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The challenge of communicating unwelcome climate messages

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Executive summary

While societal and political acceptance of the reality of anthropogenic climate change is widespread, at least in developed countries, the urgency and scale of the challenges that recent science indicates it may represent are far less recognised. With the probability that global temperature rise can be kept below the international policy 2°C 'guardrail' continuing to diminish, and growing evidence of limits to adaptation, citizens as well as economic and political decision makers need to engage with knowledge about the likelihood and implications of severe future impacts, and the scale of mitigation required to avoid them, the likes of which few want to hear. A further 'unwelcome message' is that scientific uncertainty may in many cases remain, and continue to prevent accurate predictions about impacts from being made. Communication based on 'information-deficit' or 'linear-rational' models has failed to motivate citizens, the business community or political decision makers sufficiently. Better engagement of policymakers, planners, business leaders and wider society with climate scientists and other experts, to evaluate evidence and move towards more adaptive responses, requires new approaches to communication. The EU-funded HELIX project brought together individuals from a range of disciplinary and organisational backgrounds for a workshop to discuss how 'unwelcome messages' related to 'high-end' scenarios can most effectively be communicated. Participants suggested that the specific circumstances in which particular audiences find themselves need to be the starting point of communication efforts. Unless emotional and psychological implications are acknowledged and handled sensitively, and the complexity of dealing with the thousands of decisions that might be affected by high-end climate change simplified, confronting audiences with the prospect of a 4°C world is more likely to provoke rejection, fatalism and disengagement than adaptive responses. Communicators must be more than 'narrators of doom', but recognise the need for 'active hope' (Macy and Johnstone 2012), constructed from realistic goals, imaginable paths, doable tasks and a meaningful role in addressing the problems at hand (Moser 2015). New, more dialogical forms of communication, with new audiences in new venues are needed, through which unwelcome messages can be conveyed to citizens and decision makers in a more context-specific manner. Ideally, these processes should be facilitated by interdisciplinary teams. These new forms of communication will require additional investment and training.

1. Unwelcome messages

‘To overcome feelings of overwhelm, anxiety, fear, and helplessness in the face of ongoing crises and seemingly insurmountable challenges, people need true hope. Such hope can only be constructed from realistic goals, a clear or at least imaginable path, from doable tasks and a meaningful role in addressing the problems at hand’ (Moser 2015: p9).

‘There is not a politician on earth wants to tell his or her constituents, "We've probably already blown our chance to avoid substantial suffering, but if we work really hard and devote our lives to the cause, we can somewhat reduce the even worse suffering that awaits our grandchildren." [crowd roars]’ (Roberts 2015a).

In international climate policy, a rise of 2°C above pre-industrial global mean temperature is widely taken to constitute unacceptably dangerous climate change (Jordan *et al.* 2014, Randalls 2011, Shaw 2014). Unless climate sensitivity turns out to be at the lower end of the current range of estimates, however, exceedance of this threshold is highly likely in coming decades. On current emission trends, it is also increasingly likely that warming would not stop at that point, but continue to 4°C or even beyond if positive feedbacks take effect. Even relatively conservative institutions such as the World Bank (2012), International Energy Agency (IEA 2013) and the international accountancy firm PWC (2014)¹ have begun to warn of the dangers and urgent need to avoid a rise of 4°C. The impacts brought by such a temperature rise - severe drought, unprecedented heat waves, and major floods in many regions, with serious impacts on ecosystems and associated services - are considered beyond adaptation in many cases (Klein *et al.* 2014), and widely viewed as ‘incompatible with a global organised community’ (Anderson and Bows 2011). The higher global temperatures rise, the more impacts are likely to be pervasive, systemic, and irreversible (Field *et al.* 2014, Smith *et al.* 2009). Although physical impacts will vary from country to country, and some may find impacts within their own borders relatively limited or in some cases even benign, in a highly globalised economy impacts of climate change will spread, affecting interdependent supply chains and flows of people and investment.

Despite this, media coverage has fallen since 2009,² when polled by the UN citizens globally report climate change well down their list of priority issues³, and a third of people report never having discussed climate change with anyone (Haddock research, cited in Marshall 2014). With some notable exceptions, much of the business community currently appears relatively unconcerned (Confino 2015)⁴, and the commitments being made by governments ahead of the Paris UN conference in December 2015 fail to put the world on course to hold warming to 2°C.

Work by scientists involved in the HELIX project suggests that the likelihood of high levels of warming and greater extremes, potentially occurring sooner than previously thought – e.g. 3°C in the 2040s (Jackson *et al.* 2015), 4°C rise by the 2060s relative to pre-industrial (Betts *et al.* 2011) – may be

¹ ‘To avoid two degrees of warming, the global economy now needs to decarbonise at 6.2% a year, more than five times faster than the current rate, every year from now till 2100. On our current burn rate we blow our carbon budget by 2034, sixty six years ahead of schedule. This trajectory, based on IPCC data, takes us to four degrees of warming by the end of the century’ (PWC 2014).

² According to the Daily Climate global database (<http://www.dailyclimate.org/>), 2011 coverage was 20% down on the previous year and 42% down on 2009.

³ <http://data.myworld2015.org/>

⁴ Many businesses, including 54 per cent of FTSE 100 firms, have not built climate change adaptation into their business strategy or continuity planning (London Assembly Economy Committee 2015).

increasing. Yet arguably these risks are not being communicated adequately, either to political and economic decision makers or to wider publics, all of whom are still regularly informed that holding temperature rise to below 2°C, with a reasonable probability of success, is technically feasible (Field *et al.* 2015).⁵ Such a comforting message neglects the extreme economic, political and social challenges associated with rapid decarbonisation and leaving untouched a third of oil reserves, half of gas reserves and over 80% of coal from 2010 to 2050 (McGlade and Ekins 2015). It also neglects the technical challenges associated with negative emissions technologies (NETs) that much modelling of 2°C scenarios assumes – rather heroically - will become available but still remain to be developed (Geden 2015; Sanford *et al.* 2014).⁶ Close reading of the latest reports from the Intergovernmental Panel on Climate Change (IPCC) - the scientific body charged with informing governments about climate change - suggest that the impacts corresponding to high level of temperature increase are not only relatively unknown, but also relatively unstudied (King 2005).

A further unwelcome message is that the kind of scientific uncertainty that has been used by those reluctant to respond to unwelcome climate messages as an excuse for delay may continue to prevent accurate predictions from being made (Hallegatte 2009). This should encourage greater use of scenario planning, to ensure robust decision-making (Dessai *et al.* 2008). Currently, however, the IPCC fails to provide guidance on the relative likelihood of the scenarios of future concentrations of greenhouse gases and other drivers of warming on which its climate change projections are based (Sanford *et al.* 2014). The IPCC's most recent assessment makes no judgement on the relative likelihood of the magnitude of future warming associated with each of its Representative Concentration Pathways (RCPs), implicitly treating all scenarios as equivalently plausible, and in doing so reiterating the '2°C is attainable' narrative. Since some scenarios are also projected to lead to very divergent futures in terms of impacts, effective responses to manage climate risk depend heavily, in some cases, on the scenario actually realized. 'Policymakers thus have no clear scientific guidance for confronting and managing the growing risk of high-magnitude warming' (Sanford *et al.* 2014: 1).

Underestimating the likelihood and consequences of exceeding 2°C may therefore render much current policy and planning 'maladaptive': i.e. supporting initiatives which may foster adaptation in the short-term but which insidiously affect systems' long-term vulnerability and/or adaptive capacity (Field *et al.* 2014, Magnan 2014). One particularly uncomfortable message may be that rather than proceeding incrementally, seeking to defend what is valued in the present day, adaptation may need to be 'transformational', involving the abandonment of currently cherished policy objectives and land uses. Policy responses in both mitigation and adaptation domains will likely become more interventionist and disruptive, something that will present ideological difficulties for many who have built careers devoted to the dismantling of what they perceive to be overly burdensome regulation. Whatever the rhetorical power of promising technical fixes through a new, green industrial revolution, wider cultural and social change will also be necessary to prevent rebound effects from causing unintended emissions increases (Berners-Lee and Clark 2013).

The EU-funded HELIX project (High-End cLimate Impacts and eXtremes) brought together individuals from a range of disciplinary and organisational backgrounds for a two-day workshop to discuss how the challenges associated with 'high-end' scenarios can most effectively be communicated. This briefing note, aimed at the climate research, communication and policy communities, is inspired by

⁵ Ambitious mitigation to limit warming to less than 2°C above preindustrial levels is economically feasible. Cost-effective mitigation pathways to limit warming to 2°C require reducing emissions of greenhouse gases by 40–70% below current levels by 2050 (Field *et al.* 2015).

⁶ The IPCC scenarios keeping below 2°C require the removal of between 2 and 10 gigatons of CO₂ from the atmosphere annually by 2050, using bioenergy with carbon capture and storage (BECCS). By way of comparison, all the world's oceans combined absorb about 9 gigatons a year; all the world's terrestrial carbon sinks combined absorb about 10 gigatons a year.



presentations made during that event and a number of workshop activities they informed. However, **not every participant in the workshop can be assumed to endorse all the conclusions drawn.**

2. To which 'audiences' are these messages most relevant?

The workshop attempted to differentiate between different audiences:

Policymakers

Politicians and global institutions are committed to continuing prosperity and growth. Higher-end climate impacts jeopardise prosperity and growth, thus threatening political legitimacy. This danger is increasingly recognised by the more enlightened of these institutions, such as the World Bank:

'The task of promoting human development, of ending poverty, increasing global prosperity, and reducing global inequality will be very challenging in a 2°C world, but in a 4°C world there is serious doubt whether this can be achieved at all' (World Bank 2014: xiii).

That current development paths may be unsustainable represents a profoundly uncomfortable message. Despite the rhetorical power of promising technical fixes through a new, green industrial revolution, wider cultural and social change will also prove necessary, requiring a degree of political leadership that has been lacking to date.

Land-use and infrastructure planners

Land-use and infrastructure planners have made and continue to make decisions that profoundly shape current and future societal resilience to climate impacts. A stronger prospect of more climate change occurring sooner places a greater priority on considering substantial and continuing adaptation activities, and in particular on considering adaptation decisions with long lifetimes. Although a variety of issues regarding these decisions have been raised in the academic literature, according to Stafford Smith *et al.* (2011), these have yet to be fully absorbed by practitioners. Climate change in the foreseeable future will be an ongoing 'transient' phenomenon, requiring 'an on-going adaptation process' (Pittock and Jones 2000: p...).

Industry

As noted in the introduction, despite the profound implications of climate change, with some notable exceptions climate change appears low on industry CEOs' list of concerns. In 2013, only 10% registered concern in PricewaterhouseCoopers global survey. In the following year, PWC took this as a reason not to even include it in its global survey of 1,322 business leaders (PwC's 18th annual global CEO survey). Over-regulation tops the list of perceived risks, with 78% saying that it threatens their organisation's growth prospects.

Industry stands to be hit, however, by indirect as well as direct impacts from climate change. Increasing water scarcity, extreme flooding, land loss and heatwaves are expected to become increasingly commonplace in the critical food-producing and industrialising regions which provide the basis for many of our supply chains, notably China, India and Indonesia. In turn, there will be a cascade effect of rising costs of materials and goods, and loss of trade and earnings, which will bring considerable costs (London Assembly Economy Committee 2015).

Publics

Policy action, be it mitigation or adaptation, depends in most countries on public acceptance of the reality of the climate threat and the urgent need to respond (Ming-Lee *et al.* 2015; Brugger *et al.* 2015). The UN Framework Convention on Climate Change commits its signatories to promote and facilitate 'the development and implementation of ... public participation in addressing climate change and its effects and developing adequate responses' (Article 6). [As is highlighted below, however,] there is no single "public" to consider when it comes to climate-related attitudes and beliefs. Segmentation analyses have identified a spectrum of concern ranging from 'alarmed', 'concerned' and 'cautious', to 'disengaged', 'doubtful' and 'dismissive' (e.g. Leiserowitz *et al.* 2008). Each segment had a unique perspective on climate change and appropriate policy responses.

Academics in developed countries tend to assume widespread awareness of the phenomenon of climate change. However, climate change awareness and risk perception have been shown to be highly unevenly distributed around the world. While high levels of awareness (over 90%) were reported in developed countries, including North America, Europe and Japan, majorities of populations in developing countries from Africa to the Middle East and Asia - including more than 65% of respondents in countries such as Egypt, Bangladesh, Nigeria and India - have never heard of climate change, (Ming Lee *et al.* 2015).

3. The risks and opportunities of communicating ‘unwelcome messages’

Communicating ‘unwelcome climate messages’ carries both risks and opportunities. Though the literature on the topic of psychological responses to the prospect of ‘high end’ climate impacts is only just beginning to emerge, Hamilton and Kasser (2009) usefully suggest that broadly three types of ‘coping strategy’ are likely to emerge: denial, maladaptation, and adaptive responses. Following Hamilton and Kasser (2009: 5), **the objective of communication can be framed as being to facilitate and encourage the more adaptive responses.** Although Hamilton and Kasser do not specify this, it can be argued that denial, maladaptation and adaptive strategies are as likely to be followed by *organisational* and *political decision makers* as by individual members of the public.

Denial strategies aim primarily at suppressing anxiety associated with predictions of climate disruption by not allowing such information to be accepted in the conscious mind. ‘By denying the facts, no emotions need be felt’ (Hamilton and Kasser 2009: 2). As expressed by Marshall (2014), we ‘don’t even think about it’. Commonly associated with climate sceptics with strong ideological objections to the implications that follow accepting high-end predictions – a greater degree of state intervention and shift away from consumerist values - it is also a common response from individual citizens who lack such ideological investment. As the science blogger David Roberts has expressed it: ‘Messages about high-end impacts sound “extreme”, and our instinctive heuristics conflate “extreme” with “wrong.” People display the same kind of avoidance when they find out that they or a loved one are seriously ill’ (Roberts 2011).

Maladaptive coping strategies involve acknowledging and accepting unwelcome predictions about climate change up to a point, but blunting some aspects of the science or the associated emotions to reduce emotional impact. Individuals (including, presumably, political decision makers), may seek comfort in inner narratives such as “Humans have solved these sorts of problems before”, “If it were that big a threat the government would be doing something about it” or “It won’t affect me much”. Alternatively, *distancing strategies* may emphasise the time lapse before the consequences of climate change are felt, and the physical remove at which they occur. Climate change is a ‘creeping problem’ (Moser and Dilling 2004), the lack of a definite beginning, end, or deadline requiring that respondents create our own timeline. ‘Not surprisingly, we do so in ways that remove the compulsion to act’ (Marshall 2014).

Under the umbrella of maladaptive coping it is possible to differentiate several strategies. *Diversionsary strategies* include minor behaviour changes that allow an individual (or institutional decision maker) to reassure themselves that a response has been made. Weber (2006) dubs this the ‘single action bias’. Alternatively, diversion may come through outright pleasure seeking. *Blame-shifting* is a form of moral disengagement whereby individuals disavow their responsibility for the problem or the solution, as in the case of actors in developed countries blaming China for its rapid, fossil-fuel intensive development. *Indifference strategies* operate with the unconscious narrative that “if I don’t care I won’t feel bad.” Such resignation can induce passivity, including a reluctance to engage in pro-environmental behaviour (Homburg *et al.* 2007). *Unrealistic optimism/wishful thinking* is a further sub-category worth highlighting. Taylor defines “unrealistic optimism” as a proclivity that leads those affected to predict what we would prefer to see, rather than what is objectively most likely to happen (Taylor 1989, p. 33). The uncertainty inherent in predictions opens the door to wishful, or ‘motivated’ thinking about how dangerous climate change really is (Markowitz and Shariff 2012, Lench *et al.* 2014, Harris *et al.* 2009).

These methods of coping can be unhelpful to the individual and at the same time lead to a worsening environmental (and socio-cultural) situation because they block potential social responses to climate change, or actively contribute to ecologically damaging behaviours.

The third strategy is **adaptive coping**, deployed when individuals accept both the science and the accompanying emotions, and then try to act on the basis of both (Hamilton and Kasser 2009: 2). They are adaptive, both in promoting psychological adjustment to new circumstances and in stimulating actions appropriate to the new reality. Adaptive coping strategies are akin to the later phases of mourning and involve acceptance of, rather than resistance to, some of the pain and distress that follows recognition of the facts of climate science and their meaning. Such strong negative emotions, although uncomfortable, are more likely to give rise to effective responses consistent with the new reality (Macy and Johnstone 2012).⁷

Individuals, and arguably whole cultures too, may deploy the above strategies sequentially, having to pass through stages of denial and maladaptation to finally acting adaptively. This is by no means necessarily a smooth sequence. The way individuals cope with a 4°C world will be influenced by how societies and their institutions respond to the new environment. If only a minority are pursuing adaptive coping while others persist in denial or maladaptive strategies, the former may feel isolated and disempowered, and governments and other institutions will be under less pressure to undertake adaptation measures, particularly those with long lifetimes. Thus, facilitating the majority to take at least small steps on an adaptation pathway may overcome this paralysis (Stafford Smith *et al.* 2011: 201).

Survey and other evidence in Western countries (Maibach *et al.* 2009) suggests that a minority of the population resists or ignores the evidence of climate science, while a majority adopts maladaptive coping strategies. However, a review of 75 studies (Moser 2014) from across the world indicates how frequently individuals are reporting perceived changes in the environment, or believe they have experienced impacts - despite a documented tendency to 'distancing'. Many individuals around the world have accurately detected recent changes in local temperature anomalies (Howe *et al.* 2013), with research also suggesting that perceived local warming can influence risk perceptions (Zaval *et al.* 2014). From this, Moser concludes that society is in transition from a prevalence of threat denial to increasing acceptance. Hamilton and Kasser suggest that the shift from complacency to anxiety is likely to accelerate, and at some point, governments, non-government institutions and professional organisations will recognise the benefits of promoting and supporting adaptive coping strategies.

Taking action and thereby exerting some control over a threatening situation is known to be an effective response to depression (Jacobson, Martell and Dimidjian 2001). The sense of shared purpose associated with working more collaboratively with others to protect the common interest can also reduce the "burden of knowing".⁷ Problem-solving as a coping strategy might impel people to work with others so as to prepare for a changed climate, through political activism or joining local groups or councils that might develop mitigation and adaptation measures. So far, however, little work has considered how this might be achieved.

⁷ In addition to encouraging adaptive coping strategies, Crompton and Kasser (2009) propose another type of response: acting in ways that promote a shift in intrinsic values towards greater empathy towards our descendants, vulnerable people in poor countries and non-human animals.



Overall, how the unwelcome messages arising from HELIX can best be framed for elite decision-maker and public 'audiences' alike, so as to encourage appropriate mitigation and adaptation responses, is a crucial question.

4. Lessons from climate communication efforts to date

Most early communicators of climate change were either physical scientists or environmental groups, generally lacking in awareness of social science scholarship and insights from communication and behavioural research that could have usefully informed their efforts. Professional divisions due to specialization, disciplinary boundaries, institutional disincentives, and other factors contributed to a lack of exchange among those *doing* the communicating and those *researching* it (Moser 2010).

When confronted with perceived failures of communication, scientists have tended to rely on delivering more facts (or the reiterating the same ones), on the assumption that it is information that drives understanding, acceptance, and ultimately appropriate behaviour, according to the so-called 'information-deficit' model. Although useful in some circumstances - e.g. for correcting error or misunderstanding, for establishing credentials (UCL 2014), or where basic scientific understanding of climate change has yet to develop, as in many developing countries – this approach is long discredited as an effective means to engage audiences. Similarly, with regards to the interface between science and policy making, the traditional 'linear-rational' model, according to which value-neutral, objective science 'speaks truth to power' and governments develop or amend policy accordingly, has been discredited. If decision stakes and uncertainties are high, 'post-normal' science/ 'co-production' is instead recommended as the ideal, in order to foster consensus and eventual implementation of effective environmental policies (see e.g. Hulme 2009). In this model, open consultation across society establishes the dimensions of risk that actually matter to people, followed by an assessment and explanation by experts of the risks of different degrees of climate change, and a stage in which policymakers and politicians are required to argue and negotiate in public about what level of risk is tolerable (ibid).

Despite losing credibility, the 'information-deficit' and 'linear rational' models have retained a hold on practice, partly because the alternatives tend to be demanding. The linear-rational model, for example, is visible in the new Future Earth initiative being developed by the International Council of Science as a follow-on to its previous Global Change programmes. Despite repeated references in its initial descriptive material to 'co-production with society', it is climate scientists who have defined the programme and its research agenda; policy (and outreach) are then assumed to follow, albeit with consultation (Rapley, and UCL 2014).

Existing literature also offers a warning against relying too heavily on geoscientific language to frame the results of modelling future climate change. The risk here may be regarded as two-fold. Firstly, communicating in terms of natural scientific indicators such as global mean temperature limits fails to resonate with lay audiences (Shaw?). Secondly, such language tends to present climate change as unstoppable and catastrophic:

'Catastrophic reporting reinforces the hierarchical preeminence of the geosciences and, conversely, the knowledge claims of the geosciences provide legitimacy and credibility to catastrophic framing. This serves to reinforce the message of climate change as an unfolding, almost predetermined, disaster' (O'Neill *et al.* 2010: 1000).

In general, researchers have stressed the need for caution in using fear to communicate climate change, unless it is accompanied by a clear action strategy to reduce risk (e.g., O'Neill and Nicholson Cole 2009). 'Fear messaging' can be counter-productive, leading to defensive avoidance ('this is too scary to think about') or 'reactance' ('somebody is trying to manipulate me'). When such messages are initially

accepted, they can generate a state of prolonged worry and anxiety, over time changing to numbness, desensitisation and disengagement from the issue altogether' (UCL 2014: 60).

The specific needs of different audiences have received increasing attention, from different audiences themselves and from non-scientist 'messengers' seeking to 'make climate change their own.' Policy-makers at different levels of government, business managers, religious leaders, environmentalists, or minorities 'have diverse interests and goals vis-a-vis climate change, need different information, frame the issue differently, appeal to different values, and can enact different measures and behaviours' (Moser 2010).

Numerous factors that influence individual- and/or group-level responses to climate change have been identified, including experiential, physical, psychological and socio-cultural variables (Wolf and Moser 2011, Ming-Lee 2015). As noted in the previous section, climate change communications research has produced a number of audience segmentation studies and case studies (e.g. Leiserowitz *et al* 2008; Rose *et al.* 2007). These suggest that different audiences require distinct frames, goals, messages and messengers, and indeed actions to implement. Individuals accept and trust messages more readily when conveyed by people with similar views, e.g., Republicans trusting Republican/conservative messengers; Democrats believing Democratic/liberal leaders; business leaders responding to other business leaders (Agyeman *et al.* 2007; Arroyo and Preston 2007). Appealing to different audiences with tailored communication can also potentially bring together coalitions to work toward a desired common policy goal (Moser 2007). Environmental campaigners have latterly become more aware of 'how poorly environmental language works outside its own constituency' (Marshall 2014), and how taking climate action could appeal more to politically conservative audiences if they were allowed the chance to frame it in terms of their own values. The Climate Outreach and Information Network (COIN) is unusual for having attempted to communicate to more right wing audiences through a series of workshops (see e.g. Corner 2013).

Many argue that various non-climate benefits (energy security, health, financial, social interaction etc.) from climate policy measures and more sustainable lifestyles should be the focus of communication efforts (Whitmarsh *et al.* 2010). While such an approach may indeed be effective, there is a danger that such 'brightsiding' underestimates the extent of change needed. The challenge is to find 'a balance that minimises the hand wringing but acknowledges the enormous, unprecedented challenges that climate change poses' (Corner 2014). While many constructive and attractive solutions may exist, others will surely involve losses in some sense. Individuals who are able to come to this conclusion through their own processes of learning, generating their own 'unwelcome messages' in dialogic forums informed by scientific input, rather than receiving lectures, are more likely to accept them.

Abstract concepts such as 'adaptation' need to be rendered meaningful in real, imaginable, practical, and acceptable terms to both institutional decision-makers and lay audiences. There is evidence that the term 'adaptation' may itself prove counter-productive. Few studies have explicitly tested how adaptation is perceived or understood, which of the alternative terms or phrases are most resonant and why, and which are more or less well understood. Nevertheless, the 'preparedness' frame may be more compelling than 'adaptation', which 100 climate and sustainability leaders, social science and communication experts in the US subjectively judged to be 'negative and demobilizing' (ecoAmerica 2012).

It should also be recognised that not everyone wants to protect the status quo, especially those already struggling against economic and social injustice. Such groups would respond to narratives of positive change, in which our adaptation to climate change does not just protect what is already established but also creates a more just and equitable world (Marshall 2014; Pelling 2009).

Based on place attachment theory and experiences with place-based education, some have theorized that landscape-based discourse has the potential to create new and productive space for political action on climate change. Schweizer *et al.* (2013) use insight from place-based education and experiential learning to explain the rhetorical power of national parks in the United States. Given their compelling cultural presence in the shared (both virtual and material) experience of identifying as an 'American,' Schweizer *et al.* suggest that climate change communication in U.S. national parks has the potential to promote public awareness, and to suggest lifestyle modifications that may help mitigate climate change impacts.

Evidence also highlights the potential of immersive, experiential activities to heighten concern and generate commitment to behavioural change. In a study conducted by Glasgow University Media Group (GUMG) and Chatham House (Happer *et al.*), members of the British public were submerged in an alternative news environment with stories that had not yet occurred but which they were advised would very likely occur in the near future. Authentic news broadcasts were constructed about massive floods in Bangladesh, and extreme weather and energy black-outs in the UK. The scenario involving Bangladeshi climate refugees proved particularly effective in shifting perceptions beyond climate change as a vague and theoretical issue to one which might have real and serious consequences for participants and their communities. Ethnicity was a key factor in heightening such concern and commitment to behavioural changes (Happer *et al.* 2014), with Bangladeshi participants' existing feelings of pressure from living as a minority making them more sensitive to possible backlashes against increased migration.

The lessons of communication scholarship and experience so far have been neatly encapsulated as follows:

To be effective, messages and the mental models that are imbedded in them must help overcome the challenges of communicating climate change. The distant problem must be brought home; the invisible causes and impacts must be made visible; the inconceivable solutions must be illustrated; perceived and real barriers to action must be shown as something 'people like me' have overcome. Third, messages are more than the words or information conveyed. Messages are accompanied by, and inseparable from, imagery, the tone of voice, and the emotions that are being evoked ... (Moser 2010: 40).

5. Towards better communication of unwelcome messages?

‘Sorry ... but no one's allowed to give up — our children and grandchildren will still be fighting this battle. Even if it does become finally, physically impossible to hit 2°C, so what? Carbon emissions still need to be driven to zero as quickly as possible to avoid even higher temperatures. The fight remains the same, no matter the temperature outcome’ (Roberts 2015b).

Literature on the communication of high-end change is beginning to emerge. It suggests that communicators must take care to be more than ‘narrators of doom’ (Moser 2015), and that to overcome feelings of ‘overwhelm’, anxiety, fear, and helplessness in the face of ongoing crises,

‘people need true hope. Such hope can only be constructed from realistic goals, a clear or at least imaginable path, from doable tasks and a meaningful role in addressing the problems at hand’ (Moser 2015).

Similarly, Stafford-Smith et al. (2011, pp204-5) note how ‘simply presenting people with the prospect of a 4°C world is unhelpful and disempowering unless the complexity of dealing with the thousands of decisions that might be affected by climate change can be simplified’.

On the basis of these insights, participants in the workshop discussed how unwelcome messages associated with high-end climate change could most effectively be conveyed to different audiences. A number of recommendations emerged, some of them specifically about the manner in which the risks currently being run, as carbon emissions continue to rise, are communicated to high-level decision makers, especially by organisations such as the IPCC. These are outlined first, before turning to other conclusions.

Communicating the full extent of climate risk

King *et al.* (2015) highlight weaknesses in the currently dominant approach to climate risk assessment, as embodied by the work of the IPCC, and present a new framework that has a number of advantages. Unlike the IPCC, it makes a judgment about the relative likelihood of different emissions pathways. Its consideration of the systemic risks arising from interactions between changes in the physical climate and complex human systems is in large part a security risk assessment, something that the scientists behind the IPCC’s working groups are not necessarily competent to perform. Recognizing the depth of uncertainty about the future state of complex systems, it uses the tools of scenario exercises and wargaming to help consider what might happen.

The findings of climate science should not be presented in terms of attempted prediction, or presenting the ‘central tendency’ (what is most-likely), as many audiences often expect. It is the ‘worst-case’, not accurate prediction, that is often most relevant to risk-based decision making.⁸ On this, however, there is currently relatively little communication. Close reading of the latest IPCC report suggest that the impacts corresponding to high level of temperature increase are not only relatively uncommunicated, but actually relatively unstudied (King *et al.* 2005).

A further characteristic of climate change that makes consideration of the long term even more important is also arguably underplayed in current IPCC assessments: the risks of climate change *tend to*

⁸ For others, it may be the ‘most likely’ case that is most relevant to decision-making. The timescale for such an assessment may not need to go far beyond the planning horizons in the economic sectors concerned (King *et al.* 2015).

increase over time. It is important to recognize how probabilities change, and avoid using the year 2100 as an arbitrary cut-off point, especially for the higher emission scenarios, because in some cases impacts and the probability of major climate system disruption will still be increasing. Figure 1 below shows the probability of exceeding 2°C, 4°C and 7°C respectively as a function of time, for the four emissions pathways.

There may also be a dangers in the way climate scientists currently express probabilities and in the documented tendency of the lay public to discount low-probability, high impact outcomes. While the IPCC defines 'likely' as 66-90% probability, and 'unlikely' as 10-33% probability, when college students were asked what they thought 'unlikely' meant for the probability of a land-falling hurricane, the most common response was 1-10%. 'If the scientific community tends to underestimate the severity of impacts under uncertainty, and the public tends to adjust probability of a severe event downward, the net effect may be a serious under-appreciation of the potential severity of climate change impacts among the public and decision-makers' (King *et al.* 2014: 48).

In other contexts there is a need to communicate better that past trends cannot be relied upon to continue. A roundtable hosted in February 2015 by Climatewise, in association with the insurer Aviva and the University of Cambridge's Institute for Sustainability Leadership, suggested that the use, hitherto, of trend-based Catastrophe Models, to quantify the risk posed by natural hazard events, may have resulted in systematic underestimation of insured losses from climate change by up to 50 per cent. Avoiding such underestimation in future would necessitate a shift towards viewing risk based upon what might happen in future, rather than upon historical trends (Economy Committee London Assembly 2015).

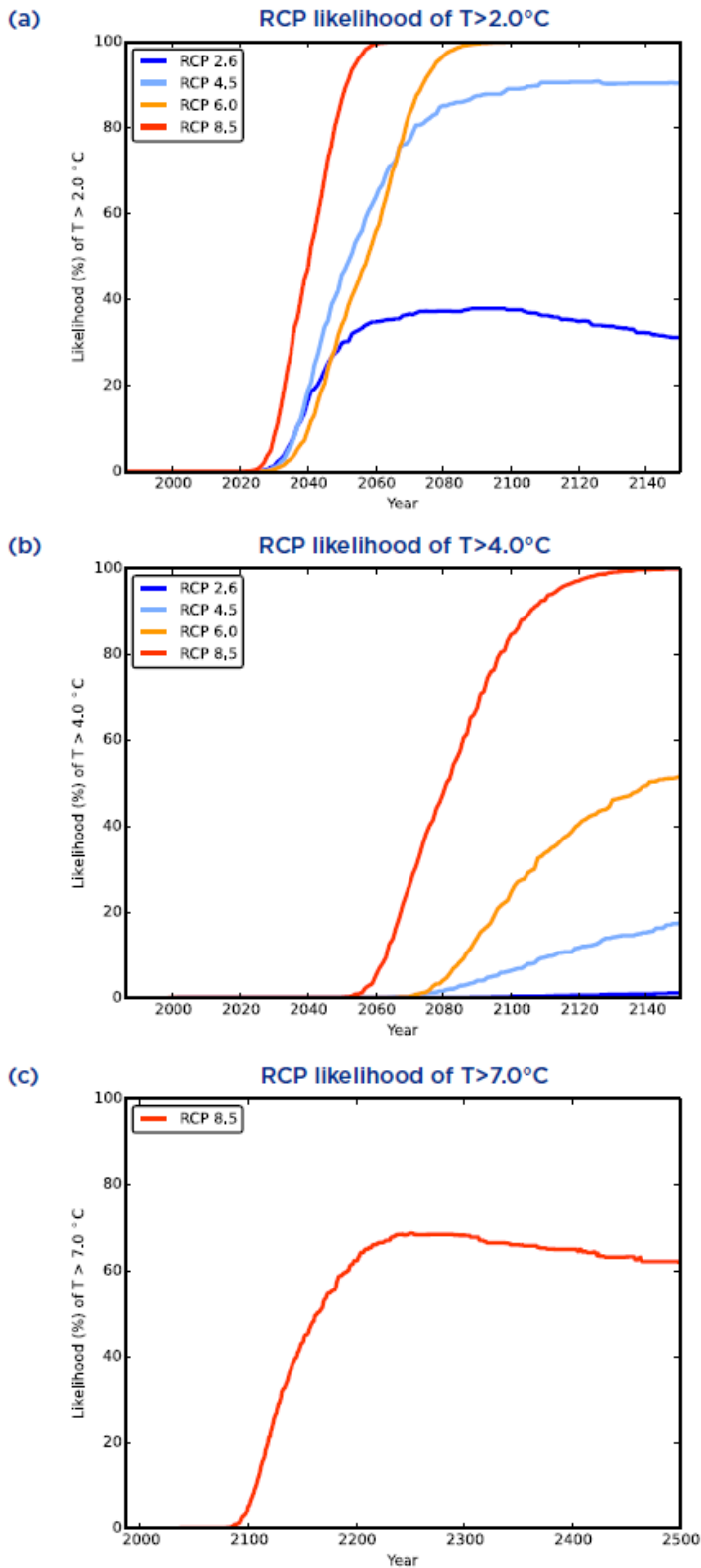


Figure 1: Probability of exceeding: (a) 2°C ; (b) 4°C ; and (c) 7°C based on the projected warming to 2500 from a simple climate model set up to cover the range of climate sensitivity from the more complex general circulation models, and sampling uncertainty in climate-carbon cycle feedback (from King *et al.* 2015, as presented at the HELIX workshop).

New narratives of high-end climate change and analytical frameworks are needed to inform robust scenario planning and decision making

Since some scenarios are projected to lead to very divergent futures in terms of impacts, effective responses to manage climate risk depend heavily, in some cases, on the scenario actually realized. As Stafford-Smith *et al.* (2011) have highlighted, simply presenting the prospect of a 4°C world as an increasingly likely one is unhelpful and disempowering unless the complexity of dealing with the thousands of decisions that might be affected by climate change can be simplified. As an over-arching narrative, there is potential in the ABC Framework: **A**im to stay below 2°C; **B**uild and budget (infrastructure) assuming 3-4°C; **C**ontingency plan for 5-7°C of warming (Mabey *et al.* 2011). This has potential to motivate difficult but much-needed dialogue and planning for the impacts of climate change under high-magnitude warming, addressing the risk that planners and decision-makers may cling to ‘unrealistic optimism’ as a maladaptive coping strategy (see section 3). Infrastructure planners and land-use planners need to be reminded of the sophisticated analytical frameworks that are available for robust decision making that can reduce complexity in dealing with the wide range of decisions sensitive to future climate change (e.g. Hallegatte 2009; Stafford-Smith *et al.* 2011).

In situations where near-term decisions have long-term consequences, adaptation planning needs to move from incremental to transformative as a contingency under scenarios of truly disruptive impacts. Pioneering examples include plans for relocation of development from floodplains around London after 2060 and the creation of water-efficient maize for Africa, both of which require planning and investment now to manage impacts in decades to come (Stanford *et al.* 2014). Building a science-based dialogue over the costs and challenges of transformative adaptation may even have the effect of motivating greater mitigation effort.

Communicate the impacts important to specific decision makers, in language they recognise.

A risk assessment aims to inform those with the power to reduce or manage risks. Assessments of specific, local, or sectoral risks of climate change may be directed at those with specific, local or sectoral responsibility. Assessments of the risk of climate change as a whole should report directly to those with responsibility for governance as a whole. At the national level, this means the head of government, the cabinet, or national security council. Globally, it means institutions where heads of government meet to make decisions (cf. King *et al.* 2015).

Politicians’ efforts to communicate the value of climate policy now frequently make use of risk language, such as emission reduction policies acting as an ‘insurance policy’. Such language speaks particularly well to the business sector, familiar as it is with assessing investment, insurance and other types of risk. The recent *Risky Business* initiative, explicitly aimed at business, uses a risk management perspective to report on the risks for agriculture, energy and coastal real estate in the US. The initial report (Houser *et al.* 2014) received widespread coverage in the US and UK business press, helping to shift the climate change story out of its ‘environment ghetto’ (Painter, undated). This enlargement of the story into other areas, including financial investments and energy security, demonstrates one of the best ways of engaging a wider audience and making it more relevant to their lives.

According to PWC, a company with considerable experience with engaging the business community on climate challenge:

‘Science debates have alienated many from the real issues. In reality, when working on climate risk assessments with companies, [we] don’t hear much debate about climate sensitivity or the heat of the ocean in 50 years’ time. It’s not the language of business decisions. [...] Instead, companies talk in terms of operational performance, asset management, business continuity, security of supply of commodities, energy and water, workforce health and well-being. How will

investment in resilience and climate mitigation today, show a rate of return in the future? It's okay that there are many uncertainties - businesses are experts at making decisions around uncertainty, and in scenario planning. Bridging this communication divide will be critical for action' (Herweijer 2013).

During the 2011 Thailand floods, 10,000 factories, including many crucial to global electronics and hard drive manufacturing were put out of action, and total national output in fell by 36%. The event cost Nissan £67 million in supply chain recovery costs. 'The language of climate change is about the issues that make politicians sit up, take notice, and take action. And these are the figures: not 2°C. ... Temperature and precipitation and modelling outputs is the language of climate science, and there's a difference'.⁹

Business should therefore be encouraged by communicators to take a 'context-first approach', looking at thresholds and tolerances within particular operations. This will afford a very good understanding of the types of action that can be taken in different scenarios without having to know precisely what that future holds (London Assembly Economy Committee 2015).

Utilise opportunities for peer-to-peer learning and individuals recognised in their own networks.

Peer-to-peer networks also have great potential to sensitise and inform decision makers, including spatial planners and others. The *Mayors Adapt* EU cities initiative is one such initiative. Technological developments also opening up new possibilities for learning and peer-to-peer interaction across long distances. For example, the World Bank has now offered a massive open on-line course (MOOC) based on its series of reports *Turn Down the Heat* to a global audience for two years running.¹⁰ Two tracks are offered: one to interested citizens and one to policy makers in more of a leadership role, and peer-to-peer interaction on dedicated web forums encouraged. The reception has been generally positive, albeit with some disquiet being expressed on the forums about the upbeat message from World Bank teaching staff on the course that the 2°C target is still feasible (refs).

Wider transformations in the cultural sphere, above all in social and digital media, are 'having ambiguous, but potentially very constructive, consequences for the ways in which stories about climate change develop and travel. Among other things, these changes encourage more plural and dynamic accounts of our understanding of climate change' (Smith *et al.* 2011: 7).

For wider publics, don't always start with climate, but with places and resources people value, then show how climate affects them

That said, there is still a place for basic education about climate change, as highlighted by research indicating how many people have yet to learn of it. Ming-Lee *et al.* (2015) suggest that improving basic education, climate literacy and public understanding of the local dimensions of climate change are vital to public engagement and support for climate action. Beyond these strategies, heterogeneities in the key predictors of climate change risk perceptions across countries suggest that each country has its own relatively unique set of correlates. Therefore, national and regional programmes aiming to increase citizen engagement with climate change must be tailored to the unique context of each country, especially in the developing world (Ming-Lee *et al.* 2015).

⁹ John Firth, CEO Acclimatise, presentation at *Our Common Future Under Climate Change*, Paris, 7-10 July 2015 <http://www.acclimatise.uk.com/network/article/video-acclimatise-ceo-john-firth-on-climate-change-adaptation-its-not-an-environmental-issue>.

¹⁰ <https://www.coursera.org/course/warmerworld>

At its root, the public discussion of climate science is as much about what sort of world we wish to live in, and hence about ethics and values, as it is about immediate and longer-term material risks to human wellbeing. This needs to be clearly acknowledged and addressed.

Encourage immersive events and experiential learning.

In advanced societies, citizens typically lack direct experiences of the severe consequences of unsustainability that are compelling enough to motivate action to address their causes. Creating widespread opportunities to learn experientially about sustainability can help to foster such commitment by:

- providing engaging and authentic learning experiences that make abstract issues of sustainability real and relevant to people and stimulate new interest in learning about their causes and consequences;
- improving affinity with the natural world through learning experiences that demonstrate the interdependence of human and natural systems and the ecological impacts of unsustainability, both for people and for the planet;
- improving understanding of physical, emotional and spiritual human needs and of the need to reconcile these with the ecological needs of the planet;
- making learning about human and ecological sustainability personally meaningful and communally supportive in ways that inspire committed and enduring engagement and action.

Ideally, policy makers should also participate in events such as scenario workshops, where stories are jointly constructed and played out.

Less debate and lecturing, more dialogue

Fuller engagement with unwelcome climate messages and their policy implications requires a more strategic approach than has been witnessed to date. The kind of approach favoured by participants in the workshop has much in common with the approach to climate risk, uncertainty communication and decision making advocated by Pidgeon and Fischhoff (2011). Firstly there is a requirement for more strategic listening, whereby communication becomes a genuine dialogue, and effort is made to understand intended audiences and their decision needs prior to communication design. Secondly, there is a requirement for more strategic organisation, corralling a range of skills including natural science, decision science, social science as well as communications specialists. In Pidgeon and Fischhoff's model, such an organisation should aim to meet basic research needs in risk and uncertainty analysis, risk perception, and risk communication as well as immediate policy goals - operating as a 'boundary organisation' between academia and public policy (House of Commons Science and Technology Committee 2014).

Such a two-way dialogic approach is inevitably resource intensive, and may therefore be too expensive to be used for communicating on climate science to the public on a significant scale (ibid).

Recognising emotions, loss and the need for 'active hope'

Knowledge of the implications of high-end climate scenarios constitutes a burden for those who are generating it, attempting to communicate it, and hearing about it as lay individuals. As already noted, emotions of anxiety, fear, guilt, loss, interdependency and helplessness are likely to be aroused in 'accept[ing] the fact that the world we have known is going to change in hideous and damaging ways'

(McKibben 2010: 176). Sensitive handling of such emotions is required by both scientists conducting research and those seeking to communicate the science. If scientists fail to acknowledge the emotional weight of unwelcome climate science, something powerful will be lost, and lay audiences may well become suspicious. As one communications practitioner has put it:

‘do climate scientists talk about the fate of their children when they speak of the fate of the planet? Probably not. Do they seem worried or professionally detached? In general they lack congruence: they announce Armageddon but are not even packing their bags’ (Rose, undated: 32).

George Marshall (2014) emphasises how **‘friendly communicators’**, especially scientists, should learn to be emotionally honest, talking openly about their hopes, fear, and anxieties, and be willing to tell personal stories. Communicators should talk about their personal journey, especially if they have come to their conviction from a position of doubt. Talking in such personal terms may cause a certain discomfort among scientists, some of whom may fear some loss of professional reputation. But the numbers willing to take this risk, and suffering no loss of reputation, are growing.¹¹ Lord Stern introduced his two-week old granddaughter at a TEDx talk in New York, asking what kind of century she would be living through.¹² Rather than being dismissed as alarmist, Susanne Moser’s recent attempts to engage at a more emotional level have met with gratitude:

‘I hope to make it required reading for the ... [agency] management team and the Climate Cabinet (Brian).

‘I have just finished ... "Getting Real About It" [...] with both horror and enormous gratitude for the way you are able to tell us what's really happening with clarity and compassion’ (Wendy) [Moser, presentation to HELIX workshop, 16th April 2015].

In order to avoid the tendency for denial or maladaptive responses, audiences themselves need more ‘safe spaces’ to make emotional connections that open up energy and engagement. ‘When people are able to tell the truth about what they know, see and feel is happening to their world, a transformation occurs. There is an increased determination to act and a renewed appetite for life’ (Macey and Johnstone 2012).

¹¹ See entries on the website <http://isthisshowyoufeel.weebly.com/this-is-how-scientists-feel.html>

¹² www.ted.com/talks/lord_nicholas_stern_the_state_of_the_climate_and_what_we_might_do_about_it?language=en

6. Towards principles of communicating unwelcome climate messages

As expressed by Susanne Moser in a presentation to the workshop, to avoid being ‘narrators of doom’ but instead foster adaptive coping strategies, communicators must move:

1. from delivering unwelcome messages...
...to participating in *difficult dialogues*
2. from delivering scientific findings...
... to making a *human connection*
3. from thinking we just speak to the mind...
... to deliberately *engaging the heart*
4. from merely giving bad news...
... to taking people on an *emotional journey*
5. from triggering fight-or-flight
... to motivating *active engagement*

In addition to accepting these, the workshop also concluded that ideally stakeholder or audience involvement should extend upstream, to involve a co-production of the science behind the messages as well, to maximise the prospects of acceptance and engagement.

Moser’s suggested principles apply when communicating to high-level policy makers as much as to lay publics. They presents **significant new demands on communicators**, and the venues in which they communicate, requiring a **move beyond traditional formats** for communication such as lectures and debates. To build a relationship with **particular audiences** takes more time and **attention to process**; first to hear particular concerns, then to offer science and conceive of possible solutions. This is likely to **need a broad, multi-disciplinary team**.

Fostering active hope

For hope to be maintained, there must be a sense in which unwelcome outcome is uncertain, not assured. Beyond that, 6 ingredients may be highlighted:

i) Clear-eyed diagnosis: Where are we at?

As noted in section 4, impacts corresponding to high-end of temperature rise are not only relatively unknown, but also relatively unstudied (King 2005). The HELIX project will need to be joined by other efforts to understand these further.

ii) Vision of a worthwhile outcome: *What is achievable?*

‘Scientists who regularly communicate about climate risks owe it to their audiences to make it clear that **there are significant differences between a lower and higher-emission future**. And it’s worth pointing people to what is being done and what can be done to address those risks’ (Huertas 2015).

iii) Feasible path: How can we get from here to there?

iv) Strategy for setbacks and interim goals: What to do when the going gets tough?

v) Meaningful role for me: What can I do?



vi) Doing it together: What will you (others) do?

Climate change is dealt with by individuals almost exclusively in private, with little public or political discourse against which to calibrate personal views. That being so, individuals easily come to assume that few people have positive views about radical solutions.

There is a need to nurture 'communities of conviction' to overcome the reluctance of individuals to fully engage with unwelcome climate messages. Individuals' inability to grasp and respond to the climate crisis is fundamentally related to the lack of social infrastructure for sharing, validating and strengthening our beliefs about this challenge (Marshall 2014). Marshall argues that by looking to other communities (such as faith groups) which provide support for their members, allowing their personal beliefs to be validated by their peers, lessons can be learned for campaigning on climate change.

References

- Agyeman J, Doppelt B, Lynn K, Hatic H. (2007). The climate-justice link: communicating risk with low-income and minority audiences. In: Moser SC, Dilling L, eds. *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*, Cambridge, UK: Cambridge University Press.
- Anderson, K. and Bows, A. (2011). Beyond “dangerous” climate change: emission scenarios for a new world. *Phil Trans R Soc A* 369: 20-44.
- Arroyo V and Preston B. (2007). Change in the marketplace: business leadership and communication. In: Moser SC, Dilling L (eds.) *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*. Cambridge, UK: Cambridge University Press; 319–338.
- Berners-Lee, M. and Clark, D. (2013). *The Burning Question*. Profile Books: London.
- Betts, R. A., M. Collins, D. L. Hemming, C. D. Jones, J. A. Lowe and M. G. Sanderson (2011). When could global warming reach 4°C? *Phil. Trans. R. Soc. A* 2011 369, 67-84.
- Brügger, A., Morton, T.A., Dessai, S. (2015). Hand in Hand: Public Endorsement of Climate Change Mitigation and Adaptation. *PLoS ONE* 10(4): e0124843.
- Confino, J. (2015). How concerned are CEOs about climate change? Not at all. *The Guardian*, 20 Jan, <http://www.theguardian.com/sustainable-business/2015/jan/20/global-warming-business-risks-government-regulation-taxes>
- Corner, A. (2013). *A new conversation with the centre-right about climate change: Values, frames and narratives*. Climate Outreach and Information Network (COIN).
- Corner, A. (2014). Three ways to build deep public support on climate change. Climate Outreach and Information Network. <http://www.climateoutreach.org.uk/three-ways-to-build-deep-public-support-on-climate-change/>
- Crompton, T. and Kasser, T. (2009). *Meeting Environmental Challenges: The Role of Human Identity*. Godalming: WWF-UK.
- Dessai, S., Hulme, M., Lempert, R. and Pielke, R. J. (2008). Climate prediction: a limit to adaptation? In *Adapting to climate change: thresholds, values, governance* (eds W. N. Adger, I. Lorenzoni & K. L. O’Brien), pp. 64–78. Cambridge, UK: Cambridge University Press.
- ecoAmerica (2012). *Changing Season, Changing Lives: New Realities, New Opportunities. Leadership Summit Report*. Washington, DC: ecoAmerica.
- Field, C.B., V.R. Barros, D.J. Dokken *et al.* (eds.) (2014). *Climate Change 2014: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press.
- Field, C., *et al.* (2015). Our Common Future under Climate Change. Outcome Statement by CFCC15 Scientific Committee*, chaired by Chris Field. July 10 2015. http://www.commonfuture-paris2015.org/?IdNode=59191&Lang=FR&KM_Session=299cbb82105bf60772c15795b34a7552
- Geden, O. (2015). Climate Advisers Must Maintain Integrity. *Nature* **521** (May 7): 27-28
- Hallegatte, S. (2009). Strategies to adapt to an uncertain climate change. *Glob. Environ. Change Hum. Policy Dimens.* **19**, 240–247.

- Hall, J., S. Brown, R. J. Nicholls, N. F. Pidgeon and R. T. Watson (2012). *Proportionate Adaptation*. *Nature Climate Change* **2**, December: 833-834.
- Hamilton, C. and T. Kasser (2009). 'Psychological adaptation to the threats and stresses of a four degree world'. A paper presented at the *Four Degrees and Beyond* conference, Oxford University 28-30 September.
- Happer, C, Philo, G. and Froggatt, A. (2012). *Climate Change and Energy Security: Assessing the Impact of Information and it's Delivery on Attitudes and Behaviour*, UK Energy Research Centre Report, Available from: <http://www.ukerc.ac.uk/support/RF2PublicAttitude>.
- Harris, A., Corner, A. and Hahn, U. (2009). Estimating the probability of negative events. *Cognition* 110, 51-64.
- Huertas, A. (2015). Esquire Falls into the Despondency Trap—We're Not "F'd" on Climate Change. <http://blog.ucsusa.org/esquire-falls-into-the-despondency-trap-were-not-fd-on-climate-change-800>
- Herweijer, C. (2013). IPCC/ PwC comment on impact for business, policy, carbon budget, science debate. http://pwc.blogs.com/press_room/2013/09/ipcc-pwc-comment-on-impact-for-business-policy-carbon-budget-science-debate.html
- Homburg, A., Stolberg, A. and Wagner, U. (2007). Coping with global environmental problems: development and first validation of scales. *Environment and Behaviour* 39 (6): 754-778.
- House of Commons Science and Technology Committee (2014). *Communicating Climate Science* Eighth Report of Session 2013-14. Report, together with formal minutes, oral and written evidence HC 254. London: The Stationary Office.
- Houser, T., S. Hsiang, R. Kopp and K. Larsen (2014). *Economic Risks of Climate Change: An American Prospectus*. Columbia University Press. ...
- Howe, P. D. *et al.* (2013). Global perceptions of local temperature change. *Nature Clim. Change* **3**, 352-356.
- Hulme, M. (2009). *Why We Disagree About Climate Change: Understanding Controversy, Inaction and Opportunity*. Cambridge: Cambridge University Press.
- IEA (International Energy Agency) (2013). *Electricity in a Climate-Constrained World: Data and Analyses*, OECD Publishing: Paris.
- IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B. *et al.* (eds.)]. Cambridge University Press, Cambridge, UK, and New York, NY, USA, 582 pp.
- Jackson, R. B., P. Friedlingstein, J. G. Canadell, and R. M. Andrew (2015). Two or Three Degrees CO₂ Emissions and Global Temperature Impacts. *The Bridge* 45 (2): 16-21.
- Jacobson, N., C. Martell and S. Dimidjian (2001). Behavioral Activation Treatment for Depression: Returning to Contextual Roots. *Clinical Psychology: Science and Practice* 8(3): 255-270.
- Jordan, A., T. Rayner, H. Schroeder *et al.* (2013). Going Beyond Two Degrees? The Risks and Opportunities of Alternative Options, *Climate Policy* 13(6): 751-769.
- Kasser, T. (2009). Shifting values in response to climate change, in R. Engelman, M. Renner and J. Sawin (eds), *2009 State of the World: Into a Warming World*, New York: W.W. Norton & Co.
- King, D. *et al.* (2015). *Climate Change: A Risk Assessment*. Centre for Science and Policy, University of Cambridge.

- Klein, R.J.T., G.F. Midgley, B.L. Preston *et al.* (2014). 'Adaptation opportunities, constraints, and limits. Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field *et al.* (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 899-943.
- Lench, H.C., Smallman, R., Darbor, K. and Bench, S. (2014). Motivated perception of probabilistic information. *Cognition* 133, 429–442.
- Leiserowitz, A., Maibach, E., Roser-Renouf, C. (2008). *Global Warming's "Six Americas". An Audience Segmentation*. New Haven, CT and Fairfax, VA: Yale Project of Climate Change, Yale School of Forestry & Environmental Studies and the Center for Climate Change Communication, George Mason University.
- London Assembly Economy Committee (2015). *Weathering the Storm: The Impact of Climate Change on London's Economy*. London: Greater London Authority.
- Mabey, N., Gullede, J., Finel, B. and Silverthorne, K. (2011). *Degrees of Risk: Defining a Risk Management Framework for Climate Security*. Brussels: E3G.
- Macy, J. and C. Johnstone (2012). *Active Hope: How to Face the Mess We're in without Going Crazy*. Novato: New World Library.
- Magnan, A. (2014). Avoiding maladaptation to climate change: towards guiding principles. *S.A.P.I.EN.S*, 7(1).
- Maibach, E., Roser-Renouf, C. and Leiserowitz, A. (2009). *Global Warming's "Six Americas" 2009: An audience segmentation*, Yale Project on Climate Change and George Mason University Center for Climate Change Communication
- Markowitz, E.M., and Shariff, A.F. (2012). Climate change and moral judgement. *Nature Climate Change* 2, 243–247. DOI10.1038.
- Marshall, G. (2014). *Don't Even Think About It: Why Our Brains Are Wired to Ignore Climate Change*. Bloomsbury.
- McGlade, C. and P. Ekins (2015). The geographical distribution of fossil fuels unused when limiting global warming to 2C. *Nature* 517, 8 January:
- Ming-Lee, T. et al (2015). Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change*. Published online 27 July 2015.
- Moser, S. C. and Dilling, L. (2004). Making climate hot: communicating the urgency and challenge of global climate change. *Environment* 46(10): 32-46.
- Moser S.C. (2007). In the long shadows of inaction: the quiet building of a climate protection movement in the United States. *Global Environmental Politics* 7:124–144.
- Moser, S. (2010). Communicating climate change: history, challenges, process and future directions. *WIREs Climate Change* 1: 31-53.
- Moser, S.C. (2012). Getting real about it: Navigating the psychological and social demands of a world in distress. In: Rigling Gallagher, D. *et al.* (eds), *Sage Handbook on Environmental Leadership*, SAGE, pp.432-440.
- Moser, S. (2014). Communicating adaptation to climate change: the art and science of public engagement when climate change comes home. *WIREs Climate Change*, 5:337–358.
- Moser, S.C. (2014). "Whither the Heart(-to-Heart)? Prospects for a humanistic turn in environmental communication as the world changes darkly." In: Hansen, A. and R. Cox (eds.), *Handbook on Environment and*

- Communication*. London: Routledge, pp. 444-456.
- O'Neill, S.J., Hulme, M., Turnpenny, J. and Screen, J. (2010), 'Disciplines, geography and gender in the framing of climate change', *Bulletin of the American Meteorological Society* 91: 997-1002.
- Painter, J. (undated). A new narrative, in UNA-UK (eds), *Climate 2020: Facing the Future*, pp30-31.
- Pelling, M. (2009). *Adaptation to Climate Change: From Resilience to Transformation*. London: Routledge.
- Pidgeon, N. and B. Fischhoff (2011). The role of social and decision sciences in communicating uncertain climate risks. *Nature Climate Change* 1: 35-41.
- Pittock, A. B. and Jones, R. N. (2000). Adaptation to what and why? *Environ. Monit. Assess.* **61**, 9–35
- Porritt, J. (2013). *The World We Made*. London: Phaidon.
- PWC (2014). *Two degrees of separation: ambition and reality*. Low Carbon Economy Index 2014
- Randalls, S. (2010). History of the 2C climate target. *WIREs Climate Change* 1(4), 598–605.
- Roberts, D. (2011). The brutal logic of climate change. <http://grist.org/climate-change/2011-12-05-the-brutal-logic-of-climate-change/>
- Roberts, D. (2015a). The awful truth about climate change no one wants to admit. Updated by [David Roberts](#) on May 15, 2015, <http://www.vox.com/2015/5/15/8612113/truth-climate-change>
- Roberts, D. (2015b). The news on climate is awful. So now what? Updated by [David Roberts](#) on May 19, 2015. <http://www.vox.com/2015/5/19/8624229/the-news-on-climate-is-awful-so-now-what>
- Rose, C., Dade, P and Scott, J. (2007). *Research into Motivating Prospectors, Settlers and Pioneers to Change Behaviours that Affect Climate Emissions*. Campaign Strategy.
- Sanford, T., P. C. Frumhoff, A. Luers and J. Gullede (2014). The climate policy narrative for a dangerously warming world. *Nature Climate Change* 4, 164–166.
- Schweizer, S., Davis, S. and Thompson, J.L. (2013). Changing the conversation about climate change: a theoretical framework for place-based climate change engagement. *Environmental Communication: A Journal of Nature & Culture* 7(1), 42-62.
- Shaw, C. (2014). Reframing climate risk to build public support for radical emission reductions: the role of deliberative democracy. *Carbon Management* 5(4): 349-360.
- Smith, J., R. Tyszczuk and R. Butler (eds.) (2014). *Culture and Climate Change: Narratives*. Cambridge: Shed Publications.
- Stafford Smith, M., L. Horrocks, A. Harvey and C. Hamilton (2011). Rethinking adaptation for a 4°C world. *Phil. Trans. R. Soc. A* 369: 196-216.
- Taylor, S. (1989). *Positive Illusions: Creative Self-deception and the Healthy Mind*, New York: Basic Books.
- Tompkins, E. L., Adger, N. W., Boyd, E. et al. (2010). Observed adaptation to climate change: UK evidence of transition to a well-adapting society. *Glob. Environ. Change*. 20 (4): 627-635.
- UCL (2014). *Time for Change: Climate Science Reconsidered*. Report of the UCL Policy Commission on the Communication of Climate Science. London: University College London.



- Weber, E (2006). Experience-based and description-based perceptions of long-term risk. *Climatic Change* 77: 103–120.
- Whitmarsh, L., O’Neill, S. and Lorenzoni, I. (eds.) (2010). *Engaging the Public with Climate Change: Behaviour change and communication*. London: Earthscan.
- Wolf, J. & Moser, S. C. (2011). Individual understandings, perceptions, and engagement with climate change: Insights from in-depth studies across the world. *WIREs Climate Change* **2**, 547-569.
- World Bank (2013). *Turn Down the Heat: Climate Impacts, Regional Impacts and the Case for Resilience*. Washington, DC: World Bank.
- World Bank (2014). *Turn Down the Heat: Confronting the New Climate Normal*. Washington, DC: World Bank.
- Zaval, L. et al. (2014). How warm days increase belief in global warming. *Nature Climate Change* **4**, 143-147.