119]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences.

Table 28

Model Outputs for Education and Age Comparative CFMs for Structural Needs Behaviours

	Age group		Education level		
Path	Younger	Older	School	Trade	University
Personal norms ← PBC	.244 [.215, .273]	.257 [.231, .283]	.186 [b] [.149, .223]	.318 [bc] [.283, .353]	.244 [c] [.215, .273]
Personal norms ← social norms	.452 [.420, .484]	.400 [.372, .428]	.388 [.348, .428]	.403 [.365, .441]	.452 [.420, .484]
Personal norms ← retrospective emotion	.221 [a] [.189, .253]	.114 [a] [.086, .142]	.144 [b] [.105, .183]	.086 [c] [.048, .124]	.221 [bc] [.189, .253]
Personal norms ← self-identity	.172 [.110, .234]	.113 [.044, .182]	.277 [b] [.186, .368]	.010 [bc] [-.077, .097]	.172 [c] [.110, .234]
Anticipated emotion ← personal norms	.530 [.500, .560]	.565 [.540, .590]	.572 [.537, .607]	.557 [.522, .592]	.530 [.500, .560]
Anticipated emotion ← social norms	.279 [.249, .309]	.231 [.204, .258]	.205 [b] [.168, .242]	.256 [.218, .294]	.279 [b] [.249, .309]
Attitudes ← personal norms	.332 [.268, .396]	.218 [.156, .280]	.235 [.164, .306]	.212 [.120, .304]	.332 [.268, .396]
Intent ← PBC	.037 [.016, .058]	.020 [.005, .035]	.026 [.004, .048]	.010 [-.010, .030]	.037 [.016, .058]
Intent ← personal norms	.654 [a] [.615, .693]	.738 [a] [.713, .763]	.686 [b] [.649, .723]	.787 [bc] [.754, .820]	.654 [c] [.615, .693]
Intent ← anticipated emotion	.223 [a] [.189, .257]	.152 [a] [.129, .175]	.205 [b] [.173, .237]	.105 [bc] [.074, .136]	.223 [c] [.189, .257]
Intent ← attitudes	.033 [-.019, .085]	.033 [-.006, .072]	.046 [-.002, .094]	.018 [-.042, .078]	.033 [-.019, .085]
Behaviour ← intent	.231 [.198, .264]	.171 [.144, .198]	.142 [b] [.104, .180]	.201 [.163, .239]	.231 [b] [.198, .264]
Behaviour ← PBC	-.077 [-.110, -.044]	.010 [-.018, .038]	.026 [b] [-.009, .061]	-.011 [-.053, .031]	-.077 [b] [-.110, -.044]
R^2 (intent)	.703 [.678, .728]	.739 [.720, .758]	.726 [.695, .757]	.754 [.730, .778]	.703 [.678, .728]
R^2 (behaviour)	.052 [.037, .067]	.030 [.021, .039]	.022 [.012, .032]	.039 [.025, .053]	.052 [.037, .067]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences.

Table 29
Model Outputs for Education and Age Comparative CFMs for Recycling

	Age group		Education level		
Path	Younger	Older	School	Trade	University
Personal norms ← PBC	.368 [a] [.333, .403]	.444 [a] [.414, .474]	.383 [b] [.337, .429]	.492 [bc] [.452, .532]	.368 [c] [.333, .403]
Personal norms ← social norms	.573 [a] [.550, .596]	.523 [a] [.502, .544]	.534 [.503, .565]	.509 [b] [.481, .537]	.573 [b] [.550, .596]
Personal norms ← retrospective emotion	.223 [a] [.202, .244]	.133 [a] [.114, .152]	.166 [b] [.138, .194]	.104 [b] [.079, .129]	.223 [b] [.202, .244]
Anticipated emotion ← personal norms	.550 [a] [.530, .570]	.602 [a] [.586, .618]	.614 [b] [.592, .636]	.588 [.566, .610]	.550 [b] [.530, .570]
Anticipated emotion ← social norms	.331 [a] [.306, .356]	.251 [a] [.232, .270]	.225 [b] [.197, .253]	.277 [c] [.249, .305]	.331 [bc] [.306, .356]
Attitudes ← personal norms	.320 [.260, .380]	.237 [.177, .297]	.232 [.138, .326]	.216 [.137, .295]	.320 [.260, .380]
Intent ← PBC	.043 [.020, .066]	.002 [-.016, .020]	.012 [-.015, .039]	-.008 [b] [-.033, .017]	.043 [b] [.020, .066]
Intent ← personal norms	.634 [a] [.608, .660]	.789 [a] [.771, .807]	.736 [b] [.709, .763]	.831 [b] [.805, .857]	.634 [b] [.608, .660]
Intent ← anticipated emotion	.215 [a] [.194, .236]	.097 [a] [.081, .113]	.149 [b] [.126, .172]	.057 [b] [.032, .082]	.215 [b] [.194, .236]
Intent ← attitudes	.136 [.090, .182]	.074 [.043, .105]	.112 [.049, .175]	.044 [b] [.011, .077]	.136 [b] [.090, .182]
Behaviour ← intent	.269 [.222, .316]	.243 [.202, .284]	.168 [b] [.111, .225]	.313 [b] [.256, .370]	.269 [.222, .316]
Behaviour ← PBC	.074 [.004, .144]	.111 [.046, .176]	.053 [-.039, .145]	.157 [.064, .250]	.074 [.004, .144]
R^2 (intent)	.732 [.715, .785]	.774 [.763, .785]	.775 [.756, .794]	.775 [.760, .790]	.732 [.715, .749]
R^2 (behaviour)	.081 [.055, .107]	.073 [.052, .94]	.032 [.012, .052]	.130 [.091, .169]	.081 [.055, .107]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences. ns indicates non-significance at alpha of .05.

Table 30

Model Outputs for Education and Age Comparative CFMs for Low Carbon Transport Use

	Age group		Education level		
Path	Younger	Older	School	Trade	University
Personal norms ← PBC	.363 [a] [.328, .398]	.443 [a] [.413, .473]	.384 [b] [.338, .430]	.491 [bc] [.452, .530]	.363 [c] [.328, .398]
Personal norms ← social norms	.572 [a] [.549, .595]	.525 [a] [.505, .545]	.535 [.504, .566]	.511 [b] [.483, .539]	.572 [b] [.549, .595]
Personal norms ← retrospective emotion	.224 [a] [.203, .245]	.133 [a] [.114, .152]	.165 [b] [.137, .193]	.104 [b] [.079, .129]	.224 [b] [.203, .245]
Anticipated emotion ← personal norms	.550 [a] [.531, .569]	.606 [a] [.591, .621]	.618 [b] [.596, .640]	.591 [.569, .613]	.550 [b] [.531, .569]
Anticipated emotion ← social norms	.332 [a] [.307, .357]	.247 [a] [.228, .266]	.222 [b] [.195, .249]	.274 [c] [.246, .302]	.332 [bc] [.307, .357]
Attitudes ← personal norms	.331 [.259, .403]	.217 [.155, .279]	.155 [b] [.063, .247]	.156 [c] [.082, .230]	.331 [bc] [.259, .403]
Intent ← PBC	.048 [a] [.024, .072]	.001 [a] [-.017, .019]	.010 [-.017, .037]	-.009 [b] [-.034, .016]	.047 [b] [.023, .071]
Intent ← personal norms	.663 [a] [.637, .689]	.810 [a] [.793, .827]	.759 [b] [.737, .781]	.855 [b] [.832, .878]	.664 [b] [.638, .690]
Intent ← anticipated emotion	.206 [a] [.185, .227]	.090 [a] [.074, .106]	.141 [b] [.118, .164]	.048 [b] [.025, .071]	.206 [b] [.185, .227]
Intent ← attitudes	.052 [.000, .104]	.011 [-.027, .049]	.067 [b] [.005, .129]	-.024 [b] [-.049, .001]	.051 [-.001, .103]
Behaviour ← intent	.103 [.057, .149]	.080 [.043, .117]	.136 [b] [.086, .186]	.016 [b] [-.038, .070]	.103 [.057, .149]
Behaviour ← PBC	-.139 [a] [-.201, -.077]	.004 [a] [-.051, .059]	-.065 [-.142, .012]	.073 [-.003, .149]	-.139 [-.201, -.077]
R^2 (intent)	.712 [.695, .728]	.771 [.761, .781]	.771 [.755, .787]	.779 [.765, .793]	.712 [.696, .728]
R^2 (behaviour)	.016 [.005, .027]	.006 [.000, .012]	.018 [.005, .031]	.003 [-.003, .009]	.016 [.005, .027]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences. ns indicates non-significance at alpha of .05.

Table 31
Model Outputs for Education and Age Comparative CFMs for Repairing Items

	Age group		Education level		
Path	Younger	Older	School	Trade	University
Personal norms ← PBC	.368 [a] [.333, .403]	.447 [a] [.417, .477]	.384 [b] [.338, .430]	.496 [bc] [.457, .535]	.368 [c] [.333, .403]
Personal norms ← social norms	.572 [a] [.549, .595]	.523 [a] [.502, .544]	.538 [.507, .569]	.506 [b] [.478, .534]	.572 [b] [.549, .595]
Personal norms ← retrospective emotion	.223 [a] [.202, .244]	.134 [a] [.115, .153]	.167 [b] [.139, .195]	.105 [b] [.080, .130]	.223 [b] [.202, .244]
Anticipated emotion ← personal norms	.549 [a] [.530, .568]	.607 [a] [.592, .622]	.627 [b] [.605, .649]	.587 [.565, .609]	.549 [b] [.530, .568]
Anticipated emotion ← social norms	.332 [a] [.307, .357]	.247 [a] [.228, .266]	.214 [b] [.187, .241]	.278 [b] [.250, .306]	.332 [b] [.307, .357]
Attitudes ← personal norms	.332 [.243, .421]	.317 [.246, .388]	.307 [.211, .403]	.315 [.211, .419]	.332 [.243, .421]
Intent ← PBC	.044 [a] [.020, .068]	-.003 [a] [-.021, .015]	.009 [-.018, .036]	-.016 [b] [-.042, .010]	.043 [b] [.019, .067]
Intent ← personal norms	.670 [a] [.642, .698]	.852 [a] [.827, .877]	.806 [b] [.766, .846]	.893 [b] [.858, .928]	.670 [b] [.642, .698]
Intent ← anticipated emotion	.203 [a] [.182, .224]	.087 [a] [.070, .104]	.137 [b] [.112, .162]	.046 [b] [.022, .070]	.203 [b] [.182, .224]
Intent ← attitudes	.038 [a] [-.023, .099]	-.117 [a] [-.162, -.072]	-.119 [b] [-.205, -.033]	-.114 [c] [-.167, -.061]	.038 [bc] [-.023, .099]
Behaviour ← intent	.109 [a] [.053, .165]	.220 [a] [.175, .265]	.189 [.129, .249]	.270 [b] [.201, .339]	.109 [b] [.053, .165]
Behaviour ← PBC	.157 [a] [.079, .235]	-.005 [a] [-.079, .069]	.003 [-.096, .102]	-.022 [-.136, .092]	.157 [.079, .235]
R^2 (intent)	.709 [.694, .724]	.783 [.769, .797]	.773 [.750, .796]	.796 [.777, .815]	.709 [.694, .724]
R^2 (behaviour)	.029 [.010, .048]	.048 [.029, .067]	.036 [.014, .058]	.070 [.035, .105]	.029 [.010, .048]

Note. 95 percent confidence intervals included in brackets below standardised path weights. Rows entries with the same superscript letter contain confidence intervals that do not overlap, indicating significant differences. ns indicates non-significance at alpha of .05.

Appendix C: Study 3 – Supporting Tables

Information presented in this appendix relates to Chapter 7 regarding Study 3. Table 32 provides a summary of the themes coded from the interview data.

Table 32
Survey Items, Scales, and Data Processing for Model Variables

Category	Theme	Description	
Contextual issues	Socio-political context	Barriers: • the lack of a stable, national climate change policy • political disengagement on climate change • the prevalence of misinformation • behavioural demand	Enablers: • behavioural demand
	Organisational context	Barriers: • organisational size • associated resourcing • organisational mandate • associated audience • staff skills/training • risk avoidance	Enablers: • organisational size • associated resourcing • organisational mandate • associated audience • strategic planning • adaptive flexibility • knowledge sharing networks • staff skills/training
	Team skills	• behaviour change professionals • consultants • non-professionals	• communications professionals • education professionals • other professionals
Campaign evaluation	Approaches	• audience retention (mailing lists) • ad hoc feedback • organisational self-reflection • multiple lines of evidence	• social media and website statistics • objective data (e.g., volume of waste disposed) • pre- and post-campaign surveys
	Sharing insights	• desire to know did/didn't work for others	• reliance on individual networks • interest in collateral outcomes

Table 32 continued.

Category	Theme	Description	
Research use	Topics	• science of climate change • technological solutions	• behaviour change • campaign design guidance
	Access points	• direct to researchers • books and audio • journals • case studies • online resources	• training and fellowships • own or contracted research • documentaries • reports
	Communication	• audience targeting and segmentation • message construction and language choices • information deficit	• communication channels • formative evaluations • images • repeated messaging
	Behavioural science	• values • self-efficacy • intent-action gap • stages of change • structural barriers	• emotional appeals • TPB • norms • prompts • vested interests
	Barriers	• information overload • lack of awareness	• conflicting research • conflict with heuristics
Audience	Scale	• local • whole-of-community	• national • state
	Segments	• concerned about climate change • different language/ cultural groups	• whole-of-community • the curious • lack of knowledge about audiences
	Channels	• email • face-to-face • leaflets • letters • telephone • website	• mass media • newsletters • other groups' platforms • referrals • social media