Literature review: effectiveness of communications to encourage productive thought and action on climate change

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Introduction

The Workshop have been commissioned to investigate effective messaging to help people think more productively about, and act on, structural causes and solutions to climate change.

This review covers research looking at the evidence for what has worked in campaigns and communications about climate change or the environment more generally. It focuses on work that aligns with The Workshop's theoretically driven, evidence-led framework of communications with a particular emphasis on framing techniques.

Specifically, the review will focus on research about the following communication strategies:

- understanding mental models,
- values-based messaging,
- values-aligned messengers,
- explanatory chains,
- explanatory metaphors,
- other messaging that utilises cognitive and social psychology, including framing and storytelling, to encourage more productive understandings of the problems and solutions.

This report summarises the findings of studies highlighting effective frames. The report is structured around the communication strategies listed above, with narrative descriptions of findings grouped by sub-themes that became apparent when reading the studies. Each sub-theme section is introduced with a summary of overall insights for practice from the findings being discussed.

Search method

The review incorporates grey literature (primarily reports and summaries prepared by groups who have worked on communications about climate change) and academic literature.

Documents covering messaging, framing and communications about climate change and actions to protect the environment have been identified through searches. Due to time

constraints, this review will focus most on those documents that summarise findings from multiple studies to make recommendations for communication strategies. Other literature based on single studies will be referenced but not described in as much detail in the text.

Our search approach was as follows:

1) We collected reports and resources from organisations we were aware have been working on climate change messaging,
2) We searched “climate change messaging” online to find other organisations working in this space and the studies they have conducted, and
3) We conducted a formal literature search. Search terms for academic literature included the following: Framing/frames, values, messaging/message, metaphor, cultural/mental models, communication, AND climate change. Literature searches were firstly conducted via Google Scholar, for reasons of accessibility and because grey literature may be included in search results. Each search combination was tried until three consecutive pages (of 20 results each) showed no new and relevant results. Reference lists of selected papers were also searched and relevant references downloaded for review.

Resources identified and recommended for further reference

The two types of resource with most relevance for this review tended to be either those produced by groups specialising in public communication on science and climate issues, or reviews of evidence on the subject. For further reference, a list of organisations, links and a summary of the climate communication resources they have made available can be found in Table A1 in the appendix.

There have been several reviews of evidence on communicating climate change in recent years; the author of one of these describes “a small but rapidly growing body of scholarly work on climate change communication”[1].Evidence reviews on climate change communication strategies, and notes on their scope and main recommendations, are listed in Table A2 in the appendix.

Context: Aim of communication strategies

Levels of action in response to climate change

A 2014 review of climate change communication literature notes that studies in the area start from the assumption that everyday people have important roles to play in mitigating the effects of climate change, and that studies identify three main ways that the public could respond to

[1] Moser, S. C. (2010). Communicating climate change: history, challenges, process and future directions. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 31-53.

climate change. These are lifestyle change, political influence, and participation in climate science and policy dialogue.[2]

Figure A depicts the spheres of influence within which individuals can inspire collective action. The figure is from a 2017 review on the psychological hurdles to effective action on climate change. [3]

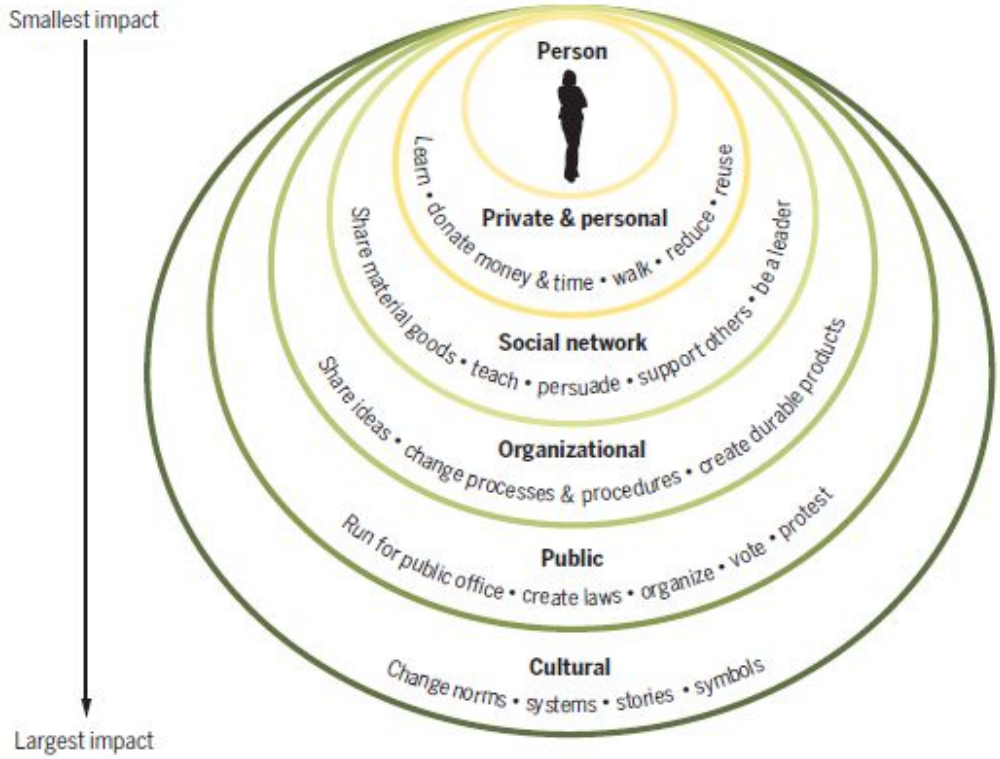

Fig. 1. An individual's spheres of influence. Individual actions have the greatest effect when they influence broader systems.

Figure A: Spheres of influence and individual actions. Illustration: Elise Amel

A lot of earlier climate or environment-based communication strategies appear to have focused more on individual behaviour change (such as switching to "greener" consumer options) rather than motivating individuals towards structural change. More recent studies have taken the systemic nature of climate change and its solutions into account when assessing communication strategies. This review will cover some research that is aimed more at individual

[2] Wibeck, V. (2014). Enhancing learning, communication and public engagement about climate change–some lessons from recent literature. Environmental Education Research, 20(3), 387-411.
[3] Amel, E., Manning, C., Scott, B., & Koger, S. (2017). Beyond the roots of human inaction: fostering collective effort toward ecosystem conservation. Science, 356(6335), 275-279.

behaviour change, but only when the findings can be applied to garnering support for higher-level measures.

One-way or interactive communications

Some authors have pointed out an awkward implication at the heart of many reported communication strategies: that the audience is starting from a place of ignorance and misinformation and needs to be manipulated into new perceptions:
There is often a wish to transmit, educate and inform the public rather than an opportunity to transform decisions and commitments on both sides.[4]

Another review points to a change in the science communication literature towards encouraging transition from a "public understanding of science" to "public engagement with science" approach: "This implies a shift of focus from deficits in lay peoples' scientific literacy to a contextual, dialogue model which acknowledges the situatedness of public understanding of science, and the legitimacy of other knowledge domains in science and policy processes."[5] Researchers and practitioners are urged to consider climate change communications as more than one-way "expert to layperson" message delivery, but to remember that the science and government sectors are part of the overall society that they are aiming to influence. People's perception of climate change issues are influenced by culture, political and social contexts, so agreeing on priorities and solutions may require more interactive dialogue, positioning climate change as part of these overall systems in which people can create change.

[4] Nerlich, B., Koteyko, N., & Brown, B. (2010). Theory and language of climate change communication. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 97-110.
[5] Wibeck, V. (2014). Enhancing learning, communication and public engagement about climate change–some lessons from recent literature. Environmental Education Research, 20(3), 387-411.

Findings

These sections summarise the reviewed evidence for communication strategies that have and have not worked, using each of the following:

- mental models,
- values-based framing,
- explanatory metaphors, and
- explanatory chains.

Mental Models

Insight summary: it is important to begin communication strategies with some understanding of the way the intended audience is likely to receive and interpret information. Communications may need to be tailored to appeal to different mental models existing within a population; within any target audience there are likely to be people more and less ready to receive and act on messages.

The filters through which communications are received

Research on climate-related messaging may use various terms to describe the psychological basis of strategies, however one of the key considerations is that people will be using mental models (potentially also called heuristics) to efficiently decide what to do with information.

"Mental models, which are based on often-incomplete facts, past experiences, and even intuitive perceptions, help shape actions and behavior, influence what people pay attention to in complicated situations, and define how people approach and solve problems. Perhaps most important to climate change communicators, mental models serve as the framework into which people fit new information"[6]

Barriers to change

Communications may be designed to "correct" mental models of public knowledge of climate change science, however research on the topic has shown that it is unlikely to be as simple as informing people of facts. Barriers to changing mental models include:

- Cognitive dissonance (or, the psychology of denial: people's intuitive resistance to ideas which conflicts with beliefs they already hold, and a resultant tendency to find ways to dismiss the uncomfortable information),

[6] Center for Research on Environmental Decisions. (2009). The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public. New York.

- The “trust-gap” hypothesis: people may be suspicious of government positions on climate change, particularly if they perceive that the issue has been politicised and that the evidence is uncertain,
- Ideology: people’s values, social norms and political preferences influence their reception of information about climate change and adaptation strategies.[7]

Worldviews and values

Research links different value priorities to different motivations, and different ways of understanding the world (worldviews), all of which influence the kinds of messages that an individual will find most motivating. Information will be filtered through people’s values and worldviews, which thus influence how people will interpret and prioritise that information. Research on climate messaging has classified people’s values and motivations into various binaries, including:

Promotion vs Prevention focus: “People with a promotion focus see a goal as an ideal and are concerned with advancement. They prefer to act eagerly to maximize or increase gains. People with a prevention focus, however, see a goal as something they ought to do and are concerned with maintaining the status quo. They prefer to act vigilantly to minimize or decrease losses.”[8]

Self-transcendence vs Self-enhancement: Research shows people with a self-transcendent mindset (also including values such as altruism) being more supportive of policies to combat climate change.[9] Although people hold a range of values at once, those who strongly identify with the more self-focused values are less likely to identify with self-transcending values like respect for the environment or altruistic concerns.[10]

Hierarchy vs Egalitarianism (a cultural preference for an equitable division of resources) and Individualism vs Communitarianism (whether individual interests should be subordinated to

[7] Zia, A., & Todd, A. M. (2010). Evaluating the effects of ideology on public understanding of climate change science: How to improve communication across ideological divides?. Public understanding of science, 19(6), 743-761.
[8] Center for Research on Environmental Decisions. (2009). The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public. New York.
[9] https://theclimatecommsproject.org/values-worldviews-and-ideology/
Corner, A. , Markowitz, E. and Pidgeon, N. (2014), Public engagement with climate change: the role of human values. WIREs Clim Change, 5: 411-422. doi:10.1002/wcc.269
[10] Schwartz SH. Universals in the content and structure of values: theoretical advances and empirical tests in 20 countries. In: Zanna MP, ed. Advances in Experimental Social Psychology, vol. 25. San Diego, CA: Academic Press; 1992, 1–65.

collective ones)[11]. Those who endorse hierarchical or individualistic values have been shown as more likely to downplay environmental risks.[12]

There have also been studies in several countries segmenting people into "types" based on their response to or acceptance of climate change information. All these studies have found varying levels of concern and acceptance, including the presence of skepticism, in each population. Overall however, the studies are taken to show that an individual's attitude towards climate change is determined by their preexisting worldview.[13]

Group identity

Research has repeatedly found that people more readily accept information that confirms with their existing biases (confirmation bias) or their group identity (social affiliation). The messengers selected to deliver climate communications will be more effective if the target audience recognises them as part of their own group, able to tap into the mental models people use to understand climate change, as well as qualified to comment (for example, religious leaders may be trusted to deliver messages about climate change as a moral issue, but less so to explain the science).[14]

Appeals to group identity can encourage positive action[15], but may also cause people to reject communications which challenge their group identity - leading to a challenge for science communicators addressing diverse audiences, since messages that work for one group may backfire for others[16]. A psychological experiment has found that emphasising in-group responsibility was not an effective climate change communication strategy. Being told their group (nation, in this case) were responsible for environmental issues made people less inclined to believe in human-made climate change.[17]

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[11] Douglas M, Wildavsky AB. Risk and Culture: An Essay on the Selection of Technical and Environmental Dangers. California: University of California Press; 1982.

[12] Dan M. Kahan, Hank Jenkins-Smith & Donald Braman (2011) Cultural cognition of scientific consensus, Journal of Risk Research, 14:2, 147-174, DOI: 10.1080/13669877.2010.511246

[13] Wolf, J., & Moser, S. C. (2011). Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. Wiley Interdisciplinary Reviews: Climate Change, 2(4), 547-569.

[14] Moser, S. C. (2010). Communicating climate change: history, challenges, process and future directions. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 31-53.

[15] Center for Research on Environmental Decisions. (2009). The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public. New York.
http://frameworksinstitute.org/assets/files/PDF_oceansclimate/expanding_our_repertoire.pdf

[16] Center for Research on Environmental Decisions. (2009). The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public. New York.
Bolsen, T., & Shapiro, M. (2017, July 27). Strategic Framing and Persuasive Messaging to Influence Climate Change Perceptions and Decisions. Oxford Research Encyclopedia of Climate Science.

[17] Jang, S. M. (2013). Framing responsibility in climate change discourse: Ethnocentric attribution bias, perceived causes, and policy attitudes. Journal of Environmental Psychology, 36, 27-36.

Values-based framing

Appeals to shared values can be used to frame issues so people engage. A values-based approach to climate change messaging has been defined as one that goes beyond the economic definition of "value" to shift attention towards "a deeper understanding of what climate change means for society"[18].

Insight summary: different value frames will be more effective for particular audiences and issues. These should be selected and adapted as needed. However, some overall advice comes up repeatedly in the literature:

- **communicate about the relevance of climate change to things people value (whether ideals or physical/ environmental features);**
- **frame climate change as more than just an environmental issue (making it relevant to the issues most valued by the target audience, and making clear that fit relates to other system-level problems);**
- **where possible make information locally-relevant, and develop solutions in consultation with affected communities;**
- **include information about solutions and positive actions alongside information about serious risks and impacts;**
- **appeal to people's sense of community membership to inspire action;**
- **emphasise facts that make people feel less social risk from taking action (social norms around environmental activity and activism);**
- **make a strategic decision on whether to appeal to an audience's current values or to attempt to move their values towards those more likely to support the required actions;**
- **do not appeal solely to fear and guilt;**
- **do not use messages that evoke political partisanship, that imply climate issues are the site of ideological warfare, or that provoke anger and defensiveness;**
- **emphasise the potential for human ingenuity to develop solutions, frame these solutions using positive wording choices, and show how people can become involved.**

Types of frame

The following table describes the types of frame that have typically been used in climate change communications in the USA. These frames appeal to different audiences and concerns. The author (Nisbet, 2009) notes that none of these frames are necessarily advocating for a particular policy or ideology. Indeed, some such as economic framing have been used to both argue for

[18] O'Brien, K. L. and Wolf, J. (2010), A values-based approach to vulnerability and adaptation to climate change. WIREs Clim Chg, 1: 232-242. doi:10.1002/wcc.30

and against climate mitigation actions. The author also notes that framing should not be seen as "placing a false spin" on an issue but rather: "as an attempt to remain true to what is conventionally known about an issue, as a communication necessity, framing can be used to pare down information, giving greater weight to certain considerations and elements over others."[19]

Table 2. Typology of frames applicable to climate change

Frame	Defines science-related issue as . . .
Social progress	A means of improving quality of life or solving problems; alternative interpretation as a way to be in harmony with nature instead of mastering it.
Economic development and competitiveness	An economic investment; market benefit or risk; or a point of local, national, or global competitiveness.
Morality and ethics	A matter of right or wrong; or of respect or disrespect for limits, thresholds, or boundaries.
Scientific and technical uncertainty	A matter of expert understanding or consensus; a debate over what is known versus unknown; or peer-reviewed, confirmed knowledge versus hype or alarmism.
Pandora's box/Frankenstein's monster/runaway science	A need for precaution or action in face of possible catastrophe and out-of-control consequences; or alternatively as fatalism, where there is no way to avoid the consequences or chosen path.
Public accountability and governance	Research or policy either in the public interest or serving special interests, emphasizing issues of control, transparency, participation, responsiveness, or ownership; or debate over proper use of science and expertise in decisionmaking ("politicization").
Middle way/alternative path	A third way between conflicting or polarized views or options.
Conflict and strategy	A game among elites, such as who is winning or losing the debate; or a battle of personalities or groups (usually a journalist-driven interpretation).

SOURCES: W. A. Gamson and A. Modigliani, "Media Discourse and Public Opinion on Nuclear Power: A Constructionist Approach," *American Journal of Sociology* 95, no. 1 (1989): 1–37; U. Dahinden, "Biotechnology in Switzerland: Frames in a Heated Debate," *Science Communication* 24, no. 2 (2002): 184–97; J. Durant, M. W. Bauer, and G. Gaskell, *Biotechnology in the Public Sphere: A European Sourcebook* (Lansing, MI: Michigan State University Press, 1998); M. C. Nisbet and B. V. Lewenstein, "Biotechnology and the American Media: The Policy Process and the Elite Press, 1970 to 1999," *Science Communication* 23, no. 4 (2002): 359–91; and M. C. Nisbet, "Framing Science: A New Paradigm in Public Engagement," in L. Kahlor and P. Stout, eds., *Understanding Science: New Agendas in Science Communication* (New York: Taylor & Francis, in press, 2009).

From: Nisbet, M. C. (2009)

[19] Nisbet, M. C. (2009). Communicating climate change: Why frames matter for public engagement. Environment: Science and policy for sustainable development, 51(2), 12-23.

Framing for science communication to counter spin and encourage action

A summary of evidence to help environmental scientists frame climate information came up with six guidelines. These were particularly geared to counter the preexisting spin being used by other interest groups such as fossil fuel advocates.

Guideline 1: Use the “Progress” Frame, and Avoid the “Trade-Off” Frame
Guideline 2: Use the “Scientific Debate” Frame, and Avoid the “Balancing Norm” Frame
Guideline 3: Use the “Land Ethic” Frame, and Avoid the “Dominion” Frame
Guideline 4: Use the “Truth” Frame, and Avoid the “Theory” Frame
Guideline 5: Use the “Problem-Solving” Frame, and Avoid the “Catastrophe” Frame
Guideline 6: Use the “Adaptation” Frame, and Avoid the “Costs vs. Benefits” Frame.[20]

Variations on these recommended frames can be found in a number of other studies, to be discussed further in this review. While some of these recommendations relate to how scientific information is reported (particularly guidelines 2 and 4), others relate to values. Avoiding the “dominion” frame (guideline 3) is an interesting moral point, and may be of particular note in societies such as New Zealand's with a history of colonisation and a strong affinity with indigenous cultural values. Whereas some audiences prefer to be told that humans have dominion over the natural world, the suggestion from this research is that it is more productive to frame the protection of animals, plants and landforms as an ethical issue. The FrameWorks Institute have identified a similar issue exacerbated by news media: that when stories pit environmental health and economic heath against each other the connection between human wellbeing and the environment is not shown, and nature is portrayed as “subservient to human exploitation”.[21] Such findings indicate that the dominion framing might need to be actively pushed back against, rather than simply avoided.

Researchers drawing on psychological literature have found, again, the cognitive barriers to people accepting messages about acting on climate change include a perception that it is non-urgent and personally distant. They recommend the following five strategies to policymakers:
(a) emphasize climate change as a present, local, and personal risk;
(b) facilitate more affective and experiential engagement;
(c) leverage relevant social group norms;
(d) frame policy solutions in terms of what can be gained from immediate action; and

[20] Rademaekers, J. K., & Johnson-Sheehan, R. (2014). Framing and re-framing in environmental science: Explaining climate change to the public. *Journal of Technical Writing and Communication*, *44*(1), 3-21.
[21] Susan Nall Bales (2009). How to Talk About Climate Change and Oceans. Washington, DC: FrameWorks Institute.

(e) appeal to intrinsically valued long-term environmental goals and outcomes.[22]

The following table summarises the key psychological issues, and advice for countering them.

Table 1. Overview of Key Psychological Lessons and Policy Advice

Psychological lesson	Policy guideline	Example policy recommendation
1. The human brain privileges experience over analysis	Highlight relevant personal experiences through affective recall, stories, and metaphors.	The National Park Service (NPS) gives concrete examples of how climate change has already harmed natural resources in specific parks.
2. People are social beings who respond to group norms	Activate and leverage relevant social group norms to promote and increase collective action.	Government climate science agencies could improve efforts to highlight descriptive norms (e.g., the scientific consensus on human-caused climate change).
3. Out of sight, out of mind: reduce psychological distance	Emphasize the present and make climate change impacts and solutions locally relevant.	NASA and The National Oceanic and Atmospheric Administration (NOAA) are supporting efforts to enable TV meteorologists to educate their viewers about current local climate change impacts.
4. Nobody likes losing but everyone likes gaining	Frame policy solutions in terms of what can be gained (not in terms of what is lost).	The Environmental Protection Agency's (EPA) "Clean Power Plan" focuses on cleaning up the nation's fuel supply, which will help clean up the nation's air and water, providing direct health benefits to all Americans.
5. Tapping the potential of human motivation	Leverage intrinsic motivation to support long-term environmental goals.	The President, Congress, and all federal agencies should be openly aspirational in designing climate policy initiatives that tap into citizens' deeply held motivations for building a better tomorrow.

From Van der Linden, S., Maibach, E., & Leiserowitz, A. (2015).

Framing tailored to existing values

A literature review of work on values and the framing of climate change campaigns notes two primary trends in recent values-based climate change campaigning: messages oriented towards self-transcendent values, and messages designed to match values the audience already holds (a technique also referred to as social marketing, which tends to incorporate audience segmentation research). The reviewers found potential unintended consequences from each of these approaches: environmental campaigns with a self-transcendent focus (environmentalism, lower consumption, exhortations to save the planet) could further polarise public opinion:

Framing the issue in these terms, while factually accurate, has worked to associate climate change with certain cultural values (e.g. self-transcendence, altruism) while ignoring or explicitly denigrating others (e.g. materialism or hedonism). One unintended result of this is that public engagement with climate change has become polarized along values-based lines: individuals and groups that tend to strongly endorse self-transcendent values have come to view climate change as a serious problem requiring immediate ameliorative action, while those who more

[22] Van der Linden, S., Maibach, E., & Leiserowitz, A. (2015). Improving public engagement with climate change: Five "best practice" insights from psychological science. *Perspectives on Psychological Science*, *10*(6), 758-763.

strongly endorse self-enhancement values have come to view action on climate change as an (implicit) attack on their values...[23]

Social marketing techniques, meanwhile, may do well at identifying ideas that various audiences will find motivating, and to prompt at least short-term behaviour change. They have the potential to provoke interest from people who do not identify with self-transcendent or traditionally 'pro-environmental' ideas. Another review of qualitative studies in different countries found such divergent views among populations that, the authors concluded, "one-size"fits-all: campaigns were unlikely to reach a wide audience; therefore message testing with target groups is needed.[24] A longstanding audience segmentation study, Global Warming's Six Americas, identifies unique audiences within the American population (Alarmed, Concerned, Cautious, Disengaged, Doubtful, Dismissive) and measures changes in the proportion of people who fit into each audience segment, to aid message development[25].

However, some campaigners have criticised these approaches for diluting the message by appealing to people's' existing values - which may not be congruent with effective climate action - when it is necessary to encourage more self-transcendent values.[26] A similar tension was found in research on New Zealand climate activists' communications strategies: the need to compromise between "speaking your own truth" and "meeting people where they are at", which risks undermining the integrity of the message.[27]

Framing climate change as more than an environmental issue

Some studies on ideological barriers to acceptance of climate change messaging have come up with suggestions for values-based framing that will be more appealing to conservative audiences. Zia and Todd drew on the "butter vs guns" theory - which posits that conservatives are more interested in issues relating to security and defence ("guns"), while climate change tends to be framed as a "butter" issues, that is, one of the issues relating to domestic and social welfare than national security. They found that as ideology shifts from liberal to conservative, survey respondents are more likely to believe that climate change scientists are not clear about understanding the climate change science. They thus suggest that climate change could be reframed as a climate security threat, or as a matter of religious morality, since conservatives in

[23] Corner, A. , Markowitz, E. and Pidgeon, N. (2014), Public engagement with climate change: the role of human values. WIREs Clim Change, 5: 411-422. doi:10.1002/wcc.269
[24] Wolf, J., & Moser, S. C. (2011). Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. Wiley Interdisciplinary Reviews: Climate Change, 2(4), 547-569.
[25] https://climatecommunication.yale.edu/about/projects/global-warmings-six-americas/
[26] Corner, A. , Markowitz, E. and Pidgeon, N. (2014), Public engagement with climate change: the role of human values. WIREs Clim Change, 5: 411-422. doi:10.1002/wcc.269
[27] Oosterman, J. (2018) Communicating for systemic change: Perspectives from the New Zealand climate movement. Counterfutures, 5: 79-107

the United States tend to be more worried about military security and more religious.[28] Others have also suggested that *morality and ethics frames* can be used to bring religious and scientific leaders' perspectives together.[29] It is unclear whether these findings would translate as well to a New Zealand audience, however; there are also the risks of polarisation to consider. The US population features significant polarisation on climate change, with scepticism more related to ideology than in other countries, so caution is urged when applying results to other populations.[30]

Another caution against using a "national security" (or "guns") frame comes from a survey in the USA of people aligned with each of the six previously identified audience segments. National security framing provoked unintended angry feelings among some audience segments. This study found that a public health framing was most successful in eliciting "emotional reactions consistent with support for climate change mitigation and adaptation".[31]

In concluding the 2014 review, the authors noted that up to that point communications had tended to concentrate more on individuals and individualistic solutions, while it would be more helpful to appeal to values that encourage participatory, group-level action. Acknowledging the potential unintended consequences of values-based messaging, they suggest that communicators need to find a way to appeal to diverse values, bearing in mind that most people likely hold a mix of values:

The challenge for climate change communicators seeking to make the most effective use of research on human values is to identify ways of bridging between the diverse values that any given group of individuals holds and the values that are congruent with a more sustainable society. Coupling, for example, values around security or freedom with self-transcending values like concern for the welfare of others is one possible way of resolving the tension between the social marketing and 'common cause' approaches to campaigning...[32]

Another 2014 review of climate change communication strategies pointed out that "climate fatigue" was a potential barrier to engagement but that, as suggested in the previous quote, climate change messages could be reframed to show the relevance to a wider range of concerns such as public health, economics, security or sustainable development.[33]

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[28] Zia, A., & Todd, A. M. (2010). Evaluating the effects of ideology on public understanding of climate change science: How to improve communication across ideological divides?. Public understanding of science, 19(6), 743-761.

[29] Nisbet, M. C. (2009). Communicating climate change: Why frames matter for public engagement. Environment: Science and policy for sustainable development, 51(2), 12-23.

[30] https://theclimatecommsproject.org/the-role-of-framing-and-message-tailoring-in-communicating-climate-change/

[31] Myers, T. A., Nisbet, M. C., Maibach, E. W., & Leiserowitz, A. A. (2012). A public health frame arouses hopeful emotions about climate change. Climatic change, 113(3-4), 1105-1112.

[32] Corner, A. , Markowitz, E. and Pidgeon, N. (2014), Public engagement with climate change: the role of human values. WIREs Clim Change, 5: 411-422. doi:10.1002/wcc.269

[33] Wibeck, V. (2014). Enhancing learning, communication and public engagement about climate change–some lessons from recent literature. Environmental Education Research, 20(3), 387-411.

Framing to address the value of place, cultural knowledge, and connection with local environments

A 2017 review on the psychological hurdles to effective action on climate change identifies that collective action, rather than small individual-level actions, is what will be needed. However there are many challenges to enabling this, particularly because climate issues do not feel immediate or personally relevant:

Human beings are reticent to change their behavior even under the most compelling of circumstances, and environmental dangers do not tend to arouse the kind of urgency that motivates individuals to act….

we need to take actions now to avoid problems later on even though we personally may not experience these consequences...

To counter this disconnect, climate change discussions need to be framed as matters related to current impacts at the local level. [34]

Another overview of values-based approaches to vulnerability and adaptation to climate change describes such an approach as one that:
recognizes and makes explicit that there are subjective, qualitative dimensions to climate change that are of importance to individuals and cultures.[35]

This review (O'Brien and Wolf 2010) also acknowledges that climate policies designed to appeal to one group's values may conflict with another's. This fact, however, is taken as further support for the idea that debates about climate change go beyond scientific finds and resource issues to cover the reasons climate change matters to people, who is seen to win and lose and whose values are being prioritised. One suggestion O'Brien and Wolf make, potentially with particular relevance to New Zealand and the Pacific, is that climate change has cultural implications and is disrupting traditional knowledge and culture in island societies. A values-based approach could highlight what those losses could mean, how affected communities are adapting and what their values and priorities are.[36]

Another review of climate communication literature also suggests that:

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[34] Amel, E., Manning, C., Scott, B., & Koger, S. (2017). Beyond the roots of human inaction: fostering collective effort toward ecosystem conservation. Science, 356(6335), 275-279.
[35] O'Brien, K. L. and Wolf, J. (2010), A values-based approach to vulnerability and adaptation to climate change. WIREs Clim Chg, 1: 232-242. doi:10.1002/wcc.30
[36] O'Brien, K. L. and Wolf, J. (2010), A values-based approach to vulnerability and adaptation to climate change. WIREs Clim Chg, 1: 232-242. doi:10.1002/wcc.30

place attachment and place identity are of particular relevance to public engagement on adaptation as it goes a long way toward explaining the quality of the adaptation debate to date while offering promising opportunities for dialogue. [37]

A research article reviewing evidence on the impacts of climate change on Arctic and Pacific nations the potential cultural and social impacts of climate change deserve more prominence in decision-making, alongside the physical and economic risks that are more usually valued.[38] It is unclear, however, whether the effectiveness of messages based on these values have been tested.

Some researchers have begun to theorise a framework for values that are at risk from sea-level rise, to inform equitable approaches to planning and adaptation[39]. These appear to be more "things that people value" as opposed to "values people hold". However further research testing values approaches to climate change adaptation in coastal communities in Australia identified diverse perspectives on which values residents prioritised most highly. This research separated approaches into "lived values" (things people value about their everyday lives) and "landscape values" (social and cultural values in geographic space), both of which have potential to inform adaptation policy:
information provided in the lived values and landscape values mapping approaches are complementary in supporting climate change risk assessment and adaptation planning in coastal areas. [40]
Another study concerning things people value found that people interested in activities such as gardening and bird watching were more motivated to action by messages about dangers to significant bird species, whereas messages about danger to humans were less effective.[41]

Ramm et al, in their 2017 study about fostering collective action for conservation, also identified the importance of people developing personal connections to the natural world. More contact with nature would lead people to value it and thus be more likely to understand the

[37] Moser, S. C. (2014). Communicating adaptation to climate change: the art and science of public engagement when climate change comes home. Wiley Interdisciplinary Reviews: Climate Change, 5(3), 337-358.
[38] Adger, W. N., Barnett, J., Chapin III, F. S., & Ellemor, H. (2011). This must be the place: underrepresentation of identity and meaning in climate change decision-making. Global Environmental Politics, 11(2), 1-25.
[39] Graham, S., Barnett, J., Fincher, R., Hurlimann, A., Mortreux, C., & Waters, E. (2013). The social values at risk from sea-level rise. Environmental Impact Assessment Review, 41, 45- 52. DOI: 10.1016/j.eiar.2013.02.002
[40] Ramm, Timothy David and Graham, Sonia and White, Christopher John and Watson, Christopher Stephen (2017) Advancing values-based approaches to climate change adaptation : a case study from Australia. Environmental Science and Policy, 76. pp. 113-123. ISSN 1462-9011 , http://dx.doi.org/10.1016/j.envsci.2017.06.014
[41] Dickinson, J. L., Crain, R., Yalowitz, S., & Cherry, T. M. (2013). How framing climate change influences citizen scientists' intentions to do something about it. The Journal of Environmental Education, 44(3), 145-158.

interdependence of human and natural systems, and to support conservation action.[42] Meanwhile, people living in urban environments and protected from climate risks by technology or insurance are less likely to notice incremental environmental changes, and can thus dismiss them.[43] A synthesis of qualitative studies also found that individuals' views on climate change are shaped by their experience, either direct or vicarious (i.e. watching films about climate change). However, some of the studies reviewed had shown that experience with the impacts of climate change does not always lead to increased concern or to behaviour change oriented towards mitigation. Levels of concern were more related to individuals' engagement with the issue than their experience of impacts.[44]

Framing to address partisanship, community membership and social influences

Because climate change has become subject to political divides, it may be particularly important to avoid word choices that evoke political partisanship. For example, Nisbet describes an unsuccessful frame used by climate activists: comparing distortion of climate science to the George W. Bush administration's misuse of evidence in making the case to go to war in Iraq.[45] To avoid this evocation of distasteful politicking, the FrameWorks Institute recommends switching words like "politician" for "elected official or community leader" and "Government" for "our state/community".[46]

Research in Victoria, Australia on framing that policymakers could consider for local-level climate adaptation also resulted in recommendations to focus on community-level messages. This included making room for co-development and exchange of ideas; centering community wellbeing as a starting point for prioritising action; and providing approiate information in order to retain trust and engagement: "Credible information and accessible, salient language, storylines, 'tangible' examples, and scenarios are needed to better engage the community".[47]

Implicit in the above suggestions is the idea that an appeal to communal values or group membership will engage people more; however this idea should perhaps be seen in light of the other findings about how some people identify more than others with such values. Moser (2010) had identified a key challenge: that trying to define a just response to climate change brings up

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[42] Amel, E., Manning, C., Scott, B., & Koger, S. (2017). Beyond the roots of human inaction: fostering collective effort toward ecosystem conservation. Science, 356(6335), 275-279.
[43] Moser, S. C. (2010). Communicating climate change: history, challenges, process and future directions. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 31-53.
[44] Wolf, J., & Moser, S. C. (2011). Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. Wiley Interdisciplinary Reviews: Climate Change, 2(4), 547-569.
[45] Nisbet, M. C. (2009). Communicating climate change: Why frames matter for public engagement. Environment: Science and policy for sustainable development, 51(2), 12-23.
[46] FrameWorks Institute (2017) Expanding Our Repertoire: Why and How to Get Collective Climate Solutions in the Frame
[47] Fünfgeld, H., & McEvoy, D. (2011). Framing climate change adaptation in policy and practice. Victorian Centre for Climate Change Adaptation Research, Melbourne.

'moral uncertainties' about what our responsibilities are (these are likely to be viewed differently by those with a more or less self-interested value frame), and that people need opportunities to jointly develop narratives that allow them to see their place in the fate of Earth and humanity.[48] These findings all back up the assertion that climate messaging needs to involve positive, collaborative dialogue.

Amel et al (2017), in investigating evidence for how to encourage more support for collective-level changes, found that alignment with social identity was key (as other research has found, appeals to "green" identity can reinforce "green" social norms[49] but may unintentionally alienate those who identify differently). They also found that perceived social risks may inhibit people from speaking out on important issues like climate change. They thus concluded that it would be useful to emphasise facts about how many other people are interested in and concerned about the issue:

Perceived social risks, such as fear of appearing biased or incompetent, fear of rejection, or the belief that others disagree about the issue, inhibit many from speaking out about critical issues. People tend to underestimate how many others share their opinion, which hampers willingness to be vocal (37). Emerging evidence suggests, however, that when individuals realize they are not alone in their beliefs about a contentious issue, they become willing to speak out. Specifically, self-censorship about anthropogenic climate change decreases when people understand just how many others acknowledge its reality and are concerned about it (38).[50]

Effective values-based frames

Two pieces of research done with the american public were found in the area of values-based frames. The first was that done by ASO COmmunications in partnership with Eco American and the Natural Resources Defense Council [51]. Along with a number of effective messages, the researchers found using "responsibility" to our future generations to be an effective intrinsic

[48] Moser, S. C. (2010). Communicating climate change: history, challenges, process and future directions. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 31-53.
[49] Center for Research on Environmental Decisions. (2009). The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public. New York.
[50] Amel, E., Manning, C., Scott, B., & Koger, S. (2017). Beyond the roots of human inaction: fostering collective effort toward ecosystem conservation. Science, 356(6335), 275-279., referencing
Geiger, N., & Swim, J. K. (2016). Climate of silence: Pluralistic ignorance as a barrier to climate change discussion. Journal of Environmental Psychology, 47, 79-90.
Donsbach, W., Salmon, C. T., & Tsfati, Y. (Eds.). (2014). *The spiral of silence: New perspectives on communication and public opinion*. Routledge.
[51] ecoAmerica, Lake Research Partners, and Krygsman, K., Speiser, M., Perkowitz, R. (2015). *Let's Talk Climate: Messages to Motivate Americans*. Washington, D.C.
https://ecoamerica.org/wp-content/uploads/2015/11/eA-lets-talk-climate.pdf

values based frame. The specific message recommended to prime this responsibility value was :

"Of all the things we'd love to leave our children and future generations, ***a healthy place for them to raise children of their own may be the most important.*** *But today, we use fuels that pollute the air in our kids' lungs and the water in their cups. We are changing our climate and, with it, many things we depend upon for the future. What do we want to work for and be remembered for? We can leave our children and future generations* ***an America where the air is clean and the water is safe.*** *By increasing the use and production of the safe sources of sustainable energy we have now, like wind and solar, we can be proud of what we have created for generations to come and a happy surprise when we open our energy bills – the choice is ours to make for a clean energy future." pg 16, ecoAmerica et al (2015)*

The FrameWorks Institute also recommends moving away from an individualistic framing towards encouraging people to act collectively as citizens to find solutions.[52] They particularly recommend two value frames to concentrate on:
Protection ("It is crucial for us to protect people, and the places we all depend on, from being harmed by the issues facing our environment") and
Responsible Management (By taking practical steps to address problems facing our environment today, we are acting in the best interest of future generations")[53]

The FrameWorks Institute found that appeals to the value of Scientific Authority were less successful than those using values of Protection and Responsible Management. They have therefore recommended that scientists communicate issues to the public using a Responsible Management framing, rather than emphasising scientific authority.[54]

Framing to avert hopelessness and emphasise solutions

A noted problem with climate change messaging is that concentrating on negative or scary messages can turn people off. If people get the impression that the situation is hopeless they may become fatalistic, while messages that seem excessively doom-laden may also prompt denial or doubt; neither of these states are likely to prime people to take action. When messages are tested, negative appeals (e.g. to fear or guilt) are mostly counterproductive.[55] The

[52] Susan Nall Bales (2009). How to Talk About Climate Change and Oceans. Washington, DC: FrameWorks Institute.
[53] http://frameworksinstitute.org/assets/files/climate/NNOCCI_flyer_02.pdf
[54] Simon, A., Volmert, A.Bunten, A., & Kendall-Taylor, N. (2014). The value of explanation: Using values and causal explanationsto reframe climate and ocean change. Washington, DC: FrameWorks Institute
[55] Wolf, J., & Moser, S. C. (2011). Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. Wiley Interdisciplinary Reviews: Climate Change, 2(4), 547-569.

FrameWorks Institute and ecoAmerica's research informed recommendations that it is important to avoid starting communications with a "crisis frame", using an argumentative tone, or linking the issue to political ideology.[56] [57]

It may be important to consider what kind of frames people have already been exposed to. For example, a study of UK tabloid stories on climate change (which reach a wide audience) found that:
news articles on climate change were predominantly framed through weather events, charismatic megafauna and the movements of political actors and rhetoric, while few stories focused on climate justice and risk. In addition, headlines with tones of fear, misery and doom were most prevalent.[58]

The Climate Institute from Australia recommends using a "Problems, Solution, Action, Values Framework" and switching from negative to positive language where possible. Examples include "responsible business" rather than "making business pay", and looking to "clean energy economy and jobs" rather than describing a "pollution-dependent economy".[59]

Center for Research on Environmental Decisions research also points to the importance of wording choices: they found messages about "carbon credit" were preferred to "carbon tax", for example.[60]

The FrameWorks Institute research findings also point to positive framing as a way of keeping people engaged by making them feel hope about climate issues. They recommend four tested themes for communications:

Ingenuity: By being resourceful and innovative, we can come up with new ways to tackle difficult problems.

Energy Shift: By using energy sources that don't add to the heat-trapping blanket effect, such as solar energy, we can get the climate system back to functioning the way it should.

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[56] Susan Nall Bales (2009). How to Talk About Climate Change and Oceans. Washington, DC: FrameWorks Institute.
[57] ecoAmerica, Lake Research Partners, and Krygsman, K., Speiser, M., Perkowitz, R. (2015). *Let's Talk Climate: Messages to Motivate Americans*. Washington, D.C. https://ecoamerica.org/wp-content/uploads/2015/11/eA-lets-talk-climate.pdf
[58] Boykoff, M. T. (2008). The cultural politics of climate change discourse in UK tabloids. Political geography, 27(5), 549-569.
[59] The Climate Institute (2010). Climate messaging guide: Cutting through the Climate Clutter. Sydney: The Climate Institute
[60] Center for Research on Environmental Decisions. (2009). The Psychology of Climate Change Communication: A Guide for Scientists, Journalists, Educators, Political Aides, and the Interested Public. New York.

Energy Efficiency: While we work towards moving away from fossil fuels for energy altogether, we can use much less of the kinds of energy that add heat-trapping gases to our atmosphere.

Change the Conversation: We all have a part to play in building support for action on climate and ocean change. By talking more often about these issues, and by joining groups, we can make a difference.[61]

Wolf and Moser, in their 2011 review, also recommend "communication on how to translate worry and concern into effective remedial action".[62]

Overall, research indicates that while doom and gloom messages are unproductive, it is important to strike a balance between seriousness and hope:

On the one hand, framing climate change solely around risks is unlikely to be an effective strategy for most audiences – it may make people feel hopeless, helpless, or even increase climate change scepticism. But framing climate change using only positive messages of hope about the potential benefits of a low-carbon future has also been questioned, as it may make people feel unrealistically complacent.[63]

Explanatory metaphors

Metaphors - figures of speech using one thing to refer to another - are used to frame, to explain, and to create common understandings.
The repeated use of metaphor by scientists and science communicators is likely to filter into public discourse, and thus a well-chosen metaphor can aid public understanding of and engagement with climate issues. For example, a study of the wording used in climate communications found that while scientists from NASA had tended to talk about metaphors of "loaded dice," "time bomb" and "slippery slope", there was a shift to talking about climate "tipping points", and that this change was reflected in the public discourse.[64] Metaphors are also used in communications about reducing personal contributions to climate change: the oft-used "carbon footprint" example has spawned other carbon-related terms such as "carbon finance" or "low carbon diet."[65]

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[61] http://frameworksinstitute.org/assets/files/climate/NNOCCI_flyer_02.pdf
[62] Wolf, J., & Moser, S. C. (2011). Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. Wiley Interdisciplinary Reviews: Climate Change, 2(4), 547-569.
[63] https://theclimatecommsproject.org/the-role-of-framing-and-message-tailoring-in-communicating-climate-change/
[64] Russill, C. (2008). Tipping point forewarnings in climate change communication: Some implications of an emerging trend. Environmental Communication, 2(2), 133-153.
[65] Nerlich, B., & Koteyko, N. (2009). Carbon reduction activism in the UK: Lexical creativity and lexical framing in the context of climate change. Environmental Communication, 3(2), 206-223.

The choice of metaphor can provide an indication of how governments and scientists are framing particular solutions to climate change, and how acceptable they expect the solutions to be. A number of the searchable studies on metaphor and climate change communications concern geoengineering, a potentially controversial response to climate issues. One study of debates about geoengineering found that war metaphors were used equally in arguments for and against, controllability metaphors were used to justify further intervention, and health metaphors tended to be used to argue against intervention.[66]

Metaphors that have tested well

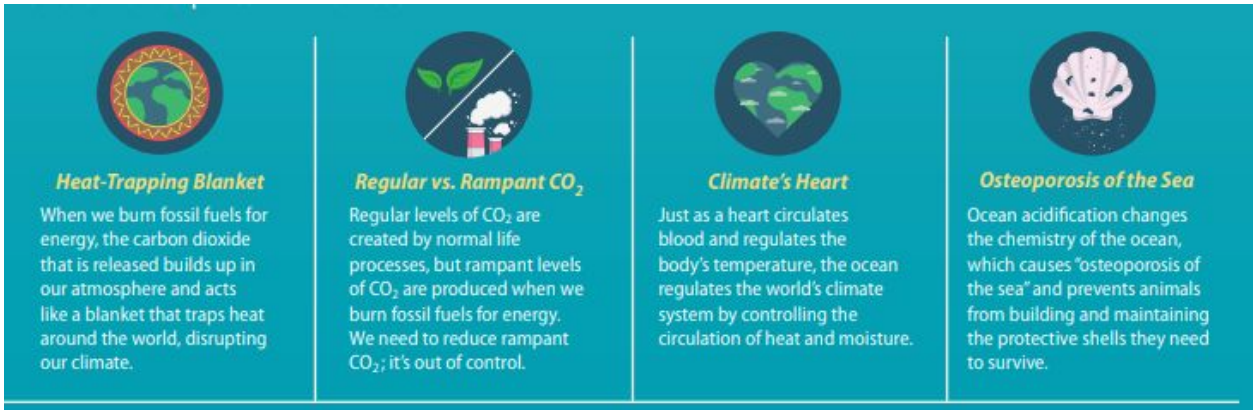
The Frameworks Institute have consistently found in studies over the past decade that the "heat trapping blanket" metaphor is effective to explain the role of carbon emissions in climate change.

Heat Trapping Blanket of CO2 Simplifying Model:
Global warming is caused, in part, by the man-made blanket of carbon dioxide that surrounds the earth and traps in heat. It is thickened by burning large quantities of fossil fuels – coal, oil and natural gas. By burning these fossil fuels, we release Carbon Dioxide (CO2) into the air where it builds up, the globe warms and the atmospheric balance that keeps the climate stable is disrupted.[67]

More recent testing found that people were best able to understand then explain to others a metaphor called "climate's heart" relating to the ocean's role in climate regulation. Two more effective metaphors identified were "Osteoporosis of the sea" and "Regular va Rampant Co2"[68]. These are all described briefly in the factsheet:
http://frameworksinstitute.org/assets/files/climate/NNOCCI_flyer_02.pdf

[66] Nerlich, B., & Jaspal, R. (2012). Metaphors we die by? Geoengineering, metaphors, and the argument from catastrophe. Metaphor and Symbol, 27(2), 131-147.
[67] Susan Nall Bales (2009). How to Talk About Climate Change and Oceans. Washington, DC: FrameWorks Institute.
[68] Volmert, A. (2014). Getting to the heart of the matter: Using metaphorical and causal explanation to increase public understanding of climate and ocean change. Washington, DC: FrameWorks Institute.

Table with Frameworks Institute metaphors



Metaphors with mixed success

While metaphors are generally understood to be linguistic, visual language is also used to communicate about climate change issues. Research on visual representations of climate change has found that "imagery plays a role in either increasing the sense of importance of the issue of climate change (saliency), or in promoting feelings of being able to do something about climate change (efficacy) – but few, if any, images seem to do both."[69] In this study with cohorts in three countries, energy futures and lifestyle choice imagery supported feelings of self-efficacy. Images of visual impacts made climate change seem important (in all three cohorts, a picture showing flooded land was deemed the most impactful) but also made people feel less engaged or empowered. Energy futures and lifestyle choice imagery supported feelings of self-efficacy.

A review on climate change communication found a similar issue in multiple studies: images have been utilised as "canaries" for climate change - that is, symbolic examples that render the effects of climate change visible before they affect the audience personally. However, studies showed that commonly-used images such as melting ice caps, polar bears, floods or dried river beds "frame climate change as a far-away issue, the consequences of which are remote in time and space, and thereby difficult for individual laypeople to influence through everyday behaviour."[70]

Less-tested metaphors

[69] O'Neill, S. J., Boykoff, M., Niemeyer, S., & Day, S. A. (2013). On the use of imagery for climate change engagement. Global environmental change, 23(2), 413-421.
[70] Wibeck, V. (2014). Enhancing learning, communication and public engagement about climate change–some lessons from recent literature. Environmental Education Research, 20(3), 387-411.

Some metaphors have been suggested to help scientists respond to common skeptical questions about climate change. It is not clear how extensively these metaphors have been tested, however they include:

- The loaded die: “provides a good response to the question of how global warming is affecting various weather phenomena. When people ask if global warming is responsible for the recent streak of heat waves, floods, wildfires, and intense hurricanes, you can say that by loading the atmosphere with excess greenhouse gases, we are loading the dice toward more of these extreme weather events.”
- On whether climate change is natural or caused by humans: “A good metaphor that reveals the fallacy of this thinking is that just because lightning strikes have long caused forest fires does not mean fires cannot also be caused by a careless camper.”[71]

An examination of frames used in climate change politics in the USA concludes with a suggestion:
the Apollo metaphor to liken the task of controlling climate change to the effort during the 1960s to put a man on the moon, is especially promising due to the wide appeal of its positive framing of climate policy in terms of technological achievement, industrial transformation and economic opportunity.[72]

Explanatory chains

Explanatory chains can be described as “a clear, concise, well-framed explanation of the causes of a problem, including the mechanism by which the problem is created”[73]. Rather than just describing a problem, they explain it, and situate it within a larger context. These messages give information about processes, rather than just effects.[74]

How best to use explanatory chains

The FrameWorks Institute used the following example of an explanatory chain:

When we burn fossil fuels like coal and gas, we release carbon dioxide into the air. The ocean absorbs a lot of this carbon dioxide, which is changing the ocean’s chemistry - a process called

[71] Hassol, S J Improving How Scientists Communicate About Climate Change Eos: Weekly Journal of the American Geophysical Union 2008 ; 89 (11): 106–107.,
in
Nerlich, B., Koteyko, N., & Brown, B. (2010). Theory and language of climate change communication. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 97-110.
[72] Fletcher, A. L. (2009). Clearing the air: the contribution of frame analysis to understanding climate policy in the United States. Environmental Politics, 18(5), 800-816.
[73] http://trnerr.org/wp-content/uploads/2016/07/Framing-With-Explanatory-Chains.pdf
[74] Simon, A., Volmert, A. Bunten, A., & Kendall-Taylor, N. (2014). The value of explanation: Using values and causal explanations to reframe climate and ocean change. Washington, DC: FrameWorks Institute.

ocean acidification. One result of this change in chemistry is that carbonate - something shellfish use to build their shells - becomes scarce. This means there will be fewer shellfish in the food chain for other creatures to eat, which then affects the whole ecosystem.

The FrameWorks Institute's other work indicates that these explanatory chains may be most effective if presented along with information about solutions:

Yet, for the scientific understanding to lead to effective action (rather than merely despair) it is imperative that science communicators close their communication by offering examples of policies that will address this problem and explain how these actions improve outcomes. To ward off fatalism, the frame element of Solutions is an integral piece of a Core Story of Climate Change.[75]

Research also suggests that values messages and Explanatory Chain messages should be combined for greater effect: *messages combining an effective value with an Explanatory Chain about human health impacts should have an even greater effect on attitudes and policies than the combination of values and descriptive information.*[76]

They further recommend, when using explanatory chains:

- Identify the cause of the problem upfront (ie, fossil fuels and carbon emissions)
- Provide general conceptual accounts of mechanisms (ie, do not get lost in details)
- End with broad repercussions (show people why they should care by connecting the effects to broader impacts).[77]

A further suggestion for future development of explanatory resources is about visualisation. A 2014 review of communication strategies found a number of suggestions for computer-aided visualisations of climate change processes, such as showing landscape change under different conditions, to enhance understanding and motivate behavior change.[78] These findings should perhaps be considered in light of other evidence that information about the process is useful but not enough on its own.

[75] Bales, S.N., Sweetland, J., & Volmert, A. (2015). How to Talk About Oceans and Climate Change: A FrameWorks MessageMemo. Washington, DC: FrameWorks Institute.
[76] Simon, A., Volmert, A. Bunten, A., & Kendall-Taylor, N. (2014). The value of explanation: Using values and causal explanations to reframe climate and ocean change. Washington, DC: FrameWorks Institute.
[77] Volmert, A. (2014). Getting to the heart of the matter: Using metaphorical and causal explanation to increase public understanding of climate and ocean change. Washington, DC: FrameWorks Institute.
[78] Wibeck, V. (2014). Enhancing learning, communication and public engagement about climate change–some lessons from recent literature. Environmental Education Research, 20(3), 387-411.

Conclusion

This review has outlined the findings of studies into climate change communication strategies; particularly, those that focus on values, framing and messages that motivate action. The review has limitations; due to time constraints it has focussed pragmatically on existing reviews of evidence and evidence-based guidelines rather than listing and evaluating all the available literature.

Some useful metaphors and explanatory chains have already been developed, while other suggestions appear less well-tested. Framing climate-related messages requires some awareness of the mental models and existing values held by the target audience.The most effective messages are framed to show the relevance of climate issues to things people value, show the effects at immediate and local levels, avoid provoking excessive negative emotion, and to make people believe there are solutions worth supporting.

Appendix

Organisations working on climate change messaging

Table A1: Organisations working on climate change messaging, with links to resources

Organisation name	**Link**	**Description**	**Products**
The Climate Communication Project (UK)	https://theclimatecommsproject.org/climate-communicators-a-visual-map/	*a collaboration between academics and practitioners working on public engagement with climate change.*	Currently available: research summary blogs. Future intentions: *The Climate Communication Project will carry out a process of expert elicitation (using in-person workshops) plus a rapid synthesis of existing research, will produce a set of consensus and confidence statements on public engagement with climate change. The resulting resource will be available on this website for practitioners to access*
Center for Research on Environmental Decisions at Columbia University	http://guide.cred.columbia.edu/index.html	*an interdisciplinary center that studies individual and group decision making under climate uncertainty and decision making in the face of environmental risk. CRED's objectives address the human responses to climate change and climate variability as well as improved communication and increased use of scientific information on climate variability and change.*	Communication guide http://guide.cred.columbia.edu/pdfs/CREDguide_full-res.pdf
The Climate Institute, Australia	http://www.climateinstitute.org.au/	"Dedicated to the development of public and corporate policy solutions for addressing issues associated with climate change and energy transformation." Closed and transferred to the Australia Institute in 2017	Communication guide: http://www.climateinstitute.org.au/verve/_resources/Campaigner_Guide.pdf
The Australia	http://www.tai	"the country's most influential	Tracks Australian attitudes on

Institute	.org.au/	progressive think tank. We conduct research on a broad range of economic, social and environmental issues in order to inform public debate and bring greater accountability to the democratic process."	climate change; may not cover as much research on strategic communications though. https://nb.tai.org.au/climateofnation_2018
The Australian National Centre for the Public Awareness of Science at ANU	http://climate.anu.edu.au/research/climate-change-communication	"a dedicated team of scholars is conducting research on climate change communication. Projects include a focus on the history of climate communication (using both qualitative and quantitative research methods); examinations of the discourse between climate science and consumers of climate research; policy decision making processes regarding climate change; the teaching of climate change in school and informal learning contexts."	The group has been doing research on communicating climate change issues, but list of publications has not been updated to reflect this.
Climate Access	https://climateaccess.org/	"a nonprofit organization building political and public support for equitable climate solutions through our learning network of climate leaders, pilot engagement projects and strategic services… We introduced the idea of shifting from a "should we act?" to a "we are acting" posture with the preparation frame that places a greater emphasis on the need for communities to ready themselves for current and future climate impacts."	Research reports and communications guides available on website: login is required for full access. See in particular: https://climateaccess.org/resource/communicating-climate-change-history-challenges-process-and-future-directions
FrameWorks Institute	http://frameworksinstitute.org	"The FrameWorks Institute is a nonprofit think tank that advances the mission-driven sector's capacity to frame the public discourse about social and scientific issues. The organization's signature approach, Strategic Frame Analysis®, offers empirical guidance on what to say, how	Guide and reports on communicating climate change issues. A very brief summary with further links: http://frameworksinstitute.org/assets/files/climate/NNOCCI_flyer_02.pdf

		to say it, and what to leave unsaid.“	
NOCCI			

Review studies

Table A2: Reviews of evidence on climate change communications (chronological order)

Reference	**Scope**	**Recommendations**
Moser, S. C. (2010). Communicating climate change: history, challenges, process and future directions. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 31-53.	“This paper synthesizes what is known, presumed, and still unknown about how to effectively communicate this problem. An introductory historical overview of climate change communication is followed by a discussion of the challenges that communicators face in trying to convey the issue...”	- Climate change seems distant and uncertain; it needs to be linked more to people’s day-to-day challenges. - Climate mitigation responses bring complex moral questions: “clearer communication is required about the technoeconomic, environmental and moral complexities, and uncertainties of responding to it.” - dialogic and interactive forms of communication are better for discussing differences in opinion and coming to common understandings of future goals and behaviour changes.
O'Brien, K. L. and Wolf, J. (2010), A values-based approach to vulnerability and adaptation to climate change. WIREs Clim Chg, 1: 232-242. doi:10.1002/wcc.30	“This article examines what a values-based approach is, why it is needed, and what its benefits for understanding adaptation are. The implications for research and policy are discussed.”	-Questions related to values are likely to become increasingly evident in discussions and debates about the implications of climate change for food security, health security, gender, equity, and culture. -Perhaps most importantly, a values-based approach can help move the human face of climate change into the center of the discourse about climate change.
Wolf, J., & Moser, S. C. (2011). Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. Wiley Interdisciplinary Reviews: Climate Change,	This paper focuses on this (qualitative, in-depth) subset of the climate change literature, highlighting similarities and differences across cultural, social, and geographical landscapes. Apart from demographic and regional differences, this	- Use positive emotions: hope, efficacy, optimism for the future, along with "communication on how to translate worry and concern into effective remedial action". Negative affective appeals (fear, guilt) are mostly counterproductive. -

2(4), 547-569.	literature also offers more detailed insights into the effectiveness of different communication strategies and into the cognitive and psychological processes that underlie public opinions.	
Corner, A. , Markowitz, E. and Pidgeon, N. (2014), Public engagement with climate change: the role of human values. WIREs Clim Change, 5: 411-422. doi:10.1002/wcc.269	"reviewing the empirical literature on human values and public engagement with climate change."	"The challenge for climate change communicators seeking to make the most effective use of research on human values is to identify ways of bridging between the diverse values that any given group of individuals holds and the values that are congruent with a more sustainable society."
Nerlich, B., Koteyko, N., & Brown, B. (2010). Theory and language of climate change communication. Wiley Interdisciplinary Reviews: Climate Change, 1(1), 97-110.	"We provide an overview of a selection of government, citizen, and science-led approaches to climate change communication, identify trends in media portrayals of climate change, and we will revisit the role of language in constructing messages about the topic... this review of applied and research case studies will provide a framework with which to probe the role of communication in perceptions of climate change, and examine the effectiveness of different tools in raising awareness and understanding of climate change."	"Before any local communication activities take place it is important to survey existing public perceptions about the issue which can be used to tailor communication initiatives." "there is no such thing as an effective communication per se – in the sense of communication strategies devised in a vacuum, ahead of time, or - like much classic attitude change research - conducted in the laboratory. Ongoing studies of public perceptions and commitments should inform the framing of a message and what it should say."
Amel, E., Manning, C., Scott, B., & Koger, S. (2017). Beyond the roots of human inaction: fostering collective effort toward ecosystem conservation. Science, 356(6335), 275-279.	Summary of barriers to change and discussion of how psychology can be used to promote sustainable conservation efforts.	"Especially crucial in moving toward long-term human and environmental well-being are transformational individuals who step outside of the norm, embrace ecological principles, and inspire collective action." "Particularly in developed countries, fostering legions of sustainability leaders rests upon a fundamental renewal of humans' connection to the natural world."
Wibeck, V. (2014).	"a review of recent research	-the CCC literature repeatedly highlights

Enhancing learning, communication and public engagement about climate change–some lessons from recent literature. Environmental Education Research, 20(3), 387-411.	literature on climate change communication (CCC) and education. It focuses on how learners of climate science understand messages on climate change, the communicative contexts for education on climate change, the barriers that can be found to public engagement with climate change issues, and how these barriers can be addressed." "The present paper complements Moser's findings in that it takes it point of departure in the growing field of climate change communication literature rather than in communication theory in general."	the shortcomings of fear-based communication on climate change. -it is crucial to communicate awareness-raising messages that still hold the potential to empower people to take action. To achieve this, studies have identified the potential of communicating local impacts and responses to climate change, and of highlighting concrete action strategies. -Focusing climate change communication on solutions rather than on problems is also suggested as a strategy for enhancing public engagement. -positive feedback on individual action to mitigate climate change could be effective for increasing public engagement...However, it is worth noting that in case individuals are not motivated to change, carbon calculators and similar tools will probably not motivate behavior change. To enhance engagement, the literature stresses the importance of positive feedback on individual actions, locally and personally relevant framings of climate change, visibility and concretization of climate change-related issues and a focus on solutions rather than on catastrophic consequences of climate change.
Drews, S., & Van den Bergh, J. C. (2016). What explains public support for climate policies? A review of empirical and experimental studies. *Climate Policy*, *16*(7), 855-876.	"a cross-disciplinary overview of empirical and experimental research on public attitudes and preferences that has emerged in the last few years"	The various factors influencing policy support are divided into three general categories: (1) social-psychological factors and climate change perception, such as the positive influences of left-wing political orientation, egalitarian worldviews, environmental and self-transcendent values, climate change knowledge, risk perception, or emotions like interest and hope; (2) the perception of climate policy and its design, which includes, among others, the preference of pull over push measures, the positive role of perceived policy effectiveness, the level of policy costs, as well as the positive effect of perceived policy fairness and the recycling of potential policy revenues; (3) contextual factors, such as the positive influence of social

		trust, norms and participation, wider economic, political and geographical aspects, or the different effects of specific media events and communications.

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