



The role of iconic places, collective efficacy, and negative emotions in climate change communication

Yolanda L. Waters^{a,b,*}, Kerrie A. Wilson^a, Angela J. Dean^{a,b}

^a Centre for the Environment, School of Biology and Environmental Science, Queensland University of Technology, Brisbane, QLD 4000, Australia

^b School of Environment, The University of Queensland, St Lucia, QLD 4072, Australia

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ABSTRACT

Communication strategies designed to strengthen individual and community climate action play a key role in reducing greenhouse gas emissions and averting worst-case climate scenarios. However, communicating climate change in a way that motivates action remains a significant challenge. Through two experimental surveys with representative samples of Australian residents ($n_1 = 723$, $n_2 = 729$), we investigated whether climate messages that highlight relevant and iconic places, such as the Great Barrier Reef (GBR), could strengthen individual action on climate change and if so, what messages are most effective in motivating climate-related behaviour. Participants were randomly allocated to receive one of eight messages about climate change and/or the GBR, or a control condition. In Study 1, we found that climate messages centred around the GBR are more effective in strengthening intentions to adopt energy reduction behaviours than generic (non-reef) climate messages when compared to control. However, we find that they are limited in their ability to motivate more impactful civic and social behaviours, including those which seek to influence climate policy support. In Study 2, we found that messages emphasising collective efficacy can enhance message effect and influence the uptake of a broader range of behaviours, both intentions and in situ behaviour. Mediation analysis suggests that this effect was largely driven by emotions related to distress and that place identity and positive emotions did not play a significant role. This research offers an alternative for those looking to expand beyond traditional climate communication strategies and has implications for both theory and practice.

1. Introduction

The Intergovernmental Panel on Climate Change (IPCC) states that embracing individuals and communities as agents of change is a critical step towards reducing global emissions and averting irreversible damage to our ecological, economic, and social systems (IPCC, 2018, 2021). Indeed, through changes in day-to-day behaviour (known as *private-sphere behaviours*, e.g., reducing household energy use) and by actively engaging in social and civic processes (known as *public-sphere behaviours*, e.g., writing to local representatives), individuals and communities can help pave the way to a decarbonised future (Wolf and Moser, 2011; IPCC, 2018; Dubois et al., 2019). However, motivating individuals to take on such behaviours, particularly at scale, has proven to be a significant challenge (Hine et al., 2013; Morrison et al., 2018; Dean et al., 2020). For example, Morrison et al. (2018) report that individual efforts to reduce household energy use are stagnant or declining and people are becoming less willing to hold companies accountable for

climate-damaging behaviours. More recently, a global survey by the Yale Program on Climate Change Communication reported that relatively few respondents, despite the majority being aware and concerned about climate change, were willing to join a climate group to convince leaders to mitigate climate change (Leiserowitz et al., 2022). Those responsible for communicating climate change issues to the public, such as government and non-government organisations focused on building threat awareness or promoting action, therefore have a difficult task ahead.

1.1. Communicating climate change in a way that motivates behaviour

Early approaches to climate change communication have been criticised for focusing on climate extremes and using techniques that did not resonate with audiences (O'Neill and Hulme, 2009; Scannell and Gifford, 2013; Kundzewicz et al., 2020). For example, it has been argued that focusing on climate impacts that are psychologically distant (e.g.,

* Corresponding author at: School of Environment, The University of Queensland, St Lucia, QLD 4072, Australia.

E-mail address: y.waters@uq.edu.au (Y.L. Waters).

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melting glaciers) and using non-specific statements (e.g., climate change affects life on Earth) has undermined the effectiveness of climate messaging (van der Linder et al., 2015). As such, recommendations typically include emphasising tangible, relatable, and localised impacts (Jones et al., 2017; Scannell and Gifford, 2013; O'Neill and Nicholson-Cole, 2009), and incorporating elements that target behaviour change (Osbaldiston and Schott, 2012; van der Linden et al., 2015; Goldberg et al., 2020).

There is ongoing debate about the effectiveness of communicating local versus generic (distant) climate impacts. The argument for the former being that behaviour change is more likely when an “object of care”, such as a person or place, is seen as threatened (Stedman, 2002; Wang et al., 2018; Gottwald and Stedman, 2020). For example, Scannell and Gifford (2013) found that including information about local areas and using specific place names led to greater intentions to engage in climate-related behaviours compared to general information about climate impacts. However, other studies have found that while emphasising local impacts can lead to more positive attitudes towards climate mitigation, distant and global climate impacts can be perceived as more severe (e.g., Spence and Pidgeon, 2010; Schuldt et al., 2018). Research that extends beyond the local-global dichotomy in place-based climate change communication is limited.

1.2. Message framing around iconic places

In this study, we raise the question of whether places that represent both severe climate impacts *and* are relevant to individuals and communities (referred to herein as ‘iconic places’) can provide an alternative solution to the global versus local place debate in climate change communication. That is, can communication strategies that embrace iconic places inspire greater public engagement with climate change? Building on existing research (Scannell and Gifford, 2013; Spence and Pidgeon, 2010), we define iconic places, in the context of climate change, as places, ecosystems or landmarks that demonstrate severe climate impacts (often associated with distant or global consequences), while also representing personal and symbolic connections (often associated with local places). For example, World Heritage sites such as the Amazon Rainforest, the Great Barrier Reef and the Swiss Alps are known to have strong social and cultural values, but are also approaching climate tipping points (Scheffer et al., 2015). This builds on the work of O'Neill and Hulme (2009) who found that representations of climate change that have high personal relevance or incorporate threats to nature are likely to be more useful in promoting individual climate engagement.

Iconic places may be a useful focus for several reasons. First, they may provoke a sense of *place identity*—the incorporation of place into one's self-concept (Peng et al., 2020; Stedman, 2002; Twigger-Ross and Uzzell, 1996). Importantly, place identity is not limited to local places, but can develop across geographical scales (Bernardo and Palma-Oliveira, 2013; Devine-Wright, 2013; Devine-Wright et al., 2015), or through symbolic connections (Wynveen et al., 2012), making it a potentially useful concept to explore ways that people might connect with and respond to iconic places. Research demonstrates that place identity, and perceived threats to it, can motivate environmental behaviours (Nicolosi and Corbett, 2017; Ramkissoon et al., 2012; Scannell and Gifford, 2013; Stedman, 2002; Vaske and Kobrin, 2001). For example, a study of citizens living near a river landscape in Germany showed that people-place relations were the most powerful predictors of willingness to preserve the local environment (Gottwald and Stedman, 2020). We suspect that messages framed around iconic places may motivate action through a similar mechanism.

However, the potential pathways by which iconic place messaging may motivate uptake of protective behaviours is not well established. For example, place identity is complex – not only may messages make place identity more salient (thus, mediating message effects), place identity may also shape how people respond to a message (thus,

moderating message effects). In addition, research suggests that emphasising climate impacts on iconic places may influence perceptions of issue severity and urgency (O'Neill and Hulme, 2009) or may strengthen perceptions that it is possible to make a difference (O'Neill and Nicholson-Cole, 2009). Drawing on this, we also apply Protection Motivation Theory (PMT) to explore pathways between messages and behavioural intentions. Specifically, PMT describes two pathways to motivating action. Firstly, threat appraisal, which is comprised of belief about the seriousness of the threat and its consequences (*threat severity*) and one's perception of personal vulnerability to experiencing those consequences (*threat vulnerability*). Secondly, coping appraisal, which comprises perception about one's ability to perform an action that tackles the threat (*self-efficacy*), the belief that taking action will alleviate the threat (*response efficacy*) and belief that taking the action will have low personal costs (*response costs*) (Rogers, 1975). Both threat and coping appraisal have been associated with engagement in environmental behaviours (e.g., Bockarjova and Steg, 2014; Hornig et al., 2014; Chen et al., 2019; Kothe et al., 2019), including taking climate action for the Great Barrier Reef (Dean and Wilson, 2022).

1.3. Incorporating additional message elements which target behaviour

Effectiveness of messages in promoting behaviours may depend on the presence of certain message elements (Chong and Druckman, 2007; Nerlich et al., 2010; Gifford and Comeau, 2011). For example, calls to action may focus attention on specific target behaviours, such as private-sphere or public-sphere behaviours (Stern, 2000). A range of other message elements may also be important for encouraging behaviour. For instance, social norms—perceptions of what others do or approve of—influence the uptake of climate-related behaviours (e.g., Rees and Bamberg, 2014; Doherty and Weber, 2016) and integrating normative statements (e.g., “Most people do this”) into climate messages has shown to be effective in motivating energy reduction behaviours and influencing climate policy support (Nolan et al., 2008; de Groot and Schuitema, 2012; Goldberg et al., 2020). In fact, normative message frames are now considered one of the “basics” of effective climate communication (van der Linden et al., 2015).

Efficacy beliefs, defined as “people's beliefs in their capability to exercise control” over certain outcomes (Bandura, 2001, p.14253), are also associated with the adoption of climate-related behaviours (Feldman and Hart, 2015; Doherty and Weblar, 2016; Xue et al., 2016; Bostrom et al., 2019). However, different forms of efficacy exist. For example, efficacy is often divided into four key types, categorised by differing levels of capability and impact: self-efficacy, personal response efficacy, collective efficacy, and collective response efficacy (Table 1). Much research on climate communication has focussed on the distinction between self-efficacy and response efficacy (i.e., one's capability and impact), and less attention has been given as to whether emphasising individual (personal) or group (collective) efficacy is more effective (Bostrom et al., 2019; Jugert et al., 2016). A handful of studies suggest that reinforcing *collective efficacy beliefs* may be more effective, particularly for increasing the adoption of, or intentions to adopt, public-sphere behaviours (Jugert et al., 2016; Doherty and Weblar, 2016; Bostrom et al., 2019; Hornsey et al., 2021).

Table 1
Four types of efficacy adapted from Doherty and Weblar (2016).

	Individual	Group
Capability	Self-efficacy (“You are capable of doing this”)	Collective efficacy (“Together we can do this”)
Impact	Personal response efficacy (“Your actions will have impact”)	Collective response efficacy (“Together, our actions will have impact”)

1.4. The role of emotions

A growing debate in the climate communication literature is on the role of emotions (e.g., [Smith and Leiserowitz, 2014](#); [Feldman and Hart, 2015](#); [Nabi et al., 2018](#)). Specifically, it is unclear whether emotional factors take precedence over other seemingly “rational” responses, such as appraisal of threats and coping responses ([Bamberg and Möser, 2007](#); [Han et al., 2017](#); [Chen, 2020](#)), or whether certain emotional states are more likely to motivate action than others. Increasing evidence suggests that a mix of “positive” and “negative” emotions is likely required ([Chapman et al., 2017](#); [Smith and Leiserowitz, 2014](#); [Hornsey and Fielding, 2016](#)). For example, efficacy messages have been shown to increase climate activism via both positive and negative emotions ([Feldman and Hart, 2015](#)). While iconic places are known to evoke emotional responses ([Coghlan et al., 2017](#); [O’Neill and Nicholson-Cole, 2009](#)), it is not clear whether emotions provide an important pathway for relevant climate messages focusing on iconic places. Thus, in addition to place identity, threat and coping appraisal, we also examine whether positive (such as those related to hope) or negative (such as those related to distress) emotions can help to explain how messages focusing on iconic places may influence climate engagement.

1.5. Case study: the Great Barrier Reef

The Great Barrier Reef (GBR), Australia, is the largest coral reef system in the world and is a national and global icon ([Great Barrier Reef Marine Park Authority, 2019](#)). However, with increased frequency and intensity of mass bleaching events, and media headlines such as “50% of the GBR is dead or dying” ([Eagle et al., 2018](#)), the GBR has grown to represent something more. Where impacts such as melting glaciers and polar bears once dominated public conceptualisations of climate change ([Leviston et al., 2014](#); [Born, 2018](#)), the GBR is an emerging symbol of climate change for many people ([Thiault et al., 2020](#)).

The GBR provides a unique opportunity for framing climate change communication for three key reasons. First, it is predicted that without transformative action to mitigate climate change, the GBR could lose over 90 % coral cover within the next decade ([IPCC, 2021](#); [The Australian Academy of Science, 2021](#)). Second, surveys show that most Australians feel a sense of identity and pride towards the GBR, regardless of physical proximity, and agree that ‘all Australians should be responsible’ for protecting it ([Goldberg et al., 2016](#); [Gurney et al., 2017](#); [Goldberg et al., 2018](#)). Third, consistent with scientific consensus, most Australians agree with statements recognising climate change as the greatest threat to the reef ([Curnock et al., 2019](#); [Thiault et al., 2020](#); [Dietzel et al., 2020](#)).

Several scholars have argued that centring climate messages around the GBR and leveraging its nature as an iconic and vulnerable place may strengthen the uptake of climate-related behaviours among the public ([Thiault et al., 2020](#); [Curnock et al., 2019](#); [Goldberg et al., 2018](#)). However, whether climate communications that centre the GBR are more effective than generic climate messages in motivating the adoption of climate-related behaviours is yet to be empirically tested.

1.6. The present study

Here, using the GBR as a case study, our overarching research question is “To what extent can framing climate change around iconic places strengthen the adoption of climate-related behaviours?” To answer this, we conduct two experimental studies with nationally representative samples of Australian residents to examine how differential framing of GBR and/or climate messages can influence behavioural intentions and in situ behaviours and what are the mechanisms behind message effect. The second study was developed based on the results of the first one to answer a range of research questions in an incremental way. This is a common approach for experimental messaging studies (e.g., [Morton et al., 2011](#); [Schuldt et al., 2018](#); [Wolsko et al., 2016](#)).

2. Methods

2.1. Study 1

In Study 1, we aimed to (1) compare the use of reef-climate messages with generic climate messages and (2) examine whether incorporating normative components into messages could strengthen intentions to adopt climate-related behaviours. We also aimed to (3) explore the mechanisms behind message effect, by testing whether reef identity, threat, and coping appraisal play a mediating role in the relationship between messages and behaviour.

2.1.1. Participants and procedure

Participants over the age of 18 years and currently residing in Australia were invited to participate online via a social research company (PureProfile, ISO 20252:2019 Market, Opinion and Social Research). The sample size required to detect a small expected effect size was calculated a priori as $n = 140$ per group. Quotas were set to collect a representative sample of Australians based on age, gender, and state of residence. An online 15-minute survey was administered during November 2020. Participants were informed that the survey was voluntary, confidential, and anonymous. Institutional ethical clearance was obtained prior to commencement (Approval number #2000000726). The study was preregistered via OSF registries (10.17605/OSF.IO/TN5B8).

2.1.2. Experimental conditions

The study was introduced to participants as “investigating perceptions of environmental issues in Australia”. Participants were randomly allocated to receive either one of four message conditions or no message (control condition) ([Table 2](#)). A no message control was included to provide a baseline measure of engagement with climate related behaviours and ensure a more accurate understanding of message effects ([Li and Su, 2018](#)). Each message ranged from 160 to 200 words, included a general call to action, and was presented in a simple infographic format. Messages about the GBR aimed to activate place identity (herein referred to as *reef identity*) by emphasising statements such as “the Great Barrier Reef is a place that shapes who we are” (similar to [Sapiains et al.,](#)

Table 2

Description and number of participants in each experimental condition (Study 1).

Message condition	Shorthand	Message content	Number of participants
1 Great Barrier Reef (information only)	<i>GBR-info</i>	Information about climate change and its impact on the Great Barrier Reef	140
2 Great Barrier Reef (social norms)	<i>GBR-norms</i>	Information about climate change and its impact on the GBR, plus a descriptive norm highlighting that “75% of Australians are concerned for the GBR and try to do things that will help”.	145
3 Climate change (information only)	<i>climate-info</i>	Information about climate change and its general impact on the environment.	140
4 Climate change (social norms)	<i>climate-norms</i>	Information about climate change and its general impact on the environment, plus a descriptive norm highlighting that “75 % of Australians are concerned about climate change and try to do things that will help”.	147
5 Control (no message)	-	-	151
Total			723

2016). Randomisation checks revealed that age, gender, state of residence, education, voting preference and visits to the GBR were similar across groups (Table S1b).

2.1.3. Outcome variables

- *Behavioural intentions* were measured by asking respondents “In the next 3 months, how likely are you to perform the following behaviours?” (1 – not at all likely, 6 – extremely likely). A list of 13 behaviours covering a range of behavioural categories were presented. Factor analysis using principal components analysis (varimax rotation, Bartlett’s test of sphericity, $\chi^2 = 6766.69$, $p < 0.001$; Table S2a) revealed two separate factors: (1) private-sphere behaviours (Cronbach’s $\alpha = 0.66$, not improved if items removed; mean = 5.21); and (2) public-sphere behaviours (including civic and social behaviours) (Cronbach’s $\alpha = 0.95$; mean = 3.28). The behaviour “switch to a renewable power supplier” was not captured in either category and was removed from further analysis.
- *In situ behaviour* was measured by offering participants the option to receive additional information (on two topics: the impacts of climate change and actions that can be taken, and how to check if your bank or superfund invests in fossil fuels) and to sign an online petition. Participants were invited to open a link on any/all of these options. Due to low frequencies for each single behaviour, we combined these for analysis (1 = clicked at least one, 0 = none).

We note that although personal transport use (e.g., driving, flying) is a major contributor to greenhouse gas emissions, transport-related behaviours were not included in this study. At the time of the survey, many Australians were travelling less due to COVID-19 restrictions, and as such, including travel intentions would have been influenced by factors other than environmental intent.

2.1.4. Mediators

All mediator items were measured using a 1–6 scale where 1 = strongly disagree, and 6 = strongly agree (Tables S4 and S5).

- Drawing on the concept of place identity, a *reef identity* scale was developed to reflect three dimensions suggested by Twigger-Ross and Uzzell (1996): Distinctiveness – “I see myself as a reef person”, continuity – “I feel that Great Barrier Reef is a part of my identity, even if I have never been”, and pride – “I think of myself as someone who loves the Great Barrier Reef and what it represents”. This resulted in one distinct variable (principal components analysis with varimax rotation, Bartlett’s test of sphericity $\chi^2 = 981.14$, $p < 0.001$) with a high reliability score (Cronbach’s $\alpha = 0.85$).
- *Threat appraisal* was measured as threat severity and vulnerability (Rogers, 1975). Severity was measured using two items adapted from Spence and Pidgeon (2010) – “To what extent do you agree with the following statements: (1) The consequences of climate change will be severe, (2) The effects of climate change are unlikely to be too serious” (reverse coded). Vulnerability was measured by adapting questions from previous research (e.g., Brody et al., 2012) – “Climate change will have negative impacts for: (1) Australia, (2) places that are important to me, (3) the environment.” Factor analysis using principal components analysis with varimax rotation showed that all five items load onto a single component with a high reliability score (Bartlett’s test of sphericity $\chi^2 = 2813.99$, $p < 0.001$, Cronbach’s $\alpha = 0.91$).
- *Coping appraisal* was measured by capturing three distinct constructs. Self-efficacy was rated by asking participants to respond to three statements: “I feel capable of helping to reduce

emissions”, “I have the necessary knowledge and skills to help reduce emissions” and “I am confident I can help reduce emissions” (adapted from Roser-Renouf and Nisbet, 2008, Doherty and Webler, 2016). Response efficacy was measured using four items adapted from Doherty and Webler (2016): “Thinking about individual actions taken around the house such as reducing energy use/actions taken in society such as signing petitions and donating, how effective do you think they would be at reducing emissions if (1) you take action, (2) most Australians take action.”. Finally, response costs were measured by adapting several statements from Sutton and Tobin (2011), van Riper et al. (2012) and Curnock et al. (2019) regarding perceived barriers to climate engagement for the GBR (e.g., “This issue is not a priority for me”). Factor analysis using principal components analysis revealed distinct factors (Table S6a). However, these variables were moderately correlated (approximately 0.5) and showed multicollinearity (VIF approaching 2.0). Thus, to avoid compromising any indirect effects (Preacher and Hayes, 2008), we combined all 15 items into a single coping appraisal component (Cronbach’s $\alpha = 0.90$).

2.1.5. Moderators and covariates

Due to the complex nature of identity, we also tested *reef identity* as a moderating variable (i.e., to explore whether identity influences message effect). In addition, we included climate belief and political orientation as moderators as responses to climate change messages may depend on whether one believes climate change is caused by humans (e.g., Jang, 2013; Kalamas et al., 2014), or one’s political orientation, where conservatives tend to be more sceptical and difficult to persuade (Whitmarsh, 2011; Hornsey et al., 2018).

- *Climate belief* was measured by asking participants which statement best reflected their beliefs about climate change: (1) I believe climate change is happening and it is caused by humans, (2) I believe climate change is happening but it is caused by natural fluctuations in Earth’s temperature, (3) I do not think climate change is happening, (4) I have no idea if climate change is happening or not. Belief in human-caused climate change was binary coded for analysis (1 = yes, if first option selected, 0 = no, coded for all other responses).
- *Political orientation* was measured by using a scale adapted from the Pew Political Typology survey used by Dean et al. (2019). Participants were asked the extent to which they agree with the following statements: ‘Business corporations make too much profit’; ‘Poor people have hard lives because government benefits don’t go far enough to help them live decently’; ‘The government today can’t afford to do much more to help the needy’ (reverse scored); ‘Stricter environmental laws and regulations cost too many jobs and hurt the economy’ (reverse scored); and ‘Government regulation of business is necessary to protect the public interest’. Participants rated each item on a 5-point scale (1 = strongly disagree; 5 = strongly agree) (Cronbach’s $\alpha = 0.64$, not improved if any items removed). High scores are associated with more politically progressive values (Table S6).

Basic demographics such as age and gender were recorded (1 = male, 2 = not male). To measure pre-existing levels of environmental behaviour (past behaviour), we asked six questions relating to general actions taken around the home including two related to household waste, two related to water conservation and two related to energy use (e.g., How often would you say you make sure you are putting the right materials in the recycling container? 1 – Never, 6 – Always).

2.1.6. Statistical analysis

Quantitative analysis was conducted using IBM SPSS Statistics (version 27). To determine the effect of message conditions on

behavioural outcomes (compared to control), we conducted a series of multivariate regression-based analyses. Linear regression was used for private and public-sphere intentions (continuous outcomes) and logistic regression was used for in situ behaviour (binary outcome). Continuous variables were standardised for analysis. Three models were conducted for each outcome variable:

- Messages only (dummy coded)
- Messages and covariates (age, gender, past behaviour)
- Messages, covariates, moderators (reef identity, political orientation and climate belief) and interactions between messages and moderators

To identify the most optimal moderation model, all covariates, moderators and interactions between moderators and messages were entered into the model and Akaike's Information Criterion (AIC) was recorded. Least significant predictors were independently removed until the lowest AIC score (within 2 units) was reached. Regression assumptions for multicollinearity, autocorrelation and normality were met. We also independently assessed whether additional factors such as education and income should be included in the models and found that neither influenced results nor significantly improved model predictability. Thus, income and education were not included in the following analysis.

We note our a priori analysis plan proposed using contrast coding (testing the effect of reef-frames vs non-reef frames, and social norm messages vs messages without social norms). This plan had assumed a consistent effect of reef frames and normative messages in each of their respective message groups (see pre-registration). However, initial inspection of the data indicated that this assumption was incorrect. Rather than examining *categories* of message frames, we elected to test the effect of each message compared to control.

Mediation analysis was conducted using the PROCESS 3.5 Macro by Andrew F. Hayes for SPSS Statistics (available at <http://processmacro.org/index.html>) (Hayes, 2017). Mediation analyses, PROCESS Model 4 (simple mediation) and Model 7 (moderated mediation), were run for each independent/dependent variable combination which demonstrated a main or interaction effect on behavioural outcomes. Mediation models included age, gender, and past behaviour as covariates. Bootstrapping procedures with 10,000 samples were used.

2.2. Study 2

In Study 2, we aimed to build on Study 1 by examining whether incorporating efficacy components into messages and changing calls to action could influence message effect on intentions to adopt climate-related behaviours. Specifically, we aimed to compare the use of personal efficacy messages with collective efficacy messages, and test whether the effect of efficacy messages was dependant on whether the target behaviour (i.e., call to action) focused on private-sphere or public-sphere actions. Moreover, this second study aimed to further explore the mechanisms behind message effect, by testing whether emotions play a mediating role in the relationship between messages and behaviour, in addition to reef identity, threat, and coping appraisal.

2.2.1. Participants and experimental conditions

An online 15-minute survey was administered during April 2021. Sampling and recruitment methods were the same as for Study 1. Respondents from Study 1 were excluded from Study 2. Participants were randomly allocated to receive either one of four message conditions about the impacts of climate change on the GBR or a neutral message (control condition) (Table 3). A neutral message control was included in Study 2 to enable additional attention checks within the survey (i.e., "What was the message you just read about?") for data quality control. Analysis of variance and non-parametric tests revealed that groups did not differ in terms of key demographics indicating our randomisation to be successful (Table S1b).

Table 3

Description and number of participants in each experimental condition (Study 2).

Message condition	Shorthand	Message emphasis	Number of participants
1 Personal efficacy and private-sphere behaviours	<i>personal-private</i>	"You can make a difference. By reducing your personal energy use..."	151
2 Personal efficacy and public-sphere behaviours	<i>personal-public</i>	"You can make a difference. Showing your personal support for renewable energies..."	151
3 Collective efficacy and private-sphere behaviours	<i>collective-private</i>	"We can all make a difference. If we all work towards reducing our energy use..."	147
4 Collective efficacy and public-sphere behaviours	<i>collective-public</i>	"We can all make a difference. If we collectively show our support for renewable energies..."	139
5 Control (message about Australian cities)	-	-	141
Total			729

2.2.2. Changes to survey item

The same survey items from Study 1 were used in Study 2. A number of items were adapted, and emotion mediators were added. The outcome variable 'private-sphere intentions' was adapted to improve its reliability score from Study 1 where Cronbach's $\alpha < 0.7$ (Table S2b). To assist with low participation frequencies, two additional options were added for in situ behaviour, including the option to receive more information on the Great Barrier Reef and how to calculate your carbon footprint. In situ behaviour was binary coded for analysis (1 = clicked 'yes' to at least one option, 0 = none).

2.2.3. Mediating variables

Threat appraisal, coping appraisal and reef identity were all measured as in Study 1 (descriptive statistics can be found in Tables S4 and S5). In addition, two scales adapted from Hornsey and Fielding (2016) measured emotional responses: positive emotions related to hope (3 items – hopefulness, encouragement, and optimism) and negative emotions related to distress (3 items – sadness, worry and anxiety). Participants were asked to indicate on a scale of 1–6, to what extent the emotion described how they felt after reading the message presented. Both scales had a high reliability score (hope, Cronbach's $\alpha = 0.89$; distress, $\alpha = 0.86$).

2.2.4. Statistical analysis

Statistical analysis was conducted following the same method in Study 1, where the effects of each message on behavioural outcomes was compared to a control followed by mediation analysis for main and interaction effects.

3. Results

3.1. Study 1

In total, 723 participants provided complete responses to the survey. Compared to the Australian population, the final sample had slightly higher rates of females (53.3 %), older ($M_{age} = 48.75$ years), and university education (45.3 %). Voting preferences generally reflected current Australian voting practices (Table S1).

3.1.1. Effects of messages on private-sphere intentions

Compared to the control condition, two messages were associated with significantly higher private-sphere intentions: *GBR-info* ($\beta = 0.20$, p

= 0.047) and *climate-norms* ($\beta=0.23$, $p = 0.021$) (Table 4 – Model 1a; Fig. 1). The effects for the *GBR-info* message remained when controlling for demographics and past behaviour, whereas the effects for the *climate-norms* message did not (Table 4 – Model 1b). No significant interactions between messages and moderators were observed (Table S7).

3.1.2. Effects of messages on public-sphere intentions

For public-sphere intentions, although our *GBR-info* message generated highest public-sphere intentions (Fig. 1), none of the messages were statistically different to control (Table 4 – Model 2a). However, moderation analysis revealed one significant interaction effect (Table S7). The effect of the *climate-norms* message on public-sphere intentions was moderated by climate belief ($\beta=0.54$, $p = 0.034$). That is, for participants who did not accept human-caused climate change, the *climate-norms* message had a negative effect on public-sphere intentions; for those who did accept human-caused climate change, the message had a minor positive effect. We found no interaction effects for political orientation or reef identity.

3.1.3. Effects of messages on in-situ behaviour

Almost of half of participants (44.5 %) signed the petition or requested information. However, compared to control, no messages had a positive effect on behaviour. In fact, those who received the *climate-info* message ($\beta = -0.56$, $p = 0.019$; Table 4 – Model 3a) were *less likely* to engage in actual behaviours compared to control. This remained when controlling for age, gender, and past behaviour (Table 4 – Model 3b). No significant interactions between messages and moderators were observed (Table S7).

3.1.4. Mediation

The effect of the *GBR-info* message on private-sphere intentions was mediated by coping appraisal (0.03, CI: 0.0003 – 0.08). Specifically, those exposed to the *GBR-info* message showed higher levels of coping appraisal ($\beta = 0.21$, $p = 0.055$) which was subsequently associated with higher levels of private-sphere intentions ($\beta = 0.16$, $p < 0.001$) (Fig. 2). No indirect effects were detected for the *climate-norms* message on private-sphere or public-sphere intentions (Table S9).

3.2. Study 2

In total, 729 participants provided complete responses to the survey. Similar to the sample in Study 1, the final sample was slightly skewed towards being female (57.2 %), older ($M_{age} = 48.9$ median = 49.7) and

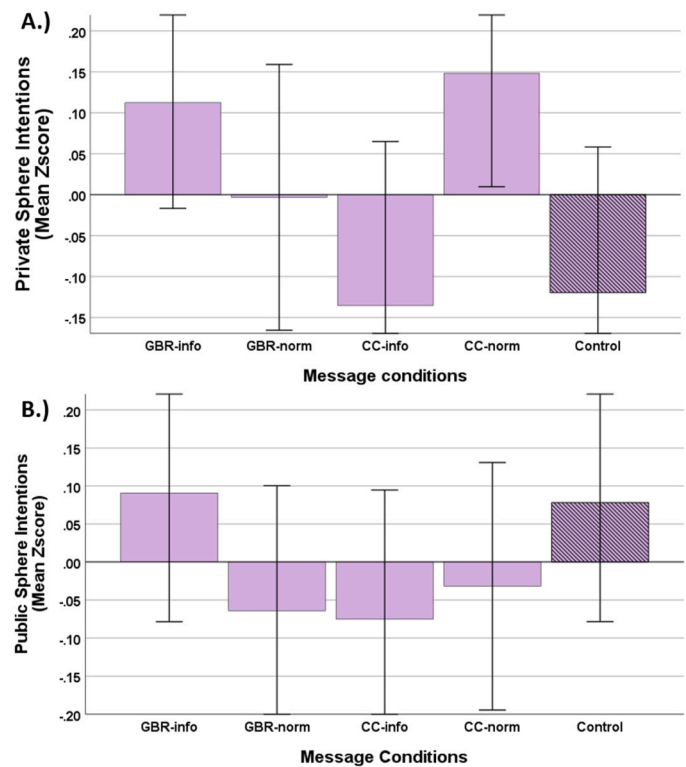


Fig. 1. Study 1 - Bar graphs showing descriptive results for private-sphere (A) and public-sphere intentions (B). For each graph, the Y-axis shows the z-scores for behavioural intentions (mean = 0 and SD=1), and the X-axis is divided by message condition. Error bars showing 95 % confidence interval are depicted. We note that confidence intervals of means are not intended to be an indicator for statistical inference. Statistical inference was based on multivariate analysis, and interpretation confidence intervals for model estimates (Table 4).

university educated (45.3 %). Voting preference reflected current Australian opinion (Table S1).

3.2.1. Effects of messages on private-sphere intentions

A significant positive effect was detected for the *collective-public* message compared to control (Table 5 – Model 1a; Fig. 3). However, when controlling for age, gender, and past behaviour, this finding fell

Table 4
Study 1 - Main effects of messages on dependent variables (with and without co-variables).

	PRIVATE-SPHERE INTENTIONS				PUBLIC-SPHERE INTENTIONS				ACTUAL IN SITU BEHAVIOUR			
	Model 1a		Model 1b		Model 2a		Model 2b		Model 3a		Model 3b	
	B (SE)	CI	B (SE)	CI	B (SE)	CI	B (SE)	CI	Odds ratio	CI	Odds ratio	CI
Messages												
<i>GBR-info</i>	0.20 (0.10)	0.00 * - 0.40	0.17 (0.08)	0.00 * - 0.34	0.02 (0.16)	-0.29 – 0.33	0.01 (0.15)	-0.28 – 0.30	0.65 1.03	0.41 – 1.03	0.66 1.03	0.41 – 1.05
<i>GBR-norms</i>	0.10 (0.10)	-0.10 – 0.30	0.10 (0.08)	-0.07 – 0.26	-0.19 (0.16)	-0.50 – 0.12	-0.18 (0.15)	-0.47 – 0.11	0.85 1.34	0.54 – 1.34	0.86 1.34	0.55 – 1.37
<i>Climate-info</i>	-0.01 (0.10)	-0.21 – 0.19	-0.04 (0.08)	-0.21 – 0.13	-0.21 (0.16)	-0.52 – 0.10	-0.18 (0.15)	-0.47 – 0.12	0.57 0.36 –	0.36 – 0.91	0.58 0.94	0.37 – 0.94
<i>Climate-norms</i>	0.23 (0.10)	0.04 – 0.43	0.16 (0.08)	-0.00 * – 0.32	-0.15 (0.16)	-0.45 – 0.16	-0.11 (0.15)	-0.40 – 0.18	0.65 1.02	0.41 – 1.02	0.64 1.02	0.40 – 1.01
Covariates												
Age	-	-	-0.08 (0.03)	-0.13 – (-0.03)	-	-	-0.39 (0.05)	-0.49 – (-0.29)	-	-	0.86	0.73–0.99
Gender	-	-	0.11 (0.06)	0.00 * – 0.22	-	-	0.08 (0.10)	-0.11 – 0.27	-	-	1.14	0.82 – 1.55
Past behaviour	-	-	0.48 (0.03)	0.42 – 0.53	-	-	0.30 (0.05)	0.20 – 0.40	-	-	1.23	1.04 – 1.44

*Indicates number slightly above zero. * *Indicates number slightly below zero. Note. CI: 95 % confidence interval. Key results are represented by text in bold.

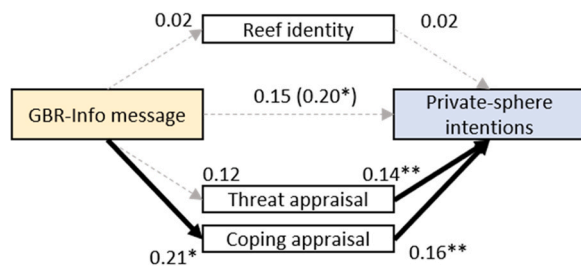


Fig. 2. Path coefficients for mediation model. Message condition is shown in yellow and behavioural outcome in blue. Significant pathways are shown by a solid black arrow and non-significant pathways are shown by a grey dotted arrow. The horizontal arrow in each model shows the direct and total (shown in brackets) effect for each model (i.e., effects not explained by the mediators). All coefficients are standardised. * $p < 0.05$, ** $p < 0.01$.

below the criteria for statistical significance ($p = 0.088$) (Table 5 – Model 1b). All other messages had no main effect on private-sphere intentions compared to control. However, the effect of *personal-private* messages was moderated by political orientation. Specifically, we found that conservatives were slightly more responsive to *personal-private* messages than control, compared to progressives ($\beta = -0.20$, $p = 0.019$) (Table S8). No interaction effects were found for reef identity or climate belief.

3.2.2. Effect of messages on public-sphere intentions

Two messages strengthened public-sphere intentions compared to control (Table 5, Fig. 3). First, a positive effect was found for the *collective-public* message ($\beta = 0.40$, $p = 0.016$; Model 2a), which remained when controlling for age, gender, and past behaviour ($\beta = 0.36$, $p = 0.014$; Model 2b). Second, for the *personal-private* message, public-sphere intentions showed a significant positive effect, but only in Model 2b ($\beta = 0.29$, $p = 0.041$). No interaction effects were found (Table S8).

3.2.3. Effect of messages on in situ behaviour

Just over half of participants (51 %) signed the petition or requested information. In assessing main effects for in situ behaviour, none of the messages were statistically different to control (Table 5 – Model 3a). However, moderation analysis showed that the effects of both collective efficacy messages, *collective-private* and *collective-public*, were moderated by climate belief (respectively, Odds Ratio [OR] = 3.86, $p = 0.030$;

[OR] = 3.55, $p = 0.047$). Specifically, both messages increased the likelihood of seeking information or signing the petition in participants who believed in human-caused climate change, and reduced likelihood of behaviour in those who did not. No interaction effects were found for reef identity or political orientation (Table S8).

3.2.4. Mediation analysis

For private-sphere intentions, the effect of the *collective-public* message was mediated by distress (0.08; CI: 0.002 – 0.17) (Fig. 4A). That is, the *collective-public* message was associated with increased levels of distress which then strengthened private-sphere intentions. Moderated mediation results for the relationship between the *personal-private* message and private-sphere intentions shows that message effect is mediated by coping appraisal and distress. That is, the *personal-private* message was associated with increased levels of both distress and coping appraisal which then strengthened private-sphere intentions. The mediating role of distress was stronger in those with progressive political orientation (Fig. 4B).

Similarly, for public-sphere intentions, the effect of the *collective-public* message was mediated only by distress (0.22; CI: 0.13 – 0.31) (Fig. 4C). In contrast, the effect of the *personal-private* message on public-sphere intentions was mediated by both coping appraisal (0.06, CI: 0.01 – 0.11) and distress (0.18, CI: 0.11 – 0.26) (Fig. 4D). That is, both messages were associated with increased feelings of distress which was associated with stronger public-sphere intentions. The effect of the *personal-private* message on public-sphere intentions was also driven by an increase in coping appraisal.

For actual behaviour, analyses showed that the effect of both collective efficacy messages (*collective-private* and *collective-public*) were mediated by distress (Figs. 4E and 4F). Namely, both messages were associated with increased levels of distress which was subsequently associated with higher levels of actual behaviour. This relationship was moderated by climate belief, where the mediating role of distress was only detected in those who believed in human-caused climate change.

4. Discussion

Here we examined whether iconic places could provide a relevant and inspiring focus for climate change communication and engagement strategies, particularly those aimed at large, general audiences. Specifically, using experimental surveys in representative samples of Australian residents, we set out to investigate whether highlighting climate impacts on the iconic Great Barrier Reef (GBR) could strengthen

Table 5
Main effects of messages on dependent variables (with and without co-variables) – Study 2.

	PRIVATE-SPHERE INTENTIONS				PUBLIC-SPHERE INTENTIONS				ACTUAL IN SITU BEHAVIOUR			
	Model 1a		Model 1b		Model 2a		Model 2b		Model 3a		Model 3b	
	B (± SE)	CI	B (± SE)	CI	B (± SE)	CI	B (± SE)	CI	Odds ratio	CI	Odds ratio	CI
Messages												
<i>personal-private</i>	0.03 (0.11)	-0.18 – 0.24	0.03 (0.09)	-0.15 – 0.20	0.29 (0.16)	-0.03 – 0.61	0.29 (0.14)	0.01 – 0.58	1.09	0.69 – 1.73	1.10	0.68 – 1.76
<i>personal-public</i>	0.04 (0.11)	-0.17 – 0.25	0.03 (0.09)	-0.15 – 0.21	0.21 (0.16)	-0.11 – 0.53	0.20 (0.14)	-0.08 – 0.48	1.06	0.67 – 1.68	1.05	0.65 – 1.68
<i>collective-private</i>	0.09 (0.11)	-0.12 – 0.30	0.09 (0.10)	-0.09 – 0.27	0.23 (0.16)	-0.09 – 0.55	0.21 (0.15)	-0.07 – 0.50	1.12	0.71 – 1.78	1.09	0.68 – 1.75
<i>collective-public</i>	0.22 (0.11)	0.01 – 0.44	0.16 (0.09)	-0.02 – 0.34	0.40 (0.17)	0.07 – 0.72	0.36 (0.15)	0.07 – 0.65	1.59	0.99 – 2.55	1.54	0.95 – 2.51
Covariates												
Age	-	-	-0.12 (0.03)	-0.18 – (-0.07)	-	-	-0.50 (0.05)	-0.59 – (-0.41)	-	-	0.72	0.62 – 0.84
Gender	-	-	0.13 (0.06)	0.02 – 0.25	-	-	0.04 (0.09)	-0.14 – 0.23	-	-	1.36	1.00 – 1.85
Past behaviour	-	-	0.49 (0.03)	0.43 – 0.54	-	-	0.46 (0.05)	0.37 – 0.55	-	-	1.39	1.19 – 1.63

*Indicates number slightly above zero. * *Indicates number slightly below zero. Note. CI: 95 % confidence interval. Key results are represented by text in bold.

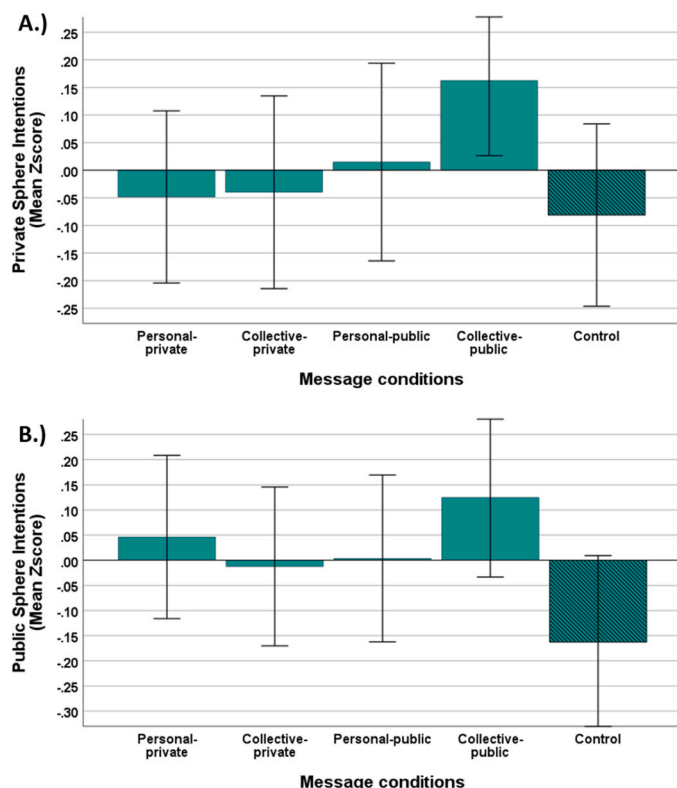


Fig. 3. Study 2 - Bar graphs showing descriptive results for private-sphere (A) and public-sphere intentions (B). For each graph, the Y-axis shows the z-scores for behavioural intentions (mean=0 and SD=1), and the X-axis is divided by message condition. Error bars showing 95 % confidence interval are depicted. We note that confidence intervals of means are not intended be an indicator for statistical inference. Statistical inference was based on multivariate analysis, and interpretation confidence intervals for model estimates (Table 5).

individual action on climate change. Our hypothesis—that climate messages centred around the GBR would be more effective than generic climate messages—was partially supported, in that GBR messages were more likely to strengthen intentions to perform private-sphere behaviours, however with little to no effect on public-sphere intentions and in situ behaviour (Study 1). Building on this, we found that emphasising collective efficacy strengthened message effectiveness, especially when promoting public-sphere behaviours (Study 2).

We reflect on these findings in the context of conservation flagships and argue that a similar concept could be applied to climate change and the GBR (Verissimo, 2019; Thompson and Rog, 2019). That is, as an iconic place, the reef could serve as the focus for broader climate communication and engagement strategies – akin to the use of charismatic species in conservation marketing (Smith and Sutton, 2008; Verissimo, 2019). Though this idea has been suggested by previous scholars (e.g., Goldberg et al., 2018; Dean et al., 2020), this is the first time it has been demonstrated empirically. That is, our study explores the theoretical premise and provides much needed empirical evidence to back up claims that the GBR has the potential to inspire action on climate change. Moreover, we found that GBR messages strengthened private-sphere intentions even for political conservatives, where responsiveness to environmental messaging can be limited (Feldman and Hart, 2018; Hornsey et al., 2018), suggesting that framing messages around the GBR may help to unite those with opposing political viewpoints around a common cause. However, we recognise that the GBR may represent special circumstances, and that our findings may not translate to other iconic ecosystems at risk of reaching climate tipping points (e.g., alpine regions). For example, the reef has been the subject of extreme and polarising media attention which may influence audience

responses (Foxwell-Norton and Konkes, 2021). Therefore, although the potential theoretical and practical implications of this research are encouraging, future research should explore the utility of iconic place messaging and their potential as climate flagships across a range of social and geographic contexts.

4.1. On place, efficacy, and emotion – what is driving message effect?

Both moderation (see supplementary materials) and mediation analysis show that reef identity was positively associated with behavioural outcomes. However, reef identity did not moderate the effects of GBR messages or mediate message effect on behavioural intentions in either study. Though this supports previous research which suggests place identity is linked to environmental behaviour (e.g., see special issue by Devine-Wright and Clayton, 2010), it challenges the role of place identity in environmental communication. There is increasing literature which supports this notion. For example, in a meta-analytical review of climate change message framing, Li and Su (2018) found that messages framed around place had little effect on individual climate engagement. This is likely because place identity, as a component of self-concept and social image, is challenging to modify through a brief message (Peng et al., 2020). Another factor that may explain the limited role of place identity in our findings is our focus on a marine ecosystem. Most place identity research has been conducted in terrestrial settings (van Putten et al., 2018). Given the diverse meanings ascribed to the ocean (Wynveen and Kyle, 2015; Wynveen et al., 2010) and that marine ecosystems may be more psychologically distant than terrestrial ecosystems, it is possible that place identity develops and operates differently for marine environments. For example, in a study looking at ocean imagery, Engel et al. (2021) found that imagery related to place identity (e.g., physical characteristics or symbolic connections) was negatively correlated with environmental behaviours. It is possible that distinct but related concepts, such as ocean connectedness or psychological ownership may be more strongly linked to behaviour (Nuojua et al., 2022; Wang et al., 2022). Gurney et al. (2017) also more broadly explore the concept of place attachment through the lens of community and suggest that attachment to places which represent diverse social, cultural and political meanings such as the GBR may extend beyond conventional definitions (Gurney et al., 2017). Thus, it would be interesting for future research to explore how place identity and related place-based constructs such as place attachment shape engagement with iconic places, including marine places, and whether globally iconic places potentially supersede notions of ‘place’.

However, an important question is then – why was the *GBR-only* message more effective than the *climate-info* message compared to control? First, research suggests that a sense of fatigue with generic climate messaging exists among the public (Morrison et al., 2018), which may explain why the *climate-info* message was generally ineffective. Next, mediation analysis showed that the effect of the *GBR-info* message on private-sphere intentions was mediated by an increase in coping appraisal. Then, in Study 2 where efficacy was emphasised, though coping appraisal played a minor mediating role we found negative emotions to be the most consistent mediators of message effects (Fig. 4). Taken together these findings demonstrate some of the challenges involved in manipulating efficacy beliefs and support assertions that behaviour may also be steered by intuitive factors (Hornsey et al., 2021, 2022). While negative emotions have the potential to reduce behavioural engagement (O'Neill and Nicholson-Cole, 2009; Comtesse et al., 2021), our results suggest that emotions related to distress have a positive role to play in motivating climate-related behaviours. This aligns with other research that indicates negative emotions are an important conduit for environmental action (e.g., Haywood et al., 2016; Dean et al., 2018a, 2018b; Massingham et al., 2019). However, we speculate that negative emotions are insufficient to motivate behaviour alone and that providing pathways to action and strengthening coping appraisal are also important ingredients for engagement (Dean et al.,

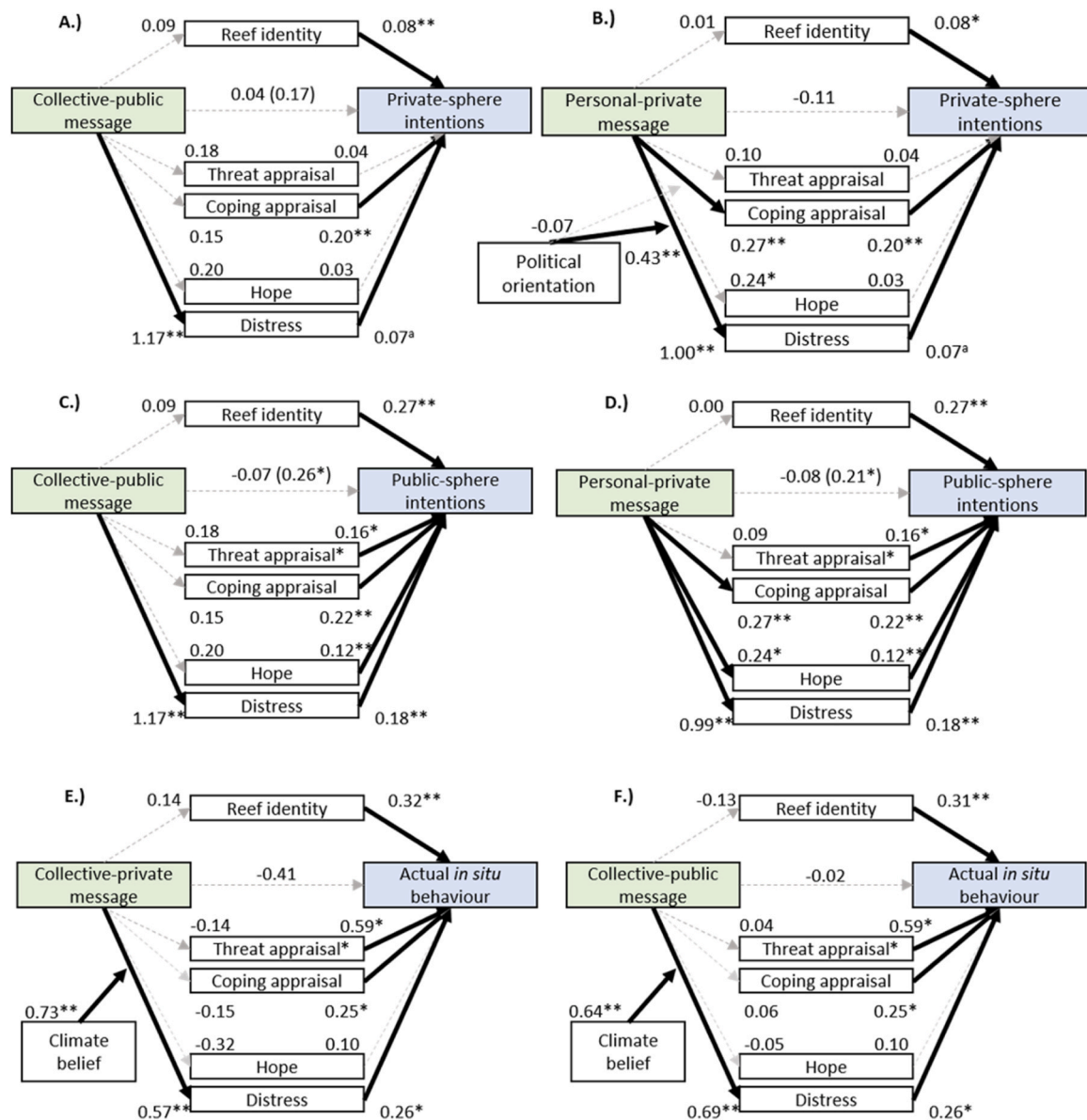


Fig. 4. Path coefficients for each mediation model. Message conditions are shown in blue and behavioural outcomes in yellow. Statistically significant pathways are shown by a solid black arrow and non-significant pathways are shown by a grey dotted arrow. The horizontal arrow in each model shows the direct and total (shown in brackets) effect for each model (i.e., effects not explained by the mediators). Models A, C and D show simple mediation; models B, E and F show moderated mediation with the moderating variable shown at the base of the model. All coefficients are standardised. * $p < 0.05$, ** $p < 0.01$. ^aIndicates a number slightly above $p = 0.05$ (e.g., 0.057), however, indirect pathways are significant.

2018a, 2018b; Dean and Wilson, 2022). In addition, though we found little evidence to suggest the co-occurrence of positive and negative emotions, we consider that perhaps the way we measured positive emotions (e.g., combining hope, optimism, and encouragement) was ineffective as some research shows these emotions may have differential effects on behaviour (i.e., Dean and Wilson, 2022 suggest that hope is more closely related to efficacy than optimism). More research on the relationship between place, efficacy and emotion is needed.

It is important to note that we cannot be certain that feelings of distress were specific to the GBR (as we did not measure emotions in Study 1). Thus, the cause of distress in our study remains an interesting question. It is possible that the reef creates greater message salience, which then generates a perception of potential loss, and subsequent distress. Alternatively, research on individual responses to large-scale or natural disasters suggests that negative emotions may result due to perceived disruptions to a places' "restorative capacity" (e.g., its

capacity to deliver stress relief, sense of calm, fascination) (Ruiz and Hernández, 2014). It is possible that iconic places such as the GBR are associated with high levels of restorative capacity which are now perceived as under threat. However, there is limited research on the role of perceived restorative capacity and environmental behaviour.

4.2. Reinforcing collective efficacy and promoting public-sphere behaviours

Our findings in Study 2 suggest that incorporating collective efficacy messages might be more effective than personal efficacy messages, consistent with emerging literature (Chen, 2015; Jugert et al., 2016), and are most effective when combined with a public-sphere call to action, such as writing to political representatives or talking to family and friends. There are a range of factors that may have contributed to our findings. With respect to efficacy building, these results support findings

from other experiments which highlight the potential of efficacy messages when targeting public-sphere behaviours such as information seeking or donating (Xue et al., 2016; Nabi et al., 2018). In our study, not only did this combination increase public-sphere intentions, but also private-sphere intentions and in situ behaviours, suggesting that emphasising the *collective* and *actions we can take together* can activate a broader motivation to act. This supports findings from Jugert et al. (2016) and the contention of Hornsey et al. (2022) who suggest that “individuals only seem to be able to be convinced that they can make a difference with climate change when they are told that *collectives* can make a difference”. Both papers suggest that this may be driven by social identity processes (e.g., Fritzsche et al., 2017) and call for more climate communications research that explores collective efficacy interventions. Research indicates that social identity has a strong influence on public-sphere behaviours (Fielding and Hornsey, 2016; Fielding et al., 2020; Fritzsche et al., 2017). For example, the Social Identity Model of Collective Action argues that an individuals’ participation in collective action could be predicted by group efficacy beliefs, social identity and perceptions of injustice (van Zomeren et al., 2008). While it was beyond the scope of the current study to explore this in detail, it would be useful for future research to explore the differential contribution of place-based and social identities, and their relationship to collective efficacy, in response to place-protective messages.

We also consider the role of language when interpreting our findings. For example, the *collective-public* message was effective in more circumstances than the *personal-private* message. A possible explanation lies in the word/verb choice for each call to action. In each of our message conditions, private-sphere calls to action used the word “reduce” (i.e., *reduce* energy use) whereas public-sphere calls to action used the word “support” (i.e., *support* renewable energies). Motivational language (“support”) combined with collective pronouns (“we”), as opposed to sacrifice-oriented language (“reduce”) combined with personal pronouns (“I”), has been associated with higher levels of perceived efficacy and climate engagement (Gifford and Comeau, 2011). Overall, our findings from Study 2 support the need to include additional message elements to influence more meaningful behaviour change. More specifically, they support the need to move beyond generic information and calls to action and start promoting the uptake of public-sphere behaviours that people can embrace together.

Finally, we note that there are also several findings from this research which we have not expanded on in detail. For example, consistent with previous research (Schultz et al., 2007; de Groot and Schuitema, 2012; Goldberg et al., 2020), Study 1 showed that normative climate messages (non-reef) can enhance the effectiveness of climate communications. However, reef-focused normative messages were not effective. It is unclear why this is the case. It is possible that respondents found the normative message to be exaggerated or implausible, as research shows most people do not associate reef protection with individual climate actions (Dean et al., 2020). It would be useful for future research to examine the role of different types of norms in responses to place-based messages and whether these are important pathways for action in the context of iconic places. In addition, we reflect on the lack of findings regarding the role of threat appraisal. Research on the GBR shows that climate risk perceptions are heightened following mass bleaching events (Thiault et al., 2021). Given that neither Study 1 or Study 2 were conducted during or after a mass bleaching event, it is possible that the climate threat may have been less salient for participants. The effect of GBR-climate messages on behaviour in the context of future mass bleaching events would be interesting for future research.

4.3. Practical and policy implications

Drawing on our findings, we recommend several principles for improving the effectiveness of communications in encouraging the uptake of climate-related behaviours. First, though our findings suggest the potential for iconic places to strengthen communications around climate

change, there is not yet enough evidence to promote widespread uptake of this approach. However, communicators interested in pursuing this angle should aim to select iconic places that *represent severe climate impacts* and are *relevant to communities*. Second, our findings reinforce the importance of including collective efficacy messages (e.g., “Together we can make a difference”) and ensuring that these are combined with specific calls to action. Ideally, calls to action should emphasise public-sphere behaviours such as talking to others and actively engaging with civic processes rather than providing a large list of relatively “easy” private-sphere behaviours (which other research suggests is ineffective, e.g., Andrews et al., 2022). Third, while normative messages can be effective, we urge communicators to use normative messages cautiously by using believable statements. Finally, echoing previous research, we recommend testing and evaluating message effectiveness when possible.

We recognise communication goals—and subsequent strategies—may vary with different types of communicators. For example, some may have an organisational culture that is less supportive of promoting behaviour change. This may be especially true for public-sphere behaviours, which are typically the focus of non-government rather than government organisations. We suggest that for organisations wanting to promote diffusion of behaviours and influence climate policy support, but striving to remain politically neutral, target behaviours could involve promoting social behaviours such as talking to family and friends about climate change and creating resources that help facilitate these discussions. For example, conversation guides have been developed for educators (e.g., Yale Program on Climate Change Communication, <https://climatecommunication.yale.edu/>) and for the general public (e.g., The Climate Council, <http://www.climatecouncil.org.au>) on how to promote climate change awareness and action. However, though calls to action may differ, ensuring communication strategies are aligned across organisations remains critical (Australian Academy of Science, 2023).

4.4. Limitations and future directions

As mentioned previously, the research presented here was conducted in the Australian context. Thus, it would be useful for future research to examine how iconic places can motivate climate action in different geographic and cultural contexts. Limited effects on public-sphere intentions and in situ behaviour also highlight the challenge of eliciting behaviour change through a brief message. In addition, while we attempted to measure behaviour as accurately as possible, it is still an online study and thus, these can be technically considered proxy measures of behaviour. We also measure in situ behaviour via “clicking” on at least one relevant information link. While this attempts to address the shortcomings of measuring behaviour online, we recognise it is limited and may not represent behavioural engagement in real world settings. Furthermore, measuring self-reported intentions comes with certain considerations such as the potential for social desirability bias (Cerri et al., 2019; Whitmarsh, 2008). Though our participants were anonymous, potentially reducing the desire for social praise, these effects are still worth considering when interpreting results (Vesely and Klöckner, 2020). It is also important to acknowledge the importance of assessing actual behaviours over longer time periods, rather than in the moment following an intervention.

We also note it is possible that, despite attempts to include relevant statements, our messages may have failed to prime reef identity. This may also explain our null findings. We recommend that future experiments explore the effects of priming identity via a range of mechanisms (e.g., priming questions, activities), rather than relying on the brief message itself, or measure alternative place-based constructs such as community-based place attachment (Gurney et al., 2017). Future research should also aim to untangle the relationship between place, collective efficacy, and emotion, particularly in the context of iconic places and climate change messaging, by exploring a wider range of mediation processes.

5. Conclusion

As the impacts of climate change continue to unfold across the globe, finding ways to motivate individual climate action through evidence-based communication strategies is paramount. This research builds on our understanding of finding broad yet relevant focus points for communicating climate change by exploring whether an iconic and vulnerable place, could be used as an inspiring focus for climate change communication strategies. Indeed, our results indicate that climate messages centred around the GBR can strengthen behavioural intentions more than to generic climate messages, particularly when combined with collective efficacy statements. As such, these findings suggest that focusing climate communications on iconic and vulnerable places are a useful addition to the climate communications toolbox. However, the iconic place approach requires further testing and research. For example, this study highlights the limitations of concepts such as place identity when exploring responsiveness to iconic place and climate change messages. In fact, whether place-based concepts play an integral role at all, and whether they relate to other concepts such as collective efficacy or interact with emotions such as hope or distress, remains an interesting and open research question. The present research is only the first step towards understanding an iconic place-based approach to climate change communication. A much deeper inquiry into the nature of iconic places, climate change engagement, and the psychological drivers of place-based behaviour change is critical for the advancement of the field.

Ethics statement

This research was approved by the Queensland University of Technology Human Research Ethics Committee.

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CRediT authorship contribution statement

Waters, Y. L.: Conceptualization, Data Collection, Formal analysis, Writing – original draft. **Dean, A. J.:** Conceptualization, Funding acquisition, Supervision, Writing – review & editing. **Wilson, K.A.:** Supervision, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

All data that is permissible to share according to ethical requirements is available upon request to the authors.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.envsci.2023.103635](https://doi.org/10.1016/j.envsci.2023.103635).

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