Contents lists available at ScienceDirect

Global Environmental Change

Preaching to different choirs: How to motivate dismissive, uncommitted, and alarmed audiences to adapt to climate change?

Donald W. Hine[a,*], Wendy J. Phillips[a], Ray Cooksey[a], Joseph P. Reser[b], Patrick Nunn[c], Anthony D.G. Marks[a], Natasha M. Loi[a], Sue E. Watt[a]

[a] University of New England, Armidale, Australia
[b] Griffith University, Queensland, Australia
[c] University of Sunshine Coast, Queensland, Australia

ABSTRACT

People vary considerably in terms of their knowledge, beliefs, and concern about climate change. Thus, an important challenge for climate change communicators is how to most effectively engage different types of audiences. This study aimed to identify distinct audience segments that vary in terms of their values, beliefs, and responses to climate change and determine for each segment which specific message attributes increased motivation to engage in climate adaptation. A sample of 1031 Australian residents (aged 18–66 years) completed an online survey assessing their values, beliefs, and behaviors related to climate change, and recording their responses to a broad range of climate change adaptation messages. Latent profile analysis identified three distinct audience segments: alarmed (34.4%), uncommitted (45.2%), and dismissive (20.3%). Sixty climate change adaptation messages were coded in terms of the presence/absence of six attributes: explicit reference to climate change, providing specific adaptation advice, strong negative emotive content, emphasis on collective responsibility, highlighting local impacts, and underscoring financial impacts. Participants viewed a random sample of six messages and rated the extent to which each message motivated them to seek out more information and immediately respond to the climate change threat portrayed in the message. Multilevel modeling indicated messages that included strong negative emotive content or provided specific adaptation advice increased adaptation intentions in all three audience segments. Omitting any mention of climate change and emphasizing local impacts increased adaptation intentions in dismissive audiences. Implications for tailoring and targeting climate change adaptation messages are discussed.

© 2015 Elsevier Ltd. All rights reserved.

1. Introduction

People vary considerably in terms of their values, knowledge, and beliefs about climate change (Hine et al., 2013a; Maibach et al., 2011; Morrison et al., 2013; Reser et al., 2012), and climate change communicators should take this diversity into account when crafting and targeting their messages (Hine et al., 2014; Moser & Dilling, 2004; Whitmarsh et al., 2011). For instance, messages that elicit adaptive responses and engage individuals who are already alarmed about global climate change are unlikely to be effective for more dismissive audiences. In particular, there is growing concern that mismatches between messages and target audiences may lead to boomerang effects in which messages elicit responses that are opposite to those intended (Byrne & Hart, 2009). In this study, we employed an innovative methodology – combining audience segmentation, representative design, and hierarchical linear modeling – to investigate which specific attributes of climate change adaptation messages increase adaptation intentions across different audience segments.

The challenges to human livelihoods posed by future climate change are many and vary globally by location, environment, and culture (IPCC, 2014; Richardson et al., 2009). What is clear in almost every society in every part of the world is that a realistic awareness of what impacts climate change will have over the next few decades is generally confined to scientists and senior government officials but not widely recognized within the general population (Eddy, 2014; Lieske et al., 2014; Ruddell et al., 2012). The greatest challenge for the next few decades is therefore less about refining climate projections and more about increasing awareness and engaging communities in climate-change adaptation and mitigation strategies (Abunnasr et al., 2015). With this in

---

mind, this project demonstrates that awareness-raising among heterogeneous populations is not straightforward – as has often been assumed in the past – and that targeted messaging may be the most efficacious means of achieving this.

1.1. Climate change audience segments

Social marketers have long recognized the utility of dividing the general public into homogeneous audience segments based on their psychological and behavioral attributes, and then tailoring and targeting communications designed to elicit socially desirable responses from each segment (Kotler et al., 2002; Lefebvre, 2013; Slater, 1996). To date, most audience segmentation research has been conducted by health researchers interested in designing and developing more effective intervention programs to address issues such as smoking, obesity, and sexually transmitted infections (Lefebvre & Flora, 1988; Mathijssen et al., 2012; Rimal et al., 2009) and by political psychologists aiming to discover the most effective ways to persuade and mobilize prospective voters (Issenberg, 2012).

Climate change researchers are also becoming increasingly interested in investigating audience segmentation as a potential tool to refine communication strategies, although the approach is not without its critics (Corner & Randall, 2011). A recent review of the literature identified 25 climate change studies that have used segmentation methodology (Hine et al., 2014). One of the longest running and best known segmentation programs is the Yale Climate Change Project (2009) under the leadership of Anthony Leiserowitz (Yale) and Edward Maibach (George Mason University). Maibach et al. (2011) conducted a segmentation analysis on a nationally representative sample of 2164 Americans. They applied latent profile analysis to 36 variables assessing climate change beliefs, issue involvement, policy preference, and behavioral responses, and concluded that the American population comprised six distinct climate change audience segments which they refer to as the *Six Americas*: 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. The Yale group's measures and methodology have also been applied to large national samples in Australia (Morrison et al., 2013) and India (Leiserowitz et al., 2013), although some have cautioned about the appropriateness of promulgating a single segmentation approach without careful consideration of communication goals and local contextual factors (Hine et al., 2014). Arguably, there is also an element of circularity in the Six Americas' work given that climate change policy preferences, albeit framed at different levels of specificity, are used as both segmentation and validation variables.

Several studies have employed a less narrow approach to audience segmentation, incorporating a broad range of psychological variables, some of which are not explicitly linked to climate change. For example, a recent Australian study identified five segments (dismissive, doubtful, uncertain, concerned, and adlarmed) using a broad set of profiling variables including environmental values, trust, emotional responses, and spatial and temporal discounting, in addition to the more standard climate change belief variables used in other studies (Hine et al., 2013b). This study also made a clear distinction between psychological variables, which were used for segmentation, and behavioral and policy preference variables, which were used to validate the segments. In the United Kingdom, the Department for Environment, Food and Rural Affairs took a similarly broad approach, segmenting 3600 English residents based on their attitudes, beliefs, and behaviors about environmental issues, including (but

not restricted to) climate change (Department for Environment Food and Rural Affairs, 2008). They identified seven segments (positive greens, waste watchers, concerned consumers, sideline supporters, cautious participants, stalled starters, and honestly disengaged), which varied in terms of unique motivations and barriers, and also in the degree to which they engaged in climate change mitigation behaviors (Barr et al., 2011). We consider these broader approaches to be important, given growing evidence that broader cultural and environmental worldviews, not just climate change specific beliefs, play a central role in determining how individuals perceive, process, and respond to information environmental risks (Douglas & Wildavsky, 1982; Dunlap et al., 2000; Kahan et al., 2011).

1.2. 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 (Moser & Ekstrom, 2010; Nisbet & Scheufele, 2009).

Spence and Pidgeon (2010) found that framing climate change outcomes in terms of gains (relative to losses) was associated with increased perceived severity of climate change impacts. They speculated that gain frames may exert this effect by heuristically cuing a sense of personal or societal self-efficacy—that is, beliefs that something can be done to address climate change. A similar study conducted by Morton et al. (2011) found that messages framed in terms of negative outcomes and high uncertainty decreased participants' intentions to engage in pro-environmental behavior, 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.

There appears to be some disagreement in the literature about the utility of eliciting fear by emphasizing the potentially devastating effects of climate change. Several studies have found fear appeals to be ineffective in eliciting recommended pro-environmental behaviors (Feinberg & Willer, 2011; O'Neill & Nicholson-Cole, 2009). Witte's extended parallel processing model (Witte, 1992) suggests that incorporating efficacy-building information in communications may play an important moderating role. That is, presenting frightening content about threats like climate change elicits fear control processing which leads audiences to disengage or reject threatening messages in an attempt to manage fears. Providing audiences with specific advice about how to cope with the threat elicits danger control processing which leads people to seek out additional information and develop strategies to reduce or eliminate the threat. A host of empirical studies, primarily in the health psychology literature, have provided evidence consistent with this view (Floyd et al., 2000; Witte & Allen, 2000).

Messages have also tacitly framed responsibility for managing climate change to either collective action (e.g., government, community groups) or to individuals that make up the collective. Focus group studies in the United Kingdom have found that messages framing climate change as a collective issue tend to elicit more pro-environmental behavioral responses. Lowe et al. (2006) found that the movie *The Day After Tomorrow* conveyed a sense of collective human responsibility among viewers, along with

increased motivation and a sense of responsibility to take personal action, and Butler (2010) found that focus group participants who took part in a discourse on individual responsibility for climate change reported increased guilt but did not intend to alter their behavior.

Framing research has also indicated that highlighting local impacts may be beneficial in fostering public engagement. Scannell and Gifford (2013) presented information posters that either emphasized local or global climate change impacts and found the locally framed posters elicited higher levels of climate change engagement. They postulated that the personal relevance of local frames may make climate change more tangible and increase an individual's motivation and ability to process the message. Similar findings have been reported by Evans et al. (2014) in the context of climate change adaptation. They found that participants who were initially asked to consider local sea level rise and adaptation measures expressed a stronger willingness to engage in climate change mitigation behavior compared to participants who were asked to consider climate change effects in more general terms.

1.3. Audience segments as a moderator of climate change communication effects

A common feature of most framing studies 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 recognizes audience heterogeneity and highlights the importance of tailoring and targeting messages for specific audiences (Hine et al., 2014; Lefebvre, 2013).

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 et al. (2012) randomly assigned members of their *Six Americas* segments to one of three experimental conditions that involved reading newspaper articles about climate change emphasizing risks 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 have also reported findings that highlight the importance of framing climate change messages to suit the political orientation of audience members. Hart and Nisbet (2012) presented simulated news stories about health impacts of climate change which varied in the proximity of the story exemplars (those occurring in an area near where the study was conducted and those occurring in more distant locations). They found that the proximity manipulation had no effect on support for climate change mitigation policies among US Democrats, yet high social distance significantly decreased support relative to controls for Republicans. In a second study investigating the moderating effects of political orientation, Schuldt et al. (2011) found that framing survey questions about global climate change as "global warming" vs. "climate change" had no impact on Democrats' and Independents' expressed beliefs about whether the phenomenon was real, although for Republicans, the "global warming" frame elicited more skeptical responses.

Finally, Bain et al. (2012) investigated how message-framing effects vary between climate change deniers and believers. For deniers, they found that framing climate change action in terms of improving economic/technological development or increasing social cohesion elicited higher levels of pro-environmental behavioral intentions than frames emphasizing avoiding the risks of climate change. For believers, there was no significant difference; all frames were equally effective.

1.4. Current study

The current study extends previous research on climate change communication in two important ways. First, in the majority of previous studies, audience segments were defined by differences on a single conceptual dimension (e.g., political orientation or belief in climate change). In contrast, we adopted a segmentation strategy that incorporated a much broader range of profiling variables – including values, attitudes, beliefs, trust, and affect – which enabled us to better understand the underlying psychological factors that lead different audiences to respond to climate change communications in different ways.

Second, the majority of previous climate change communication 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 six message attributes that varied across these messages:

- direct reference to climate change,
- specific advice about how to adapt to the threat presented in the message,
- strong negative emotive content,
- appeals to collective responsibility,
- direct reference to local impacts, and
- negative financial impacts associated with inaction.

This enabled us to assess the influence of specific message attributes on the extent to which viewers were motivated to seek out more information and take action in response to the threats conveyed in the messages.

Based on previous climate change audience segmentation studies involving Australian samples (Hine et al., 2013b; Morrison et al., 2013), we hypothesized that latent profile analysis would identify audience segments that ranged from being dismissive or skeptical about climate change to being highly concerned and alarmed. In addition, we predicted these segments would differ significantly in terms of their reported behavioral responses to climate change and their policy preferences for managing existing and potential threats.

Consistent with previous communication framing studies, we hypothesized that the content and framing of climate change communications would reliably predict viewers' intentions to take adaptive action to reduce climate change related threats (e.g., severe storms, bushfires, and heatwaves). In particular, we expected that messages that emphasized local impacts and provided specific advice about how to adapt to climate change threats would increase motivation to adapt in all audience segments. Based on Bain et al.'s (Bain et al., 2012) finding that climate change deniers in Australia were particularly receptive to messages emphasizing social cohesion and economic outcomes, we predicted that messages framed in terms of collective responsibility and financial impacts would resonate most strongly with segments that were dismissive or skeptical about climate change. We also predicted that messages including explicit references to "climate change" in messages that encourage adaptive responses (e.g., to protect against severe storms, floods, or bushfires) would be counterproductive for audiences who did not believe that climate change is occurring. We also predicted that

the presence of strong negative emotive content about climate change outcomes may be less effective with skeptical audiences. For example, Stern (2012) suggested that climate change deniers may manage their fear by rejecting information about climate change and, as a result, may be immune to subsequent messages that focus on fear-inducing adverse outcomes.

2. Method

2.1. Participants

A total of 1182 Australian residents, all members of an online panel sourced by Qualtrics™ (Qualtrics, Provo, UT), responded to the survey. Of these, 151 completed the survey in less than 20 min which we estimated as the minimum time needed to seriously consider and respond to all survey items and messages. These respondents differed significantly from slower respondents on mean scores for the profiling and judgment dimension variables (both variable sets: Wilks' $\lambda = 0.85$, $p < .001$, $\eta^2 = .15$). Consequently, these respondents were dropped from the sample prior to analysing the data.

The final 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 for individuals aged over 18 years were 16.5%, 51.8%, and 31.7%. Most participants (88.3%) indicated that they had completed Year 12 and/or tertiary or trade qualifications, as compared to 73% in the general population. Overall, comparisons with 2011 census data indicated that our sample was younger and better educated relative to national norms (Australian Bureau of Statistics (ABS), 2011).

2.2. Design and procedural overview

After providing demographic details, participants answered questions assessing a broad range of values, beliefs, and affective responses relevant to climate change. These items were used to group respondents into homogenous segments which enabled us to assess which types of climate change adaptation messages were most effective in increasing adaptation intentions within which segments. Next, participants were presented with a series of brief communications promoting adoption of a particular adaptation response to the effects of climate change 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 were coded on the presence or absence of six attributes (e.g., whether the message explicitly mentioned climate change, whether it provided detailed advice to address the climate change threat, etc.), details of which are provided later in Section 2. 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 assessing the extent to which the message elicited perceptions of threat (5 items) and efficacy (2 items), message rejection (3 items) and adaptation intentions (2 items). In the present paper, we focus on the associations between the presence of the six message attributes and extent to which messages motivated viewers to develop intentions to seek out more information and take action related to climate change adaptation. We also assessed whether the magnitude and direction of these associations varied across different audience segments.

Qualtrics™ provided all respondents with a small financial payment for completing the survey.

2.3. Audience segmentation variables

Participants were segmented into "like-minded" subgroups based on their responses on 15 variables reflecting their values, beliefs, attitudes, and emotional responses relevant to climate change: belief that climate change is occurring (2 items, $\alpha = .84$), belief in anthropogenic climate change (1 item assessing the extent to which climate change is due to human activity), perceived risk from climate change (5 items, $\alpha = .89$), knowledge about climate change (10 true-false items, KR-20 = .69), perceived self-efficacy to mitigate climate change (5 items, $\alpha = .90$), trust in climate change authorities (4 items, $\alpha = .75$), perceived spatial proximity of climate change effects (5 items, $\alpha = .73$), perceived temporal proximity of climate change effects (1 item), concern about climate change and the environment (25 items, $\alpha = .93$), distress about climate change (7-items, $\alpha = .93$), outrage about climate change (2 items, $\alpha = .82$), green self-identify (3 items, $\alpha = .87$), and connection with nature (6 items, $\alpha = .93$). The majority of these segmentation items were the same as those used in a previous study to identify distinct climate change audience segments in a large Australian sample (Hine et al., 2013b). The present study included an additional measure to assess outrage in response to climate change, a new decomposed measure of climate change belief that distinguishes between belief that climate change is happening and that humans are a primary cause, and the removal of a measure assessing support for nuclear power.

2.4. Climate change adaptation communications

Sixty climate change adaptation communications were sourced from the Internet following consultation with Australian stakeholders: Commonwealth Scientific and Industrial Research Organisation (CSIRO), Department of Environment and Heritage Protection, Department of Climate Change Energy and Efficiency, Australian Bureau of Agricultural and Resource Economics and Sciences, and Australian Psychological Society. 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; minimizing 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 s to 4 min. Forty messages were categorized as short (estimated viewing time <2 min) and 20 were classified as long (estimated viewing time ≥2 min). A list of the communications used in this study may be found in Hine et al. (2013a, Appendix 2).

2.5. Message attributes

Before survey launch, each message was coded on the presence or absence of six message attributes: (1) explicit reference to climate change/global warming, (2) specific advice about how to adapt to the threat presented in the message, (3) strong negative emotive content (4) appeals to collective responsibility, (5) explicit reference to local impacts, and (6) explicit reference to financial impacts.

Two independent researchers coded all messages. Inter-coder agreement was high, ranging from 93% agreement for financial impacts to 98% agreement for adaptation advice and reference to climate change. Discrepancies were resolved through discussion. Percentages of messages with each attribute are shown in Table 1.

2.6. Adaptation intentions

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 motivated) to 5 (extremely motivated). We created intention scores by averaging across items (α = .84).

3. Results

3.1. Audience segmentation analysis

Latent profile analysis (LPA) was conducted using MPlus 4.1 (Muthén & Muthén, 2006) to classify respondents into audience segments 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), Entropy, the Bayesian Information Criterion (BIC; Schwartz, 1978), and overall interpretability of the solution. The LMR test assesses difference in goodness-of-fit between model k and model $k-1$, where k refers to the number of retained profiles (audience segments). Significant p values indicate that model $k-1$ should be rejected in favor of model k. Entropy indicates classification certainty ranging from 0 to 1.00. The BIC assesses improvement in fit after penalizing for the number of model parameters, where the best fitting model is indicated by the smallest BIC value generated among competing models. All psychological profiling variables were standardized to a mean of 0 and a standard deviation of 1 to equate scales and facilitate computation and interpretation of the segments. The dataset contained no missing values).

Fit indices for 2- through 7-segment solutions are presented in Table 2. The LRM tests indicated that the 3-segment solution fit the data significantly better than the 2-segment solution, and that fit could not be further improved by retaining a 4th segment. A plot of the BIC values indicated that the curve flattened out between segments 3 and 4. This was consistent with the results from the LMR test, indicating that the increase in fit offered by the 4-segment solution was not substantial. The 3-segment solution also produced a high entropy value (.90) and was also the most interpretable. Characteristics of the three climate change audience segments identified by the LPA are shown in Fig. 1.

The first audience segment comprised 20.3% of respondents who we labeled as dismissive about climate change. Mean scores on all psychological indicators were well below the sample average. The second segment included 45.2% of respondents who could be characterized 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. The third segment comprised 34.4% of respondents who we labeled as being alarmed

Table 1
Percentage of messages with each attribute.

Predictor	No	Yes
Climate change reference	62%	38%
Adaptation advice	47%	53%
Negative emotive content	90%	10%
Collective responsibility	67%	33%
Local impacts	37%	63%
Financial impacts	72%	28%

Table 2
Model fit indices for latent profile analysis solutions.

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

Note: BIC: Bayesian information criterion; LMR: Lo-Mendell-Rubin likelihood ratio test.

about climate change. This group scored highly on all assessed cognitive and affective indicators.

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 univariate Fs were significant at $p < .001$, and Tukey's post-hoc tests indicated that all indicator means increased significantly from the dismissive segment to uncommitted segment and from uncommitted segment to the alarmed segment (η^2 ranged from .14 to .60). The predictive utility of the climate change segments was validated by a further MANOVA which revealed that segment membership explained a significant 19.9% of the variance in two adaptive responses to climate change: behavioral responses and support for climate change funding, Wilks' Λ = 0.64, $F(4, 2054)$ = 127.51, $p < .001$, η^2 = .20. Univariate analyses indicated that both outcomes differed significantly across groups at $p < .001$, with behavioral responses and support for funding increasing significantly from dismissive to uncommitted, and from uncommitted to alarmed (η^2 = .18 and .28, respectively).

3.2. Message attributes predicting adaptation intentions

We used policy capturing, in conjunction with multilevel modeling to test our hypotheses about which message attributes would predict adaptation intentions in which audience segments. Policy capturing is a method used in applied psychology to explore the relationships between people's judgments and the information used to make those judgments (Cooksey, 1996), and multilevel modeling provides a flexible statistical platform for quantifying the magnitude of these relationships. In combination, these two tools have been applied in a range of domains including: environmental sustainability (Hine et al., 2009), job performance (Rotundo & Sackett, 2002), and academic decision making (Dahling & Thompson, 2010). In the current study, all of the policy capturing analyses were conducted using HLM 6 (Raudenbush et al., 2004).

Given that each respondent provided adaptation intention judgments for six climate change adaptation messages, randomly selected from a pool of 60 messages, judgments were nested within participants. In the Level 1 (within-person) analysis, regression equations were computed for each participant using adaptation intentions as the criterion variable and the six message attributes (i.e., explicit reference to climate change, adaptation advice, strong negative emotive content, appeals to collective responsibility, reference to local impacts, and reference to financial impacts) as predictors.

The Level 2 (between-person) analysis employed a restricted maximum likelihood approach in which the intercept and beta coefficients from the Level 1 analyses were regressed on two Level 2 dummy coded audience segment variables (i.e., dismissive vs. alarmed, and uncommitted vs. alarmed). Alarmed respondents were used as the reference group given that a key aim of the study was to determine how to improve engagement with audiences that
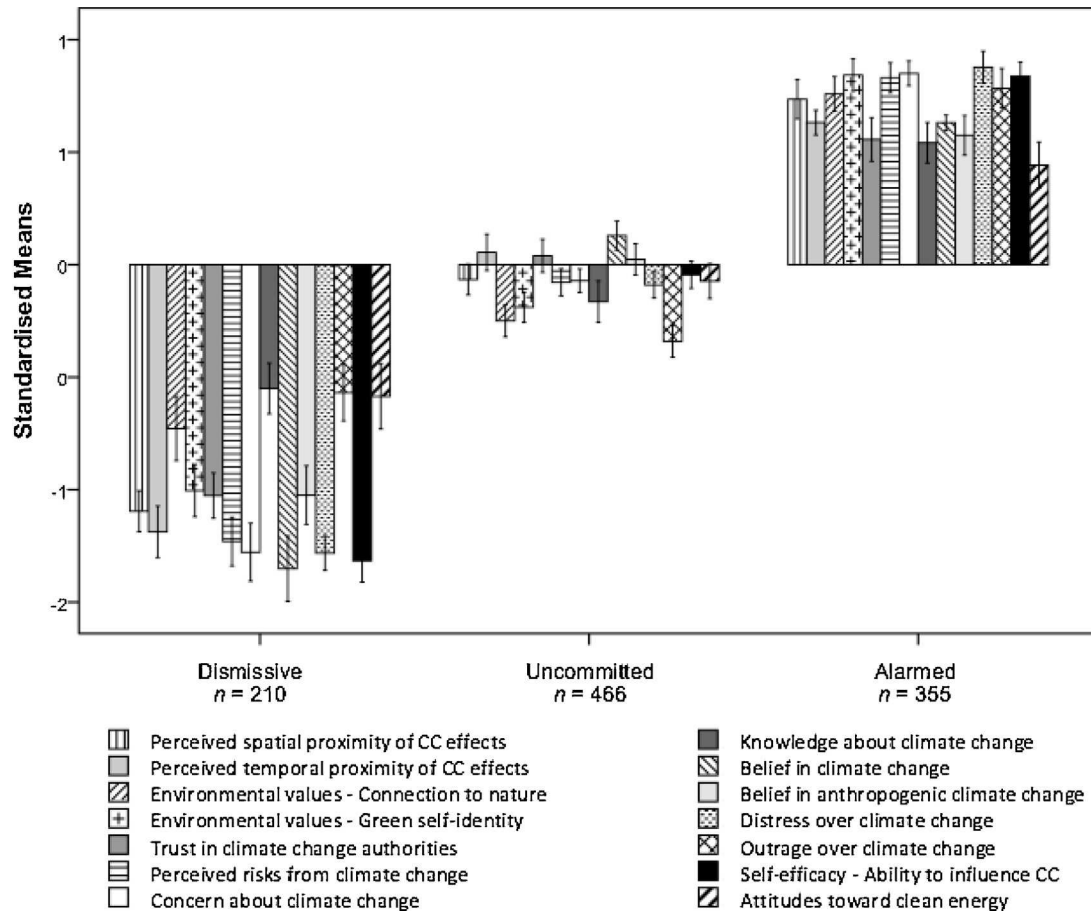
Fig. 1. Psychological characteristics of the climate change audience segments based on latent profile analysis. Error bars: ±1 SE.

were dismissive and uncommitted in their views about climate change. The Level 2 analysis enabled us to assess whether the relation between the climate change adaptation message attributes and adaptation intentions varied systematically as a function of pre-existing mindsets about climate change, and determine which message attributes were associated with increased adaptation intentions within each audience segment.

Sample size is an important consideration in multilevel studies. Maas and Hox (2005) ran a series of simulations in which they varied Level 1 and Level 2 sample sizes. They found that only simulations with small Level 2 samples (consisting of 50 or fewer cases) produced biased Level 2 standard errors. All other simulations, including those with Level 1 sample sizes as small as five, produced accurate and unbiased regression coefficients, variance components, and standard errors at both Level 1 and Level 2. Given the current study had over 1000 respondents at Level 2 and six ratings per respondent at Level 1, it exceeded Maas and Hox's (2005) recommended sample size guidelines.

3.2.1. Unconditional model

As an initial step, an unconditional model (i.e., no predictors at within-individual or between-individual levels) was used to decompose the total variance in adaptation intentions into within- and between-person components. The intraclass correlation from the unconditional model was $r_I = .61$, indicating that over half of the variance in adaptation intentions was attributable to individual differences (between-subjects variance), and less than half reflected within-subjects variance across messages. Given that the intraclass correlation was large, multilevel analysis was an appropriate analysis strategy (Garson, 2013).

3.2.2. Level 1 model: which message attributes predict adaptation intentions?

The Level 1 analysis involved regressing climate change adaptation intentions (the criterion variable) on six dichotomous predictors: explicit reference to climate change, specific adaptation advice provided, strong negative emotional content, appeals to collective responsibility, explicit reference to local impacts, and explicit reference to financial impacts. For all predictors, messages that included the message attribute were coded 2 and messages that did not include the attribute were coded 1.

Average unstandardized coefficients and robust standard errors for the intercept and each of the message attributes are presented in Table 3. The intercept value indicates that, on average, respondents reported adaptation intention ratings of 2.44 ($SE = .13$), just under the mid-point on the 5-point scale. Three of the six message attributes significantly predicted adaptation intentions. Messages that did not specifically mention climate change, provided specific adaptation advice, and contained strong negative emotional content all elicited stronger intentions to adapt to threats conveyed in the messages.

3.2.3. Level 2 model: do message attribute effects vary as a function of audience segment?

A second major aim of the study was to determine whether the effects of message attributes on adaptation intentions varied as a function of audience segment; that is, whether participants were classified as dismissive, uncommitted, and alarmed about climate change. This was addressed by conducting a Level 2 analysis in which segment membership was used to predict the intercept and beta coefficients associated with the message attributes from the

Table 3

HLM level 1 analysis: relationships between message attributes and climate change adaptation intentions.

Variable	Coefficient	SE	t (1029)	Valid cases
Intercept	2.44	.13	18.82**	1030
Climate change reference	−.08	.03	−2.52*	1001
Adaptation advice	.08	.03	2.98**	1011
Negative emotive content	.16	.03	4.68**	493
Collective responsibility	−.01	.04	−.28	947
Local impacts	.03	.03	1.08	927
Financial impacts	.04	.02	1.72	987

Coefficients were computed using HLM's restricted maximum likelihood algorithm, and are interpreted as average unstandardized beta weights. Random effects for each predictor were assessed one at a time, with all other predictors fixed. Given that each participant viewed 6 of 60 messages, some predictors did not vary for some participants in the in the Level 1 regression equation (i.e., the predictor was a constant). In such instances, the HLM software dropped cases with no variability from the analysis. Valid cases refers to the number of cases used to compute each Level 1 coefficient.

* $p < .05$.
** $p < .01$.

Level 1 analysis. Significant Level 2 effects are sometimes referred to as cross-level interactions because the magnitude of the relation between the Level 1 predictors and criterion vary as a function of the value of one or more Level 2 predictors. To aid in the interpretation of the cross-level interactions, all significant Level 2 effects were plotted using HLM's graph module. A summary of the Level 2 analysis is presented in Table 4.

Significant Level 2 effects were found between the dismissive and alarmed segments for the intercept, reference to climate change, and local impacts. The significant effect for the intercept indicated that, on average, members of the alarmed segment scored 1.24 points higher on the 5-point adaptation intention scale than the dismissive segment across the full set of climate change adaptation messages. The climate change reference effect

Table 4

HLM level 2 analyses: message attribute effects on climate change adaptation intentions as a function of audience segment.

Effect	Coefficient	SE	t(1027)
L1 intercept (mean intention)			
Dismissive	−1.24	.35	−3.59**
Uncommitted	−0.52	.29	−1.78
Climate change reference			
Dismissive	−0.37	.08	−4.57**
Uncommitted	−0.11	.07	−1.62
Specific adaptation advice			
Dismissive	0.00	.07	−.02
Uncommitted	−0.02	.06	−.28
Negative emotive content			
Dismissive	−0.06	.10	−.61
Uncommitted	−0.08	.08	−1.08
Collective responsibility			
Dismissive	0.10	.10	1.06
Uncommitted	0.01	.09	.09
Local impacts			
Dismissive	0.20	.08	2.43*
Uncommitted	0.04	.07	.53
Financial impacts			
Dismissive	−0.04	.06	−.68
Uncommitted	−0.03	.05	−.57

Note: for the dismissive and uncommitted effects, alarmed segment members served as the reference group. All significance tests are based on robust standard errors.

* $p < .05$.
** $p < .01$.

indicated that members of the dismissive segment reported lower adaptation intentions in response to messages that explicitly mentioned climate change, relative to messages that did not. In contrast, mentioning climate change had no effect on adaptation intentions for alarmed participants. This group reported relatively strong intentions regardless of whether climate change was mentioned (see Fig. 2a). For the local frame effect, members of the dismissive group were more engaged by messages that emphasized local impacts relative to messages that made no reference to local impacts. For the alarmed segment, emphasizing local impacts had no effect on adaptation intentions (see Fig. 2b).

There were no significant differences in intercepts or beta coefficients between uncommitted and alarmed respondents. That is, climate change message attributes elicited similar adaptation intentions in both of these audience segments.

4. Discussion

We investigated how three Australian climate change audience segments (alarmed, uncommitted, and dismissive) responded to a diverse set of climate change adaptation communications sourced from the Internet. Using hierarchical linear modeling, we determined that climate change adaptation intentions could be increased by including or excluding particular message attributes, and also that message effectiveness could be further enhanced by matching message attributes to specific audience segments. In the sections that follow, we discuss these findings, highlight implications for climate change engagement strategies, and make suggestions for future research.

4.1. Climate change audience segments

We applied latent profile analysis to a set of 14 psychological variables (values, knowledge, beliefs, and affective responses) to identify three distinct climate change audience segments which were characterized as being alarmed (34.4%), uncommitted (45.2%), or dismissive (20.3%) about climate change. This three-group solution is broadly similar to an earlier study by Hine et al. (2013b) who, using a similar set of profiling variables, identified five segments: alarmed (26%), concerned (39%), uncertain (14%), doubtful (12%), and dismissive (9%). Both solutions produced conceptually equivalent anchor segments, but respondents with more moderate views were less differentiated in the current study, all falling within a single segment (uncommitted).

Differences between the two studies are likely attributable to at least three factors. First, Hine et al. (2013b) used a larger sample that was designed to be broadly representative of the Australian population, whereas our current sample was more urban, educated, and younger. Thus, the two samples are not directly comparable. Second, as noted in Section 2, the current study used a slightly modified set of profiling variables compared to Hine et al. (2013b), including additional measures assessing climate change outrage and beliefs about climate change causes, and the removal of a measure assessing support for nuclear power. Finally, there was approximately a two-year gap between data collection periods for the two studies. Audience segments may change over time, with existing segments merging or disappearing, and new segments being created, in line with increasing global understanding and experience of climate change (Hine et al., 2014, 2013b; Leiserowitz et al., 2015).

Despite differences in the number of audience segments identified, validation analyses yielded a similar pattern of results across both studies. Respondents classified as alarmed engaged in more adaptive behavioral responses and reported greater support for climate change funding than those assigned to the uncommitted segment (in this study) or to one of the three central segments;
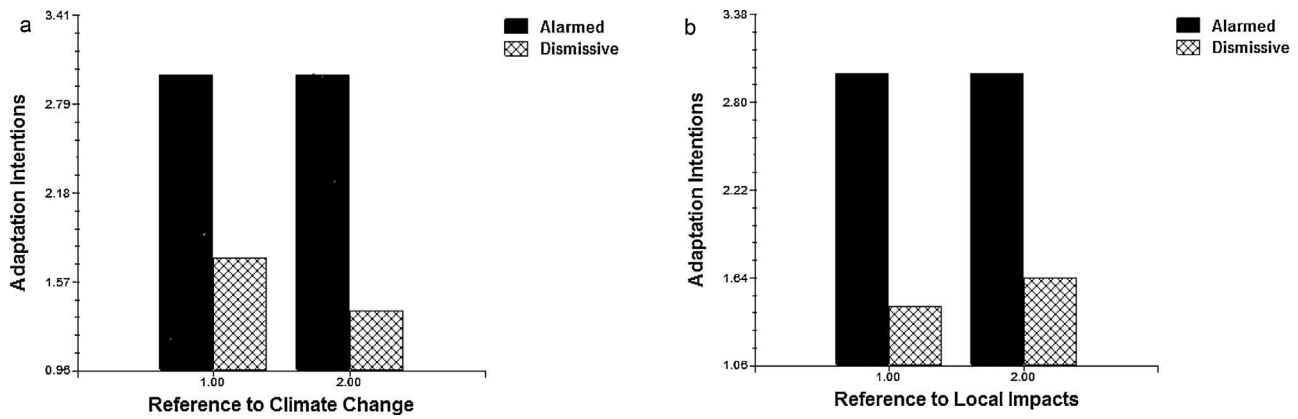
Fig. 2. (a) Cross-level interaction indicating that mentioning climate change decreases adaptation intentions in respondents who are dismissive about climate change, but not in those who are alarmed. (b) Cross-level interaction indicating that highlighting local impacts increases adaptation intentions in respondents who are dismissive about climate change, but not in those who are alarmed.

doubtful, uncertain, or concerned (in Hine et al., 2013b). In turn, *uncommitted/central segment* respondents reported more behavioral responses and support for climate change funding than those classified as dismissive. Thus, our audience segments could be distinguished from each other not only on the basis of their values, knowledge, beliefs, and affective responses to climate change, but also in terms of the extent to which they actively engaged in behaviors to reduce their carbon footprint and adapt to climate change. This is consistent with other climate change audience segmentation studies that have also reported clear differences across audience segments on a range of variables assessing climate-change-related cognition, behavior, and policy support (Hine et al., 2014; Maibach et al., 2011; Morrison et al., 2013).

4.2. Message attributes and adaptation intentions

A central aim of the study was to determine if including specific message attributes in climate change adaptation communications could motivate viewers to generate intentions to adapt to the climate change threats. If yes, which attributes would be most effective for which audience segments, defined on the basis of members' values, beliefs, and behavioral responses to climate change? Although numerous studies have demonstrated the effectiveness of message framing on climate change concern and support for various climate change policies, only a handful of studies have systematically evaluated which frames work best for which audience segments. Our findings support the view advocated by social marketers that messaging should be tailored and targeted to specific audience segments for optimum impact (Kotler et al., 2002; Lefebvre, 2013; Slater, 1996), 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 & Nisbet, 2012; Myers et al., 2012; Schuldt et al., 2011). In other words, the inclusion of certain types of content in climate change messages can be beneficial, detrimental, or have no impact, depending on whether the audience is dismissive, uncommitted, or alarmed about climate change.

Table 5 provides a summary of which message attributes increase and decrease adaptation intentions for each of the audience segments investigated in this study. Two message attributes, providing specific adaptation advice and negative emotive content, were significantly associated with increased adaptation in all audience segments. The adaptation-advice effect is consistent with the extended parallel processing model (Witte, 1992), which suggests audiences are more likely to respond in an

Table 5
Summary of messaging recommendations for motivating dismissive, uncommitted, and alarmed audiences to adapt to climate change.

Message attribute	Dismissive	Uncommitted	Alarmed
Refer to climate change	Detrimental	No effect	No effect
Specific adaptation advice	Beneficial	Beneficial	Beneficial
Negative emotive content	Beneficial	Beneficial	Beneficial
Highlight collective responsibility	No effect	No effect	No effect
Highlight local impacts	Beneficial	No effect	No effect
Highlight financial impacts	No effect	No effect	No effect

adaptive manner when messages about threats, such as climate change, include concrete strategies about how to reduce or eliminate the threat. According to the model, in the absence of efficacy-building information, threat messages often result in fear-control processing in which individuals either attempt to the deny the importance of the threat or discredit the message or messenger. Our finding that negative emotive content increased adaptation intentions for all audience segments surprised us, and runs somewhat counter to the conventional wisdom in climate change communication circles. For example, Feinberg and Willer (2011) argued that messages with dire warnings about climate change may be counterproductive because they contradict people's faith in a just world. Markowitz and Shariff (2012) recommended using emotional carrots (e.g., hope, pride, and gratitude) as opposed to emotional sticks (e.g., guilt, shame, and anxiety) to increase moral engagement with climate change. Stern (2012) argued that climate change deniers may be immune to fear appeals, given they manage their fear by rejecting that climate change is occurring. One possible explanation for our findings running counter to the norm may be fundamental differences between climate change mitigation (the primary focus of previous studies) and climate change adaptation (the focus of the current study). Markowitz and Shariff (2012) cite evidence that suggests that positive emotions are more effective than negative emotions in driving pro-social behavior. Climate change mitigation clearly falls within the class of pro-social behavior, given that if we fail to take action, the future of humanity, or at least civilization as we know it, is threatened; yet this is a distant threat requiring, in the minds of many, only gradual behavioral change. Climate change adaptation, on the other hand, is different; it often requires more immediate responses to short-onset threats such as floods and bushfires. Most of the adaptation messages included in our study focused on taking action to protect one's family and property against severe storms, floods, and bushfires. That is, the focus was not primarily on protecting society and future generations, but

rather on saving oneself and one's direct interests. Thus, although fear may not be particularly effective in eliciting pro-social responses to save the world, highlighting direct threats to self, property, and/or family in an emotionally evocative way appears to be an effective strategy for engaging all types of audiences, particularly, as noted above, if concrete advice for dealing with these threats is also provided. In terms of tailoring messages for specific audience segments, we found that adaptation messages that emphasized local impacts and avoided direct reference to climate change may be particularly effective for audiences who are dismissive about climate change. Providing this information to uncommitted and alarmed segments provided no added benefit, suggesting that this information could be included or excluded without impacting the overall effectiveness of the messages. Our finding regarding the positive impact of local framing on dismissive audiences runs counter to a recent study by Schoenefeld and McCauley (2015) published after we initially submitted this paper. In a small study involving 99 US residents, they found that value orientation moderated the impact of geographical framing on climate change engagement. In particular, they identified a reactance effect involving local framing among participants with high self-enhancement values – values related to power, wealth and hedonism – which have been linked to climate change skepticism in previous research (Corner et al., 2014). High self-enhancement participants who read information about the local impacts of climate change, as opposed to those who read no information, were less likely to consider climate change to be important, engage in pro-environmental behavior and support polices to mitigate climate change. Given substantial differences in sampling, methodology, and outcome measures, it is difficult to pinpoint why the results from our study diverged from those reported by Schoenefeld and McCauley. Additional research is needed to assess the robustness and boundary conditions for effects of message frames highlighting local impacts.

Interestingly, emphasizing collective responsibility and financial impacts associated with climate change threats was unrelated to adaptation intentions for any of the audience segments in our study. This result ran counter to our prediction that these two factors might resonate particularly strongly with audience segments that were skeptical or dismissive about climate change. Bain et al. (2012) found that climate change deniers were particularly receptive to messages that framed climate change mitigation initiatives in terms of potential positive impacts on society and the economy. The failure of the collectivist and financial frames to increase adaptation intentions in our study may once again reflect differences in climate change mitigation and adaptation. These types of frames may be more effective in engaging audiences about global problems that affect all of humanity rather than for messages that emphasize direct personal threats to self, property, and family. It is also worth noting that the failure of the financial frame to increase adaptation intentions in our sample can be viewed as a positive outcome, given growing evidence that activating values related to personal power and financial gain may actively suppress values which foster cooperation and caring for the environment (Corner & Randall, 2011; Thogerson & Crompton, 2009).

Finally, we found that all of the climate change message attributes investigated in this study elicited similar responses from Uncommitted and Alarmed audience segments. If this finding can be replicated, this is good news for climate change communicators given that it suggests that tailoring and targeting messages, which in some instances can be prohibitively expensive, may not be required for these two segments. Messages may need to be specifically crafted for those who are dismissive about climate change. Everyone else can receive similar messages.

4.3. Limitations and future research

This study had several limitations that should be considered when interpreting our findings. First, although we employed a large, diverse national sample, readers should not assume that our findings will necessarily generalize to the Australian population or to other countries where perspectives on climate change may vary substantially from those expressed by our respondents. To evaluate the robustness of our findings, it would be beneficial to conduct additional studies, using a similar methodology, with different representative sets of climate change communications, including those focusing on mitigation as opposed to adaptation, to evaluate the robustness of our findings.

A second important limitation of this study is that it employed a correlational research design. Our results indicated that the presence or absence of specific message attributes was significantly associated with audience responses, and that the nature of these associations varied across climate change audience segments. Yet 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 casual mechanisms. We suggest that the Brunswikian principle of representative design (Brunswik, 1955; Cooksey, 1996) – assessing a broad range of messages currently in use – continue to be applied to ensure a high degree of practical relevance.

Third, although our study was quite broad by conventional standards – both in terms of the number of message attributes and audience segments assessed – it really only scratches the surface in terms of what can be done in this area. There are many other potentially important message features that could be explored in future research, including impacts related to communication channels, the use of imagery, temporal framing, health impacts, and environmental impacts, to name but a few. Similarly, alternative segmentation strategies that focus less directly on climate change beliefs and behaviors also should be explored. It would be particularly beneficial to investigate the effect of different messaging strategies on audience segments derived from influential models of basic human values (Schwartz & Bilsky, 1987), cultural cognition (Kahan, 2012), and environmental worldviews (Dunlap et al., 2000).

Fourth, a major outstanding challenge for climate change communicators is to broaden their focus beyond messages designed to initiate behavior change to strategies designed to sustain behavior change over time. Several studies have shown that prolonged weather extremes (like heatwaves) consistent with popular perceptions of climate change invariably increase concern and promote adaptive behavior (Capstick & Pidgeon, 2014; Capstick et al., 2015). Yet when opposing extremes (like unusually cold winter storms) occur, skepticism about climate change increases, often resulting in the abandonment of mitigation and adaptation initiatives. More research is needed about how to design messaging to help sustain vigilance and behavioral commitment through periods of climate and weather variability, some of which through their very nature encourage complacency.

Finally, it is important that readers not view our findings as a definitive "how-to" guide for developing climate change messages. Rather we consider our results to be general signposts to help climate change communication specialists 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 adjusting communication strategies in response to new climate science findings, trends in media reporting, and the possible emergence of new audience segments. It is also important to acknowledge that increasing audience adaptation intentions, the main outcome variable in this

study, does not necessarily directly translate into effective behavioral responses to climate change. It is also important to understand barriers that may prevent individuals from acting on their good intentions. Identifying and understanding message attributes that drive intention is an important first step. But the behavioral challenges associated with adapting to climate change remain substantial.

4.4. Conclusion

In this study we introduced an innovative methodology – combining audience segmentation, representative design, and hierarchical linear modeling – to assess the impact of tailoring climate change adaptation messages on audiences that were dismissive, uncommitted, or alarmed about climate change. We found that messages that included specific adaptation advice and strong negative emotive content increased adaptation intentions for all three segments. Avoiding direct reference to climate change and highlighting local impacts were particularly effective for the dismissive segment. Highlighting collective responsibility and financial impact were not effective strategies for increasing adaptation intentions for any of the segments. Our results highlight the importance of understanding one's audiences and crafting climate change messages that resonate with them.

Acknowledgements

References

Abunnasr, Y., Hamin, E.M., Brabec, E., 2015. Windows of opportunity: addressing climate uncertainty through adaptation plan implementation. J. Environ. Plan. Manag. 58 (1), 135–155. doi:http://dx.doi.org/10.1080/09640568.2013.849233.

Australian Bureau of Statistics (ABS), 2011. Census of Population and Housing. ACT: Australian Bureau of Statistics, Canberra.

Bain, P.G., Hornsey, M.J., Bongiorno, R., Jeffries, C., 2012. Promoting pro-environmental action in climate change deniers. Nat. Clim. Change 2, 600–603. doi:http://dx.doi.org/10.1038/nclimate1532.

Barr, S., Gilg, A., Shaw, G., 2011. 'Helping people make better choices': exploring the behaviour change agenda for environmental sustainability. Appl. Geogr. 31 (2), 712–720.

Brunswik, E., 1955. Representative design and probabilistic theory in a functional psychology. Psychol. Rev. 62, 193–217.

Butler, C., 2010. Morality and climate change: is leaving your TV on standby a risky behaviour? Environ. Values 19 (2), 169–192. doi:http://dx.doi.org/10.3197/096327110x12699420220554.

Byrne, S., Hart, P.S., 2009. The boomerang effect: a synthesis of findings and a preliminary theoretical framework. In: Beck, C. (Ed.), Communication Yearbook 33. Lawrence Erlbaum, Mahwah, NJ, pp. 3–38.

Capstick, S., Pidgeon, N., 2014. Public perception of cold weather events as evidence for and against climate change. Clim. Change 122 (4), 695–708. doi:http://dx.doi.org/10.1007/s10584-013-1003-1.

Capstick, S., Whitmarsh, L., Poortinga, W., Pidgeon, N., Upham, P., 2015. International trends in public perceptions of climate change over the past quarter century. Wiley Interdisc. Rev. Clim. Change 6 (1), 35–61. doi:http://dx.doi.org/10.1002/wcc.321.

Cooksey, R., 1996. Judgment Analysis: Theory, Methods, and Applications. Academic Press, New York. NY.

Corner, A., Markowitz, E., Pidgeon, N., 2014. Public engagement with climate change: the role of human values. Wiley Interdisc. Rev. Clim. Change 5, 411–422. doi:http://dx.doi.org/10.1002/wcc.269.

Corner, A., Randall, A., 2011. Selling climate change? The limitations of social marketing as a strategy for climate change public engagement. Glob. Environ. Change 21 (3), 1005–1014. doi:http://dx.doi.org/10.1016/j.gloenvcha.2011.05.002.

Dahling, J.J., Thompson, M.N., 2010. Contextual supports and barriers to academic choices: a policy-capturing analysis. J. Vocat. Behav. 77 (3), 374–382. doi:http://dx.doi.org/10.1016/j.jvb.2010.07.007.

Department for Environment Food and Rural Affairs, 2008. A Framework for Pro-Environmental Behaviours. Department for Environment Food and Rural Affairs, London, UK. http://www.defra.gov.uk.

Douglas, M., Wildavsky, A.B., 1982. Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers. University of California Press, Berkeley.

Dunlap, R.E., Van Liere, K.D., Mertig, A.G., Jones, R.E., 2000. Measuring endorsement of the new ecological paradigm: a revised NEP scale. J. Soc. Issues 56 (3), 425–442.

Eddy, T.D., 2014. One hundred-fold difference between perceived and actual levels of marine protection in New Zealand. Mar. Policy 46, 61–67. doi:http://dx.doi.org/10.1016/j.marpol.2014.01.004.

Evans, L., Milfont, T.L., Lawrence, J., 2014. Considering local adaptation increases willingness to mitigate. Glob. Environ. Change 25, 69–75. doi:http://dx.doi.org/10.1016/j.gloenvcha.2013.12.013.

Feinberg, M., Willer, R., 2011. Apocalypse soon? Dire messages reduce belief in global warming by contradicting just-world beliefs. Psychol. Sci. 22 (1), 34–38. doi:http://dx.doi.org/10.1177/0956797610391911.

Floyd, D.L., Prentice-Dunn, S., Rogers, R.W., 2000. A meta-analysis of research on protection motivation theory. J. Appl. Soc. Psychol. 30 (2), 407–429. doi:http://dx.doi.org/10.1111/j. 1559-1816.2000. tb02323.x.

Hart, P.S., Nisbet, E.C., 2012. Boomerang effects in science communication: how motivated reasoning and identity cues amplify opinion polarization about climate mitigation policies. Commun. Res. 39 (6), 701–723. doi:http://dx.doi.org/10.1177/0093650211416646.

Hine, D.W., Gifford, R., Heath, Y., Cooksey, R., Quain, P., 2009. A cue utilization approach for investigating harvest decisions in commons dilemmas. J. Appl. Soc. Psychol. 39 (3), 564–588. doi:http://dx.doi.org/10.2222/j.1559-1816.2009.00451.x.

Hine, D.W., Phillips, W.J., Reser, J.P., Cooksey, R.W., Marks, A.D.G., Nunn, P.D., Watt, S. E., 2013a. Enhancing Climate Change Communication: Strategies for Profiling and Targeting Australian Interpretive CommunitiesNational Climate Change Adaptation Research Facility, Gold Coast, QLD. . 95 pp http://www.nccarf.edu.au/publications/enhancing-climate-change-communication-strategies.

Hine, D.W., Reser, J.P., Phillips, W.J., Cooksey, R., Marks, A.D.G., Nunn, P., Glendon, A.I., 2013b. Identifying climate change interpretive communities in a large Australian sample. J. Environ. Psychol. 36, 229–239. doi:http://dx.doi.org/10.1016/j.jenvp.2013.08.006.

Hine, D.W., Reser, J.P., Morrison, M., Phillips, W.J., Nunn, P., Cooksey, R., 2014. Audience segmentation and climate change communication: conceptual and methodological considerations. Wiley Interdisc. Rev. Clim. Change 5 (4), 441–459. doi:http://dx.doi.org/10.1002/wcc.279.

IPCC, 2014. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. In: Core Writing Team, Pachauri, R.K., Meyer, L.A. (Eds.), IPCC, Geneva.

Issenberg, S., 2012. The Victory Lab: The Secret Science of Winning Campaigns. Crown Publishers, New York.

Kahan, D.M., 2012. Cultural cognition as a conception of the cultural theory of risk. In: Hillerbrand, R., Sandin, P., Roeser, S., Peterson, M. (Eds.), Handbook of Risk Theory: Epistemology, Decision theory, Ethics and Social Implications of Risk. Springer, London, UK, pp. 725–760.

Kahan, D.M., Jenkins-Smith, H., Braman, D., 2011. Cultural cognition of scientific consensus. J. Risk Res. 14, 147–174. doi:http://dx.doi.org/10.1080/13669877.2010.511246.

Kotler, P., Roberto, N., Lee, N., 2002. Social Marketing: Improving the Quality of Life. Sage, Thousand Oaks, CA.

Social Marketing: Six Volume Set. In: Lefebvre, C.R. (Ed.), Sage, Thousand Oaks, CA.

Lefebvre, C.R., Flora, J.A., 1988. Social marketing and public health intervention. Health Educ. Behav. 15 (3), 299–315. doi:http://dx.doi.org/10.1177/109019818801500305.

Leiserowitz, A., Maibach, E., Roser-Renouf, C., Feinberg, G., Rosenthal, S., 2015. Climate Change in the American Mind: March, 2015 Yale Project on Climate Change Communication. Yale University and George Mason University, New Haven.

Leiserowitz, A., Thaker, J., Feinberg, G., Cooper, D., 2013. Global Warming's Six Indias. Yale University, New Haven, CT.

Lieske, D.J., Wade, T., Roness, L.A., 2014. Climate change awareness and strategies for communicating the risk of coastal flooding: a Canadian Maritime case example. Estuar. Coast. Shelf Sci. 140, 83–94. doi:http://dx.doi.org/10.1016/j.ecss.2013.04.017.

Lo, Y., Mendell, N.R., Rubin, D.B., 2001. Testing the number of components in a normal mixture. Biometrika 88, 767–778. doi:http://dx.doi.org/10.1093/biomet/88.3.767.

Lowe, T., Brown, K., Dessai, S., de França Doria, M., Haynes, K., Vincent, K., 2006. Does tomorrow ever come? Disaster narrative and public perceptions of climate change. Publ. Underst. Sci. 15 (4), 435–457. doi:http://dx.doi.org/10.1177/0963662506063796.

Maas, C.J.M., Hox, J.J., 2005. Sufficient sample sizes for multilevel modeling. Methodology 1 (3), 86–92. doi:http://dx.doi.org/10.1027/1614-1881.1.3.86.

Maibach, E.W., Leiserowitz, A., Roser-Renouf, C., Mertz, C.K., 2011. Identifying like-minded audiences for global warming public engagement campaigns: an audience segmentation analysis and tool development. PLoS One 6 (3), e17571. doi:http://dx.doi.org/10.1371/journal.pone.0017571.

Markowitz, E.M., Shariff, A.F., 2012. Climate change and moral judgement. Nat. Clim. Change 2, 243–247. doi:http://dx.doi.org/10.1038/NCLIMATE378.

Mathijssen, J.J.P., Janssen, M.M., van Bon-Martens, M.J.H., van de Goor, I.A.M., 2012. Adolescents and alcohol: an explorative audience segmentation analysis. BMC Public Health 12 (742) Provisional pdf. doi: 10.1186/1471-2458-12-742.

Morrison, M., Duncan, R., Sherley, C., Parton, K., 2013. A comparison of the attitudes toward climate change in Australian and the United States. Aust. J. Environ. Manag. 20 (2), 87–100. doi:http://dx.doi.org/10.1080/14486563.2012.762946.

Morton, T.A., Rabinovich, A., Marshall, D., Bretschneider, P., 2011. The future that may (or may not) come: how framing changes responses to uncertainty in climate change communications. Glob. Environ. Change 21 (1), 103–109. doi: http://dx.doi.org/10.1016/j.gloenvcha.2010.09.013.

Moser, S.C., Dilling, L., 2004. Making climate hot: communicating the urgency and challenge of global climate change. Environment 46 (10), 32–46. doi:http://dx.doi.org/10.1080/00139150409605820.

Moser, S.C., Ekstrom, J.A., 2010. A framework to diagnose barriers to climate change adaptation. Proc. Natl. Acad. Sci. U. S. A. doi:http://dx.doi.org/10.1073/pnas.1007887107.

Muthén, L.K., Muthén, B.O., 2006. MPlus 4.1. Muthén & Muthén, Los Angeles, CA.

Myers, T.A., Nisbet, M.C., Maibach, E.W., Leiserowitz, A.A., 2012. A public health frame arouses hopeful emotions about climate change: a letter. Clim. Change 113 (3–4), 1105–1112. doi:http://dx.doi.org/10.1007/s10584-012-0513-6.

Nisbet, M.C., Scheufele, D.A., 2009. What's next for science communication? Promising directions and lingering distractions. Am. J. Bot. 96 (10), 1767–1778. doi:http://dx.doi.org/10.3732/ajb.0900041.

O'Neill, S., Nicholson-Cole, S., 2009. Fear won't do it promoting positive engagement with climate change through visual and iconic representations. Sci. Commun. 30 (3), 355–379.

Raudenbush, S.W., Bryk, A.S., Congdon, R., 2004. HLM 6 for Windows Skokie. Scientific Software International, Inc., IL.

Reser, J.P., Bradley, G.L., Glendon, A.I., Ellul, M.C., Callaghan, R., 2012. Public Risk Perceptions, Understandings, and Responses to Climate Change and Natural Disasters in Australia and Great Britain. National Climate Change Adaptation Research Facility, Gold Coast, Australia.

Richardson, K., Steffen, W., Schellnhuber, H.J., Alcamo, J., Barker, T., Kammen, D.M., Waever, O., 2009. Climate Change—Global Risks, Challenges & Decisions: Synthesis Report. Museum Tusculanum, København.

Rimal, R.N., Brown, J., Mkandawire, G., Folda, L., Böse, K., Creel, A.H., 2009. Audience segmentation as a social-marketing tool in health promotion: Use of the risk perception attitude framework in HIV prevention in Malawi. Am. J. Public Health 99 (12), 2224–2229. doi:http://dx.doi.org/10.2105/ajph.2008.155234.

Rotundo, M., Sackett, P.R., 2002. The relative importance of task, citizenship, and counterproductive performance to global ratings of job performance: a policy-capturing study. J. Appl. Psychol. 87 (1), 66–80. doi:http://dx.doi.org/10.1037/0021-9010.87.1.66.

Ruddell, D., Harlan, S.L., Grossman-Clarke, S., Chowell, G., 2012. Scales of perception: public awareness of regional and neighborhood climates. Clim. Change 111 (3–4), 581–607. doi:http://dx.doi.org/10.1007/s10584-011-0165-y.

Scannell, L., Gifford, R., 2013. Personally relevant climate change: the role of place attachment and local versus global message framing in engagement. Environ. Behav. 45 (1), 60–85. doi:http://dx.doi.org/10.1177/0013916511421196.

Schoenefeld, J.J., McCauley, M.R., 2015. Local is not always better: the impact of climate change information on values, behavior and policy support. J. Environ. Stud. Sci. doi:http://dx.doi.org/10.1007/s13412-015-0288-y.

Schuldt, J.P., Konrath, S.H., Schwarz, N., 2011. Global warming or climate change? Whether the planet is warming depends on question wording. Public Opin. Q. 75 (1), 115–124. doi:http://dx.doi.org/10.1093/poq/nfq073.

Schwartz, G., 1978. Estimating the dimension of a model. Ann. Stat. 6, 461–464. doi:http://dx.doi.org/10.1214/aos/1176344136.

Schwartz, S.H., Bilsky, W., 1987. Toward a universal psychology of values. J. Pers. Soc. Psychol. 53, 550–562.

Slater, M.D., 1996. Theory and method in health audience segmentation. J. Health Commun.: Int. Perspect. 1 (3), 267–284. doi:http://dx.doi.org/10.1080/108107396128059.

Spence, A., Pidgeon, N., 2010. Framing and communicating climate change: the effects of distance and outcome frame manipulations. Glob. Environ. Change 20 (4), 656–667. doi:http://dx.doi.org/10.1016/j.gloenvcha.2010.07.002.

Stern, P.C., 2012. Psychology: fear and hope in climate messages. Nat. Clim. Change 2, 572–573. doi:http://dx.doi.org/10.1038/nclimate1610.

Thogerson, J., Crompton, T., 2009. Simple and painless? The limitations of spillover in environmental campaigning. J. Consumer Policy 32, 141–163.

Whitmarsh, L., O'Neill, S., Lorenzoni, I., 2011. Engaging the Public with Climate Change: Behaviour Change and Communication. Earthscan, London, UK.

Witte, K., 1992. Putting the fear back into fear appeals: the extended parallel process model. Commun. Monogr. 59, 329–349.

Witte, K., Allen, M., 2000. A meta-analysis of fear appeals: implications for effective public health campaigns. Health Educ. Behav. 27 (5), 591–615. doi:http://dx.doi.org/10.1177/109019810002700506.

Yale Climate Change Project, 2009. Global Warming's Six Americas 2009: An Audience Segmentation Analysis. Yale University and George Mason University. http://environment.yale.edu/climate/files/climatechange-6americas.pdf.