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Enhancing climate change communication: strategies for profiling and targeting Australian interpretive communities

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Enhancing Climate Change Communication: Strategies for Profiling and Targeting Australian Interpretive Communities

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ABSTRACT

This research aimed to provide practical information about how to design communications on climate change adaptation and target these to the Australian population. This was achieved by:

1) identifying and increasing awareness of different climate change audiences in Australia, and;
2) evaluating how each audience responds to different types of climate change messages.

Phase 1 of the study used audience segmentation analysis to identify the main climate change interpretive communities within Australia; that is, groups of Australians who share similar views and understandings about climate change. A nationwide sample consisting of 3,096 Australian residents (aged 15 to 108 years, 47% male and 53% female) completed an online survey assessing a broad range of psychological and behavioural factors related to climate change. Latent profile analysis applied to the psychological variables suggested that this Australian sample consists of five distinct interpretive communities:

- *Alarmed* (26%);
- *Concerned* (39%);
- *Uncertain* (14%);
- *Doubtful* (12%), and;
- *Dismissive* (9%).

Validation analyses revealed that these groups differed in terms of how they responded to perceived climate change threats, and also in their support for particular climate change mitigation and adaptation policies.

Phase 2 of the project examined how Australian interpretive communities respond to climate change adaptation messages and identified the specific message attributes that drive these responses. An online survey was completed by 1,031 Australian residents (aged 18 to 66 years, 49.8% male, 50.2% female). It assessed a similar set of psychological and behavioural responses to climate change to those assessed in Phase 1.

Respondents subsequently viewed six climate change adaptation messages that were randomly allocated from a pool of 60 messages sourced from the internet. Messages were pre-coded on ten communication cues (e.g. language complexity, normative influence), and respondents rated them on four judgement dimensions:

- perceived threat;
- perceived efficacy;
- fear control (message rejection), and;
- danger control (message acceptance).

Latent profile analysis applied to the psychological variables identified three climate change interpretive communities in this sample: *Alarmed* (34.4%), *Uncommitted* (45.2%), and *Dismissive* (20.3%). Judgement analysis methodology (Cooksey, 1996) found that the three interpretive communities based their threat and efficacy evaluations on unique combinations of communication cues, and thathigh perceived threat and high perceived efficacy were related to message acceptance for all communities.

- Effective messages for *Dismissive* respondents used simple language and did not emphasize descriptive social norms.
- *Uncommitted* audience members responded positively to messages that focused on preventing losses and had a strong emotional component.
- *Alarmed* respondents preferred messages that focused on local issues and had a collectivist frame.

Providing specific adaptation advice in messages was found to be effective for all communities. The results largely support the Extended Parallel Processing Model of risk communication (Witte, 1992), and suggest that message attributes should be adjusted to effectively communicate with different climate change interpretive communities within Australia.

EXECUTIVE SUMMARY

Australians vary considerably in their perceptions of and responses to climate change (Ashworth et al. 2011, Morrison et al. in press, Reser et al. 2012a, 2012b). To address this diversity, climate change adaptation messages should be tailored to suit specific climate change audiences (Moser and Dilling, 2004, Whitmarsh et al. 2011). Audience characteristics influence how a message is perceived. For example, a message that elicits adaptive responses from individuals who accept climate change may not motivate people who do not believe that climate change is occurring. Mismatches between messages and target audiences may even lead to *boomerang effects*–a phenomenon in which messages elicit responses that are opposite to those intended (Byrne and Hart, 2009).

This research aimed to inform climate change adaptation communication strategies in Australia by:

1. identifying and increasing awareness of different climate change audiences, and;
2. evaluating how each audience tends to process and respond to climate change messages, thereby increasing understanding of specific features of messages that are likely to influence each audience.

Audience segmentation methodology was used to identify Australian climate change interpretive communities; that is, groups of Australians who share similar attitudes, concerns, and feelings about climate change. Two analyses were conducted on data collected from two Australian samples two years apart (2010 and 2012). We aimed to identify prominent climate change interpretive communities that exhibited similar psychological characteristics at both time points. We reasoned that these communities might offer relatively stable (short-term) targets for social marketers who aim to promote climate change adaptation behaviours.

In Phase 1 of the project, we analysed the responses of Australian residents (*N* = 3,096, aged 15 to 108 years, 47% male) to an online survey that assessed a wide range of psychological, geographic, and demographic variables relevant to climate change adaptation (Reser et al. 2011). Results indicated that the sample comprised of five distinct interpretive communities whose psychological responses to climate change ranged from well below the sample average to well above the sample average:

- *Dismissive* (9%);
- *Doubtful* (12%);
- *Uncertain (*14%);
- *Concerned (*39%), and;
- *Alarmed* (26%).

These groups also differed in the extent of their climate change adaptation behaviours[1].

[1]Given that the segmentation analysis used aggregated variables, percentages of respondents within the interpretive communities may not perfectly align with distributions of responses to individual items about climate change beliefs and concern reported by Reser et al. (2012a, 2012b).

In Phase 2, data were collected from a new Australian sample (*N* = 1,031, aged 18 to 66 years, 49.8% male) via an online survey that presented a similar set of profiling variables to those used in Phase 1. Three interpretive communities were identified in this sample: *Dismissive*, *Uncommitted,* and *Alarmed*. The *Dismissive* and *Alarmed* profiles resembled the similarly labelled segments identified in Phase 1, and the *Uncommitted* group exhibited responses that were near the sample average. Overall, the three interpretive communities identified in the Phase 2 sample appeared to express sets of climate change attitudes and perceptions that remained prevalent over the two-year period. Group characteristics are summarised on page 5.

We then investigated which attributes of climate change adaptation messages produced adaptive and maladaptive responses from the three interpretive communities (Cooksey, 1996, Hammond et al. 1975). Respondents viewed a set of messages, sourced from the internet, which promoted adoption of a particular adaptation response to possible effects of climate change. The messages were coded on several message characteristics suggested by the climate change and social marketing literature (e.g. emotion vs. reason, social norms, language complexity; Spence and Pidgeon, 2010, Griskevicius et al. 2008, Chaudhuri, 2002). Respondents then rated each message on 12 items assessing four judgement dimensions derived from Witte's (1992) Extended Parallel Processing Model (EPPM):

- perceived threat;
- perceived efficacy;
- fear control responses (message rejection), and;
- danger control responses (message acceptance).

Consistent with predictions of the EPPM, members of all audience segments tended to be more accepting of messages that they considered to be highly threatening and to contain advice about effective and personally achievable ways to manage the threat (i.e. high in efficacy). But importantly, unique combinations of message attributes were found to predict each interpretive community's responses to the set of climate change communications.The results suggest that climate change adaptation messages should be tailored to suit different climate change interpretive communities, with message attributes being matched with audience characteristics to maximise impact.

In terms of specific message characteristics, our results indicate that:

- Messages for *Dismissive* respondents may be most effective when they use simple language, provide specific advice about how to adapt to climate change threats, and avoid descriptions about how 'typical' Australians adapt (descriptive normative feedback) in the absence of clear statements describing how they should adapt(injunctive norms).

- For *Uncommitted* Australians, messages tended to be more effective if they included a strong emotional component, were framed in terms of preventing losses, and included specific advice about how to adapt to climate change threats.

- Messages for the *Alarmed* interpretive community may be most effective if messages emphasise local impacts and collective responsibility, and convey specific adaptation advice.

A table containing a summary of the characteristics of the Australian Climate Change Interpretive Communities, along with effective message characteristics and messaging options for each group follows on page 5.

Summary of Australian Climate Change Interpretive Communities: Psychological Characteristics, Effective Message Characteristics, and Messaging Options

Group	Characteristics	Effective Messages	Messaging Options
Dismissive 20%	• Very low belief in climate change • Effects perceived to be remote in space and time • Very low distress, concern, perceived risk, environmental values, trust in authorities, and self-efficacy • Low outrage and knowledge • Negative attitudes toward clean energy	• Use simple language • Do not include information about how most Australians currently adapt to climate change threats (descriptive norms) in the absence of information about how they should adapt (injunctive norms) • Provide specific advice about what actions to take	• Avoid direct references to climate change and sustainability •Develop strategies that emphasise other valued outcomes (e.g. economic development or a caring society)
Uncommitted 45%	• Moderate belief in climate change • Effects perceived as moderately close in space and time • Moderate distress, concern, perceived risk, attitudes toward clean energy, trust in authorities, and self-efficacy • Moderately low outrage, environmental values, and knowledge	• Have a strong emotional component • Are framed in terms of preventing losses • Provide specific advice about what actions to take	• Provide motivational messages to increase self-efficacy and concern
Alarmed 34%	• Strong belief in climate change • Effects perceived as imminent • High distress, outrage, concern, perceived risk, knowledge, and self-efficacy • Strong environmental values, trust in climate change authorities, and attitudes toward clean energy	• Emphasise local impacts • Emphasise collective responsibility • Provide specific adaptation advice about what actions to take	• Provide information about – effective ways to adapt to climate change threats – how to lobby industry and government – where to access relevant means and resources • Remove structural barriers preventing translation from intention into action • Provide feedback that climate change views are shared by others

Note: The interpretive communities described in this table are based on the audience segmentation findings from Phase 2 of the project. The Phase 2 sample did not match the demographic characteristics of the Australian population. Thus, the percentages in the table should not be interpreted as reflecting the proportion of Australians who are dismissive, uncommitted, and alarmed about climate change.

1. OBJECTIVES OF THE RESEARCH

Recent surveys indicate that Australians vary substantially in their understandings and responses to climate change challenges (Ashworth et al. 2011, Leviston and Walker, 2010, Leviston and Walker, 2011, Reser et al. 2012b, Reser et al. 2012a). To be optimally effective, climate change communication strategies should take this diversity into account, and be tailored to specific audiences (Moser and Dilling, 2004, Whitmarsh et al. 2011); for instance, messages that engage and elicit adaptive responses from individuals who accept climate change are unlikely to be effective for climate change deniers. Distinct groups require different strategies to elicit behaviour change (Rimer and Kreuter, 2006, Slater et al. 2006).

Thus, two essential bodies of knowledge underpin the implementation of effective climate change communication: an awareness of different climate change audiences and an understanding of specific features of climate change messages that are likely to influence each audience. Consequently, this project had two main objectives:

1) *To identify Australian climate change interpretive communities, and*
2) *To determine how each community responds to climate change adaptation messages.*

1.1 Objective 1 – Identifying Australian Climate Change Interpretive Communities

In this report, we describe a quantitative approach to segmenting members of two large, nationwide samples of Australian residents based on their values, attitudes, beliefs, and emotional responses to climate change. The analyses enabled us to empirically identify the main *interpretive communities* (Fish, 1980) in these Australian samples – that is, groups that share similar views and understandings about climate change.

These segmentation exercises represent a starting point for further work aimed at developing more effective communication and behaviour change strategies to help Australians adapt to the challenges posed by global climate change. Adaptation has been defined as 'adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities' (IPPC, 2007, p. 27). This research focussed on the human dimensions of adaptation to climate change, which includes individual adjustments in psychological and behavioural responses; as processes, actions, or outcomes within a system (e.g. households, communities).

1.1.1 Previous Audience Segmentation Research

Audience segmentation has become a cornerstone of social marketing - a movement that applies marketing practices to change behaviour in ways that create net benefits for society (Kotler et al. 2002). A common starting point for most social marketing exercises involves understanding the motives, attitudes, and beliefs of one's target audience, and then identifying segments of like-minded individuals within the population of interest (Slater et al. 2006). Once an audience is segmented, interventions can be tailored to match each segment's psychographic profile. To date most audience segmentation research has been conducted by health scientists, focusing on how to develop and deliver behaviour change programs targeting a diverse set of health threats including: smoking, substance abuse, obesity, high cholesterol, and sexually transmitted disease (Lefebvre and Flora, 1988, Rimal et al. 2009, Mathijssen et al. 2012). Audience segmentation has also been applied to examine

population characteristics, such as ecological worldview, lifestyle, motivations, barriers, knowledge and engagement, to identify efficient ways to promote pro-environmental behaviours (DEFRA, 2008).

Climate change communication researchers increasingly recognize the utility of social marketing. Three recent studies have conducted audience segmentation analyses based on large, representative, national surveys. Ashworth et al. (2011) collected data from 1,602 Australians in an online survey and conducted a cluster analysis on nine variables assessing knowledge and concern about climate change. Four distinct clusters emerged:

1) *Engaged* (27% of the sample, moderate to high knowledge and high concern);
2) *Concerned and Confused* (36%, moderate knowledge and moderate to high concern);
3) *Doubtful* (23%, moderate knowledge and low concern, and;
4) *Disengaged* (15%, low knowledge and low to moderate concern).

Cluster membership significantly predicted several outcome variables including: concern about the environment, expected climate change outcomes in Australia, support for a range of specific policy actions (e.g. placing a price on emissions, increasing prices for electricity and petrol, and improving infrastructure to adapt to climate change), perceived media bias in reporting about climate change, and desire to learn more about climate change.

Maibach et al. (2011) conducted a similar segmentation analysis on a nationally representative sample of 2,164 Americans. They applied latent class analysis to 36 variables assessing climate change beliefs, issue involvement, policy preference and behavioural responses. The analysis identified six distinct segments in the American population:

- Alarmed (18% of the sample);
- Concerned (33%);
- Cautious (19%);
- Disengaged (12%);
- Doubtful (11%), and;
- Dismissive (7%).

After controlling for a range of demographic variables, including political orientation, segment membership explained unique variance in respondents' support for several greenhouse gas emission policies.

Maibach et al.'s (2011) data were collected in 2008. Subsequently, their research group collected five additional waves of data that have been used to monitor shifts across the six profiles over time (Leiserowitz et al. 2010a, Leiserowitz et al. 2012, Leiserowitz et al. 2010c, Leiserowitz et al. 2011, Yale Climate Change Project, 2009). Longitudinal analyses indicated that the percentage of alarmed and concerned respondents decreased substantially from 51% in 2008 to 39% in 2010, subsequently remaining relatively stable into 2012. Dismissive and Doubtful respondents increased from 18% to 29% from 2008 to 2010, but then decreased to 25% by 2012.

In a study designed to facilitate cross-nation comparisons, Morrison, Duncan, Sherley and Parton (in press)applied Maibach et al.'s (2011) methodology, including the same set of profiling variables, to an online panel sample of 1,927 Australians, representative of the general population in age and gender. They retained six profiles to match the

American solution, although like Maibach's results, some statistical evidence suggested better fits for other potential solutions. They found that Australians were less polarised in their climate change views and behaviours than were their American counterparts, with fewer respondents in the Alarmed/Concerned (33%) and Dismissive/Doubtful groups (21%), and more in the central Cautious/Disengaged groups (46%).

1.1.2 Psychological Profiling Variables

Together, the results of previous segmentation studies indicate that populations tend to comprise groups of individuals who share similar views and understandings about climate change, and that delineation of these groups is largely determined by the specific cognitive, emotional, or behavioural characteristics assessed. Therefore, the selection of appropriate indicators is an important element of effective segmentation research.

Cognitive constructs used in previous climate change audience segmentation studies have primarily involved attitudes, knowledge, self-efficacy, and concerns about climate change, which have been associated with adaptive climate change responses (Maibach et al. 2011, Leviston and Walker, 2010, Morrison et al. in press). These relationships, however, may not always be straightforward. For example, some individuals with knowledge of the causes of climate change may form relatively low risk perceptions (Bord et al. 2000) because they tend to distance themselves from the issue (van der Linden, 2012). Consequently, perceived distance from the effects of climate change may also be usefully included in segmentation analyses. Maibach et al. (2011) included perceived temporal proximity, but they did not assess spatial proximity.

Assessments of perceived spatial proximity address the finding that individuals tend to underestimate the threat of environmental problems presented to their local region, but become increasingly more accurate as the focus becomes more global (Lima and Castro, 2005, Uzzell, 2004). Reser et al(2012b) found that this phenomenon, known as environmental hyperopia, was considerably stronger in an Australian sample than in a British sample, despite evidence that Australia is likely to experience more severe climate change effects than Britain.

Other potentially useful profile variables include an emotional connection to nature and a sense of environmental identity. Strong connections with nature and a tendency to place environmental issues as an integral part of self and lifestyle have been associated with pro-environmental behaviours, including actions to address climate change (Hinds and Sparks, 2008, Whitmarsh and O'Neill, 2010, Kals et al. 1999).

Affective responses to the issue of climate change may also be an important element of climate change psychological profiles(Slovic, 2010). Leiserowitz, Maibach and colleagues (2010b) observed a tendency for self-reported emotional responses (e.g. afraid, guilty) to increase in strength across audience segments in line with the strength of climate change cognitions. A recent Australian study found that self-reported feelings of shame, guilt, fear, and anger about climate change were particularly strongly related to adaptive behaviours, and mediated the relationship between climate change belief and behaviour (Walker, Leviston and Price 2011). Additionally, trust in climate change authorities may be viewed as an important cognitive characteristic, as it indirectly addresses source credibility (Earle, 2010). Individuals who tend to trust authorities who produce climate change adaptation messages are likely to report greater concern, self-efficacy, risk-perception, and adaptive behaviours about climate change (Reser et al. 2012a, 2012b).

1.1.3 Audience Segment Instability

Leiserowitz, Maibach and colleagues have produced an important and interesting set of reports showing how the percentage of the American public in each of their climate change segments change over time, especially as societal and political trends and actions on the climate change front continue to dynamically evolve. It is also worth noting that there is no reason to assume that the general structure of the segments identified by previous research should necessarily exhibit temporal stability. That is, not only is it possible for individuals to shift from one segment to another, it is also possible for the segments themselves to change, with existing segments merging or disappearing, and new segments emerging from future analyses. For example, Heberlein (2012) provides several compelling examples of cohort effects in which old attitudes toward the environment essentially 'die out' with demographic shifts in the population, and period effects in which transformative events, such as wars, natural disasters etc. may lead to fundamental changes in public views. To determine the extent that such changes are occurring in response to climate change, it may not be sufficient to simply apply classification equations derived from past studies to allocate new respondents to segments identified in past research – as recommended by Maibach et al. (2011). Rather, researchers should be open to the emergence of new segment structures and not be constrained by the solutions from previous studies.

For this reason, we conducted two segmentation analyses on data collected from Australian samples two years apart (2010 and 2012). We hoped to identify prominent climate change communities that exhibited similar psychological characteristics at both time points. We reasoned that these communities might offer relatively stable targets (at least in the short term) for social marketers who aim to promote climate adaptation behaviours.

1.1.4 The Current Segmentation Studies

Like previous climate change audience segmentation research, we conducted two studies that employed large national samples with the aim of identifying similar subgroups for which climate change adaptation messages could be tailored and targeted. However, our studies were not simply replications; they extended research in this area in three important respects.

First, relative to previous studies, we included a much broader range of psychological variables to create profiles and define our climate change interpretive communities. Whereas Ashworth et al. (2011) focused exclusively on climate change knowledge and concern, and Maibach and colleagues (Maibach et al. 2011, Myers et al. 2012)and Morrison et al. (in press)created profiles primarily based on respondents' climate beliefs, issue engagement, policy support, and behavioural responses; we included additional variables previously shown to underlie the public's responses to

- environmental concerns
- green self-identity;
- emotional connection with nature;
- perceived spatial proximity of potential effects;
- trust in authorities, and;
- distress.

Our selection of variables, relative to those used in previous studies, has the potential to provide a richer understanding of the different interpretive lenses through which the public's understanding of climate change and their responses to it are filtered.

These results should provide a solid platform for designing and developing more effective climate change communication and behaviour change interventions.

A second important distinguishing feature of our approach relates to our general strategy for identifying and validating our audience segments. Whereas Maibach et al. (2011) and Morrison et al. (in press) used policy support and behavioural responses to climate change to define their segments, we adopted a different approach that disaggregated cognitive-affective and behavioural dimensions in the profiling process. Given that we were primarily interested in identifying the psychological factors that distinguish different interpretive communities in the Australian population, we conducted our profiling analyses solely on cognitive-affective constructs (i.e. values, attitudes, trust, distress, etc.). Behavioural responses to climate change, including respondents' support for various climate change mitigation and adaptation policies, were used to validate the psychological profiles, but were not included as defining features of the profiles. This decision was based on the assumption that pre-existing knowledge structures (e.g. schemata and mental models; Sterman and Sweeney, 2007, Ross, 2002) play a critical role in how climate change adaptation messages are attended to, interpreted and subsequently acted upon.

A final distinction between the current studies and previous climate change segmentation relates to how the profiling constructs were measured. Whereas Maibach et al. (2011)and Morrison et al. (in press)conducted their profiling analyses on variables assessed using single items, we employed internally consistent, multi-item scales to assess almost all of the psychological constructs used in our study. The use of multi-item variables reduces measurement error by filtering out random noise (Bradburn, Sudman and Wansink 2004) – a form of measurement error – which should produce a more stable and precise profile solution.

1.2 Objective 2 – Determining How Each Community Responds to Climate Change Messages

As previously noted, individuals vary considerably in terms of their values, knowledge, and beliefs about climate change (Maibach et al. 2011, Morrison et al. in press). Climate change communicators must take this diversity into account when crafting and targeting their messages(Moser and Dilling, 2004, Whitmarsh et al. 2011). For example, messages that elicit adaptive responses from individuals who are alarmed about global climate change are unlikely to be effective for audiences that are more sceptical.

In particular, there is growing concern that mismatches between messages and target audiences may lead to *boomerang effects* – a phenomenon in which messages elicit responses that are opposite to those intended (Byrne and Hart, 2009). Boomerang effects may occur when a message triggers unintended constructs in the receiver. This may follow competitive processing of different components of a message, with certain aspects becoming more salient than others due to the influence of pre-existing attitudes or values (Byrne and Hart, 2009). In this study, we employed a judgement analysis methodology (Cooksey, 1996, Hammond et al. 1975)to investigate which specific attributes of climate change adaptation messages elicit adaptive and maladaptive responses across different interpretive communities.

1.2.1 Climate Change Communication

A body of work on climate change communication has focused on experimentally manipulating message attributes to evaluate their impact on audience responses. For

example, several researchers have examined the impact of message frames. Framing involves emphasizing specific aspects of an issue in order to establish a context for a message. A frame may influence risk perceptions and responses by interacting with audience members' pre-existing predispositions, values, and/or interpretive schemas. Consequently, the influence of a message frame is largely determined by its relevance to the audience (Nisbet and Scheufele, 2009, Moser and Ekstrom, 2010).

Spence and Pidgeon (2010) found that framing climate change outcomes in terms of gains (relative to losses) and social (relative to personal) outcomes, elicited more positive attitudes toward climate change mitigation. In addition, outcomes framed as global (relative to local) impacts were associated with increased perceived severity of climate change impacts. A similar study conducted by Morton, Rabinovich, Marshall and Bretscheider (2011) found that messages that combined a negative outcomes frame with a high uncertainty frame decreased participants' intentions to engage in pro-environmental behaviour, whereas positive message frames (highlighting the avoidance of losses due to climate change), combined with high uncertainty, produced higher levels of collective efficacy and stronger intentions to act.

A common feature of the two framing studies discussed above is that they implicitly assume that the manipulated message attributes will influence all respondents in exactly the same way. This runs counter to the predominant view in social marketing, which explicitly recognises audience heterogeneity, and highlights the importance of tailoring and targeting messages for specific audience segments.

Several recent climate change communication studies have directly addressed the *audience heterogeneity* issue by incorporating audience segments as potential moderators of message-attribute effects. For example, Myers, Nesbit, Maibach and Leiserowitz (2012) randomly assigned members of their *Six America* segments to one of three experimental conditions that involved reading newspaper articles that emphasised the risks of climate change to public health, the environment, or national security. Controlling for audience segments, they noted that framing climate change as a public health issue elicited more hopeful emotional responses about climate change mitigation and adaptation. Importantly, they also presented evidence to suggest that messages framed in terms of national security may *boomerang* by eliciting an angry backlash among members of the doubtful and dismissive segments.

Several other climate change communication studies also have reported findings that highlight the importance of taking the political orientation of audience members into account when framing climate change messages. Hart and Nisbet (2012) presented simulated news stories that varied as a function of the proximity of those impacted by climate change (those residing in an area near to where the study was conducted and those residing in more distant locations). They found that the proximity manipulation had no effect on support for climate change mitigation policies amongst Democrats. However, high social distance significantly decreased support relative to controls for Republicans. In a second study investigating the moderating effects of political orientation, Schuldt, Konrath and Schwartz (2011) found that framing survey questions about global climate change as 'Global Warming' versus 'Climate Change' had no impact on Democrats' and Independents' expressed beliefs about whether the phenomenon was real. However, for Republicans, the global warming frame elicited more sceptical responses than climate change.

Finally, Bain, Hornsey, Bongiorno and Jeffries (2012) investigated how message-framing effects vary between climate change deniers and believers. For deniers, they found framing climate change action in terms of improving economic/technological development or increasing societal warmth elicited higher levels of pro-environmental

behavioural intentions than frames emphasizing avoiding the risks of climate change. For believers, there were no significant effects; all frames were equally effective.

1.2.2 The Current 'Climate Change Adaptation' Message Study

Our Phase 2 study extended previous research on climate change communication in three important ways. First, most previous studies compared message impacts on audience segments defined by differences on a single conceptual dimension (e.g. political orientation or belief in climate change). As previously described, we adopted a segmentation strategy that incorporated a much broader range of profiling variables that were confined to cognitive/analytic and affective/feeling constructs (i.e. values, attitudes, trust, distress, etc.). We considered this appropriate, given that our primary goal was to understand the psychological factors underlying responses to climate change adaptation messages.

Second, most previous studies have involved the manipulation of a small number of message attributes, often in communications that were specifically constructed or modified for research purposes. The present study implemented the principle of *representative design*(Brunswik, 1955), by employing 60 climate change adaptation messages sourced from the Internet, and investigating the potential effects of 10 message attributes (topic, message source, language complexity, inclusion of adaptation advice, descriptive and injunctive normative influence, and framing linked to geography, consequence, promotion vs. prevention, emotion vs. reason, individual vs. collective) that varied naturally across these messages. This enabled us to determine whether the presence or absence of specific message attributes reliably predicted how favourably or unfavourably participants in our study responded to each message, and whether different message attributes elicited different responses across our audience segments.

Finally, whereas most climate change communication studies have focussed on only one or two outcome measures (e.g. support for climate change mitigation policies or perceived severity of climate change outcomes, etc.), we investigated the effect of message attributes on four response dimensions derived from Witte's (1992)*Extended Parallel Processing Model*(EPPM)*:*

- perceived threat;
- perceived efficacy;
- fear control responses, and;
- danger control responses.

According to the EPPM, individuals who are exposed to health messages that elicit higher levels of perceived threat and efficacy are likely to engage in danger control processing, which activates motivation to avert the threat. This often generates danger control responses, which may take the form of attitudes, intentions, and behaviours that are in accordance with the message's recommendations. In contrast, when individuals are presented with messages that elicit high levels of perceived threat but lower levels of efficacy, they are more likely to engage in fear control processing, which involves taking steps to manage one's emotions without actually taking direct action to reduce the threat. This often produces fear control responses, which may take the form of message denial, reactance, or avoidance (Witte, 1992, Witte, 1994, Witte, 1998, Witte, Meyer and Martell, 2001). According to the model, messages that are low in threat and efficacy tend to elicit neither type of response. Numerous studies focusing on health or safety communication have supported the basic tenets of the model (Witte and Allen, 2000, Popova, 2012), but to our knowledge the model has yet to be formally applied to climate change.

To assess the model, we employed hierarchical judgement analysis to determine which message attributes predicted perceived threat and efficacy responses, and, in turn, how these two first order judgement responses predicted second order responses related to fear and danger control. We also assessed how these patterns of responses varied across audience segments.

2. RESEARCH ACTIVITIES AND METHODS

The project had two phases:

1. *Typology Generation* and
2. *'Climate Change Adaptation' Message Evaluation*.

2.1 Phase 1 – Typology Generation

2.1.1 Summary of Phase 1 Methodology

In Phase 1, we applied audience segmentation methodology to identify Australian climate change interpretive communities; that is, groups of Australians who share similar concerns and understandings about climate change. To this end, we used a large (*N* = 3,096) national data set (Reser et al. 2011, Reser et al. 2012b) which contained a diverse range of psychological variables relevant to climate change adaptation. These data were collected via an online survey conducted in 2010.

Variables used to identify the audience segments (i.e. climate change interpretive communicates) included:

- perceived spatial proximity of climate change effects;
- perceived temporal proximity of climate change effects;
- environmental values –connection to nature;
- environmental values – green self-identity,
- trust in climate change authorities;
- perceived risks from climate change,
- concern about climate change and the environment;
- knowledge about climate change, belief in climate change;
- distress about climate change;
- self-efficacy (perceived ability to influence climate change);
- knowledge about climate change;
- belief in climate change, attitudes toward clean energy, and;
- attitudes toward nuclear power.

Following the segmentation analysis, we compared the interpretive communities on a range of outcome variables related to psychological and behavioural responses to the perceived threat of climate change, and also policy preferences for addressing the issue.

Full details of the methods used in this study are described below. A detailed description of the segmentation analytical strategy (Latent Profile Analysis) can be found in the Results and Outputs section of this report.

2.1.2 Procedure

This study used an existing dataset from a collaborative research project between the Understanding Risk Research Group at Cardiff University and the Psychology and Climate Change Research Group at Griffith University. The collaborative project examined differences in climate change perceptions and behaviours between Britain and Australia (Reser et al. 2012b, Spence et al. 2010).

Data were gathered during 2010 via an 80-item web-based survey administered by Qualtrics (Australia) to panel respondents aged 15 years and older, who resided in designated population centres within demographically and geographically stratified areas of Australia. Details of the data collection process were provided by Reser et al.

(2012b). As segmentation profiling was not part of the originally planned data analysis, most variables in the current study were composites created from groups of survey items that assessed a specific type of climate change or environmental cognition (e.g. concerns, knowledge, attitudes, and affect). Reser and colleagues created the majority of these variables and reported the scale development process, which included factor analyses to establish the independence of conceptually similar constructs (e.g. general concern, risk perception, and distress). As there were no missing scores for any individual rating items, composite scores were computed by summing their constituent items. Internal consistencies of all variables in the current study were confirmed by reliability analyses in SPSS 20.0. Items that assessed future concern about climate change were created by Spence et al. (2010). Sources and descriptions of all other items used in this study were detailed in Reser et al. (2012b).

2.1.3 Respondents

The sample comprised 3,096 respondents (53% female). Ages ranged from 15 to 108 years (*M* = 45.82, *SD* = 14.89; *Median* = 46.00), which included 7.8% aged between 15 and 24, 60.0% between 25 and 54, and 31.6% aged 55 and over.

Australian census figures for 2011 indicate that the sample included a large number of respondents aged between 25 and 54 compared to percentages of individuals in these age groups within the general population (13.6%, 42.2% and 22.0%, respectively; ABS, 2006). This distribution may reflect the probability that many respondents associated with a survey panel, like that used by Qualtrics, are of working age(Reser et al. 2012b).

Most respondents (87%) completed Year 12 at high school and 64% completed tertiary or trade qualifications. Seventy-one percent described their residential circumstances as either urban or suburban, 17% reported residence in a country town, and 12% indicated that they resided in rural residential or rural areas. These figures closely correspond with 2011 national statistics, which show that 69% of Australians lived in major cities at that time(ABS, 2011).

2.1.4 Profiling Variables

Perceived spatial proximity of climate change effects
Perceived spatial proximity was assessed by five items. Respondents indicated their level of agreement with three statements about the proximity of climate change effects (e.g. 'My local area is likely to be affected by climate change') on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*). *Don't know* and *no opinion* responses scored three points.

Scores were reverse-coded for one statement that described the inverse perspective that climate change would mainly affect distant regions. Two further items assessed respondents' perceptions of their local vulnerability to climate change (e.g. 'How vulnerable do you think the region where you live is to the impacts of climate change?').Response options ranged from 1 (*not vulnerable)* to 6 (*very vulnerable*). Total scores could range from 5 (low spatial proximity) to 27 (high spatial proximity). The spatial proximity variable had good internal consistency (α = .76)[2].

[2]Cronbach's alpha (α) is a measure of internal consistency reliability, reflecting the extent to which a set of survey items all assess the same underlying psychological or behavioural construct. Other measures of internal consistency used in this report are the Kuder-Richardson coefficient (*KR-20*)and Kappa (*k*).

Perceived temporal proximity of climate change effects
A single item assessed when respondents expect Australia to start feeling the effects of climate change. Response options ranged from 1 (*never*) to 5 (*we are already feeling the effects*). Thus, higher scores represented higher perceived temporal proximity of climate change effects.

Environmental values – connection to nature
Respondents indicated their agreement with six statements describing a sense of connection with nature (e.g. 'I often feel that I am a part of nature') by selecting an option ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). This scale exhibited excellent reliability (α = .94).

Environmental values – Green self-identity
Green self-identity was assessed by respondents' level of agreement with three statements that placed environmental issues as an integral part of self and lifestyle (e.g. 'Being environmentally friendly is an important part of who I am'). Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*), and *don't know* and *no opinion* responses scored 3 points. The scale was highly internally consistent (α = .85).

Trust in climate change authorities
Level of agreement with statements expressing trust in information from each of three climate change authorities (i.e., government, scientists, and media) were indicated by responses ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). A fourth statement described trust in the Australian Government to take action against climate change, with response options ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). *Don't know* and *no opinion* options scored 3 points. Variable scores could range from 4 to 23. Cronbach's α was.79.

Perceived risks from climate change
Perceptions of risks associated with climate change were measured by five items. Respondents indicated their degree of agreement with three statements describing potential consequences of climate change over the next 25 years (e.g. 'Climate change will have a noticeably negative impact on my health'), and selected a response to two questions that best reflected their risk estimation (e.g. 'In your opinion, what is the risk of climate change exerting a significant impact on economic development in your state?'). For each item, respondents selected one of six response options that reflected low to high levels of perceived risk. Total scores could range from 5 (*low perceived risk*) to 30 (*high perceived risk*). Cronbach's α for the resulting composite scale was .90.

Concern about climate change and the environment
Twenty-five items comprised a composite concern variable. Seven items assessed respondents' general concern about climate change (e.g. 'If nothing is done to reduce climate change in the future, how serious a problem do you think it will be for Australia?'); six items addressed respondents' future concerns about the effects of climate change (e.g. 'Supplies of fossil fuels will run out'); and 12 items assessed the extent of biospheric, altruistic, and egoistic concerns for the environment (Schultz, 2001). Response sets included options representing low to high levels of concern, with possible total scores ranging from 30 (*low concern*) to 140 (*high concern*). Overall, the concern variable demonstrated high internal consistency (α = .87).[3]

[3] Three separate concern variables were initially created: general concern, future concern, and

Knowledge about climate change
Objective knowledge about climate change was assessed by responses to ten statements. Seven statements were accurate descriptions of an aspect of climate change (e.g. 'Australia's average temperature has increased by approximately 1°C from 1910 to 2002') and three statements were inaccurate (e.g. 'Methane is emitted mainly from fossil fuels'). Respondents selected *true*, *false*, or *don't know* in response to each statement. Correct responses scored one point, and incorrect and *don't know* responses scored zero. Total scores could range from 0 to 10. The objective knowledge composite variable had adequate internal consistency (*KR-20* = .63).

Belief in climate change
Three items assessed the extent of respondents' belief in climate change. Respondents indicated their level of agreement with one statement about the existence of climate change ('I am certain that climate change is really happening') on a scale from 1 (*strongly disagree*) to 5 (*strongly agree*); selected one of five statements that best described their opinion about the cause of climate change that ranged from 1 (*entirely caused by natural processes*) to 5 (*entirely caused by human activity*)*;* and answered one question ('As far as you know, do you think that the world's climate is changing?') with 1 (*no*), 3 (*don't know*), or 5 (*yes*). Variable scores could range from 3 (*disbelief*) to 15 (*strong belief*). Belief in climate change exhibited high internal consistency (α = .81).

Distress about climate change
Respondents reported levels of agreement with seven statements describing distress experienced over climate change in a particular context (e.g. 'I experience some distress each time I see or read media coverage of the likely impacts and consequences of climate change'), by selecting a response from options on a scale ranging from 1 (*strongly disagree*) to 6 (*strongly agree*). Items addressed the degree of experienced apprehension, fear, pessimism, anxiety, sorrow, or loss due to the threat and projected consequences of climate change. The distress over climate change scale exhibited excellent reliability (α = .93).

Self-efficacy – perceived ability to influence climate change
Self-efficacy to influence climate change was indicated by levels of agreement with five positive statements, (e.g. 'I can personally help to reduce climate change by changing my behaviour'). Response options ranged from 1 (*strongly disagree*) to 5 (*strongly agree*) for two statements and from 1 to 6 for three statements. Items scored on 5-point scales also offered *don't know* and *no opinion* responses, which were scored 3. The scale exhibited high internal consistency (α = .89).

Attitudes toward clean energy
Respondents gave their opinions about the suitability of five energy sources for producing electricity (i.e., coal, gas, oil, sun/solar power, and wind power). Response options for each source ranged from 1 (*very unfavourable*) to 5 (*very favourable*) and also included *never heard of it*, *don't know* and *no opinion* (3 points each). Attitudes toward clean energy had adequate internal consistency (α = .64).

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environmental concern. These variables were highly inter-correlated and exhibited similar relationships with all other study variables. We therefore combined them to increase model stability and to produce a more parsimonious and interpretable profile solution.

Attitudes toward nuclear power
Support for nuclear power was assessed by four items. Respondents answered two questions about their stance toward, and degree of concern about, the construction of nuclear power stations (e.g. 'Do you favour or oppose the construction of nuclear power stations in Australia?') on 2- and 4-point scales, respectively. They also indicated their level of agreement with two statements about the risks and benefits of nuclear power (e.g. 'There are risks to people in Australia from nuclear power') by selecting a response from 1 *strongly disagree* to 5 *strongly agree*. Possible total scores ranged from four (unfavourable attitudes) to 16 (favourable attitudes). The reliability estimate for attitudes toward nuclear power was high (α = .82). We assessed attitudes toward nuclear power separately from attitudes towards clean energy technologies for psychometric and conceptual reasons. A composite measure of both constructs exhibited poor reliability, which may reflect perceived differences in their effects. Even though nuclear power plants do not emit greenhouse gases (like other clean energies), they are not carbon neutral over their entire lifecycle, and they do produce other wastes that present a potential threat to human health and the environment.

2.1.5 Profile Validation Variables

Behavioural responses to climate change
Respondents indicated whether they were currently taking action to reduce their carbon footprint in fifteen different ways (e.g. using less electricity, reducing travel, recycling). A score of 1 indicated *current action* and a score of 0 indicated *no action*. The scale displayed good internal consistency (α = .74). Although the primary focus of this project was climate change adaptation, we included this measure of mitigation behaviour to ensure that the audience segmentation typology was validated using as broad a range of conceptually-relevant climate change variables as possible.

Psychological responses to climate change
Eight items assessed the extent to which respondents thought about climate change-related problems, attended to news reports or discussions about climate change, or considered ways to change their lifestyle because of climate change. Responses were on 6-point scales reflecting low to high levels of psychological adaptation, (α = .89).

Climate change media consumption
Respondents indicated whether they had seen each of 14 listed documentaries (e.g. *An Inconvenient Truth*) and commercial films (e.g. *The Day After Tomorrow*) addressing climate change by clicking 1 (*yes*) or 0 (*no*), (*KR-20* = .61).

Responsibility – personal
Self-perceived personal responsibility for managing the effects of climate change was assessed by four statements expressing a sense of 'urgency to change my behaviour', 'responsibility to help to do something', and preparedness to 'greatly reduce my energy use' and 'pay significantly more money for energy efficient products'. Level of agreement was indicated on a scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), (α = .82).

Responsibility – public
Respondents indicated whether they considered each of three public groups (environmental groups, individuals and families, and international communities) should take responsibility for managing the effects of climate change by clicking 1 (*take responsibility*) or 0 (*not applicable*), (α = .73).

Responsibility – Authorities
Four items assessed whether respondents believed that each of four authorities (industry and companies, local authorities, state governments, and national governments) should take responsibility for managing the effects of climate change, by clicking 1 (*take responsibility*) or 0 (*not applicable*), (α = .88).

Support for climate change policies
Three single-item variables assessed respondents' support for policies relevant to mitigating climate change. Respondents indicated how they would vote in an election held today in relation to policies advocating building new wind farms in Australia, building new coal-fired power stations in Australia, and spending taxpayers' money on Australian projects designed to tackle climate change. Responses were made on a scale ranging from 1 (*definitely vote against*) to 4 (*definitely vote in favour*). The coal-fired power variable was reverse scored. Response options also included *I would not vote*, *don't know* and *no opinion*, which each scored 2.5.

2.2 Phase 2 – 'Climate Change Adaptation' Message Evaluation

2.2.1 Summary of Phase 2 Methodology

In Phase 2, we collected data from a new national sample (*N* = 1,031) via an online survey with the primary aim of determining how each climate change interpretive community responds to current climate change adaptation messages, and to identify the specific attributes of messages that drive these responses.

Respondents were presented with a set of psychological measures similar to those used in the audience segmentation analyses in Phase 1. Then they viewed a set of climate change adaptation messages that promoted the effective self-management of current or expected adverse effects of climate change, including:

- preparing for bushfires;
- floods; or extreme weather;
- saving water or energy;
- minimising psychological distress; and
- providing advice about national or international climate change adaptation measures.

Messages were sourced from the internet following consultation with Australian stakeholders (e.g. CSIRO, Department of Environment and Heritage Protection, Department of Climate Change Energy and Efficiency, Australian Bureau of Agricultural and Resource Economics and Sciences, Australian Psychological Society).

We coded all messages on ten attributes (communication cues):

- topic;
- source;
- nature of adaptation advice;
- language complexity;
- geographic frame;
- focus on promoting gains versus preventing losses;
- appeal to emotion versus reason;
- consequence frame;
- emphasis on individual versus collective responsibility/action; and,
- reference to social norms.

Respondents rated each message on several criteria informed by the Extended Parallel Process Model of risk perception and response (Witte, 1992):

- *perceived level of threat elicited by the message;*
- *perceived level of efficacy elicited;*
- *fear control (the extent to which the message was rejected)*, and;
- *danger control (the extent to which the message was accepted and motivated an adaptive response)*.

Quantitative judgement analysis (Cooksey, 1996, Hammond et al. 1975) was employed to determine:

1) which message attributes (communication cues) predicted perceived threat and efficacy responses, and;
2) how perceived threat and efficacy responses predicted fear control (message rejection) and danger control (message acceptance).

Details of methods used in this study are presented below. A full description of the quantitative judgement analysis paradigm is provided in the Results and Outputs section of this report. The survey questions appear in Appendix 1 and the climate change adaptation messages are described in Appendices 2 and 3.

2.2.2 Design and Procedural Overview

Data were gathered by a web-based survey administered by Qualtrics to panel participants, aged 18 years and older, who resided in demographically and geographically diverse areas of Australia. All respondents received $12 for taking part. After providing demographic details, participants answered questions about their cognitive, affective, and behavioural responses to climate change. These questions replicated the items used in the Phase 1 study. Next, participants were presented with a series of brief communications promoting the adoption of particular adaptation responses to the effects of climate change (e.g. bushfires, floods, droughts, etc.) in Australia. The communications were introduced to participants as 'brief messages about adapting to the effects of climate change', which were 'expected to include changes in the incidence of certain events, like bushfires and floods'. The messages had been previously coded on 10 communication cues. From a pool of 60 messages, each participant viewed a subset of six messages presented in blocks according to their length: long (1), short (4), long (1). Messages within each block were randomly selected from pools of 40 short and 20 long messages. After viewing each message, participants responded to 12 items that measured four judgement dimensions relating to that message (i.e., the extent that the message elicited responses related to perceived threat, efficacy, fear control, and danger control).

2.2.3 Participants

A total of 1,182 Australian residents responded to the survey. Of these, 151 completed the survey in less than 20 minutes, which we estimated as the minimum time needed to seriously consider and respond to all survey items and messages. These respondents differed significantly on mean scores for the cognitive/affective and judgement dimension variables from slower respondents (both variable sets: Wilks' Λ = 0.85, $p < .001$, $\eta^2 = .15$). Consequently, these respondents were dropped from the sample prior to analysing the data.

The resulting sample comprised 1031 participants (50.2% female). Ages ranged from 18 to 66 years (M = 35.45, SD = 8.22; *Median* = 35.00), which included 9.3% aged

between 18 and 24, 90.2% between 25 and 54, and 0.5% between 55 and 66. The corresponding Australian population values from the 2011 census were 13.3%, 41.8% and 25.6%. Most participants (88.3%) indicated that they had completed Year 12 and/or tertiary or trade qualifications, as compared to 42.2% in the general population. Most respondents (83.9%) resided in urban or suburban areas, as compared to the population value of 69% (ABS, 2011). Overall, comparisons with 2011 census data indicate that non-urban, less educated, and older respondents were under-represented in the sample (ABS, 2011).

2.2.4 Climate Change Adaptation Messages

Sixty climate change adaptation messages were sourced from the Internet following consultation with Australian stakeholders (e.g. CSIRO, Department of Environment and Heritage Protection, Department of Climate Change Energy and Efficiency, Australian Bureau of Agricultural and Resource Economics and Sciences, Australian Psychological Society).

Stakeholders were contacted by phone and given access to our online repository of messages. They then provided advice about types of messages that could be added, and/or forwarded links to messages to be included.

Selected messages promoted the effective management of current or expected adverse effects of climate change; including preparing for bushfires, floods, or extreme weather; saving water or energy; minimising psychological distress; and providing advice about national or international climate change adaptation measures. Mode of delivery included audio-visual presentations (31.7%), websites (20.0%), and materials designed to be printed (48.3%). All messages were brief, with reading/viewing times ranging from approximately 30 seconds to 4.5 minutes. Forty messages were categorised as short (estimated viewing time < 2 minutes) and 20 were classified as long in length (estimated viewing time ≥ 2 minutes).

2.2.5 Communication Cues

Before survey launch, each message was coded on10communication cues sourced from the climate change and social marketing literature and considered likely to influence participants' responses (e.g. Clark et al. 2012, Spence and Pidgeon, 2010, Spence, Poortinga and Pidgeon, 2012, Griskevicius, Cialdini and Goldstein, 2008, Chaudhuri, 2002, Hosman, 2002, Kahan et al. 2012). Communication cues and cue categories are listed in Table 1.

Table 1. Communication Cues and Cue Categories

Communication Cues	Cue Categories
Topic	Bushfires, floods, water conservation, energy conservation, psychological adaptation, general climate change, extreme weather, multiple
Source	Government, not-for-profit organisation, industry, media
Adaptation advice	None/general, specific
Language complexity	Low, moderate
Geographic frame	Local, national, global/all people, multiple
Focus on promoting gains versus preventing losses	Promotion, prevention, neither, both

Appeal to emotion versus reason	Primarily emotion, balanced, primarily reason
Consequence frame	Human health, environmental, economic/property/possessions, national security, multiple, not explicitly specified
Emphasis on individual versus collective responsibility/action	Individual, collective, both

Communication Cues	**Cue Categories**
Reference to social norms	Descriptive – descriptions of how people actually behave, injunctive – assertions about how people should behave, neither, both

Coding was performed by two independent researchers. Coder 1 coded all messages and Coder 2 coded a random selection of 25% of the messages. Inter-coder consistency for the double-coded messages was high, with complete agreement on 7 cues (Cohen's $\kappa = 1.00$) and high agreement on 3 cues ($\kappa = .82$, .89 and .91), which indicated that the remaining messages were appropriately coded.

2.2.6 Judgement Dimensions

Perceived threat
Five items assessed participants' beliefs about the magnitude or significance of the threat contained in each message (severity) and the probability of personally experiencing the threat (susceptibility). Participants indicated how 'important' they found the issue addressed by the message, how 'serious' they estimated its potential effects, and the extent to which it made them feel 'that urgent action is required', 'personally vulnerable' and 'fearful' on scales ranging from 1 (*not at all)* to 5 (*extremely)*. Variable scores were created by averaging across items ($\alpha = .93$).

Perceived efficacy
Beliefs about the efficacy of each message's content (response efficacy) and about self-perceived ability to carry out the recommended response (self-efficacy) were assessed by two items. Participants rated how effectively they thought 'the message's recommended actions will manage the issue' and the extent to which the message made them feel 'equipped to deal with the issue' on scales ranging from 1 (*not at all)* to 5 (*extremely)*. Variable scores were created by averaging across items ($\alpha = .84$).

Danger control responses
Two items examined participants' intentions to follow each message's recommendations. Participants rated the extent to which each message made them feel motivated to 'seek out more information on the topic' and to 'take action' on scales ranging from 1 (*not at all)* to 5 (*extremely)*. Variable scores were created by averaging across items ($\alpha = .84$).

Fear control responses
Three items addressed participants' rejection of each message by defensive avoidance, message minimisation, and/or perceived manipulation. Participants rated the extent to which each message made them 'want to avoid thinking about the issue it addressed', 'find the information in the message was exaggerated', and 'feel that the message tried to manipulate your views or feelings' on scales ranging from 1 (*not at all*) to 5 (*extremely*). Variable scores were created by averaging across items ($\alpha = .85$).

2.2.7 Profiling Variables

Most of the variables used to identify latent profiles in this dataset were identical to those used in Phase 1. Therefore, only brief summaries of these variables are provided below, whereas new or modified variables are described in detail. Cronbach's alphas (estimates of internal consistency) for the variables in the Phase 2 dataset are indicated below in parentheses.

Perceived spatial proximity of climate change effects
Five items measured the extent to which participants believed that their local area was vulnerable to the effects of climate change (α = .73).

Perceived temporal proximity of climate change effects
A single item assessed when participants expect Australia to start feeling the effects of climate change.

Environmental values: Green self-identity
Green self-identity was assessed by participants' level of agreement with three statements that placed environmental issues as an integral part of self and lifestyle (α = .87).

Environmental values – Connection to nature
Respondents indicated their agreement with six statements describing a sense of affective connection with nature (α = .93).

Trust in climate change authorities
Participants indicated level of agreement with statements expressing trust in information from the government, scientists, and media, and in the Australian Government to take action against climate change (α = .75).

Perceived risks from climate change
Perceptions of risks associated with climate change were measured by five items (α = .89).

Concern about climate change and the environment
A composite concern variable assessed participants' levels of concern about the general and future effects of climate change, and their biospheric, altruistic, and egoistic concern about the environment (α = .93).

Knowledge about climate change
Objective knowledge of the effects of climate change was assessed by true/false responses to ten statements (α = .69).

General belief in climate change
General belief in climate change and belief in anthropogenic climate change were assessed separately. This differs from the belief variable used in our previous study (Hine et al. 2012) which combined both beliefs.
For general belief in climate change, participants indicated their level of agreement with one statement about the existence of climate change ('I am certain that climate change is really happening') on a scale from 1 (*strongly disagree)* to 5 (*strongly agree),* and answered one question ('As far as you know, do you think that the world's climate is changing?') with 1 (*no)*, 3 (*don't know)*, or 5 (*yes).* As there were no missing scores on any items, composite scores were computed by summing items(α = .84).

Belief in anthropogenic climate change
A single item assessed participants' belief in anthropogenic climate change. They selected one of five statements that best described their opinion about the cause of climate change that ranged from 1 (*entirely caused by natural processes*) to 6 (*entirely caused by human activity*).

Distress experienced over climate change
Participants reported levels of agreement with seven statements describing distress experienced over climate change in particular contexts (α = .93).
Outrage experienced over climate change
Levels of outrage toward climate change were indicated by responses to two questions that asked participants to rate how strongly they felt angry and disgusted when thinking about the issue of climate change on a scale from 1 (*not at all*) to 5 (*extremely*). As there were no missing scores on any items, variable scores were formed by summing items (α = .82).

Self-efficacy – Ability to influence climate change
Self-efficacy to influence climate change was indicated by levels of agreement with five positive statements (α = .90).

Attitudes toward clean energy
Participants gave their opinions about the suitability of five energy sources for producing electricity (α = .68).

2.2.8 Profile Validation Variables

Behavioural responses to climate change
Participants indicated how often they currently take action to reduce their carbon footprint in fifteen different ways (e.g. using less electricity, reducing travel, recycling) on a scale ranging from 1 (*never*) to 4 (*often or all the time*). Variable scores were formed by averaging items. The scale displayed high internal consistency(α = .86).

Psychological responses to climate change
Eight items assessed the extent to which participants think about climate change-related problems, attend to news reports or discussions about climate change, or consider ways to change their lifestyle because of climate change. Responses were made on six point scales reflecting low to high levels of adaptive thinking. As there were no missing scores on any items, scale scores were calculated by summing items (α = .90).

3. RESULTS AND OUTPUTS

3.1 Phase 1 – Typology Generation

3.1.1 Summary of Phase 1 Results

The audience segmentation analysis indicated that our Phase 1 Australian sample comprised five distinct interpretive communities: *Alarmed* (26%), *Concerned* (39%), *Uncertain* (14%), *Doubtful* (12%), and *Dismissive* (9%).

- *Dismissive* respondents, on average, reported very low levels of belief in climate change and considered its effects to be remote in space and time. They also exhibited low distress, concern, perceived risks, and self-efficacy regarding climate change.

- *Doubtful* Australians, on average, reported little belief in climate change and considerable disengagement from the issue, but their views were less extreme than those of *Dismissive* respondents.

- *Uncertain* respondents, were similar to the Doubtful group except that they tended to believe that climate change was occurring.

- *Concerned* Australians, on average, reported moderately strong levels of belief in climate change and the imminence of its effects. They also reported moderate levels of perceived risk, concern, distress, trust in authorities, self-efficacy, and perceived proximity of climate change effects. However, they reported lower (near average) levels of environmental values, climate change knowledge, and attitudes towards clean energy.

- *Alarmed* respondents, on average, were characterised by very high levels of distress, concern, perceived risk, and self-efficacy regarding climate change, along with a strong belief in climate change and the imminence and proximity of its effects, strong environmental values, considerable trust in climate change authorities, and positive attitudes toward clean energy.

The five interpretive communities also differed in their responses to climate change. Self-reported frequency of engaging in several psychological (e.g. thinking about climate change) and behavioural (e.g. using less electricity) responses increased incrementally across the five groups; ranging from very low average levels reported by *Dismissive* Australians to very high average levels reported by *Alarmed* respondents.

A detailed description of the analyses and results is provided next .

3.1.2 Statistical Approach

Latent profile analysis (LPA)was conducted using MPlus 4.1 (Muthén and Muthén, 2006) to classify respondents into Australian climate change interpretive communities. LPA is a model-based procedure that groups participants according to shared responses across multiple measures; in this case, the procedure grouped participants according to patterns in the strength of their cognitive and affective responses to climate change.

When assessing model fit, particular emphasis was given to the Lo-Mendell-Rubin likelihood ratio test (LMR; Lo et al. 2001) and the Bootstrapped Likelihood Ratio Test

(BLRT; McLachlan and Peel, 2000). The LMR and BLRT assess difference in goodness-of-fit between model *k* and model *k*-1, where *k* refers to the number of retained profiles significant *p* values for the LMR and the BLRT indicate that model *k*-1 should be rejected in favour of model *k.* Also considered was the Bayesian Information Criterion (BIC; Schwartz, 1978), which assesses improvement in fit after penalising for the number of parameters in a modelIn MPlus, the best fitting model for a dataset is indicated by the smallest BIC value generated amongst competing models. Overall interpretability of the solution was also considered.

All psychological profiling variables were standardised to a mean of 0 with a standard deviation of 1 to equate scales and facilitate computation and interpretation of the profiles. The dataset contained no missing values, and bootstrapping procedures were used in MPlus to counter the effects of multiple skewed variablesSPSS 20.0 was used to conduct Multivariate Analysis of Variance (MANOVA), Analyses of Variance (ANOVAs), and Chi Square tests to identify characteristics of the emergent profiles and to validate the profile solution. Correlations between the profiling variables are presented in Table 2.

3.1.3 Climate Change Interpretive Communities

Table 3 shows fit indices for 2- through 7-profile solutions generated by the LPA. Significant LMR and BLRT values indicated that the 5-profile solution provided better fit for the dataset than the 4-profile model. The BLRT indicated that the 6-profile solution offered significant improvement in fit over the 5-profile model. However, the LMR signaled non-significant improvement. The BIC did not clarify the relative fit of the 5- and 6-profile solutions because values continued to decrease as more profiles were added to the model. When the BIC exhibits this behaviour, Nagin (2005) recommended using subjective criteria to assist model selection

Consequently, we investigated the incremental explanatory value of the 6-profile solution by plotting log likelihood values for 2- to 8- profile solutions as a descriptive aid (Nylund, Asparouhov and Muthén 2007). The curve increased steadily from 2 to 5 profiles but flattened out between profiles 5 and 6, indicating that the increase in likelihood offered by the 6-profile solution was not substantial, despite the significant BLRT

Nylund, Asparouhov and Muthén noted that the LMR may be preferred over the BLRT in cases of complex survey data and/or skewed variables (as in this case). Greater weight was therefore placed on the LMR index which, coupled with a significant BLRT, indicated that the 5-profile solution was the best fitting model for the data. Importantly, the 5-profile solution was also the most interpretable. Characteristics of the five cognitive profiles are depicted in Figure 1.

Profile 1 comprised 9.0% of respondents who were labelled as being *Dismissive* about climate change. On average, they reported a strong disbelief in climate change, very low levels of distress, concern, perceived risks and self-efficacy regarding climate change, and considered its effects to be remote in space and time. With the exception of attitudes toward nuclear power (which were the most positive across the five profiles), mean scores on all psychological indicators were well below the sample average.

Table 2Correlations Between Psychological Profile Variables

Variables	2	3	4	5	6	7	8	9	10	11	12	13
1 Spatial Proximity	.59	.42	.49	.32	.63	.65	.37	.61	.60	.56	.29	-.28
2 Temporal Proximity		.31	.42	.35	.53	.60	.31	.70	.53	.51	.26	-.25
3 Environmental Values – Connection to Nature			.62	.23	.40	.51	.30	.30	.51	.51	.26	-.20
4 Environmental Values – Green Self Identity				.31	.45	.62	.32	.45	.59	.61	.32	-.33
5 Trust					.41	.47	.19	.46	.46	.47	.07	-.12
6 Perceived Risk						.70	.35	.57	.71	.59	.23	-.29
7 Concern							.34	.63	.73	.69	.29	-.36
8 Knowledge								.36	.38	.31	.24	-.05
9 Belief in Climate Change									.60	.58	.29	-.24
10 Distress										.66	.28	-.31
11 Self-efficacy											.28	-.29
12 Attitudes–Clean energy												-.16
13 Attitudes – Nuclear												

Notes. N = 3,096. All correlations are significant at $p < .01$ A correlation describes the degree of linear relationship between two variables on a scale from -1 to +1. The closer the correlation is to −1 or +1, the stronger the relationship. A perfect positive relationship is indicated by +1 and a perfect negative relationship is indicated by -1. Zero indicates no relationship.

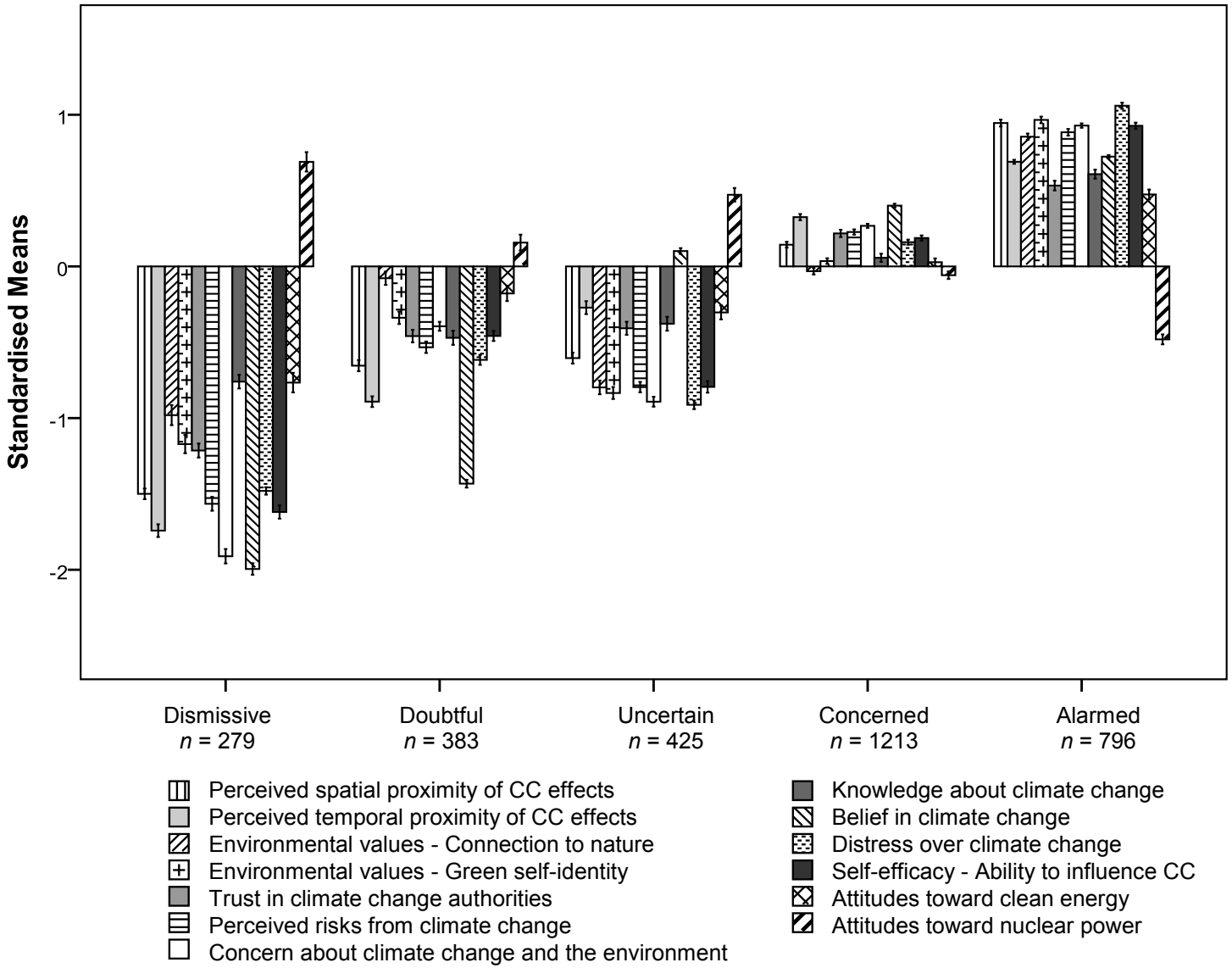


Figure 1. Cognitive Characteristics of the Climate Change Interpretive Communities
Average standardised sample mean = 0. Error Bars: +/- 1 SE.

Table 3. Model Fit Indices for Two to Seven Profile Solutions

Profile solution	BIC	LMR	BLRT
2	101245.28	<.001	<.001
3	97573.71	<.001	<.001
4	95977.78	<.001	<.001
5	**94979.60**	**.03**	**<.001**
6	94165.32	.08	<.001
7	93674.67	.24	F

Note. BIC = Bayesian information criterion, LMR = Lo-Mendell-Rubin likelihood ratio test, BLRT = Bootstrapped likelihood ratio test, F = failed to converge.

Profile 2 included 12.4% of respondents, whose responses could be characterised as *Doubtful* about climate change. On average, their responses indicated very little belief in climate change and general disengagement with the issue. However, mean scores on all psychological indicators were less extreme than those exhibited by *Dismissive* respondents. Their mean connection to nature score approached the sample average.

The third profile, labelled *Uncertain*, comprised 13.7% of the sample, and was similar in many respects to the *Doubtful* group. Mean scores on most of the profiling variables were below the sample average. However, whereas the *Doubtful* group was characterised by strong disbelief that climate change was occurring, *Uncertain* respondents tended to score just above the sample mean on this variable. This suggests the possible emergence of cognitive dissonance within this group, with climate change beliefs diverging from an otherwise internally consistent psychological profile. Also noteworthy is that *Uncertain* respondents showed a substantively more positive mean attitude toward nuclear power (similar to the *Dismissive* profile) compared to the *Doubtful* respondents, possibly signaling a cognitive link between belief in climate change and nuclear power as a solution for this group.

Profile 4 included 39.2% of respondents, who on average reported a moderately strong belief that global climate change was occurring and that its effects were imminent. This group also exhibited moderate levels of perceived risk, concern, distress, trust in authorities, self-efficacy, and perceived physical proximity of climate change effects. However, they scored near the sample mean on environmental values, climate change knowledge, attitudes towards clean energy and nuclear power. Members of this profile were labelled as being *Concerned* about climate change.

Profile 5 comprised 25.7% of respondents, who were labelled as being *Alarmed* about climate change. This profile was characterised by very high mean levels of distress, concern, and perceived risk, along with very strong environmental values and self-efficacy. Alarmed respondents also tended to report strong belief in climate change, the imminence and proximity of its effects, considerable trust in climate change authorities, and positive attitudes toward clean energy. Mean scores on all psychological indicators were well above average, except for attitudes towards nuclear power, which were the lowest of all the profile groups identified in the sample.

MANOVA revealed that the five climate change segments explained a significant 54.7% of the variance in the set of climate change cognitions, which is a substantial proportion, indicating good model fit. Significant differences between respondent segments were observed on all variables in the model. Means, standard deviations and group differences are shown in Table 4.

Table 4. Psychological Variables – Means, SDs, and Mean Differences across the Climate Change Interpretive Communities

	Profile 1 Dismissive		Profile 2 Doubtful		Profile 3 Uncertain		Profile 4 Concerned		Profile 5 Alarmed		Univariate	
Profile Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	η^2
Spatial Proximity	11.66[a]	2.59	15.37[b]	3.15	15.59[b]	3.27	18.88[c]	2.97	22.40[d]	2.83	920.67	.54
Temporal Proximity	1.75[a]	0.90	2.83[b]	0.88	3.62[c]	1.12	4.38[d]	0.93	4.85[e]	0.48	928.71	.55
Environmental Values – Connection to Nature	18.66[a]	7.66	24.90[c]	5.96	19.92[b]	6.49	25.23[c]	5.28	31.36[d]	4.02	441.00	.36
Environmental Values – Green Self Identity	6.95[a]	2.77	9.23[c]	2.21	7.87[b]	2.24	10.26[d]	1.79	12.81[e]	1.69	696.30	.47
Trust	7.84[a]	2.67	10.44[b]	2.79	10.62[b]	3.07	12.78[c]	2.89	13.86[d]	3.11	290.77	.27
Perceived Risk	9.71[a]	4.53	15.80[c]	4.37	14.25[b]	4.19	20.28[c]	3.59	24.16[d]	3.69	1000.83	.56
Concern	60.38[a]	18.08	94.75[c]	13.10	83.48[b]	15.33	109.76[c]	10.72	124.75[d]	9.37	1869.22	.71
Knowledge	2.69[a]	1.75	3.36[b]	2.12	3.58[b]	2.19	4.59[c]	2.18	5.87[d]	1.97	187.78	.20
Belief in Climate Change	5.61[a]	2.03	7.39[b]	1.62	12.25[c]	1.26	13.20[d]	1.38	14.22[e]	0.95	3330.55	.81
Distress	9.60[a]	3.41	16.78[c]	5.41	14.32[b]	4.90	23.23[d]	4.96	30.71[e]	4.87	1482.77	.66
Self-efficacy	10.07[a]	3.75	16.03[c]	3.34	14.30[b]	4.03	19.34[d]	3.11	23.13[e]	2.99	1084.09	.58
Attitudes – Clean energy	16.93[a]	3.10	18.61[b]	2.84	18.25[b]	2.71	19.20[c]	2.53	20.48[d]	2.65	113.05	.13
Attitudes – Nuclear	11.70[e]	3.37	10.03[c]	3.24	11.02[d]	2.89	9.35[b]	2.71	8.02[a]	2.90	123.02	.14

Notes: N = 3096. Wilks' Λ = .04, $F(52,11927)$ =290.54, $p < .001$, η^2 = .55. All Univariate *F*'s are significant at $p < .001$. Means with different superscripts (in rows) differ significantly at $p < .05$ (Tukey's HSD).

3.1.4 Demographic and Geographic Characteristics of the Climate Change Interpretive Communities

The ANOVAs reported in Table 5 show that, on average, dismissive and doubtful profile members were significantly older than *Uncertain*, *Concerned* and *Alarmed* respondents and less educated than *Alarmed* members. Additionally, *Dismissive* respondents reported less income than *Uncertain* and *Concerned* profile members.

Examination of adjusted standardised residuals from a contingency table analysis revealed that significantly more males and fewer females than expected were in the *Dismissive*, *Doubtful*, and *Uncertain* profiles, and more females and fewer males than expected belonged to the *Concerned* and *Alarmed* profiles.Significantly greater than expected proportions of respondents with children occupied the *Dismissive* and *Doubtful* profiles, while fewer than expected belonged to the *Concerned* profile. Individuals who reported that they had not experienced climate change effects formed larger than expected proportions of the *Dismissive*, *Doubtful*, *Uncertain* and *Concerned* profiles, whereas a significant majority of alarmed members believed that at least some of the local weather events they had experienced (e.g. floods, droughts, bushfires, etc.) were due to climate change.

Several geographic differences between profiles were also observed. Overall, percentages of respondents from the Australian states of New South Wales and Queensland tended to decrease across the profiles from *Dismissive* to *Alarmed*, whereas percentages of respondents from Victoria and Western Australia tended to increase across profiles. Adjusted standardised residuals indicated that significantly larger than expected proportions of respondents from New South Wales were in the *Dismissive* or *Doubtfu*l profiles, greater than expected percentages of Queensland respondents exhibited a *Doubtful* profile and fewer than anticipated displayed a *Concerned* profile, and fewer Western Australian respondents than expected exhibited a *Doubtful* profile. Significant mean differences in past and current residence in types of regions (ranging from suburban to rural) were also observed, however there were no clear trends across profiles for these variables.

3.1.5 Validation of the Climate Change Interpretive Communities

To validate the predictive utility of the climate change profiles, we examined the relationship between profile membership and nine responses to climate change: behavioural, psychological, climate change media consumption, locus of perceived responsibility to act (i.e., personal, public, or authorities), and intentions to vote for new wind farms, coal-fired power stations, or public funding of projects to tackle climate change in Australia. As shown in Table 6, MANOVA revealed that the climate change profiles explained a significant 28.9% of the variance in the set of responses to climate change. Univariate analyses indicated that all assessed outcomes differed significantly across groups at $p < .001$.

Overall, respondents in the *Alarmed* segment reported more psychological and behavioural responses to climate change; attributed more responsibility for managing climate change to people generally (including authorities); reported having viewed more climate change films; and had stronger intentions to support clean energy policies than respondents from the other four profiles. Additionally, *Concerned* and *Alarmed* respondents reported greater intentions to support funding of projects to tackle climate change than did *Dismissive*, *Doubtful*, and *Uncertain* respondents.

Table 5. Key Demographic and Geographic variables – Means, SDs and Mean Differences or Distributions across the Interpretive Communities

Variables		Profile 1 Dismissive		Profile 2 Doubtful		Profile 3 Uncertain		Profile 4 Concerned		Profile 5 Alarmed		Group Differences	
		M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	η^2
Mean Age (years)		51.30^{c}	15.17	50.08^{c}	14.56	47.27^{b}	15.40	43.16^{a}	14.52	45.13^{ab}	14.19	29.40***	.04
Education Level		3.92^{a}	1.88	4.06^{ab}	1.83	4.15^{abc}	1.80	4.32^{bc}	1.88	4.47^{c}	1.83	6.60***	.01
Income Group		2.77^{a}	1.66	2.90^{abc}	1.62	3.30^{c}	1.72	3.08^{bc}	1.70	2.84^{ab}	1.62	7.23***	.01
Region – Past		2.41^{ab}	1.00	2.49^{b}	1.07	2.30^{a}	0.93	2.31^{a}	0.94	2.36^{ab}	1.02	2.94*	.00
Region – Present		2.43^{bc}	1.03	2.50^{c}	1.07	2.23^{a}	0.92	2.28^{ab}	0.98	2.43^{bc}	1.11	6.84***	.01
		%	Z_{Resid}	%	Z_{Resid}	%	Z_{Resid}	%	Z_{Resid}	%	Z_{Resid}	χ^2(df)	
Gender:	Male	69.2%	7.8	53.0%	2.5	60.9%	6.2	39.7%	-6.6	40.1%	-4.5	χ^2 (4) = 135.38***	
	Female	30.8%	-7.8	47.0%	-2.5	39.1%	-6.2	60.3%	6.6	59.9%	4.5		
Parental Status:	No	25.4%	-2.5	27.5%	-2.0	31.5%	-0.1	34.2%	2.1	33.1%	0.9	χ^2 (4) = 12.25*	
	Yes	74.6%	2.5	72.5%	2.0	68.5%	0.1	65.8%	-2.1	66.9%	-0.9		
State of residence:	ACT	2.9%	0.3	1.3%	-1.7	2.6%	0.0	3.0%	1.1	2.5%	-0.1	χ^2 (28) = 52.79**	
	NSW	24.4%	2.0	26.9%	3.7	17.6%	-1.2	18.6%	-1.3	17.6%	-1.8		
	NT	1.1%	-0.6	0.5%	-1.7	1.4%	-0.2	1.6%	0.2	2.1%	1.7		
	VIC	12.2%	-1.6	12.8%	-1.5	14.4%	-0.6	16.2%	0.9	17.2%	1.6		
	QLD	31.9%	0.7	35.2%	2.3	34.1%	1.9	27.8%	-2.3	28.6%	-1.1		
	SA	12.9%	-0.5	10.7%	-1.9	13.6%	-0.1	14.8%	1.3	14.2%	0.4		
	WA	9.7%	-1.4	8.6%	-2.4	11.8%	-0.4	13.4%	1.4	13.8%	1.4		
	TAS	5.0%	0.6	3.9%	-0.5	4.5%	0.1	4.6%	0.6	3.9%	-0.7		
CC Experience :	No	96.4%	11.7	89.3%	10.9	81.9%	8.2	63.1%	-1.1	33.3%	-21.2	χ^2 (4) = 620.78***	
	Yes	3.6%	-11.7	10.7%	-10.9	18.1%	-8.2	36.9%	1.1	66.7%	21.2		

Notes: *N* = 3096 except for Income *N* = 3030 and Parental Status *N* = 3082. Means with different superscripts (in rows) differ significantly at $p < .05$. Education, from 1 (≤ Year 10) to 5 (postgraduate); Income, from 1 (≤ $40K) to 7 ($200Kp.a.); Residential region past and present, from 1 (urban) to 5 (rural); CC Experience, effects experienced in local area. Z_{Resid} = Adjusted standardised residual, where $Z_{Resid} = 1.96$ is significant at $p < .05$. *$p < .05$, **$p < .01$, ***$p < .001$

Table 6. Outcome Variables – Means, SDs, and Mean Differences across the Communities

	Profile 1 Dismissive		Profile 2 Doubtful		Profile 3 Uncertain		Profile 4 Concerned		Profile 5 Alarmed		Univariate	
Outcome Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	η^2
Psychological responses	16.51[a]	2.55	23.76[c]	5.90	20.75[b]	6.09	29.71[d]	5.24	37.84[e]	4.68	1273.06	.62
Behavioural responses	3.42[a]	2.73	6.02[c]	2.50	5.03[b]	2.64	6.52[d]	2.39	8.28[e]	2.62	240.87	.24
CC media consumption	0.97[a]	1.22	1.26[b]	1.31	1.14[ab]	1.37	1.34[b]	1.30	2.13[c]	1.78	60.43	.07
Responsibility: personal	7.42[a]	2.69	10.84[c]	2.36	9.92[b]	2.65	13.27[d]	2.20	16.00[e]	2.31	962.90	.56
Responsibility: public	0.37[a]	0.66	1.24[b]	1.06	1.20[b]	1.02	1.97[c]	1.06	2.35[d]	0.95	280.16	.27
Responsibility: authorities	0.73[a]	1.23	2.08[b]	1.61	2.24[b]	1.55	3.01[c]	1.36	3.36[d]	1.22	234.84	.23
Policy support: wind power	3.28[a]	0.83	3.53[bc]	0.66	3.49[b]	0.69	3.64[c]	0.58	3.79[d]	0.51	42.97	.05
Policy support: (against) coal power	2.38[a]	0.82	2.77[bc]	0.73	2.71[b]	0.71	2.87[c]	0.74	3.21[d]	0.82	72.78	.09
Policy support: funding CC projects	1.75[a]	0.81	2.37[b]	0.80	2.56[c]	0.81	3.12[d]	0.71	3.51[d]	0.71	392.04	.34

Notes: N = 3096. Wilks' Λ = 0.26, $F(36,11555) = 141.03$, $p < .001$, $\eta^2 = .29$. All Univariate*F*'s are significant at $p < .001$. Means with different superscripts (in rows) differ significantly at $p < .05$ (Tukey's HSD). Possible score ranges: Psychological responses, 8-48; Behavioural responses, 0-15; CC media consumption, 0-14; Responsibility personal, 4-20; Responsibility public, 0-3; Responsibility authorities, 0-4; Policy Support, 1-4.

3.2 Phase 2 – 'Climate Change Adaptation' Message Evaluation

3.2.1 Summary of Phase 2 Results

In the Phase 2 sample, we identified three climate change interpretive communities: *Dismissive* (20.3%), *Uncommitted* (45.2%), and *Alarmed* (34.4%). The *Dismissive* and *Alarmed* groups resembled the similarly labelled segments identified in Phase 1, and the *Uncommitted* group exhibited attitudes, concerns and feelings about climate change that were close to the sample average.

Unique combinations of communication cues were found to predict each interpretive community's responses to the set of climate change messages. Consistent with predictions of the EPPM, high perceived threat and high perceived efficacy were associated with higher levels of message acceptance (danger control responses) for all profiles. Messages eliciting high perceived threat and low perceived efficacy were associated with higher levels of message rejection (fear control responses), but this relationship was present in *Uncommitted* respondents only.

We also found that a unique set of message attributes predicted message acceptance in each interpretive community.

- For the *Dismissive* community, messages tended to be accepted when they used simple language, provided specific advice about what actions to take to address climate change threats, and avoided descriptions about how 'typical' Australians respond to climate change threats (descriptive normative feedback) in the absence of clear statements of how they ought to respond (injunctive norms).

- For the *Uncommitted* group, well-received messages tended to have a strong emotional component, were framed in terms of preventing losses, and/or provided specific adaptation advice. However, messages with strong emotional content and a prevention frame were also associated with message rejection when perceived efficacy was low. In contrast, specific adaptation advice was uniquely associated with message acceptance for this group through its association with high perceived efficacy.

- For the *Alarmed* interpretive community, message acceptance was highest when messages emphasised local impacts and collective responsibility, and conveyed specific adaptation advice.

A detailed description of the analyses and results appears below. Further interpretation and discussion of the results may be found in the General Discussion. An effectiveness rating for each message for each interpretive community is reported in Appendix 2.

3.2.2 Climate Change Interpretive Communities

Latent profile analysis (LPA) was conducted using MPlus 4.1 (Muthén and Muthén, 2006) to classify respondents into interpretive communities based on patterns in the strength of their climate change cognitions. When assessing model fit, we considered the Lo-Mendell-Rubin likelihood ratio test (LMR; Lo et al. 2001), the Bootstrapped Likelihood Ratio Test (BLRT; McLachlan and Peel, 2000), Entropy, the Bayesian Information Criterion (BIC; Schwartz, 1978), and overall interpretability of the solution.

The LMR and BLRT assess difference in goodness-of-fit between model *k* and model *k*-1, where *k* refers to the number of retained profiles. Significant *p* values indicate that model *k*-1 should be rejected in favour of model *k*. Entropy indicates classification certainty ranging from 0 to 1.00. The BIC assesses improvement in fit after penalising for the number of model parameters, where the best fitting model is indicated by the smallest BIC value generated amongst competing models. All psychological profiling variables were standardised to a mean of zero and a standard deviation of one to equate scales and facilitate computation and interpretation of the profiles. The dataset contained no missing values.

Fit indices for 2-through 7- profile solutions are presented in Table 7. Significant LMR and BLRT values and a high entropy value indicated that the 3-profile solution provided the best fit for the dataset. The BIC continued to decrease as more profiles were added to the model. However, a plot of the BIC values for 2- to 7- profile solutions indicated that the curve flattened out between profiles 3 and 4, indicating that the increase in fit offered by the 4- profile solution was not substantial. Importantly, the 3-profile solution was also the most interpretable. Characteristics of the three profiles are shown in Figure 2.

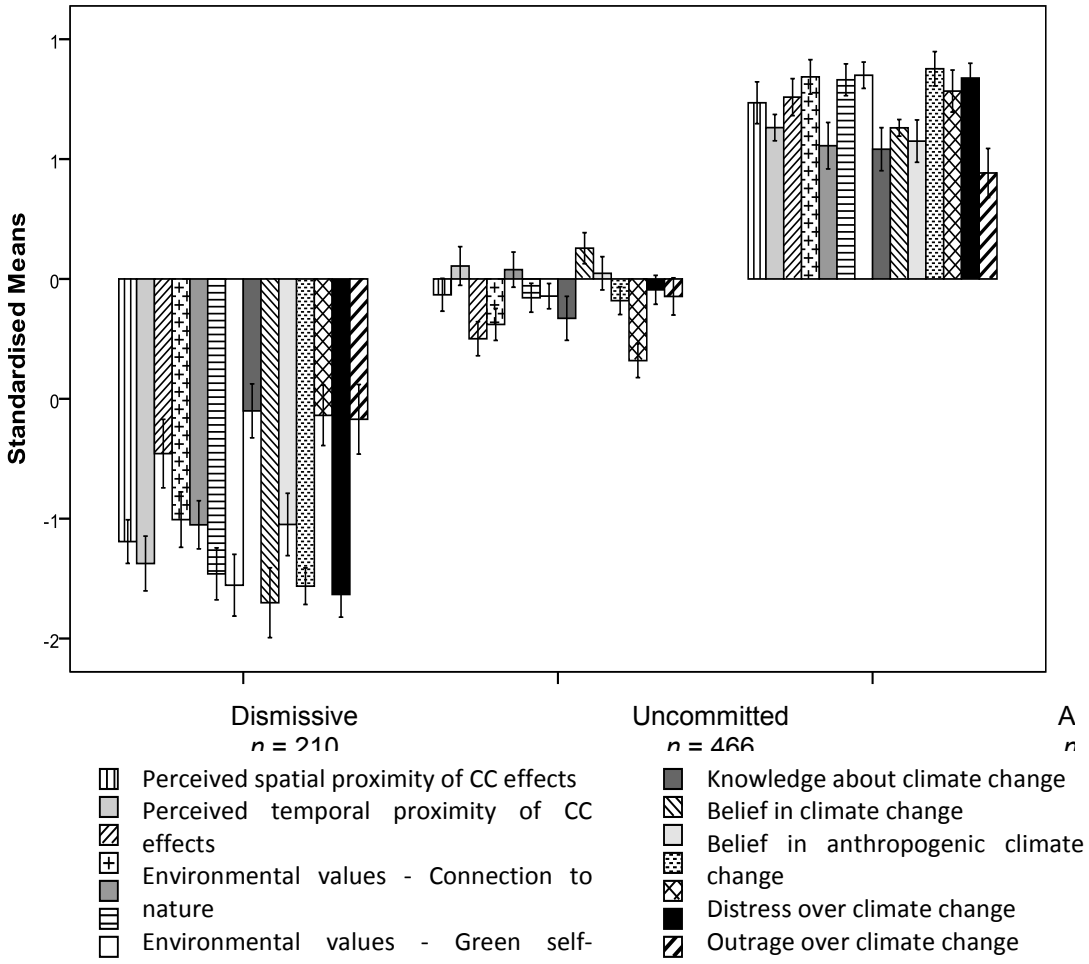
Table 7. Model Fit Indices for Two to Seven Profile Solutions

Profile Solution	BIC	LMR	BLRT	Entropy
1	41142.18			
2	36662.82	*p*< .001	*p*< .001	.92
3	**35240.47**	***p*< .001**	***p*< .001**	**.90**
4	34843.66	.15	*p*< .001	.87
5	34414.09	.12	F	.91
6	34220.92	.17	F	.88
7	34063.00	.44	F	.88

Note. BIC = Bayesian information criterion, LMR = Lo-Mendell-Rubin likelihood ratio test, BLRT = Bootstrapped likelihood ratio test, F = failed to converge.

Profile 1 comprised 20.3% of respondents who we labelled as *Dismissive* about climate change. Mean scores on all psychological indicators were well below the sample average. Profile 2 included 45.2% of respondents who could be characterised as *Uncommitted* about climate change. Mean scores on most of the profiling variables were close to the sample average. Although these individuals exhibited slightly above average levels of general belief in climate change, they reported lower than average levels of connection with nature, green self-identity, trust in authorities, concern, knowledge, and distress and outrage over climate change.

Finally, Profile 3 comprised 34.4% of respondents who we labelled as being *Alarmed* about climate change. On average, this profile was characterised by very high levels of all assessed cognitive and affective indicators.



Average Standardised Sample Mean = 0. Error Bars: +/- 1 SE

Figure 2. Cognitive Characteristics of the Climate Change Interpretive Communities.

A MANOVA conducted in SPSS 20 revealed that the three climate change audience segments explained a significant 64.0% of the variance in the set of climate change cognitions, Wilks' Λ = 0.13, $F(28,2030)$ =129.08, p< .001, η^2 = .64. All unilabiate F's were significant at p< .001, and Tukey's post-hoc tests indicated that all indicator means increased significantly from profile 1 to profile 2 and from profile 2 to profile 3 (η^2 ranged from .14 to .60). The predictive utility of the climate change profiles was validated by a further MANOVA, which revealed that profile membership explained a significant 36.6% of the variance in two responses to climate change: *Behavioural* and *Psychological*,Wilks' Λ = 0.40, $F(4,2054)$ =296.56, p< .001, η^2 = .37. Univariate analyses indicated that both outcomes differed significantly across groups at p< .001, with behavioural and psychological responses increasing significantly from profile 1 to profile 2 and from profile 2 to profile 3 (η^2 = .18 and .59, respectively).

3.2.3 Judgement Analysis

Between 85 and 113 participants viewed each climate change adaptation message. For each profile, a new dataset was created in which the 60 climate change messages were the unit of analysis, and the variables comprised the four judgement dimensions:

- perceived threat;
- perceived efficacy;
- fear control responses, and;
- danger control responses.

And ten communication cues:

- topic;
- source;
- adaptation advice,
- language complexity,
- geographic frame,
- promotion/prevention frame,
- emotion/reason frame,
- consequence frame,
- individual/collective, and;
- social norms.

Each judgement dimension score for each message was created by calculating the mean of all participants' ratings for that dimension for that message.

We combined the three profile datasets and created a grouping variable for an initial MANOVA which determined that profile membership explained a substantial 62.6% of the variance in the set of four judgement dimensions, Wilks' Λ = 0.14, $F(8,348)$ =72.81, p< .001, η^2 = .63. Perceived threat, perceived efficacy and danger control responses differed significantly between profiles at p< .001 and fear control responses differed significantly at p = .03. Judgement dimension means for the three profiles are shown in Table 8.

Table 8. Judgement Dimension Means, SDs, and Mean Differences across the three Interpretive Communities

	Dismissive *n* = 210		Uncommitted *n* = 466		Alarmed *n* = 355	
Judgement Dimensions	*M*	*SD*	*M*	*SD*	*M*	*SD*
Perceived Threat	2.17[a]	.38	2.79[b]	.26	3.46[c]	.29
Perceived Efficacy	2.51[a]	.51	2.94[b]	.32	3.45[c]	.28
Fear Control Responses	2.24[ab]	.45	2.13[a]	.24	2.28[b]	.22
Danger Control Responses	1.92[a]	.35	2.58[b]	.21	3.34[c]	.22

Notes. Means with different superscripts (in rows) differ significantly at $p < .05$ (Tukey's HSD)

Using the separate datasets, we then conducted two Univariate Analyses of Variance (UniANOVAs) for each of the three profiles (i.e. six analyses in total) to determine which policies (combinations of cues) were used by each profile when forming threat and efficacy perceptions of the messages. For each profile, the ten communication cues were entered as categorical independent variables predicting each judgement dimension in separate main effects models. Partial eta-squared was used to indicate the judgement policy weight for each communication cue (see Cooksey, 1996, p. 294-295). Cue category means were then examined to determine which categories underpinned each significant cue/judgement dimension relationship. Next, six regression analyses were performed to determine if perceived threat and perceived efficacy (and their concomitant policies) predicted mean fear control responses and danger control responses of the three profiles. Significant relationships at $p < .01$ are depicted in Figure 3.[4]

Perceived threat

UniANOVA revealed that the set of ten communication cues explained large amounts of variance in perceived threat for all three profiles:

- Dismissive, 70.1%;
- Uncommitted, 68.7%; and,
- Alarmed, 63.3%.

(all percentages reflect *Adjusted* R^2, ps $< .001$).

One cue was significantly associated with perceived threat for the Dismissive profile, and two cues were significant predictors for the Uncommitted and Alarmed profiles. Mean differences between cue categories revealed that messages about bushfires evoked significantly greater threat than other topics for the Dismissive and Alarmed profiles, and messages addressing general climate change/other also influenced high threat ratings by the Alarmed profile. Alarmed profile members also perceived higher threat from messages that focused on collective, rather than individual, responsibility. Uncommitted profile members perceived high threat from messages that primarily

[4]Given the large number of significance tests computed for the judgement analysis, we used a conservative cut-off for significance to identify the most robust effects that may offer practical value. However, because the difference between significant and non-significant effects across our interpretive community groups can, in some instances, be quite small, a complete list of effects including exact *p*-values is presented in Tables 9 and 10.

appealed to emotion, and from messages that emphasised engaging in the advocated behaviour to prevent losses or offered no promotion/prevention rationale. Cue weights, cue category means, standard deviations and mean differences for perceived threat are presented in Table 9.

Perceived efficacy

The set of cues also explained large amounts of variance in perceived efficacy for all profiles:

- Dismissive, 77.1% ($p < .001$);
- Uncommitted, 53.9% ($p = .001$); and,
- Alarmed, 56.7% ($p < .001$).

Perceived efficacy was significantly associated with three, one, and two cues for the Dismissive, Uncommitted, and Alarmed profiles, respectively. Category means for the significant cues indicated that Dismissive profile members perceived greater efficacy from messages on bushfire protection than from messages on floods, general climate change/other, or multiple topics. Dismissive members also perceived higher levels of efficacy from messages that emphasised injunctive rather than descriptive social norms, and from messages that used simple language. For the Uncommitted and Alarmed profiles, messages that conveyed specific adaptation advice were associated with higher perceived efficacy than messages that provided no or general adaptation advice. Alarmed profile members also perceived higher levels of efficacy from messages about local issues than from messages relating to national, global, or multiple geographic regions. Cue weights, cue category means, standard deviations and mean differences for perceived efficacy are presented in Table 10.

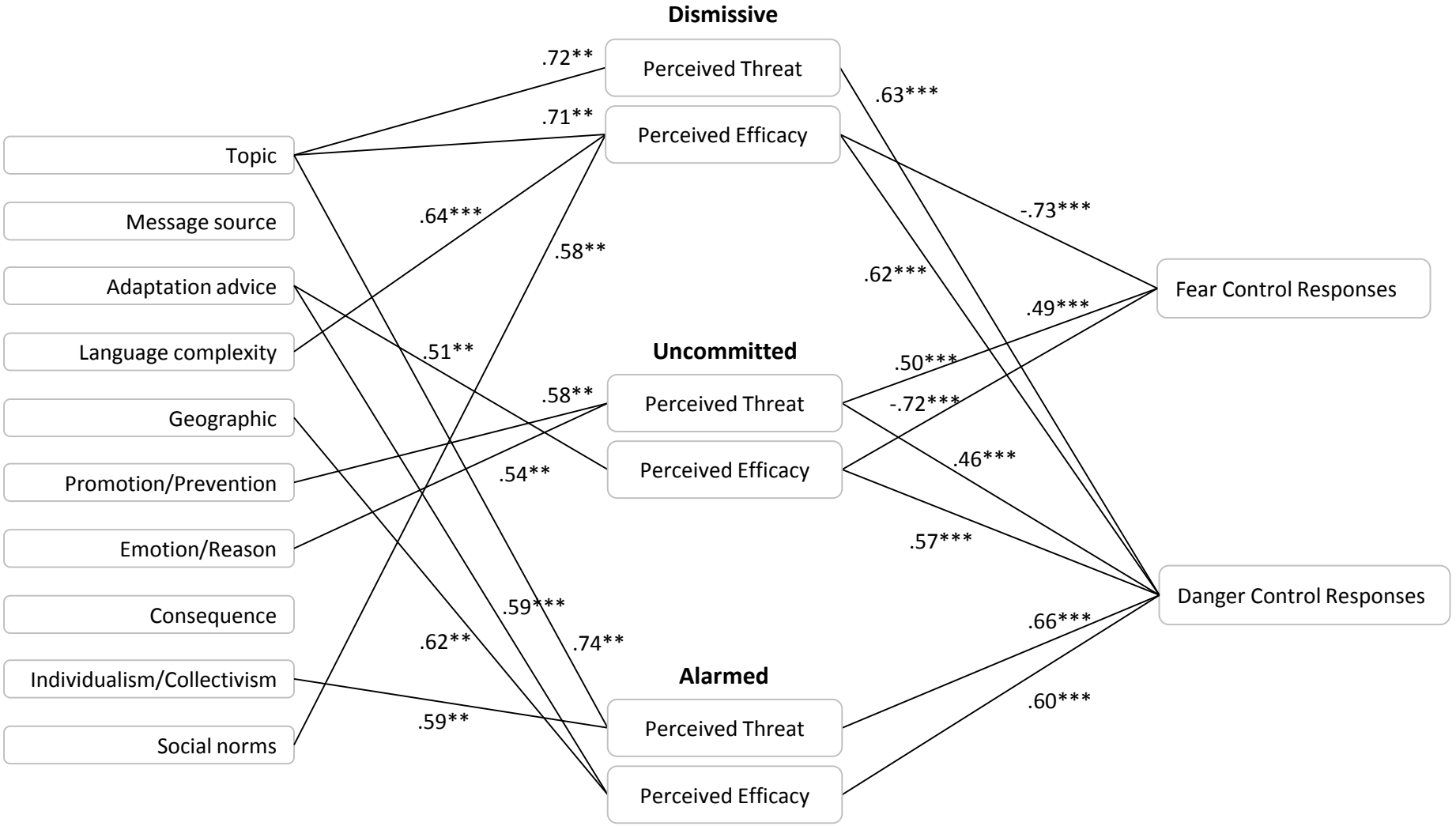


Figure 2. Significant Partial Correlations (at p < .01) between Communication Cues, Perceived Threat, Perceived Efficacy, Fear Control Responses, and Danger Control Responses for the Three Interpretive Communities.

Notes: ***p*< .01, ****p*< .001

Table 9. Judgement Policies for Perceived Threat: Cue Weights and Category Means and SDs for the Three Interpretive Communities

		Dismissive *n* = 210		Uncommitted *n* = 466		Alarmed *n* = 355	
Cues and Cue Categories	(*n*)	*M*	*SD*	*M*	*SD*	*M*	*SD*
Topic		**η^2_p = .52, *p* = .001**		η^2_p = .36, *p* = .04		**η^2_p = .55, *p* = .001**	
Bushfire protection	(9)	2.80[b]	.21	3.15	.20	3.81[d]	.13
Flood	(5)	2.05[a]	.21	2.71	.13	3.39[abc]	.28
Water conservation	(9)	2.07[a]	.28	2.52	.27	3.14[a]	.23
Energy conservation	(3)	2.04[a]	.23	2.56	.27	3.31[ab]	.42
Psychology Adaptation	(4)	2.13[a]	.37	2.76	.19	3.39[abc]	.10
General/Other CC	(12)	2.02[a]	.21	2.86	.12	3.62[cd]	.13
Extreme weather	(8)	2.19[a]	.39	2.77	.18	3.36[abc]	.26
Multiple	(10)	1.97[a]	.28	2.78	.12	3.47[bc]	.16
Message source		η^2_p = .11, *p* = .33		η^2_p = .05, *p* = .66		η^2_p = .13, *p* = .24	
Government	(29)	2.30	.43	2.83	.34	3.47	.36
Not-for-profit organisation	(21)	2.01	.28	2.77	.11	3.50	.20
Industry	(4)	2.12	.24	2.57	.03	3.27	.12
Media	(6)	2.11	.28	2.79	.15	3.41	.23
Adaptation advice		η^2_p= .11, *p* = .07		η^2_p= .08, *p* = .11		η^2_p = 07, *p* = .13	
None or general	(30)	2.09	.37	2.80	.30	3.50	.31
Specific	(30)	2.25	.38	2.78	.21	3.43	.26
Language complexity		η^2_p = .11, *p* = .06		η^2_p = .01, *p* = .58		η^2_p = .09, *p* = .10	
Low	(35)	2.32	.39	2.79	.30	3.42	.30
Moderate	(25)	1.96	.23	2.79	.18	3.52	.26
Geographic frame		η^2_p= .19, *p* = .10		η^2_p = .02, *p* = .87		η^2_p = .24, *p* = .04	
Local	(32)	2.34	.41	2.79	.33	3.42	.33
National	(18)	1.95	.16	2.81	.14	3.56	.21
Global	(5)	2.17	.35	2.76	.14	3.46	.23
Multiple	(5)	1.87	.15	2.77	.14	3.35	.26

Cues and Cue Categories	(*n*)	Dismissive *n* = 210		Uncommitted *n* = 466		Alarmed *n* = 355	
		η^2_p = .18, *p* = .11		**η^2_p = .34, *p* = .006**		η^2_p = .10, *p* = .34	
Promotion/prevention frame							
Neither	(6)	2.28	.38	2.81[b]	.21	3.46	.22
Promotion	(6)	1.92	.21	2.55[a]	.30	3.23	.38
Prevention	(42)	2.21	.40	2.85[b]	.21	3.52	.26
Both	(6)	1.99	.24	2.54[a]	.30	3.27	.31
Emotion/Reason frame		η^2_p = .11, *p* = .16		**η^2_p = .29, *p* = .006**		η^2_p = .10, *p* = .19	
Primarily emotion	(2)	2.91	.23	3.44[c]	.05	3.86	.14
Balanced	(5)	2.48	.32	3.00[b]	.21	3.73	.22
Primarily reason	(53)	2.11	.35	2.74[a]	.22	3.42	.27
Consequence frame		η^2_p = .06, *p* = .77		η^2_p = .08, *p* = .63		η^2_p = .34, *p* = .01	
Human health	(10)	2.13	.39	2.78	.28	3.43	.29
Environment	(6)	2.00	.24	2.82	.15	3.59	.28
Financial	(3)	2.05	.24	2.53	.31	3.15	.24
Multiple	(31)	2.23	.40	2.88	.19	3.57	.22
Not specified	(10)	2.17	.40	2.57	.30	3.19	.27
Collective/Individual		η^2_p = .24, *p* = .02		η^2_p = .25, *p* = .01		**η^2_p = .35, *p* = .002**	
Individual responsibility	(39)	2.24	.42	2.77	.31	3.40[a]	.32
Collective responsibility	(17)	2.02	.24	2.84	.11	3.61[b]	.17
Both	(4)	2.12	.19	2.80	.14	3.47[ab]	.15
Social norms		η^2_p= .24, *p* = .04		η^2_p= .01, *p* = .96		η^2_p = .03, *p* = .83	
Neither	(3)	2.22	.56	2.88	.29	3.57	.26
Descriptive norm	(2)	1.75	.14	2.41	.19	3.04	.21
Injunctive norm	(49)	2.17	.38	2.80	.27	3.47	.29
Both	(6)	2.27	.26	2.81	.05	3.46	.19

Notes. Cue weights significant at $p < .01$ are in bold. Category means with different superscripts (in columns and within cues) differ significantly at $p < .05$ (Tukey's HSD). Parenthesised (*n*) values refer to messages per category.

Table 10. Judgement Policies for Perceived Efficacy: Cue Weights and Category Means and SDs for the Three Interpretive Communities

Cues and Cue Categories	(*n*)	Dismissive *n* = 210 *M*	*SD*	Uncommitted *n* = 466 *M*	*SD*	Alarmed *n* = 355 *M*	*SD*
Topic		**η^2_p = .50, *p* = .002**		η^2_p = .31, *p* = .10		η^2_p = .41, *p* = .02	
Bushfire protection	(9)	2.97[d]	.31	3.14	.19	3.63	.23
Flood	(5)	2.47[bc]	.50	2.87	.30	3.39	.27
Water conservation	(9)	2.84[cd]	.46	3.09	.38	3.61	.30
Energy conservation	(3)	2.63[cd]	.50	3.02	.28	3.42	.15
Psychology Adaptation	(4)	2.74[cd]	.45	3.07	.07	3.53	.09
General/Other CC	(12)	1.96[a]	.22	2.63	.23	3.23	.27
Extreme weather	(8)	2.70[cd]	.48	3.13	.34	3.56	.23
Multiple	(10)	2.16[ab]	.28	2.77	.18	3.31	.25
Message source		η^2_p = .03, *p* = .79		η^2_p = .02, *p* = .88		η^2_p = .09, *p* = .41	
Government	(29)	2.67	.48	3.01	.29	3.49	.27
Not-for-profit organisation	(21)	2.25	.44	2.83	.34	3.42	.30
Industry	(4)	2.76	.42	3.08	.17	3.47	.14
Media	(6)	2.46	.69	2.88	.37	3.31	.33
Adaptation advice		η^2_p = .19, *p* = .01		**η^2_p = .26, *p* = .003**		**η^2_p = 35, *p*< .001**	
None or general	(30)	2.27	.50	2.75	.28	3.30	.27
Specific	(30)	2.75	.41	3.12	.24	3.59	.21
Language complexity		**η^2_p= .41, *p*< .001**		η^2_p = .19, *p* = .01		η^2_p = .20, *p* = .01	
Low	(35)	2.81	.40	3.08	.29	3.57	.25
Moderate	(25)	2.10	.34	2.74	.25	3.28	.23
Geographic frame		η^2_p= .04, *p* = .74		η^2_p = .03, *p* = .82		**η^2_p = .38, *p* = .002**	
Local	(32)	2.85	.36	3.11	.27	3.59[b]	.24
National	(18)	2.11	.33	2.70	.20	3.31[a]	.19
Global	(5)	2.28	.66	2.86	.41	3.34[a]	.38
Multiple	(5)	2.14	.34	2.83	.30	3.21[a]	.26

Promotion/prevention frame		η^2_p = .16, *p* = .14		η^2_p = .16, *p* = .14		η^2_p = .25, *p* = .04	
Neither	(6)	2.73	.51	3.08	.30	3.54	.27
Promotion	(6)	2.60	.42	2.93	.32	3.44	.32
Prevention	(42)	2.49	.56	2.93	.33	3.43	.29
Both	(6)	2.34	.21	2.85	.23	3.49	.19
Emotion/Reason frame		η^2_p = .08, *p* = .27		η^2_p = .07, *p* = .35		η^2_p = .05, *p* = .50	
Primarily emotion	(2)	2.80	.13	3.14	.09	3.42	.03
Balanced	(5)	2.61	.24	2.93	.20	3.46	.17
Primarily reason	(53)	2.49	.54	2.93	.33	3.45	.29
Consequence frame		η^2_p = .11, *p* = .46		η^2_p = .09, *p* = .55		η^2_p = .18, *p* = .19	
Human health	(10)	2.60	.51	3.05	.28	3.51	.19
Environment	(6)	2.14	.55	2.74	.28	3.25	.28
Financial	(3)	2.83	.19	3.07	.24	3.52	.12
Multiple	(31)	2.45	.52	2.92	.33	3.43	.30
Not specified	(10)	2.73	.44	2.96	.36	3.53	.30
Collective/Individual		η^2_p = .13, *p* = .13		η^2_p = .01, *p* = .90		η^2_p = .08, *p* = .27	
Individual responsibility	(39)	2.72	.42	3.07	.26	3.54	.25
Collective responsibility	(17)	2.09	.49	2.68	.28	3.26	.27
Both	(4)	2.27	.16	2.76	.26	3.34	.26
Social norms^		**η^2_p = .33, *p* = .007**		η^2_p = .09, *p* = .40		η^2_p = .02, *p* = .90	
Neither	(3)	2.45^{ab}	.49	2.89	.08	3.33	.20
Descriptive norm	(2)	2.25^{a}	.05	2.73	.07	3.53	.22
Injunctive norm	(49)	2.53^{b}	.53	2.96	.33	3.46	.29
Both	(6)	2.47^{ab}	.54	2.81	.37	3.41	.27

Notes. Cue weights significant at $p < .01$ are in bold. Category means with different superscripts (in columns and within cues) differ significantly at $p < .05$ (Tukey's HSD). ^ One-way ANOVA with Games-Howell post hoc test conducted to address large unequal variances. Parenthesised (*n*) values refer to messages per category.

Fear control responses
Threemultiple regressions were conducted to determine whether perceived threat and perceived efficacy were associated with each profile's fear control responses. Perceived threat and perceived efficacy were entered as independent variables predicting fear control responses as the dependent variable. Using $p < .01$ as the criterion, the regression model accounted for significant amounts of variance in mean fear control responses for the Dismissive (61.0%) and Uncommitted (54.1%) profiles but did not explain significant variance for the Alarmed group (11.4%).

As shown in Table 11, high levels of fear control were significantly associated with high perceived threat and low perceived efficacy for the Uncommitted profile. However, only perceived efficacy was a significant predictor for the Dismissive profile, whereas lower perceived efficacy predicted higher levels of fear control responses.

Danger control responses. A similar series of multiple regressions revealed that perceived threat and perceived efficacy explained significant amounts of variance in danger control responses for the Dismissive (77.9%), Uncommitted (45.4%) and Alarmed (56.0%) profiles. For all profiles, higher levels of perceived threat and efficacy were associated with higher levels of danger control responses.

3.2.4 Message Effectiveness Index

To assist climate change communicators and social marketers, we calculated an index to convey the effectiveness of each climate change adaptation message for each climate change interpretive community. The message effectiveness index was created by multiplying perceived threat and perceived efficacy. Thus, higher scores indicated higher levels of both constructs and higher levels of effectiveness, and lower scores indicated lower levels of perceived threat and efficacy and lower message effectiveness. On average the alarmed group ($M = 11.93$, $SD = 1.39$) rated the set of messages as more effective than the uncommitted group ($M = 8.20$, $SD = 1.26$), who in turn rated the messages as more effective than the dismissive group ($M = 5.57$, $SD = 1.94$), $F(2,177) = 252.40$, $p < .001$. The index is presented in Appendix 2.

Table 11. Perceived Threat and Perceived Efficacy predicting Fear Control Responses and Danger Control Responses

	Dismissive Profile				Uncommitted Profile				Alarmed Profile			
	β	*sr*	*t*	*p*	β	*sr*	*t*	*p*	β	*sr*	*t*	*p*
Fear Control Responses												
Perceived Threat	.12	.09	1.14	.26	**.39**	**.38**	**4.30**	**<.001**	.27	.27	2.18	.03
Perceived Efficacy	**-.86**	**-.66**	**-8.07**	**<.001**	**-.71**	**-.70**	**-7.91**	**<.001**	-.28	-.28	-2.24	.03
	Model R^2 = .62, AdjR^2 = .61, $F(2,57) = 47.23$, $p < .001$				Model R^2 = .56, AdjR^2 = .54, $F(2,57) = 35.78$, $p < .001$				Model R^2 = .14, AdjR^2 = .11, $F(2,57) = 4.81$, $p = .01$			
Danger Control Responses												
Perceived Threat	**.50**	**.38**	**6.19**	**<.001**	**.38**	**.38**	**3.93**	**<.001**	**.57**	**.57**	**6.57**	**<.001**
Perceived Efficacy	**.48**	**.36**	**5.92**	**<.001**	**.51**	**.50**	**5.21**	**<.001**	**.50**	**.50**	**5.73**	**<.001**
	Model R^2 = .79, AdjR^2 = .78, $F(2,57) = 104.96$, $p < .001$				Model R^2 = .47, AdjR^2 = .45, $F(2,57) = 25.52$, $p < .001$				Model R^2 = .58, AdjR^2 = .56, $F(2,57) = 38.58$, $p < .001$			

Notes: Beta weights significant at $p < .01$ are in bold.

4. GENERAL DISCUSSION

4.1 Australian Climate Change Interpretive Communities

Latent profile analysis was used to identify audience segments within two Australian national samples based on their values, attitudes, and beliefs relevant to climate change.

The Phase 1 analysis indicated that the 2010 Australian sample could be divided into five distinct interpretive communities, which were labelled: *Dismissive (9%)*, *Doubtful (12%)*, *Uncertain (14%)*, *Concerned (39%)*, and *Alarmed (26%)*.

The Phase 2 analysis revealed that the 2012 Australian sample could be classified into three climate change interpretive communities, which were labelled: *Dismissive (20%), Uncommitted (45%)*, and *Alarmed (34%).*

Characteristics and distributions of the interpretive communities identified in Phases 1 and 2 are summarised in Table 12 and Figure 4.

Table 12: Characteristics of the Climate Change Interpretive Communities

Phase 1 (2010)	Phase 2 (2012)
Dismissive 9% • Very little belief in climate change • Effects perceived as remote in space and time • Very low levels of distress, concern, perceived risk, environmental values, trust in authorities, and self-efficacy • Low levels of knowledge • Negative attitudes toward clean energy	**Dismissive 20%** • Very little belief in climate change • Effects perceived as remote in space and time • Very low levels of distress, concern, perceived risk, environmental values, trust in authorities, and self-efficacy • Low levels of outrage and knowledge • Negative attitudes toward clean energy
Doubtful 12% • Low belief in climate change • Similar to dismissive profile in all respects but less extreme	
Uncertain 14% • Moderate belief in climate change • Otherwise similar to doubtful group	**Uncommitted 45%** • Moderate belief in climate change • Effects perceived as moderately close in space and time • Moderate distress, concern, perceived risk, attitudes toward clean energy, trust in authorities, and self-efficacy • Moderately low levels of outrage, environmental values, and knowledge
Concerned 39% • Moderately strong belief in climate change • Effects perceived as moderately close in space and time • Moderate distress, concern, perceived risk, knowledge, attitudes toward clean energy, environmental values, trust in authorities, and self-efficacy	

Phase 1 (2010)	Phase 2 (2012)
Alarmed 26% • Strong belief in climate change • Perceived effects to be very close in space and time • High levels of distress, concern, perceived risk, knowledge, and self-efficacy • Strong environmental values, trust in climate change authorities, and attitudes toward clean energy	**Alarmed 34%** • Strong belief in climate change • Perceived effects to be very close in space and time • High levels of distress, outrage, concern, perceived risk, knowledge, and self-efficacy • Strong environmental values, trust in climate change authorities, and attitudes toward clean energy

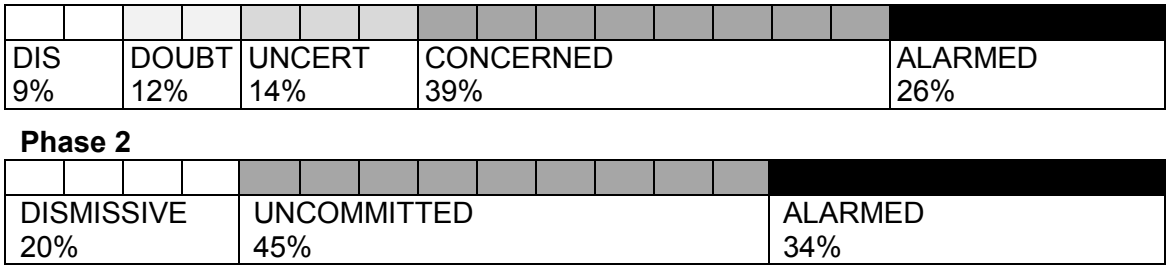


Figure 3. Comparative distributions of the climate change interpretive communities identified in Phases 1 and 2

Notes: DIS = Dismissive, DOUBT = Doubtful, UNCERT= Uncertain. Scale shows percentages rounded to the nearest 5% interval.

The observation of different numbers of interpretive communities in both studies is not surprising. Differences between the two studies are likely attributable to at least four factors.

First, there was approximately a 2-year gap between data collection periods for the two studies. As previously noted, audience segments may change over time, with existing segments merging or disappearing, and new segments being created (Leiserowitz et al. 2010b).

Second, although both studies employed *Qualtrics* panel samples, the sample used in the Phase 2 study included greater proportions of males and respondents from urban settings. It also included considerably fewer older individuals (over the age of 55 years).

Third, the Phase 2 study used a slightly modified set of profiling variables compared to Phase 1 including an additional measure to assess outrage in response to climate change, a new decomposed measure of climate change belief that distinguished between belief that climate change was happening and that humans were a primary cause, and the removal of a measure assessing support for nuclear power. Finally, respondents who completed the Phase 2 survey in less than 20 minutes were excluded from the analysis, whereas all respondents were included in the Phase 1 dataset. The expected reading/viewing time of messages informed the Phase 2 strategy.

Nevertheless, both Australian samples comprised conceptually equivalent anchor segments (*Dismissive and Alarmed*). It is noteworthy that similar proportions of respondents in both studies indicated low levels of belief in climate change (~20%);

represented by the *Dismissive* and *Doubtful* groups in Phase 1 and the *Dismissive* group in Phase 2. Based on this percentage and the similarity of their cognitive characteristics, it is likely that Phase 2's *Dismissive* group included respondents with similar views to those expressed by both *Dismissive* and *Doubtful* respondents in Phase 1 (See Figure 4).

Although Phase 1's *Uncertain* and *Doubtful* groups shared many of the same characteristics (e.g. lower than average risk perceptions, concern about climate change and the environment, and trust in climate change authorities), they differed in two ways:

1) on average, members of the *Doubtful* group expressed strong disbelief that climate change was occurring, whereas the *Uncertain* group was more accepting of this view and
2) members of the *Uncertain* group were generally, more positively disposed toward nuclear power compared to the *Doubtful* group.

Respondents with more moderate views were less differentiated in the Phase 2 study; with most falling within a single segment (*Uncommitted*). On average, this group expressed moderate levels of belief in climate change that were similar to Phase 1's *Uncertain* and *Concerned* groups, and their other climate change attitudes and perceptions were near (above or below) the sample average.[5]

Thus, the three interpretive communities identified in our Phase 2 sample appeared to express sets of climate change attitudes and perceptions whose prevalence remained relatively similar over the two-year period.

4.1.1 Previous Audience Segmentations

Despite using very different sets of profiling variables, the current segmentation analyses generated segments that were, for the most part, similar to those reported by Maibach et al. (2011) and Morrison (in press). All four studies identified segments that were dismissive and alarmed about climate change. The main difference was that whereas Mariachi et al.(2011) and Morrison et al. (in press) retained four central categories (*Doubtful, Concerned, Disengaged* and *Cautious)*, our Phase 1 study produced only three, which were labelled *Doubtful, Uncertain*, and *Concerned*, and our Phase 2 study produced only one, which was labelled *Uncommitted*.

Given that Morrison et al.'s (in press) study was based on an Australian sample, it represents the most appropriate point of comparison regarding the proportion of respondents in each segment. At the dismissive/doubtful end of the spectrum, our results are very similar. Morrison et al. categorised 9% and 11% of their sample as *Dismissive* and *Doubtful* respectively, compared to 9% and 12% of our Phase 1 sample. Similarly, 20% of the Phase 2 sample comprised the *Dismissive* group. However, our studies differed substantially in the proportions of respondents classified as *Alarmed*; 39% and 26% respectively in our Phase 1 and Phase 2 studies compared with 11% in Morrison et al.'s study. Part of this difference may be attributable to the fact that our segmentation solution had fewer central groups, which may have increased the likelihood of respondents being classified as *Alarmed*. A second possibility is that the differences reflect the type of profiling variables used. We included a broad range

[5]It is important to note that the segmentation analyses used composite variables and assessed mean responses across variables. Therefore, percentages of respondents within each segment identified in Phase 1 may not perfectly align with distributions of responses to individual items within each variable, as reported by Reser et al. (2012a, 2012b).

of variables, some of which reflected climate change specific knowledge and beliefs, but others that assessed participants' more general environmental concerns and interests. In contrast, Morrison et al.'s set of profiling variables focused more narrowly on climate change.

4.1.2 Validation of the Audience Segments

The current studies not only demonstrated that two samples of Australian residents could be segmented on the basis of their climate change profiles, but also that these segments differed significantly on a diverse set of validation measures.

Concerned and *Alarmed* Phase 1 respondents were more likely than those in the *Dismissive*, *Doubtful*, and *Uncertain* segments to: a) report engaging in psychological and behavioural responses to climate change, b) support climate friendly energy projects, c) oppose coal power, and d) express more personal responsibility for managing climate change problems. Respondents classified as *Dismissive* consistently scored lowest on these validation variables. Overall, these findings are consistent with those reported by Maibach et al. (2011), who found that *Dismissive* and *Doubtful* respondents in their sample were significantly less engaged and less likely to support policies to address climate change than members of the other groups.

Respondents in these groups were also much less likely to report having directly experienced climate change (*Dismissive* 4%; *Doubtful* 11%) compared with those classified as *Concerned* (37%) or *Alarmed* (67%). This raises an important question about direction of causality. Does direct experience with extreme weather cause individuals to become more concerned about climate change (experiential learning)? Alternatively, does being concerned about climate change lead individuals to interpret extreme weather events as being caused by climate change (motivated reasoning)? Recent research by Myers, Maibach, Roser-Renouf, Akerlof and Leiserowitz (2012) suggests that both processes may be at work. Individuals who are less engaged with climate change issues appear to be guided by experiential learning, whereas those who are more engaged are guided by motivated reasoning.

Extreme weather events are predicted to have an increased impact on human societies in the future (Seneviratne et al. 2012). In Australia, there are specific concerns around extremes relating to temperature and human heat tolerance (Hanna et al. 2011), extreme waves (Hemer et al. 2012), and tropical cyclone intensity and frequency (Knutson et al. 2010). It will be informative to track whether such changes will be attributed to global climate change, particularly by members of the *Dismissive* and *Doubtful* groups. It will also be important to determine whether these attributions, by themselves or in concert with other events or planned intervention strategies, result in significant shifts in the proportion of Australians within each segment.

Despite differences in the number of audience segments identified in phases 1 and 2, validation analyses produced a similar pattern of results across both studies. In Phase 2, respondents classified as *Alarmed* engaged in more thinking about climate change and more adaptive and mitigative behaviours on average than those assigned to the *Uncommitted* segment. In turn, *Uncommitted/Central segment* respondents engaged in more psychological and behavioural responses to climate change on average than those classified as *Dismissive*. Thus, the interpretive communities could be distinguished from each other not only based on their values, knowledge, beliefs, and affective responses to climate change, but also in terms of the extent to which they actively engaged in information seeking, problem solving, and overt behaviours to reduce their carbon footprint and adapt to climate change.

4.2 Climate Change Adaptation Message Evaluation

In Phase 2, we investigated how three Australian climate change interpretive communities (*Dismissive*, *Uncommitted*, and *Alarmed*) responded to a diverse set of climate change adaptation messages sourced from the Internet. Using a judgement analysis paradigm, we found that these three communities utilised different message cues when making judgements about the magnitude of the threat and the effectiveness of advice provided to deal with the threat. The three interpretive communities also differed in terms of how their threat and efficacy judgements predicted their intention to act upon the message (danger control response), or reject the message (fear control response). In the sections that follow, we discuss these findings, highlight implications for climate change engagement strategies, and make suggestions for future research.

4.2.1 Message Responses across Climate Change Communities

Respondents were required to make four types of judgements in response to the climate change adaptation messages presented during the study:

- perceived threat;
- perceived efficacy;
- danger control, and;
- fear control.

Our results indicated that the three interpretive communities responded to the messages, taken as a set, in different ways. Compared to members of the *Uncommitted* community, *Alarmed* respondents indicated that the messages:

- were effective in eliciting feelings of threat and personal susceptibility (perceived threat);
- provided more useful information to effectively deal with the threat (perceived efficacy),and
- evoked stronger motivations to seek out more information or take action to reduce the threat (danger control response).

In turn, members of the *Uncommitted* community scored significantly higher on all three of these judgement dimensions compared to respondents classified as *Dismissive*. Differences in fear control processes were less pronounced, with the *Alarmed* community scoring higher on average than *Uncommitted respondents*, and at essentially the same level as *Dismissive respondents*. For all three interpretive communities, the mean on the fear control response measure was well below the mid-point on the scale, indicating that respondents did not tend to perceive the climate change adaptation messages used in this study as being exaggerated, manipulative, or prompting avoidant thinking.

Overall, our pattern of results suggests that respondents who were already very concerned about climate change were most receptive to the adaptation messages used in the study. This is not surprising given that individuals are generally more receptive to messages that are consistent with their prior beliefs (Nickerson, 1998). From a climate change communication standpoint, perhaps a more important and encouraging finding was that all three interpretive communities exhibited low fear control responses, indicating that none of the communities were reflexively rejecting the adaptation messages. This suggests that the door is still open to reach these groups. One important challenge for climate change communication specialists will be to develop messaging strategies that will resonate strongly with the *Uncommitted* and *Dismissive* communities, while at the same time avoiding messages that generate

strong *audience backlash* and boomerang effects.

4.2.2 Judgement Analysis – Threat and Efficacy Perceptions

A central aim of the judgement analysis component of the study was to identify specific message attributes associated with adaptive and non-adaptive audience responses, and determine whether these patterns varied across climate change interpretive communities. Recall, that the Extended Parallel Process Model of risk communication (Witte, 1992, 1994, 1998) proposes that messages that elicit higher levels of perceived threat and efficacy increase the probability of danger control responses in which individuals develop intentions to take action to address the threat. In contrast, messages that elicit high levels of perceived threat and lower levels of efficacy are more likely to lead to fear responses in which individuals attempt to manage their negative affective responses by avoiding or rejecting the communication. Understanding how these message-response processes operate in different climate change communities will help climate change communicators to tailor their messages to be maximally effective within each community.

Our results are consistent with the view that members of different climate change interpretive communities largely rely on different sets of message attributes when formulating judgements about perceived threat and efficacy. For the *Alarmed* community, threat perceptions were most strongly associated with message topic (bushfire protection messages elicited the strongest threat perceptions) and an individual/collective frame (messages emphasizing collective responsibility and action elicited higher levels of perceived threat than messages emphasizing individual responsibility and action). Efficacy perceptions were most linked to adaptation advice and geographic frame (messages that provided specific adaptation advice and emphasised local climate change consequences were associated with higher efficacy perceptions). In contrast, for the *Uncommitted* community, messages with a strong emotional component and those framed in terms of preventing losses tended to elicit stronger threat perceptions, and only the provision of specific adaptation advice was associated with higher efficacy. Finally, for the *Dismissive* community, the message topic was the sole message attribute associated with perceived threat (once again, bushfire protection messages were judged as most threatening), and language complexity, normative messaging, and topic were associated with perceived efficacy (messages that used simple language, avoided information about descriptive norms, and focused on bushfires, water and energy conservation, and extreme weather were associated with the strongest efficacy responses).

4.2.3 Judgement Analysis – Fear and Danger Control Responses

The second component of our judgement analysis involved testing predictions derived from the Extended parallel Process Model (EPPM). According to the EPPM, messages that elicit high levels of perceived threat and efficacy increase the probability of danger control responses, whereas messages that elicit high levels of threat and low levels of efficacy elicit fear control. For danger control, our results were consistent with EPPM's predictions; there were strong positive relationships between threat and efficacy perceptions and danger control responses, and these effects were consistent across all three climate change interpretive communities. In concrete terms, this means that respondents were more likely to be motivated to seek out information and take action in response to climate change adaptation messages that elicited higher levels of perceived threat and efficacy (Poumadere, Mays, Pfeifle and Vafeidis, 2008). This also parallels work conducted in the disaster preparedness literature in which suggests that perceived threat and prior experience with disasters, which can build enhanced self-efficacy is predictive preparative responses (Sattler et al. 2000).

For fear control responses, the findings were less clear-cut, but still generally consistent with the model's predictions. For the *Uncommitted* community, stronger fear control responses (message rejection) were associated with higher levels of perceived threat and lower levels of perceived efficacy. A similar pattern of relationships was evident for other audience segments. However, in the case of the *Alarmed* community, both effects failed to reach significance when a conservative *p-value* of .01 was adopted. For the *Dismissive* community, lower perceived efficacy was associated with stronger fear control, but perceived threat was not a significant predictor. This null finding may be related to the very low overall levels of perceived threat reported by members of this community.

4.2.4 Message Effectiveness

An effectiveness index for each climate change adaptation message used in this study for the three interpretive communities may be found in Appendix 2. We included the index in this report to allow climate change communicators and social marketers to identify which messages produced high levels of perceived threat and efficacy in each of the three Australian audience segments. Not surprisingly, the alarmed group rated the set of messages as more effective than the uncommitted group, who in turn rated the messages as more effective than the dismissive group. Examples of effective messages for each group are described below, under 'Implications for Climate Change Adaptation Messages'.[6]

4.3 Implications for Climate Change Adaptation Messages

A central aim of the judgement analysis component of the Phase 2 study was to identify specific message attributes associated with adaptive and non-adaptive audience responses, and determine whether these patterns varied across climate change interpretive communities. Together, our findings support the view advocated by social marketers that climate change messages should be tailored and targeted to specific audience segments (Kotler et al. 2002), and are also consistent with previous climate change framing studies that indicate that even subtle variations in message format and content can elicit different responses from different subgroups (e.g. Hart and Nisbet, 2012; Myers et al. 2012; Schuldt et al. 2011). In this way, our results have implications for organisations, particularly government agencies, wishing to develop climate change social marketing strategies to increase public engagement.

More specifically, our results support the view that climate change communicators may benefit from adjusting the content of their messages when targeting different climate change interpretive communities within Australia. One possibility would be to develop

[6]The messages rated as most effective by each group were not perfectly consistent with the results of the judgement analysis. That is, several of the most effective messages according to the effectiveness rating did not have the attributes identified as being important by the judgement analysis. This is likely to have occurred for two main reasons. First, this form of inconsistency is statistically likely because the results of the analyses are based on patterns of intercorrelations across all 60 messages. It is possible for a certain relationship to be present across all messages (e.g. emotional messages being more effective for uncommitted respondents in general), without that specific attribute being present in a message that was identified as being highly effective. Second, our judgement analysis conclusions were limited to the variables that we included in the statistical models we evaluated. As noted elsewhere in the discussion, it is possible that other message attributes not included in our models (e.g. mode of communication, length, image to words ratio, temporal frame, etc.) may be responsible for high threat and efficacy ratings attributed to specific messages.

communication plans based on Witte's (1994)Extended Parallel Process Model, which has been applied extensively by health psychologists. According to the model, communications should be designed to educate about the severity and likely consequences of the threat, but also to provide the audience with concrete strategies to respond to the climate change challenges efficaciously (Witte and Allen, 2000).

To this end, we provide the following discussion about the implications of our findings in relation to potential policy strategies and effective message characteristics for each community. A summary of these factors is provided below in Table 13.

Table 13. Potential Policy Strategies, Messaging Options, and Effective Message Characteristics for the Three Climate Change Interpretive Communities

Interpretive Community	Messaging options and Policy Strategies	Effective Messages
Dismissive	• Avoid direct references to climate change and sustainability • develop strategies that emphasise other valued outcomes (e.g. economic development or a caring society)	• Use simple language • Do not emphasise descriptive norms • Provide specific advice about what actions to take
Uncommitted	• Provide motivational messages to increase self-efficacy and concern	• Have a strong emotional component • Are framed in terms of preventing losses • Provide specific advice about what actions to take
Alarmed	• Provide information about – effective ways to minimise personal carbon footprint – how to lobby industry and government – where to access relevant means and resources • Remove structural barriers preventing translation from intention to action • Provide feedback that climate change views are shared by others (as 'social proof')	• Emphasise local impacts • Emphasise collective responsibility • Provide specific adaptation advice about what actions to take

4.3.1 Alarmed Interpretive Community

The *Alarmed* segment consists of individuals who tend to exhibit green environmental values and attitudes, believe that climate change is occurring, and anticipate the effects to be imminent and experienced locally. They also report a high mean level of self-efficacy, and are already engaging in a wide range of behaviours in response to climate change. In terms of social marketing strategies, this segment is likely to be a very receptive audience. Perhaps an optimum approach would be to provide information about the most effective ways to adapt to climate change threats, and how to lobby industry and government to maximise the likelihood that climate friendly policies are adopted. The prime goal should be to equip these individuals with the most current information about how to maximise the impact of their climate change related behaviours, and where to access the relevant means and resources to do so (e.g. Gardner and Stern, 2008). It would also be useful to develop and implement policies that remove structural barriers that might prevent members of this group from translating their positive intentions toward the environment into action (Kollmuss and Agyeman, 2002). Providing feedback to Alarmed audiences that their beliefs on climate change are shared by the majority of Australians may serve as an important form of 'social proof' that may spur further adaptive responses and encourage others to adopt similar views (Cialdini, 1993).

Results from the judgement analysis part of our study indicate that messages that include specific adaptation advice and emphasise local impacts and/or collective responsibility appear to be effective for audiences that are alarmed about climate change. In particular, messages that focused on collective responsibility tended to be more effective this group. Notable examples of more effective messages for this group included a documentary style 4.5 minute video on how scientists are devising solutions to manage the effects of climate change on Australia's residents, wildlife, and infrastructure (message #33), a brochure describing climate change effects on the Great Barrier Reef and strategies to manage them (message #58), and an information sheet describing the effects of extreme weather on mental health and community wellbeing (message #27).

4.3.2 Uncommitted Interpretive Community

Uncommitted community members reported mean scores on most of the profiling variables that were close to the sample average. Although these individuals tended to exhibit slightly above average levels of general belief in climate change, they reported lower than average levels of connection with nature, green self-identity, trust in authorities, concern, knowledge, and distress and outrage over climate change. The discrepancy between belief and other climate change cognitions suggests that messages may be effective if they motivate these individuals to adjust their low levels of self-efficacy and concern to match their belief in climate change, in order to relieve possible cognitive dissonance arising from possessing conflicting attitudes (Festinger, 1956).

For uncommitted audiences, our judgement analysis indicated that messages should have a strong emotional component and be framed in terms of preventing losses to promote high threat perceptions. For example, a particularly evocative bushfire TV commercial had a high effectiveness rating for this group (message #2). This one-minute video featured blackness and smoke, and the soundtrack of an unprepared family encountering the arrival of a bushfire at their home. In their panic, family members identified the actions they should have already taken to prepare for the disaster but had not. The video ends with an image of the burnt ruins of the house followed by the words: 'Don't risk your life on a last minute decision'. In addition to its emotional content, this video also included advice in the form of preventative/protective

actions that should have been taken. For this group, it is important that emotional features are accompanied by specific adaptation advice to promote high perceived efficacy. This is crucial because high threat perceptions may trigger either message acceptance or rejection by uncommitted audiences, whereas high efficacy appears to be uniquely related to message acceptance. Other effective messages for this group included a brochure detailing in words and photographs how Australians can protect themselves during severe thunderstorms (message #12), and a brochure about bushfire protection which began with an atmospheric description and photos showing what it is like to experience a bushfire (message #10).

4.3.3 Dismissive Interpretive Community

On average, members of the *Dismissive* segment deny that climate change is occurring, perceive few risks, are negatively predisposed to clean energy, exhibit low trust in authorities, have little knowledge about climate change, express very low levels of concern, and engage in few adaptive responses to climate change. They also tend to possess strong anti-green values and attitudes, making it challenging for social marketers to constructively engage with this group. To avoid strong reactance and avoidance effects, perhaps the best approach would be to avoid direct references to climate change and sustainability, and instead develop strategies that emphasise other outcomes valued by this group. For example, Bain, Hornsey, Bongiorno and Jefferies (2012) found that climate change deniers were more likely to develop pro-environmental intentions when climate change action was framed in terms of technological and economic development and creating a more caring and considerate society.

Messages directed at audiences that are dismissive about climate change appear to be most effective when they use simple language, provide specific adaptation advice, and avoid providing information about descriptive norms. For example, brochures that produced higher danger control responses and lower fear control responses from this group often used bullet points and/or instructive illustrations to present information about the right way to prepare for and survive events like bushfires or cyclones (e.g. messages #6, 9 and 23).

5. GAPS AND FUTURE RESEARCH DIRECTIONS

These two studies had several limitations that should be considered when interpreting our findings. First, although we employed large, diverse national samples, it should not be assumed that our findings will necessarily generalise to the Australian population or to other countries, where perspectives on climate change may vary substantially from those expressed by our respondents. It would be beneficial to conduct additional studies, using a similar methodology, with different representative sets of climate change adaptation messages and samples, to evaluate the robustness of our findings.

Our research found that two Australian samples comprised distinct interpretive communities that differed in their climate change beliefs and perceptions, and in their psychological and behavioural responses to climate change. Although the two samples comprised segments that were largely conceptually similar, the number of segments and extent of differentiation between them differed. These differences provide some support for the view that the general structure of climate change audience segments may not necessarily exhibit temporal stability. That is, not only is it possible for individuals to shift from one audience segment to another, it is also possible for the segments themselves to change, with existing segments merging or disappearing and new segments being created. Leiserowitz, Maibach and colleagues have produced an interesting series of studies showing that percentages of the American public in each of their climate change segments change over time, especially as societal and political trends and actions on the climate change front continue to dynamically evolve. To determine the extent that such changes are occurring, it may not be sufficient to simply apply classification equations derived from past studies to new samples – an approach recommended by Maibach et al. (2011). Rather, researchers may also wish to investigate new profile solutions that are not constrained by the structure(s) identified in previous studies.

Similar work should also be done to track shifts in segment membership in response to direct experience with extreme weather, media coverage, as well as more formal climate change communication and behaviour-change interventions. Extreme weather events are predicted to have an increased impact on human societies in the future (Seneviratne et al. 2012). For Australians, there are concerns about the effects of extreme temperatures and human heat tolerance (Hanna et al. 2011), extreme waves (Hemer, McInnes and Ranasinghe 2012), and tropical cyclone intensity and frequency (Knutson et al. 2010). It will be informative to track whether Australians, particularly members of the *Dismissive* community, attribute these changes to climate change. It will also be important to determine if these attributions, by themselves or in concert with other events or planned intervention strategies, result in significant shifts in the proportion of Australians within each audience segment.

Further research is also needed to determine the sources of climate change information received by members of each audience segment (e.g. mainstream media, non-governmental organisations, issue-specific online sites, etc.), and the nature of this information. Understanding baseline messaging will help social marketers to develop new strategies to complement or counteract current communications. This will also help to identify the primary information channels used by each segment so that future messaging can be targeted more effectively.

Potential limitations of audience segmentation should also be addressed by future research. Corner and Randall (2011) suggested that by focussing on differences between individuals, audience segmentation may exacerbate those differences and adversely impact social capital. Further study is needed to increase academic understanding of the roles of social capital and social networks in promoting adaptive

climate change behaviours, and to develop methods and approaches that engage individuals at this level. Incorporating these types of approaches may be viewed as supplementary to social marketing techniques.

This research aimed to identify message attributes that can be used by climate change communicators and social marketers to address the diversity of responses to climate change within the Australian population. Therefore, it is important to appreciate that the climate change beliefs and perceptions of individuals grouped together by our segmentation analyses are not identical. The segments are based on patterns of average responses across the profiling variables, and variation between individuals within each segment is expected. It would be potentially interesting to explore the effects of variation within each group on message effectiveness.

Results of the judgement analysis indicated that the presence and absence of specific message attributes were significantly associated with audience responses, and that the nature of these associations varied across climate change interpretive communities. However, the presence of significant associations in this study does not necessitate the existence of causal links. Future research in which message attributes are experimentally manipulated should be conducted to provide a more in-depth understanding of potential causal mechanisms. We would, however, suggest that the Brunswikian principle of representative design (Brunswik, 1955; Cooksey, 1996) continue to be applied to ensure that what is learned has more direct generalisability to circumstances outside a simulated message environment.

It is also of interest to use surveys such as those conducted to monitor the effects of tipping points in natural systems on people's perceptions of climate change and the imperatives of adapting appropriately (Russill and Nyssa, 2009). Tipping points are those changes to the natural system that result in irreversible change, such as the collapse and melting of the West Antarctic Ice Sheet that might raise sea levels around the Australian coast by more than 3 m comparatively rapidly (Lenton and Ciscar, 2013). Our study also suggests that more locally-defined tipping points (e.g. relating to bushfire incidence, water management, flood prevention) might be useful as tools for convincing doubters about the need to adapt, something that has been applied elsewhere (Kwadijk et al. 2010).

Finally, although our study investigated a broad range of message attributes that explained substantial amounts of variance in audience responses, there are many other potentially important message features (e.g. mode of communication, length, image to words ratio, temporal frame, etc.) were not investigated. Similarly, our analyses of audience responses were restricted to four message-response dimensions identified as being most relevant to the EPPM. Alternative models of risk communication suggest that other dimensions, such as whether exposure to the threat is perceived to be voluntary, expected time of occurrence, and threat familiarity, are also important determinants of response and non-response (Fischhoff, Bostrom and Quadrel, 1993). Future research should investigate these possibilities.

6. CONCLUSION

Individuals differ in terms of the psychological lenses through which they perceive and respond to the threat of global climate change. We found that the Australian population consists of interpretive communities whose responses to climate change tend to range from dismissive to alarmed, and demonstrated that these groups differ in their cognitive and behavioural responses to climate change, and in their preference for particular climate change mitigation and adaptation policies. The current results also indicate that these communities differ in how they perceive and respond to climate change adaptation messages.

Communication specialists should take this heterogeneity in the Australian population into account when developing climate change messaging strategies. In short, the content and structure of climate change adaptation messages matter, and our results suggest that it is important to match message attributes with audience characteristics to increase their impact. However, we do not view our findings as a definitive 'how-to' guide for developing climate change messages, but rather as broad signposts to help climate change communication specialists to continue to refine their messaging strategies. We consider this to be an iterative, ongoing process involving the assessment of additional message attributes not explicitly investigated in this study, and adjustments in communication strategy in response to the new climate science findings, trends in media reporting, and the possible emergence of new audience segments.

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APPENDIX 1: PHASE 2 SURVEY

Beliefs and Responses to Climate Change and Responses to Messages about Managing its Effects

General Instructions

Please read and answer every question carefully. You will be asked to click on a button that best indicates your answer. To move through the questionnaire, please press the 'next' button at the bottom of each page. It is possible to change a response to an earlier question without losing your subsequent responses. To move to a previous page, please click on the 'back' button at the bottom of the page. The survey will take up to 60 minutes to complete. If unexpected circumstances prevent you from completing it in one session, it is possible to reopen and complete the survey WITHIN 7 DAYS without losing your responses. Clicking the survey link will return you to the last question answered.

Part 1

In this section, we are interested in some information about you. All information is confidential.

1. What is your gender? Male (1) Female (2)

2. What is your home postcode?

3. In what year were you born?

4. What is your current employment status?

   Working – Full-time (30+ hrs per week) (1)
   Working - Part-time (up to 30 hrs per week) (2)
   Unemployed – seeking work (3)
   Unemployed - not seeking work (4)
   Not working - retired (5)
   Not working - looking after house/children (6)
   Not working - disabled (7)
   Student (8)
   Other (please specify below) (9) _____

5. Please indicate the highest level of education you have completed:

   Year 10 or less (1)
   Year 11 (2)
   Year 12 (3)
   College Certificate or Diploma (4)
   Trade Qualification/Apprenticeship (5)
   Undergraduate Degree (6)
   Postgraduate Degree (7)
   Other (please specify below) (8) _____

6. What is your current (or last) main occupation?

   Manager (1)
   Professional (2)
   Technician/Trade Worker (3)
   Community and Personal Service (4)
   Domestic Duties (5)
   Labourer (6)
   Machinery Operator/Driver (7)
   Sales Worker (8)
   Clerical/Admin (9)
   Retired (10)
   Other (please specify below) (11) _____

7. Do you have any children or grandchildren? Yes (1) No (2)

7a. How many do you have?
Number of children (1)Number of grandchildren (2)

8. Which of the following would best describe the residential circumstance that you have had for most of your life?

Urban (1)
Suburban (2)
Country town (3)
Rural residential (4)
Rural (5)

9. How would you describe your current residential circumstances?

Urban (1)
Suburban (2)
Country town (3)
Rural residential (4)
Rural (5)

10. Approximately how far in kilometres is your house from the town centre or central business district (CBD)?

11. How close do you live to areas frequently affected by extreme weather events or natural disasters? (Please tick the box that applies to you)

0 – 25 km (1)
26 – 50km (2)
51 – 100kms (3)
101 – 250kms (4)
over 250km (5)

12. Approximately how many kilometres do you live from the nearest Australian coastline?

13. How would you vote if there were a Federal Election tomorrow?

Labor (1)
Liberal (2)
National Party (3)
Greens (4)
Independent (5)
Other (please specify below) (6) _____

14. Were you born in Australia? Yes (1) No (2)

14a. If born outside Australia:

In what country were you born? (1)
For how many years have you lived in Australia? (2)

15. For how many years have you lived in the general area that you are now living? Years: (1)

16. What are your current living arrangements?

Buying with mortgage/loan (1)
Own home outright (2)
Part rent/part mortgage (3)
Renting (including rents paid by housing benefit) (4)
Living here rent free (5)

17. Please indicate your approximate annual combined household income (before tax):

$40,000 or less (1)
$40 001-$60,000 (2)
$60,001-$80,000 (3)
$80,001-$100,000 (4)
$100,001-$150,000 (5)
$150,001-$200,000 (6)
Greater than $200,000 (7)

Part 2

18. How favourable or unfavourable are your overall opinions or impressions of the following energy sources for producing electricity currently?

SCALE: 1) Very favourable, 2) Mainly favourable, 3) Neither favourable nor unfavourable, 4) Mainly unfavourable, 5) Very unfavourable, 6) Never heard of it, 7) No opinion, 8) Don't Know

a) Biomass (e.g. wood, energy crops, human and animal waste) (1)
b) Coal (2)
c) Gas (3)
d) Hydroelectric power (4)
e) Nuclear power (5)
f) Oil (6)
g) Sun/Solar power (7)
h) Wind power (8)

19. Do you favour or oppose the construction of nuclear power stations in Australia?

SCALE: Favour (1) Oppose (2) Don't know (3)

20. How concerned, if at all, are you about nuclear power in Australia? (Select one only)

a) Very concerned (1)
b) Fairly concerned (2)
c) Not very concerned (3)
d) Not at all concerned (4)
e) Don't know (5)
f) No opinion (6)

21. To what extent do you agree or disagree with each of the following statements about nuclear power? (Select one answer for each statement)

SCALE: 1) Strongly agree, 2) Tend to agree, 3) Neither agree nor disagree,

4) Tend to disagree, 5) Strongly disagree, 6) No opinion, 7) Don't know

a) There are risks to people in Australia from nuclear power (1)
b) There are benefits to people in Australia from nuclear power (2)

22. How concerned, if at all, are you that in the future... (Select one answer for each statement)

SCALE: 1) Very concerned, 2) Fairly concerned, 3) Not very concerned, 4) Not at all concerned, 5) No opinion, 6) Don't know

a) Electricity will become unaffordable? (1)
b) Electricity will be rationed? (2)
c) Australia will become too dependent on energy from other countries? (3)
d) Terrorist attacks will cause interruptions to electricity supplies? (4)
e) Supplies of fossil fuels (e.g. coal and gas) will run out? (5)
f) There will be power cuts? (6)

23. How concerned, if at all, are you about climate change, sometimes referred to as 'global warming'?

Very concerned (1)
Fairly concerned (2)
Not very concerned (3)
Not at all concerned (4)
Don't know (5)
No opinion (6)

24. As far as you know, do you personally think that the world's climate is changing?

SCALE: Yes (1) No (2) Don't know (3)

25. Thinking about the causes of climate change, which of the following best describes your opinion? (Please read all these alternatives, then select one answer only)

a) Climate change is entirely caused by natural processes (1)
b) Climate change is mainly caused by natural processes (2)
c) Climate change is partly caused by natural processes and partly caused by human activity (3)
d) Climate change is mainly caused by human activity (4)
e) Climate change is entirely caused by human activity (5)
f) I think there is no such thing as climate change (6)
g) Don't know (7)
h) No Opinion (8)

26. If nothing is done to reduce climate change in the future, how serious a problem do you think it will be for Australia?

Very serious (1)
Somewhat serious (2)
Not so serious (3)
Not serious at all (4)

27. If nothing is done to reduce climate change in the future, how serious a problem do you think it will be for the world?

Very serious (1)
Somewhat serious (2)
Not so serious (3)
Not serious at all (4)

28. To what extent to you agree or disagree with each of the following statements about climate change? (Select one answer for each statement)

SCALE: 1) Strongly agree, 2) Tend to agree, 3) Neither agree nor disagree,

4) Tend to disagree, 5) Strongly disagree, 6) No opinion, 7) Don't know

a) I am certain that climate change is really happening (1)
b) I trust the Australian Government to take appropriate action against climate change (2)

29. To what extent to you agree or disagree with each of the following statements about climate change? (Select one answer for each statement)

SCALE: 1) Strongly agree, 2) Tend to agree, 3) Neither agree nor disagree,

4) Tend to disagree, 5) Strongly disagree, 6) No opinion, 7) Don't know

a) I can personally help to reduce climate change by changing my behaviour (1)
b) I personally feel that I can make a difference with regard to climate change (2)
c) I feel a sense of urgency to change my behaviour to help to reduce climate change (3)
d) It is my responsibility to help to do something about climate change (4)

30. When, if at all, do you think Australia will start feeling the effects of climate change? (Please read all these alternatives, then select one answer only)

a) We are already feeling the effects (1)
b) In the next 10 years (2)
c) In the next 25 years (3)
d) In the next 50 years (4)
e) In the next 100 years (5)
f) Beyond the next 100 years (6)
g) Never (7)
h) Don't know (8)
i) No opinion (9)

31. To what extent do you agree or disagree with each of the following statements about climate change?

SCALE: 1) Strongly agree, 2) Tend to agree, 3) Neither agree nor disagree, 4) Tend to disagree, 5) Strongly disagree, 6) No opinion, 7) Don't know

a) Climate change will mostly affect areas that are far away from here (1)
b) My local area is likely to be affected by climate change (2)
c) Climate change is likely to have a big impact on people like me (3)

32. Considering any potential effects of climate change that might affect you personally, how concerned, if at all, are you about climate change?

Very concerned (1)
Fairly concerned (2)
Not very concerned (3)
Not at all concerned (4)
Don't know (5)
No opinion (6)

33. Considering any potential effects of climate change that there might be on society in general, how concerned are you about climate change?

Very concerned (1)
Fairly concerned (2)
Not very concerned (3)
Not at all concerned (4)
Don't know (5)
No opinion (6)

34. Which of the following do you think should be mainly responsible for taking action against climate change? (Please tick all that apply)

a) Environmental groups (1)
b) Individuals and their families (2)
c) Industry/companies (3)
d) Local authorities (4)
e) State governments (5)
f) National governments (6)
g) The international community (7)
h) None of these (8)
i) Don't know (9)
j) Other (please specify) (10) _____

35. If you were to vote today, how do you think you would be likely to vote in relation to the following?

SCALE: 1) Definitely vote against, 2) Probably vote against, 3) Probably vote in favour,

4) Definitely vote in favour, 5) I would not vote, 6) No opinion, 7) Don't know

a) Whether to build new wind farms in Australia (1)
b) Whether to build new coal-fired power stations in Australia (2)
c) Whether to spend taxpayers' money on Australian projects designed to tackle climate change

36. To what extent do you agree or disagree with the following statements?

SCALE: 1) Strongly agree, 2) Tend to agree, 3) Neither agree nor disagree,

4) Tend to disagree, 5) Strongly disagree, 6) No opinion, 7) Don't know

a) I am prepared to greatly reduce my energy use to help tackle climate change (1)
b) I am prepared to pay significantly more money for energy efficient products (2)

37. To what extent do you agree or disagree with each of the following statements?

SCALE: 1) Strongly agree, 2) Tend to agree, 3) Neither agree nor disagree,

4) Tend to disagree, 5) Strongly disagree, 6) No opinion, 7) Don't know

a) I think of myself as someone who is very concerned with environmental issues (1)
b) Being environmentally friendly is an important part of who I am (2)
c) I identify with the aims of environmental groups such as Greenpeace and Friends of the Earth

38. People around the world are generally concerned about environmental problems because of the consequences that result from harming nature. However, people differ in the consequences that concern them the most. Please rate each of the following items in response to the question: I am concerned about environmental problems because of the consequences for _____

1) Extremely Concerned to 7) Not at all Concerned

a) Plants
b) Me
c) People in the community
d) Marine life
e) My lifestyle
f) All people
g) Birds
h) My health
i) Children
j) Animals
k) My future
l) Future generations

Part 3

In this part of this questionnaire you are being asked questions that are more specific to living in Australia. Some questions may seem similar to questions you have already answered, but they differ in important ways. Climate change considerations remain a strong focus in this section of the survey, but other environmental matters of particular relevance to Australia are also given emphasis (e.g. natural disasters).

39. How concerned are you that the impacts of climate change might directly affect you, your family, or your local environment in the foreseeable future?(Click on a circle from 'Very concerned' to 'Not at all concerned' to indicate your level of concern).

SCALE: 1) Very concerned to 6) Not at all concerned

40. How important is the issue of climate change to you personally?

SCALE: 1) Extremely important to 6) Not at all important

41. How much do you feel you know about climate change?

SCALE: 1) A lot to 6) Nothing

42. How much do you trust what different sources say about the environment?

SCALE: 1) Completely to 6) Not at all

a) Scientists
b) Media
c) Government

43. Please answer each of these questions in terms of the way you generally feel when being in or thinking about the natural environment.

SCALE: 1) Strongly agree to 6) Strongly disagree

a) I often feel that I am a part of nature
b) I often feel close to the natural world around me
c) I often feel a personal bond with things in my natural surroundings, like trees, wildlife or the view on the horizon
d) I often feel connected to nature
e) My own welfare is linked to the welfare of the natural world
f) I recognise and appreciate the intelligence of other living things

44. In the following statements, natural environments refer to natural areas that are familiar to you and which you may have visited and spent some time in regularly or occasionally (e.g. national or state parks, coastal areas, woodlands, rivers, mountains, lakes, countryside and rural areas).

SCALE: 1) Strongly agree to 6) Strongly disagree

a) I frequently engage in activities that are located in the natural environment.
b) My employment is such that I am often working or traveling outdoors in natural settings.
c) I have resided for part of my life in the country.
d) I often spend time with family and friends relaxing in the natural environment.
e) I prefer to spend my time in the country rather than the city.

45. How serious a problem do you think climate change is right now?

SCALE: 1) Very serious to 6) Not serious at all

46. A person's 'carbon footprint' is the amount of greenhouse gases put out as a result of his or her energy use. This includes energy used directly, like electricity and fuel, as well as the energy it takes to make and transport all the products you use. How often do you take each of the following actions to reduce your carbon footprint?

SCALE: 1) Never, 2) Rarely, 3) Sometimes, 4) Often or all the time

a) Use less electricity (1)
b) Use compact florescent light bulbs (2)
c) Use less water (3)
d) Buy energy from renewable sources/hydro/wind/solar power (4)
e) Drive less (5)
f) Use less petrol (6)
g) Buy/use smaller/more fuel efficient car (7)
h) Carpool (8)
i) Walk/bicycle/scooter (9)
j) Reduce travel/vacation travel (10)
k) Use trains/buses/subways/other public transport/mass transit (11)
l) Recycle (12)
m) Buy local food/organic food/growing own food (13)
n) Buy carbon offsets (14)
o) Reduce air travel (15)
p) Other (please specify) (16)

47. Please click the response that best indicates your level of agreement for each statement below.

SCALE: 1) Strongly agree to 6) Strongly disagree

a). I believe my actions have an influence on climate change.
b). I believe my actions have a positive influence on how I am feeling and thinking about climate change and environmental problems generally.
c). My actions to reduce the effects of climate change in my community will encourage others to reduce the effects of global warming through their own actions.
d). Human beings are responsible for global warming and climate change.
e). Humans have little control over the forces of nature such as climate change.
f). I believe that climate change is inevitable, no matter what we try and do to stop it.

48. How closely are you following news about the environment these days?

SCALE: 1) A great deal to 6) Not at all

49. How often do you find yourself thinking about the issue of climate change?

SCALE: 1) A great deal to 6) Not at all

50. Please indicate whether you think the following statements are true or false. If you do not know, just click on 'Don't know', rather than asking someone else.

SCALE: 1) True, 2) False, 3) Don't know

a). The projected average sea level rise provided by the Intergovernmental Panel on Climate Change (IPCC) for the remainder of this century (2010-2099) is between 18 - 59 centimetres.
b). Australia is one of the most exposed nations with respect to projected impacts of climate change.
c). Climate change will increase the risk in Australia for diseases transmitted by water and mosquitoes (i.e., diarrhoea, dengue fever) over the next 100 years.
d). Globally, the current burning of fossil fuels accounts for 80-85% of carbon dioxide (CO_2) emissions added to the atmosphere.
e). Methane is emitted mainly from fossil fuels.
f). Climate change is mainly caused by the hole in the ozone layer.
g). Australia produces about 5.5% of the planet's carbon emissions.
h). Australia's average temperature has increased by approximately 1°C from 1910 to 2002.
i). The change in global temperature for the last 100 years is greater than for the last 1000 years.
j). The number of weather-related disasters around the world has doubled since the mid-1990s.

51. How certain are you about the correctness of the answers you have given to the above true/false statements? SCALE: 1) Certain to 6) Uncertain

52. Some people may be finding this global threat to be particularly distressing. This may not be the case for you and it is important that you respond in the context of your own personal experience and feelings. Please indicate the extent to which each of the following statements reflects your own response to the threat of climate change.

SCALE: 1) Strongly agree to 6) Strongly disagree

a). I experience some distress each time I see or read media coverage of the likely impacts and consequences of climate change.
b). At times I find myself thinking about and worrying about what the world will really be like for future generations because of climate change.
c). I experience some guilt over the fact that my family and friends' lifestyles and consumption patterns are in part responsible for the unfolding impacts of climate change.
d). It upsets me that there seems to be so little that I can do to address environmental problems such as climate change.
e). At times I feel some personal responsibility for the problems and unfolding impacts of climate change.

f). The threat of climate change is affecting my quality of life and my assessment of environmental quality more generally.
g). I feel some sense of loss because of climate change impacts that are becoming apparent in my local area.

53. Please indicate the extent to which each of the following statements best describes your own response to the threat of climate change.

SCALE: 1) Strongly agree to 6) Strongly disagree

a). I have changed the way I think about the seriousness of environmental problems because of climate change.
b). Increasingly I find myself less likely to attend to media reports, articles and discussions about the nature or impacts of climate change.
c). I have seriously thought about alternative places to live because of the increasingly evident impacts of climate change.
d). Climate change has forced me to change the way I think about and view how we live in and use our natural environment in Australia.
e). I have often discussed my thoughts and feelings about climate change with others over the past several years.
f). I tend to think differently these days about what is acceptable and sustainable and not acceptable with respect to consumer products and packaging, and consumption in general.
g). When considering the challenges of climate change it is important to look for things that I can address and change in my everyday life.

54. Have you experienced any noteworthy changes or events in your local natural environment over the past ten years which you think might be due to climate change? Yes (1) No (2)

55. Have you directly experienced any other noteworthy environmental changes, circumstances, or events elsewhere in Australia or the world which you think might be due to climate change? Yes (1) No (2)

56. Have you ever experienced a natural disaster warning or natural disaster impact situation? Yes (1) No (2)

Answer If 56. Have you ever experienced a natural disaster warning ... Yes Is Selected

57. If yes, please indicate the type of event(s) and the approximate number of times you may have experienced such an event.

SCALE: 1) 0 to 6) 5+

Cyclone (1)
Bushfire (2)
Drought (3)
Flood (4)
Other (5)

58. Overall how much property damage did you experience in this or these situations?

SCALE: 1) Considerable damage to 6) No damage

59. Overall how much anxiety and stress did you experience in this or these situations?

SCALE: 1) Considerable stress to 6) No stress

60. How vulnerable do you think the region where you live is to natural disasters (e.g. floods, droughts, cyclones and bushfires)?

SCALE: 1) Not very vulnerable to 6) Not vulnerable

61. How vulnerable do you think the region where you live is to the impacts of climate change?

SCALE: 1) Not very vulnerable to 6) Not vulnerable

62. There have been a number of films, television mini-series, and documentaries addressing climate change over the past few years. (Please indicate which of the following you may have seen).

SCALE: 1) Yes, 2) No

The Day after Tomorrow (Commercial film) (1)

a) An Inconvenient Truth Al Gore (Documentary film) (2)
b) Burn Up Canadian (ABC mini-series 25 April 25 and 2 May, 2010) (3)
c) Six Degrees (National Geographic documentary) (4)
d) The 11th Hour (Narrated by Leonardo DiCapricio (5)
e) Catalyst (ABC program about Antarctica 29 April 2010) (6)
f) State of the Planet (BBC David Attenborough documentary series) (7)
g) Earth 2100 (ABC mini-series) (8)
h) Home (You Tube) (9)
i) Not Evil Just Wrong (Commercial film) (10)
j) The Great Warming (Documentary narrated by Keanu Reeves and Alanis Morrisette) (11)
k) Age of Stupid (Commercial film) (12)
l) Everything's Cool (Documentary film) (13)
m) No Impact Man (Documentary film) (14)
n) Other (Please indicate any other films, documentaries or mini-series you have watched.)

63. Please indicate the extent to which you agree or disagree with each of the following statements.

SCALE: 1) Strongly agree to 6) Strongly disagree

a). Climate change will have a noticeably negative impact on my health (over the next 25 years)
b). Climate change will have a noticeably negative impact on my economic and financial situation (over the next 25 years)
c). Climate change will have a noticeably negative impact on the environment in which my family and I live
d). In your opinion, what is the risk of climate change exerting a significant impact on public health in your state?
e). In your opinion, what is the risk of climate change exerting a significant impact on economic development in your state?

64. How strongly do you feel the following emotions when you think about the issue of climate change?

SCALE: 5) Extremely, 4) Very, 3) Moderately, 2) Slightly, 1) Not at all

Interested (1)
Worried (2)
Helpless (3)
Hopeful (4)
Sad (5)
Angry (6)
Afraid (7)
Guilty (8)
Depressed (9)
Bored (10)
Disgusted (11)

Part 4

In this section, we will present six brief messages about adapting to the effects of climate change. These effects are expected to include changes in the incidence of certain events, like bushfires and floods. The messages vary in format, and may include videos, brochures, newspaper articles, radio broadcasts, or websites. Most messages are short (e.g. 30 second videos, or one or two page brochures) but some are longer. Please limit the time you spend on each message to four minutes. After you have viewed each message, please answer a series of questions about your responses to that message. There are no right or wrong responses. People often respond differently to the same message, and we are interested in your personal responses. Most messages will open in a new browser window. To return to the survey after viewing a message, please click on the 'Survey: Climate Change' browser tab.

Example item:

Please click on the link below to view the message: Prepare to survive

[LINK TO MESSAGE]

After you have viewed the message, please respond to each of the following questions about the message by clicking the appropriate button.

SCALE: 1) Extremely, 2) Very, 3) Moderately, 4) Slightly, 5) Not at all

a) To what extent did you find the message believable? (1)
b) To what extent did you find the message easy to understand? (2)
c) To what extent did you find the message appealing? (3)
d) To what extent did the message make you feel that urgent action is required? (4)
e) To what extent did the message make you feel personally vulnerable? (5)
f) To what extent did the message make you feel equipped to effectively deal with the issue?
g) To what extent did the message make you feel motivated to take action? (7)
h) To what extent did the message make you feel fearful? (8)
i) How serious are the potential effects of the issue addressed by the message? (9)
j) How effectively do you think the message's recommended actions will manage the issue?
k) How important did you find the issue addressed by the message? (11)
l) To what extent did the message make you want to avoid thinking about the issue it addressed? (12)
m) To what extent did you find the information in the message was exaggerated? (13)
n) To what extent did you feel that the message tried to manipulate your views or feelings? (14)
o) To what extent did the communication make you feel motivated to seek out more information about this topic? (15)

Thank you for taking the time to fill out this survey. Please click the NEXT button to submit your responses.

APPENDIX 2: CLIMATE CHANGE ADAPTATION MESSAGES AND EFFECTIVENESS INDEX

	Climate Change Adaptation Messages	URL	Message Effectiveness Index		
			Dismissive	Uncommitted	Alarmed
1.	CFS bushfire awareness TV ad - via Mumbrella	http://www.youtube.com/watch?feature=endscreenandNR=1andv=968u4TOZOAM	7.44	10.49	12.78
2.	2011/12 FireReady TV	http://www.youtube.com/watch?feature=player_embeddedandv=1QI_MYvG5fE	8.88	11.11	13.62
3.	CFS Question Time TV ad	http://www.youtube.com/watch?v=rGo5fq5Y2UAandfeature=mfu_in_orderandlist=UL	8.38	8.67	12.08
4.	Prepare Act Survive TV ad - Country version	http://www.youtube.com/watch?v=pXIZNdekx0kandfeature=relmfu	7.31	10.28	14.39
5.	Prepare Act Survive TV ad - City version	http://www.youtube.com/watch?v=vEBsg01H7qAandfeature=related	6.21	9.36	14.17
6.	Bushfire Survival Plan – TWO PAGE EXTRACT	http://www.rfs.nsw.gov.au/file_system/attachments/Attachment_BushFireSurvivalPlan.pdf	9.59	8.75	14.35
7.	CFS FACT SHEET - PREPARING YOURSELF FOR BUSHFIRES – ONE PAGE EXTRACT (Page 4)	http://www.sustainabletourismonline.com/awms/Upload/PORTAL%20MICROSITES/CRISIS/cfs_fact_sheet_05_preparing_yourself_for_bushfires.pdf	7.74	9.02	12.03
8.	CFS FACT SHEET - PREPARING YOURSELF FOR BUSHFIRES – ONE PAGE EXTRACT (Page 3)	http://www.sustainabletourismonline.com/awms/Upload/PORTAL%20MICROSITES/CRISIS/cfs_fact_sheet_05_preparing_yourself_for_bushfires.pdf	6.03	8.72	12.59
9.	Prepare Act Survive brochure	http://www.rfs.nsw.gov.au/file_system/attachments/Attachment_PrepareActSurvive.pdf	10.21	10.25	14.02
10.	Bushfire - Prepare to Survive – FOUR PAGE EXTRACT (Pages 6, 13, 16, 17)	www.fire.tas.gov.au/mysite/.../BushfirePrepareToSurvive.pdf	9.28	10.47	14.04

Climate Change Adaptation Messages	URL	Message Effectiveness Index		
		Dismissive	Uncommitted	Alarmed
11. Maintain your yard – Harden Up - Protecting Queensland	http://hardenup.org/prepare-yourself/practical-preparation-advice/property-and-assets/prepare-for-bushfires/maintain-your-yard.aspx	7.87	9.61	14.67
12. Australian Bureau of Meteorology: Severe Thunderstorms	http://www.bom.gov.au/info/thunder/#precautions	8.29	10.10	13.28
13. Pictorial community safety action guides – Cyclones	http://www.em.gov.au/Emergencymanagement/communityengagement/Pages/Communitysafetyactionguides.aspx	5.30	9.50	10.36
14. Pictorial community safety action guides – Heatwave	http://www.em.gov.au/Emergencymanagement/communityengagement/Pages/Communitysafetyactionguides.aspx	5.38	8.56	11.75
15. Pictorial community safety action guides - Severe Storms	http://www.em.gov.au/Emergencymanagement/communityengagement/Pages/Communitysafetyactionguides.aspx	5.38	8.11	13.53
16. Prepare | Australian Red Cross - The Power Of Humanity	http://www.redcross.org.au/step-1---be-informed.aspx	5.81	8.45	12.28
17. Storm guide	http://www.em.gov.au/Publications/Communityawarenesspublications/Pages/EmergencyActionGuides.aspx	8.31	10.40	13.23
18. Extreme Weather Heroes - The Science of Extreme Weather	http://www.extremeweatherheroes.org/science-of-extreme-weather.aspx	3.84	7.49	12.66
19. Extreme Weather Heroes BLOCKBUSTER video	http://www.youtube.com/watch?feature=endscreenandNR=1andv=yFk_r1_avko	4.79	7.31	11.73
20. Nova's Extreme Weather Hero CSA	http://www.youtube.com/watch?v=4lT93W7-tSIandfeature=relmfu	4.50	6.94	11.08
21. Nation must manage rising tide of climate-driven disasters | The Australian	http://www.theaustralian.com.au/opinion/nation-must-manage-rising-tide-of-climate-driven-disasters/story-e6frg6zo-1225776607889	3.95	7.66	11.99

Climate Change Adaptation Messages	URL	Message Effectiveness Index		
		Dismissive	Uncommitted	Alarmed
22. Early preparation will help us weather the storm | The Australian	http://www.theaustralian.com.au/opinion/early-preparation-will-help-us-weather-the-storm/story-e6frg6zo-1225843007038	4.68	7.62	10.40
23. Preparing for Cyclones brochure – FIVE PAGE EXTRACT – (Cover, pages 4 to 7) f	http://www.emergency.qld.gov.au/emq/css/pdf/1982EMQ_Preparing_for_cyclones_ENGLISH_web.pd	8.68	8.38	11.15
24. Polar bears discussing global warming	http://www.youtube.com/watch?v=_Zo7wTOdc_Mandfeature=related	4.04	6.70	9.51
25. Australian Psychological Society: Climate change - what you can do	http://www.psychology.org.au/publications/tip_sheets/climate/	4.05	7.69	11.32
26. We Must Break The Low Exercise - Air Conditioning - Obesity Vicious Circle - Planet Green	http://planetgreen.discovery.com/work-connect/break-the-low-exercise-air-conditioning-obesity-vicious-circle.html	3.38	6.87	9.89
27. The Climate Institute - A Climate of Suffering Summary	http://www.climateinstitute.org.au/verve/_resources/tci_aclimateofsuffering_summary_august2011.pdf	3.41	6.69	12.45
28. The Climate Institute - A climate of Suffering – TWO PAGE EXTRACT on Mass Migrations -(Page 21, 22)	http://www.climateinstitute.org.au/verve/_resources/tci_aclimateofsuffering_august2011_web.pdf	4.29	6.26	10.21
29. The Climate Institute - A climate of Suffering – TWO PAGE EXTRACT on Action, Hope, and Empowerment – (Page 27, 28)	http://www.climateinstitute.org.au/verve/_resources/tci_aclimateofsuffering_august2011_web.pdf	3.29	7.53	11.50
30. Adaptation for Queensland summary-brochure.pdf	http://www.ehp.qld.gov.au/climatechange/pdf/adaptation-summary-brochure.pdf	4.21	7.46	12.71
31. Adapting to Change – Harden Up - Protecting Queensland	http://hardenup.org/climate-change/adapting-to-change.aspx	3.25	7.47	11.82

	Climate Change Adaptation Messages	URL	Message Effectiveness Index		
			Dismissive	Uncommitted	Alarmed
32.	climate-change-in-qld-brochure.pdf	http://www.climatechange.qld.gov.au/pdf/climate-change-in-qld-brochure.pdf	3.95	8.68	11.83
33.	Climate Adaptation Flagship	http://www.csiro.au/Organisation-Structure/Flagships/Climate-Adaptation-Flagship/ClimateAdaptationFlagshipOverview.aspx#a2	4.12	7.65	13.33
34.	Climate Change: Science and Solutions for Australia – FOUR PAGE EXTRACT (Page 59–62)	http://www.csiro.au/en/Outcomes/Climate/Climate-Change-Book.aspx#a3	4.23	6.99	11.75
35.	Home - LivingGreener.gov.au	http://www.livinggreener.gov.au/	4.37	7.58	11.63
36.	Sustainability explained through animation	http://www.youtube.com/watch?NR=1andfeature=endscreenandv=B5NiTN0chj0	5.23	9.18	13.20
37.	Climate Change Commercial	http://www.youtube.com/watch?v=s0EME_NmefAandfeature=related	3.81	8.48	12.99
38.	In the Media: What should we do about climate change?	http://www.skepticalscience.com/podcasts/climate_action.mp3	2.84	7.86	9.93
39.	In the Media: Voicing values and climate change	http://www.skepticalscience.com/podcasts/values.mp3	2.86	7.03	11.33
40.	Oxfam urges climate action to help poor	http://www.smh.com.au/environment/climate-change/oxfam-urges-climate-action-to-help-poor-20111128-1o2vd.html	4.53	7.52	10.62
41.	Climate change position paper - FOUR PAGE EXTRACT (Pages 3, 4, 6, 9)	http://www.climatechange.gov.au/publications/adaptation/position-paper/adapting-to-climate-change-paper.aspx	3.42	7.41	10.72
42.	Floods, warning, preparedness, safety – Poster	http://www.em.gov.au/Documents/Floods%20-%20warning%20prepredness%20safety.pdf	5.37	7.21	9.91
43.	How to Protect Your Home Against Flood Damage | Home Insurance Comparison	http://homeinsurancecomparison.com.au/how-to-protect-your-home-against-flood-damage/	6.61	7.30	11.49

Climate Change Adaptation Messages	URL	Message Effectiveness Index		
		Dismissive	Uncommitted	Alarmed
44. FLOOD Emergency Action Guide	http://www.em.gov.au/Publications/Communityawarenesspublications/Pages/EmergencyActionGuides.aspx	8.63	8.99	12.50
45. What to do before, during and after a flood brochure – BEFORE THE FLOOD – FIVE PAGE EXTRACT – (Cover, page 3, 4, 5, 6)	http://www.em.gov.au/Publications/Communityawarenesspublications/Pages/default.aspx	5.81	8.55	11.87
46. Experts predict surge in floods	http://www.smh.com.au/environment/weather/experts-predict-surge-in-floods-20120311-1usn6.html	3.28	7.56	11.19
47. New Norm 1 Water Conservation	http://www.youtube.com/watch?v=fEQxpsHpgrg	6.25	9.39	12.00
48. Aquatic Avenger	http://www.youtube.com/watch?v=ikJdou1DIYoandfeature=endscreenandNR=1	5.37	5.68	8.05
49. Wasting Water is Weird: Dishwasher	http://www.youtube.com/watch?v=wicpGUkBJ6wandcontext=C4634f8cADvjVQa1PpcFM5pINxvLJuJe9d9lpbUBe5cPW5Ft4QNQo=	3.65	6.09	9.76
50. Wasting Water is Weird: Car Wash	http://www.youtube.com/watch?v=-I1oyppakM0andcontext=C42579cfADvjVQa1PpcFM5pINxvLJuJa3AVMsDB7D4xIDP34wH7gc=	4.22	7.07	11.75
51. Easy ways to be water wise in your home	http://www.youtube.com/watch?v=-I1oyppakM0andcontext=C42579cfADvjVQa1PpcFM5pINxvLJuJa3AVMsDB7D4xIDP34wH7gc=	8.09	9.49	13.16
52. Save Water in the Bathroom	http://www.savewater.com.au/how-to-save-water/in-the-home/bathroom	5.70	8.98	12.42
53. Water Saving Tips | ACTEW	http://www.actew.com.au/Community%20and%20Education/Saving%20Water%20for%20Life/Water%20Saving%20Tips.aspx	6.55	9.28	11.31
54. Water Corporation Saving water in your home	http://www.watercorporation.com.au/W/waterwise_home.cfm	7.07	9.37	12.28

	Climate Change Adaptation Messages	URL	Message Effectiveness Index		
			Dismissive	Uncommitted	Alarmed
55.	Savewater.com.au - Put the right plant in the right position	http://www.savewater.com.au/how-to-save-water/in-the-garden/savewater-smart-gardening-ads/put-the-right-plant-in-the-right-position	4.57	5.71	11.13
56.	NSW Energy Efficiency Tips	http://www.countryenergy.com.au/asset/cms/pdf/residential/NSW_EnergyEfficiencyTips_CE_web.pdf	7.56	8.52	12.37
57.	Energy and Water Savings Calculator | ActewAGL	http://www.actewagl.com.au/Help-and-advice/Energy-and-water-management/Energy-and-water-savings-calculator.aspx	5.46	8.08	10.32
58.	Great Barrier Reef Climate Change Action Plan – TWO PAGE EXTRACT (Page 4, 9)	http://www.gbrmpa.gov.au/__data/assets/pdf_file/0020/4493/climate-change-action-plan-2007-2012.pdf	3.84	8.13	12.68
59.	Energy efficiency in the home (Department of Environment and Resource Management)	http://www.derm.qld.gov.au/environmental_management/sustainability/energy/energy_efficiency_in_the_home/index.html	4.68	6.67	9.82
60.	Climate Change Threats to the Great Barrier Reef - VIDEO	http://www.aims.gov.au/docs/research/climate-change/climate-change.html;jsessionid=E3609A78B04442788B3D4D62A50A66C4	3.97	7.53	12.78

Note: The Message Effectiveness Index is the product of perceived efficacy and perceived threat ratings for each community.

APPENDIX 3: COMMUNICATION CUE CODINGS AND JUDGEMENT DIMENSION SCORES ON THE CLIMATE CHANGE ADAPTATION MESSAGES

MSG ID #	TOPIC	SOURCE	ADAPT	LANG	GEOG	PROM	EMOT	CONS	INDIV	NORMS	FEAR	DANGER	THREAT	EFFICACY
1	1	1	1	1	1	2	1	5	1	2	2.49	2.84	3.33	3.07
2	1	1	1	1	1	2	1	1	1	2	2.22	3.07	3.57	3.22
3	1	1	1	1	1	0	2	6	1	0	2.37	3.03	3.25	3.00
4	1	1	2	1	1	2	2	5	1	2	2.09	2.84	3.36	3.20
5	1	1	1	1	1	2	2	5	1	2	2.09	2.90	3.27	3.12
6	1	1	2	1	1	2	3	5	1	2	2.08	2.95	3.16	3.38
7	5	1	2	1	1	0	3	5	1	2	2.04	2.71	3.00	3.29
8	5	1	2	1	1	1	3	1	1	2	2.15	2.78	3.04	3.23
9	1	1	2	1	1	2	3	5	1	2	2.02	3.10	3.30	3.62
10	1	1	2	1	1	2	3	5	1	2	2.15	2.94	3.39	3.41
11	1	2	2	1	1	2	3	5	1	2	2.08	2.81	3.04	3.41
12	7	1	2	1	1	2	3	5	1	2	2.00	2.75	3.08	3.41
13	7	2	2	1	4	2	3	1	1	2	1.94	2.52	2.77	3.14
14	7	2	2	1	1	2	3	1	1	2	1.90	2.58	2.73	3.35
15	7	2	2	1	1	2	3	1	1	2	2.01	2.70	2.83	3.25
16	8	2	2	1	1	2	2	1	1	3	2.06	2.86	2.96	3.12
17	7	1	2	1	1	2	3	5	1	2	2.03	2.77	2.99	3.63
18	7	2	2	2	4	1	3	2	1	2	2.59	2.70	2.94	2.79
19	8	2	1	1	2	3	2	5	3	3	2.74	2.58	2.89	2.78
20	8	2	1	1	2	3	3	6	3	2	2.33	2.57	2.75	2.78
21	8	4	1	2	2	2	3	5	2	2	2.36	2.48	2.94	2.70
22	8	4	1	2	2	2	3	5	3	2	2.43	2.60	2.93	2.77
23	7	1	2	1	1	2	3	6	1	3	2.09	2.57	2.92	3.17
24	6	2	1	1	4	2	3	2	2	2	2.53	2.66	2.81	2.49
25	5	3	2	2	4	3	3	1	1	2	2.46	2.67	2.63	2.98
26	7	4	1	2	3	2	3	1	1	2	2.54	2.57	2.61	2.80
27	5	2	1	2	2	2	3	1	2	2	2.41	2.37	2.78	2.53

MSG ID #	TOPIC	SOURCE	ADAPT	LANG	GEOG	PROM	EMOT	CONS	INDIV	NORMS	FEAR	DANGER	THREAT	EFFICACY
28	6	2	1	2	3	2	3	5	2	3	2.51	2.60	2.95	2.44
29	6	2	1	2	2	2	3	5	2	2	2.47	2.55	2.86	2.60
30	6	1	2	2	2	2	3	5	2	2	2.24	2.60	2.86	2.91
31	8	2	1	2	2	2	3	5	2	2	2.51	2.65	2.88	2.87
32	6	1	1	2	2	0	3	5	2	0	2.28	2.78	3.08	2.78
33	6	2	1	2	2	2	3	5	2	3	2.36	2.55	2.95	2.81
34	6	2	1	2	2	2	3	5	2	2	2.29	2.66	2.94	2.78
35	8	1	2	1	2	1	3	5	1	0	2.09	2.75	2.70	3.12
36	6	2	2	2	3	3	3	5	3	2	2.20	2.86	3.04	3.15
37	8	2	2	1	3	2	3	5	1	2	2.21	2.84	2.87	3.13
38	8	2	1	2	4	2	3	2	1	2	2.51	2.60	2.66	2.60
39	6	2	1	2	2	2	3	5	2	2	2.39	2.58	2.93	2.57
40	8	4	1	2	3	2	3	5	2	2	2.38	2.50	3.06	2.54
41	6	1	1	2	2	2	3	5	2	2	2.63	2.52	2.85	2.48
42	2	1	2	2	2	2	3	5	1	2	1.87	2.43	2.68	2.88
43	2	3	2	1	1	2	3	3	1	2	1.98	2.46	2.71	3.07
44	2	4	1	1	3	2	3	1	2	2	1.93	2.62	2.87	3.54
45	2	1	2	1	1	2	3	5	1	2	1.90	2.66	2.82	3.23
46	2	1	2	2	1	2	3	5	1	2	2.50	2.58	2.89	2.65
47	3	4	1	1	2	2	3	3	2	3	2.09	2.81	2.79	3.34
48	3	1	1	1	1	1	3	6	1	2	2.18	2.22	2.32	2.78
49	3	1	1	1	1	1	3	6	1	1	2.11	2.51	2.37	2.84
50	3	2	1	1	1	0	3	6	1	1	2.15	2.58	2.61	2.96
51	3	2	1	1	1	0	3	6	1	2	1.99	3.11	2.89	3.58
52	3	1	2	2	1	0	3	6	1	2	2.00	2.97	2.74	3.37
53	3	1	2	2	1	2	3	5	1	2	2.17	2.99	2.89	3.31
54	3	1	2	1	1	1	3	6	1	2	1.99	3.02	2.72	3.54
55	3	1	1	1	1	3	3	6	1	2	1.96	2.57	2.34	3.02
56	4	3	2	1	1	2	3	2	1	2	2.08	3.05	2.79	3.36
57	4	3	2	1	1	2	3	5	1	2	2.01	2.95	2.65	3.12
58	6	1	1	2	2	2	3	2	2	2	2.17	2.81	3.23	2.77

MSG ID #	TOPIC	SOURCE	ADAPT	LANG	GEOG	PROM	EMOT	CONS	INDIV	NORMS	FEAR	DANGER	THREAT	EFFICACY
59	4	1	2	2	1	3	3	3	1	2	1.75	2.57	2.33	3.06
60	6	1	1	2	2	2	3	2	2	2	2.40	2.61	2.95	2.68

Key to Appendix 3 Table

Communication Cues		Cue Categories
TOPIC	Topic	(1) Bushfires, (2) floods, (3) water conservation, (4) energy conservation, (5) psychological adaptation, (6) general climate change, (7) extreme weather, (8) multiple
SOURCE	Source	(1) Government, (2) not-for-profit organisation, (3) industry, (4) media
ADAPT	Adaptation advice	(1) None/general, (2) specific
LANG	Language complexity	(1) Low, (2) moderate
GEOG	Geographic frame	(1) Local, (2) national, (3) global/all people, (4) multiple
PROM	Focus on promoting gains versus preventing losses	(1) Promotion, (2) prevention, (0) neither, (3) both
EMOT	Appeal to emotion versus reason	(1) Primarily emotion, (2) balanced, (3) primarily reason
CONS	Consequence frame	(1) Human health, (2) environmental, (3) economic/property/possessions, (4) national security, (5) multiple, (6) not explicitly specified
INDIV	Emphasis on individual versus collective responsibility/action	(1) Individual, (2) collective, (3) both
NORMS	Reference to social norms	(1) Descriptive – descriptions of how people actually behave, (2) injunctive – assertions about how people should behave, (0) neither, (3) both
EPPM Variables		
FEAR	Fear Control Responses	Sample mean – indicates average level of message rejection
DANG	Danger Control Responses	Sample mean – indicates average level of message acceptance
THREAT	Perceived Threat	Sample mean – indicates average level of threat perceived from the message
EFFIC	Perceived Efficacy	Sample mean – indicates average level of efficacy perceived from the message

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