



On the use of imagery for climate change engagement

Saffron J. O'Neill^{a,*}, Maxwell Boykoff^b, Simon Niemeyer^c, Sophie A. Day^d

^a Geography, College of Life & Environmental Sciences, University of Exeter, Amory Building, Rennes Drive, Exeter EX4 4RJ, UK

^b CIRES Center for Science and Technology Policy Research, 1333 Grandview Avenue, University of Colorado-Boulder, CO 80309-0488, USA

^c School of Politics & International Relations, H.C. Coombs Building, Australian National University, Canberra, ACT 0200, Australia

^d Tyndall Centre for Climate Change Research, Faculty of Engineering and the Environment, University of Southampton, UK

ARTICLE INFO

Article history:

Received 13 March 2012

Received in revised form 24 September 2012

Accepted 14 November 2012

Available online xxx

Keywords:

Climate imagery

Perceptions

Public engagement

Q-method

Saliency

Efficacy

ABSTRACT

This article answers calls from scholars to attend to a research gap concerning the visual representation of climate change. We present results from three Q-methodology workshops held in Melbourne (Australia), Norwich (UK) and Boulder (USA) investigating engagement with climate change imagery drawn from mass media sources. Participants were provided with a concourse of climate change images drawn from a newspaper content analysis carried out across all three countries, and asked to carry out two Q-sorts: first, for salience ('this image makes me feel climate change is important') and second, for efficacy ('this image makes me feel I can do something about climate change'). We found results remarkably consistent both across and within country cohorts. This may indicate the presence of a dominant, mainstream discourse around climate imagery. We found that imagery of climate impacts promotes feelings of salience, but undermines self-efficacy; that imagery of energy futures imagery promotes self-efficacy; and that images of politicians and celebrities strongly undermine saliency, and undermine self-efficacy for the Australian cohort. These results, if widely replicable, have implications for climate change communication and engagement. Our results suggest 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. Communications strategies should assess the purpose of their messages, considering these findings regarding salience and efficacy in this study, and choose to employ images accordingly.

© 2012 Elsevier Ltd. All rights reserved.

1. Climate change and public engagement

The 2007 United Nations' Intergovernmental Panel on Climate Change (IPCC) report stated that climate warming is 'unequivocal' (Solomon et al., 2007). There are two broad responses to the issue of climate change; mitigation (reducing greenhouse gas emissions) and adaptation (anticipating and adjusting to the inevitable impacts to which past emissions have committed us). Both adapting to and mitigating for climate change will become increasingly important, and have major impacts on the way people live their lives.

The media act as powerful agents shaping, translating and interpreting information (Bell, 1994), and people rely upon media representations to help interpret and make sense of the many complexities surrounding climate science, governance and decision-making (Moser and Dilling, 2007). Boykoff (2011) calls this process of the production and consumption of a multiplicity of climate change media the 'cultural politics of climate change'.

Media representations are therefore powerful and important links between people's daily realities and experiences, and the ways in which these are discussed at a distance between science, policy and public actors. Examining the interactions between media representations and public engagement can therefore facilitate our understanding of how texts and images inform and influence peoples' conceptualisation of climate change. Yet whilst many studies have explored this interface through textual mass media coverage (e.g. Boykoff, 2007; Carvalho and Burgess, 2005; Painter, 2011), few studies have critically examined how people engage with visual representations of climate change in the mass media.

1.1. The role of imagery in shaping perceptions of climate change

Bauder (2010), examining the impact of imagery on public perception of the 2009 Gulf of Mexico oil spill, shows how imagery is key to shaping perceptions of real-world issues: 'For many following the news, the Gulf oil spill was an important but abstract story – until [imagery] became widely available showing plumes of oil gushing into the water at a furious pace, hour after hour and day after day'. When communicating complex concepts and abstract issues to members of the public citizenry, imagery has been an effective

* Corresponding author. Tel.: +44 01392 726202; fax: +44 01326 371859.

E-mail address: S.O'Neill@exeter.ac.uk (S.J. O'Neill).

vehicle for meaning-making. This has particularly been the case with the high-stakes and highly-contested issue of climate change.

While texts are often privileged as primary means of climate communication, images have been considered as a powerful way to “bear witness” to climate change (Doyle, 2007, p. 131). For many decades, mass media images have been harnessed and woven into texts in a variety of ways to develop narratives on complex and abstract issues about climate and the environment. Perhaps the first powerful example of this is the well-known Apollo 8 photo ‘Earth Rise’, taken in December 1968. This was the first view that the general public had of planet Earth in its entirety (Cosgrove, 1994). Images accompanying stories and advertising have served to identify threats and dangers associated with climate change as well as personify the climate change ‘problem’ (Smith and Joffe, 2009).

Imagery has the power to engage at an affective, emotional level. Leiserowitz (2006) outlines how dual processing theory – the two parallel, but distinct, risk processing systems we use for understanding risk (Epstein, 1994) – can shed light on how we engage with climate change imagery. Whilst the cognitive processing system is rational, analytic, logical and deliberative, encoding reality in abstract terms; the experiential processing system is holistic, affective, fast and intuitive, encoding reality through imagery and metaphors. Leiserowitz states that this experiential system is engaged by the use of imagery, playing a role in shaping the emotions we feel about climate change.

Arresting, startling, attention-getting, amazing, uplifting, upsetting and even shocking images therefore have the potential to raise awareness, as well as inspire people to explore possible actions to take in the face of climate challenges. But in making the intangible tangible, climate imagery can also paralyse and demobilise. In making climate change meaningful through imagery, communications can act to increase or decrease peoples’ sense of both issue salience (whether climate change is considered important) and their self-efficacy (a sense of being able to do anything about climate change).

1.2. Climate images in the public domain

Climate change is often perceived as distant to everyday experience across both time and space (Lorenzoni et al., 2007), leading some scholars to claim that climate change is often effectively invisible (Doyle, 2011). Where climate change is visualised in advertising media, images tend towards aesthetically pleasing landscapes, drawing on myths of unspoiled wilderness and nature at risk (Linder, 2006). Doyle (2007) found ice imagery played a particular role in NGO communications. Hansen and Machin (2008) studied the images that global image manager, Getty Images, associate with climate change to fulfil the marketing needs of their clients. They found that the Getty Green Images Collection had moved away from naturalistic scenes towards the representation of climate change in abstract, decontextualised and symbolic imagery.

Several studies have examined climate imagery in the print media. Smith and Joffe (2009) analysed visuals attached to stories about ‘global warming’, ‘climate change’ or the ‘greenhouse effect’ in six UK Sunday newspapers from 2000 to 2006. They found three broad themes dominated: immediate impacts of climate change, personification of the issue, and graphical representations. Although different coding schemes make it somewhat difficult to compare the studies, an analysis of visual coverage in two national newspapers over 6 months in 2008 in Canada appears broadly similar; with people dominating coverage, followed by climate impact imagery (DiFrancesco and Young, 2011).

An international cross-comparative study of visual coverage in the US, UK and Australia provides the most comprehensive image

content analysis to date (O'Neill, 2012). Thirteen newspapers were examined for imagery attached to climate stories during 2010, yielding a concourse of over 1500 images. The study demonstrated how climate change is often framed as a political, contested and distant issue rather than as a cultural or social phenomenon close to individual experiences. O'Neill found people, many of whom were political figures, dominated coverage; with impact imagery depicting geographically distant (like ice imagery) or personally distant visuals (e.g. smokestack images).

1.3. Public engagement with climate imagery

A growing body of research (Moser and Dilling, 2007; Whitmarsh et al., 2011a,b, provide overviews from the USA and UK respectively) seeks to understand public engagement with climate change. Moreover, along with a dramatic increase in media coverage of climate change in the last decade, there has also been a rise in studies that explore text-based media representations of climate change (e.g. Boykoff, 2007; Carvalho, 2007; Painter, 2011). Yet analytical examination of public engagement with climate change imagery in the public domain – as communicated through mass media – has been largely absent from this literature, remaining a key research gap (see Moser, 2010, p. 43).

The only studies to have investigated public engagement with climate images in the public domain were undertaken in the UK (ImageS and IconS studies; O'Neill and Nicholson-Cole, 2009). The studies demonstrate how dramatic, sensational, fearful and shocking imagery can successfully capture people’s attention to the issue of climate change, making them feel that climate change is an important issue. However, these same fear-inducing images tended to distance or disengage individuals, rendering them feeling helpless, overwhelmed and not empowered to act.

Here, we report the results of a study examining public engagement with climate imagery from newspapers, carried out through Q-methodology workshops in Melbourne (Australia), Boulder (USA) and Norwich (UK). These three countries hold similarities in being active in the climate policy arena and in hosting significant contrarian voices (see O'Neill and Boykoff, 2010). However, this study is not intended to be representative of the nation states involved. Instead, we gathered rich and in-depth data, to begin to shed light on how people may engage with climate imagery in mass media sources.

2. Methodology

This study draws on the image-sorting Q-method technique described by O'Neill and Nicholson-Cole (2009; also see Nicholson-Cole, 2004) to investigate peoples engagement with climate imagery. Q-method is a method exploring an issue under the rubric of subjectivity (Brown, 1980; Watts and Stenner, 2012), although many researchers use it to explore discourses at play in the context of particular issues (Dryzek, 1994; Barry and Proops, 1999; Hobson and Niemeyer, in press). Discourses are shaped by underlying attitudes and values. Q-method elicits these discourses through the process of Q-sorts, where participants are asked to sort a number of items (usually statements) in a concourse (the full representation of different points of view of the issue). Q-method enables the elicitation, evaluation and comparison of human subjectivity; it offers the means to identify shared opinions and perspectives among individuals based on the similarities and differences expressed in their Q-sorts (Brown, 1980; McKeown and Thomas, 1988; Robbins and Krueger, 2000). Q-method is typically carried out using attitude statements but more recent research has used visual images (e.g. Fairweather and Swaffield, 2001; Nicholson-Cole, 2004), and it is increasingly used to elicit discourses surrounding the issue of climate change (e.g. Niemeyer

et al., 2005; O'Neill and Nicholson-Cole, 2009; Hobson and Niemeyer, 2011).

This particular technique investigates the relationship between visual imagery of climate change and people's perceptions of the issue: firstly with regard to whether they consider climate change personally important (salience); and secondly with regard to their sense of being able to do anything about it (efficacy). Q-method is distinctive in that it allows both quantitative and qualitative data to be collected. Quantitative data are collected from rankings of an image concourse by each participant, with qualitative data gathered via interviewing participants about the reasoning behind their rankings.

In Q-method, comprehensiveness and representativeness are sought through the careful selection of items (statements or images) representative of the issue in question (or "concourse" to use Q terminology), which is more critical than the selection of participants. To use an ecological analogy, the process of discovering the main response types to the climate images in this research is more consistent with the task faced by a research seeking to 'discover' which particular species inhabit a particular biome. The researcher uses a relatively small number of quadrants (analogous to participants) to intensively examine for different species (factors). Beyond a small number of quadrants the chances of discovering new species decrease logarithmically, while at the same time deploying scarce resources ever more thinly. Thus, the relative priority in Q methodology is not to achieve a statistically representative participant sample, rather it seeks to submit a comprehensive array of statements for participants to sort and submit for analysis.

Here, a representative sample of climate visual imagery was collected through a content analysis of thirteen newspapers from Australia (*Herald Sun*, *Age*, *Australian*, *Courier Mail*, *Telegraph*) the UK (*Sun*, *Daily Express*, *Daily Mail*, *Times*, *Guardian*) and the USA (*New York Times*, *Wall Street Journal*, *USA Today*). The content analysis collected all images attached to articles about 'climate change', 'global warming' or the 'greenhouse effect' during 2010 from these newspapers ($n = 1603$). These images were subject to thematic coding (drawing from previous studies, see [Leiserowitz, 2006](#); [Smith and Joffe, 2009](#)) but also from themes emerging from the data. There were 16 categories in total, containing 75 sub-categories. Each image was single coded. Pilot testing revealed the coding scheme to be stable, with a sub-sample of the concourse estimating an inter-coder reliability of 93.5% (see [O'Neill, 2012](#) for further methodological details).

Forty images representing the main code themes from [O'Neill \(2012\)](#) were selected to comprise the Q concourse ([Box 1](#)). Images were selected for the set based on three considerations. First, based on their coverage in the content analysis (so images categories that saw higher levels of newspaper coverage also were more numerous in the Q concourse); second, with regard to producing a concourse that could be understood internationally (for example, the political leaders of each country – PM Julia Gillard, PM David Cameron and President Barack Obama – were all pictured in the image concourse); and third, in order to explore particular aspects of the climate change communication literature (e.g. an image representing climate and religion was selected, see [Bingham, 2007](#), as was a celebrity, see [Boykoff and Goodman, 2009](#)). Piloting was undertaken with Australian, British and American participants to test the Q-sort instruction protocol and the comprehension of the image concourse. Participants were interviewed both as part of the Q-method undertaking itself, but also about the process of undertaking the Q-sort. Piloting revealed no changes to the protocol or images were required.

Workshops were held in Boulder ($n = 30$), Norwich ($n = 26$) and Melbourne ($n = 25$). The workshops were all held in quiet but publicly-accessible buildings, located in busy public spaces in each

Box 1. Images used in the study.

1. Rajenda Pachuri	15. Traffic jam	28. Richard Branson
2. Coral reef	16. Low reservoir	29. Car in snowstorm
3. David Cameron	17. Smokestacks	30. Felling tropical forest
4. Prince Charles	18. Volcano	31. Julia Gillard
5. Solar panels	19. Church congregation	32. Fighting bushfire
6. Wind farm	20. Electric car	33. Globe from space
7. Tractor on farm	21. Coastal erosion	34. Bob Geldof at rock concert
8. Temperature graph	22. Al Gore	35. Barack Obama
9. Climate scientist	23. Ice sheet	36. Red meat for sale
10. Flooding map	24. Home insulation	37. Climate protest
11. Deckchairs	25. Polar bear	38. Glacier
12. Cracked ground	26. Coral atoll	39. Ecohouse
13. Planes at airport	27. Flood aerial view	40. Fuel pump
14. Nuclear power plant		

city. Recruitment of participants involved members of the research team approaching members of the public to invite them to participate in research investigating peoples' thoughts about pictures of climate change. Potential participants were approached so as to ensure diversity across age and gender. Participants were told that the workshop would take between 30 min and an hour, and they would be given an honorarium of 5 pounds (UK) or 10 dollars (US/UK).

While the recruitment sought to achieve a diversity of participants in respect to age and gender, the aim was less to achieve a descriptively representative sample than an attitudinally diverse sample that would indicate the range of different responses to the stimulus of the climate change images. Indeed, the climate change attitude questions at the beginning of the workshop confirmed a diversity of views were present. For example, when asked how worried they were about climate change, participants' views fell across the spectrum: with 7%, 4%, 12% (US, Australia, UK) 'not at all worried'; and 17%, 17%, 12% at the opposite 'very worried' extreme. When asked how serious a threat climate change was: 20%, 17%, 21% considered it 'very serious' to themselves personally; but similar numbers (23%, 33%, 21%) also considered climate change 'not very serious' personally.

In this sense, the approach is consistent with a 'discursively representative' sample (see [Dryzek and Niemeyer, 2008](#)) where Q methodology reveals a relatively small number of attitudinal 'types'. What is important here is not that participants perfectly mirror the population, but that there is enough diversity in the group where perspectives are represented beyond a threshold ([Kymlicka, 1993](#)) sufficient to reveal that perspective in the analysis. In most cases, as long as that perspective is sufficiently unique, the threshold can be as low as a single individual ([Brown, 1980](#)) – in much the same way that it only requires a single example to confirm a new biological species.

Participants were provided with forty randomly numbered colour postcard-sized laminated images, an A0-poster sized sorting grid and an instruction booklet. Before describing the Q-sort procedure, the instruction book requested participants record three affective images of climate change (results not reported here), as well as record their responses to some climate change attitudinal statements. The instruction booklet then requested participants undertake the first Q-sort by sorting the images from 'most disagree' (−4) to 'most agree' (+4) based on the statement: 'this image makes me feel climate change is important'. Participants were asked to sort the images quickly, based on their first reaction (their 'gut feeling'). To ease the task, participants were first



Fig. 1. Research assistant Alex Lee interviewing a participant after a completed Q-sort in the USA workshop (O'Neill).

instructed to sort the images into three piles (e.g. for the salience sort: 'these pictures make me feel that climate change is not important', 'I am undecided about these pictures' and 'these pictures make me feel that climate change is important'). They were then asked to take the two that 'make you feel most strongly that climate change is important', and place these in the +4 position on the grid, and so on until all the 'most important' images were allocated. The procedure was then repeated with the 'least important' images, with the 'undecided' allocated to the middle of the grid last.

Participants were then interviewed about the way they had ranked the images, particularly focussing on the extremes of the distribution and on any images participants felt particularly strongly about. Participants were also asked if there were images which were particularly hard to place, or which they did not recognise. Last, participants were asked if they would like to move the position of the median (the '0' column) in order to have a greater (or lesser) number of images which they agreed (or disagreed) with. The interviews were audio recorded (see Fig. 1), and participants were asked to record the position of each image in a corresponding grid in the instruction booklet (a digital photo was also taken of each image sort grid, as a data backup). After the first sort, all images were removed from the grid and mixed. The second sort was then conducted answering the statement: 'this image makes me feel I can do something about climate change'; with another interview, following the same protocol. Note that participants were allowed to interpret the sort conditions as they liked – no further information was provided in terms of how to interpret 'important' (salience) or being 'able to do something' (efficacy).

3. Results

The Q-sorts were analysed separately for each study site using inverted factor analysis (where individuals are correlated, rather than variables). Inverted factor analysis, as used in Q methodology, reduces the complexity within the raw data by correlating individuals according to their Q sorts and, in the case of Principal Components analysis, producing a factor (expressed initially as an array of factor loadings, or level of concordance with all participants with a hypothetical Q sort response) that explains the greatest possible variance among the Q sorts for the first factor. The next factor explains the greatest possible variance among the residual not accounted for by existing factors, and so on (see Brown, 1980; Watts and Stenner, 2012).

There were a number of possibilities for analysing the data, including factor analysing all the data together as one group and investigating the way in which participant from the different case

study sites fell onto the resulting factors, or separately to examine the differences between the resulting factors for each study site (using the ecosystem analogy, the first approach treats the different study site as a variation on the same ecosystem, whereas the latter as different ecosystems with different species assemblages). Both approaches were used, but it was quickly evident that each site produced different (if overlapping) factors. So it is the latter approach, analysing each site separately, that is reported here. In all cases the analysis produced a very 'strong' factor – in terms of the amount of variation explained by it, as measured by an Eigenvalue – with the remaining factors being much weaker, particularly in the case of the salience Q sorts. It was also the case that these strong factors were strongly similar between the country cohorts for both Q sorts (salience and efficacy).

The following analysis is therefore concerned with the features of these main discourses and the differences in respect to them between the three country cohorts. In essence, we are exploring both the similarities and differences in the role of imagery in the main climate change discourses between the three country cohorts, where each discourse can be seen as the 'mainstream' view in our participant groups.

The interviews yielded over 15 h of audio data total; each interview was an average of 7 min in length. The audio recordings were fully transcribed. They were treated as two separate datasets (first sort, salience; second sort, efficacy) and then coded by image number (1–40). Thematic coding was then undertaken for each image, using grounded theory (as Henwood and Pidgeon, 2006) in NVivo.

Supplementary material Figs. 2a–c and 3a–c compare the z-scores of the main discourse for each study site – where a z-score indicates the strength of the typical response to each of the images for that factor. Here, the more positive the z-score, the greater the level of perceived salience or efficacy associated with the image, vice versa for negative scores. Most Q studies report these scores in the form of factor scores, where the z-scores are converted back into an array of 'typical' response to the Q sort represented by that factor using the same range of responses that were provided in the sorts performed by participants (i.e. in the range –4 to +4). We use z-scores in the supplementary material figures, because they permit a higher degree of precision in making comparisons between the study sites. The plots compare the results for each pair of countries. Similar results for each country (that are not statistically different) fall within the shaded zone; whereas those responses that are statistically significantly different between sites fall into the NW or SE sectors of the plots. Tables 1 and 2 provide factor scores illustrating the dominant features of the main discourse for both the salience and efficacy sorts, together with excerpts from the Q-sort interviews to illustrate reasoning behind rankings of particular images (or image groupings).

3.1. Which imagery is salient?

There is striking consistency between which images are most and least salient: i.e., the images that participants most and least disagreed with when sorting to the statement: 'this image makes me feel climate change is important' (see supplementary material Figs. 2a–c and 3a–c). This indicates that there is a dominant discourse present across the US, UK and Australian cohorts. This discourse is characterised by two distinctive features: first, that images of climate change impacts rank as highly salient; and second, that images of identifiable people are not at all salient. Further distinctive features of this discourse are the consistent ranking of the church image as unimportant, and the temperature graph, smokestacks and traffic jam as important (Table 1).

A group of images (flood aerial view, ice sheet, deforestation, polar bear, cracked ground, coral reef) depicting the climate impacts were

Table 1

Results for Sort A (saliency). By-country factor scores show images defining the dominant factor (or discourse). Factor scores are converted from z-scores and so provide a simplified portrayal of participant views. The underlined factor score (for Al Gore, US) indicates a significant difference ($p < 0.01$) between country cohorts (note the otherwise considerable agreement between country cohorts ranking images for saliency).

Theme	Image	Country			Reasoning	Illustrative quotes
		US	UK	Aus		
Climate impacts	Flood aerial view	++++	++++	++++	Threat is visible, personal, threatening	<ul style="list-style-type: none"> '...these three are just sort of things to do with the planet, the effects that climate change will have on the planet. [...] So that's what will happen if we don't start doing something' (UK_p8; ice sheet, flood aerial view, cracked ground).
	Ice sheet	++++	+++	+++		<ul style="list-style-type: none"> 'it just affects people and it's actually you can physically see it and physically feel it' (Aus_p17; flood aerial view).
	Deforestation	+++	++++	++		<ul style="list-style-type: none"> 'a lot of the ice in Antarctica is now starting to dissolve and breaking away. So I think we've got a danger of getting floods and that, when the ocean goes up even one inch it will make a big difference' (Aus_p16; ice sheet).
	Polar bear	+++	+++	++	Links to (personal experience of) unusual weather	<ul style="list-style-type: none"> 'the weather has been all messed up. It's been raining here for like three weeks and it never rains here, so something is going on' (US_p20; flood aerial view).
	Cracked ground	++	++	++		<ul style="list-style-type: none"> 'Using up all the petrol and whatnot causes climate change which will cause flooding in low lying areas. I think they're connected' (UK_p4; flood aerial view).
	Coral reef	++	0	+++		<ul style="list-style-type: none"> 'they're the most emotive images to me about kind of what we, as human beings are doing to the world' (UK_p17; flood aerial view).
					Imagery is emotive	<ul style="list-style-type: none"> 'a graphic picture of a drought, you know ruined land... it's horrible' (UK_p6; cracked earth). 'I feel like a loss of a future, and a loss of choice, and I feel like it's horrific to me' (US_p17; deforestation).
					Valuing ecosystems	<ul style="list-style-type: none"> 'that's obviously man destroying, like, the natural balance of the Earth' (Aus_p2; deforestation). 'it's happening so exponentially fast and it's a major place which can lock up carbon and is quite uncontrolled in third world countries' (Aus_p8; deforestation).
Climate pollution	Smokestacks	+++	+++	++++	Drastic imagery of carbon pollution	<ul style="list-style-type: none"> 'a drastic vision of pollution' (Aus_p22; smokestacks).
	Traffic jam	++	++	+	Feeling disgust, distress Blame for industry or government	<ul style="list-style-type: none"> 'gridlocked cars, the idea of how much carbon is pumped out basically into the air' (UK_p17; traffic jam). 'the picture of all the plumes of smoke coming out I find quite distressing with the amount of pollution that goes into the world' (UK_p12; smokestacks). 'a very blatant display of pollution [...] I get a little disgusted when I see that' (US_p3; smokestacks). 'it just shows how industries are behind major pollution' (US_p17; smokestacks).
Scientific evidence	Temperature graph	++	++	++	Evidence for rapid, frightening change	<ul style="list-style-type: none"> 'That's kind of scary [...] It brings it home a bit more that it's not something vague which is happening in the far off future, it's happening now, it's getting worse' (UK_p26). 'seeing something like that feels like pretty kind of blatant evidence towards the increasing of the global temperature average' (US_p3).
People	David Cameron	---	---	---	No connection between person and climate change	<ul style="list-style-type: none"> 'I haven't really heard them talking about climate change or being involved in any climate support [...] I don't have connection to climate change if I see them' (Aus_p17; Cameron, Gillard, Obama). 'I don't really think about climate change, I just think 'celebrity' [...] publicity stunt is what comes to mind rather than an actual... anything about climate change' (UK_p11, Geldof).
	Prince Charles Julia Gillard	---	--	----	Lack of trust in politicians/political system	<ul style="list-style-type: none"> 'these leaders aren't leading [...] They haven't got a clue' (Aus_p3; Cameron, Gillard, Obama).
	Rajenda Pachuri	--	----	--		<ul style="list-style-type: none"> 'people like the mainstream politicians will say what they say on climate change, really, to make themselves appear more popular' (UK_p13; 'Cameron, Gillard, Obama). 'All politicians, that's what you do, you take them with a grain of salt. I don't trust any of them' (Aus_p6).
	Bob Geldof	--	--	---		<ul style="list-style-type: none"> 'she said there'll be no carbon tax when she went in' (Aus_p13; Gillard). 'he made a lot of promises about climate change and I don't really see a lot of effort going towards trying to make things better' (US_p20; Obama).
	Richard Branson	--	---	--	Ineffective	<ul style="list-style-type: none"> 'he's concerned with climate change, but he's not really in a position. He's got too much on his mind to think about that' (UK_p19; Cameron). 'I mean I feel like he's definitely trying hard [...] but at the same time he is one person and I feel like not enough people are really playing attention to him' (US_p26; Obama).
	Al Gore	0	--	----		<ul style="list-style-type: none"> 'is this Live Aid? [...] celebrities kind of dipping into political issues but not really doing anything about it and going, 'let's have a big concert' and it's not very helpful' (UK_p2; Geldof).
	Barack Obama	-	-	--	Greenwash	<ul style="list-style-type: none"> 'he's this big boss of this multi conglomerate, whatever, in charge of everything, Virgin. I don't think that Virgin's very green at all. I think that they're one of those people that do a lot of greenwashing' (Aus_p19; Branson).
						Hypocritical

Table 1 (Continued)

Theme	Image	Country			Reasoning	Illustrative quotes
		US	UK	Aus		
Climate and religion	Church congregation	----	----	---	No connection between faith and climate change	<ul style="list-style-type: none"> 'I don't associate religion with climate change at all' (Aus_p10). 'I'm religious myself. I'm Catholic. And looking at a picture of a church I don't feel that they're very interested in anything to do with climate change' (Aus_p19).
					Ineffective	<ul style="list-style-type: none"> 'It's significant in that I believe in prayer, but [...] it's not going to stop climate change' (UK_p4). 'I'm sure there are religious groups out there who are trying to help with climate change but I don't feel like they're going to be such a huge influence' (US_p26).

Table 2

Results for Sort B (efficacy). By-country factor scores show images defining the dominant factor (or discourse). Factor scores are converted from z-scores and so provide a simplified portrayal of participant views. The underlined factor scores indicate significant difference ($p < 0.01$) between country cohorts (note the otherwise considerable agreement between country cohorts ranking images for efficacy).

Theme	Image	Country			Reasoning	Illustrative quotes
		US	UK	Aus		
Energy futures	Solar panels	++++	++	++++	Ability to take personal action	<ul style="list-style-type: none"> 'this idea of creating wind energy and solar power and stuff and re-using this energy and then transforming it into energy such as electric cars, so we can get around without having to use oil [...] it's a possibility for a personal change on a personal level' (UK_p21; 'energy futures' group).
	Electric car	+++	++++	+++	Ownership	<ul style="list-style-type: none"> 'something which people can really actively do themselves' (Aus_p8; traffic jam, fuel pump).
	Traffic jam	++	++++	++++		<ul style="list-style-type: none"> 'insert solar panels, swapping to electric fuel, so it feels like sort of ownership of that part of the change to address climate change' (UK_p17; 'energy futures' group).
	Home insulation	++++	+++	++	Co-benefits	<ul style="list-style-type: none"> 'preventable measures that I can do to help stop climate change by insulating my house better and keeping the heat in and all those kind of things and in Britain, where our house is so cold. I think that's a very worthwhile measure for me personally' (UK_p25; home insulation).
	Wind farm	+++	++	+++	Positive change	<ul style="list-style-type: none"> 'I feel quite positively about renewable energy sources and sort of making changes on the small scale in the home' (UK_p2; 'energy futures' group).
Effective lifestyle choices	Fuel pump	++	++	+++	Food choices	<ul style="list-style-type: none"> 'by not eating red meat I feel like that has a huge impact on lessening my carbon footprint' (US_p1; red meat).
	Red meat	++	++	++		<ul style="list-style-type: none"> 'we can, ourselves, make much better choices and get local produce. Eat seasonally and that' (Aus_p8; red meat).
	Climate protest	++	+++	±	Political action	<ul style="list-style-type: none"> 'I think it's a clear way that just individual or normal people can get involved and get their ideas across to the political leaders' (UK_p5; protest).
Ecohouse	+++	+	++	Sustainable housing		<ul style="list-style-type: none"> 'It makes me feel that people are already trying to do stuff anyway, so they are all individuals doing something individual that could possibly be bigger than that' (US_p21; protest). 'you can do something. If everyone kind of makes an effort to live in a different way, to live in a different type of building, it is possible to drastically reduce electric use, heat use' (UK_p13; ecohouse).
Political leaders (esp. Australia cohort)	Julia Gillard	-	--	0	Lack of trust in politicians/political system	<ul style="list-style-type: none"> 'I just think if we're going to rely on any politician [...] we're in trouble' (Aus_p15; 'political leaders' group).
	David Cameron	<u>0</u>	±	----		<ul style="list-style-type: none"> 'I don't think I can do anything to sort of, like, change their mind [...] the people can't voice out much. Even if we do it's sort of, like, pushed aside' (Aus_p18; 'political leaders' group).
	Barack Obama	+	0	----		<ul style="list-style-type: none"> 'I can't influence their agendas anymore. It's pointless. [...] These guys, waste of time' (Aus_p20; 'political leaders' group). 'it's my decision who I'm going for in the next election, so there is a small influence on that. I would say, yeah, it's my vote. But even though, voting for certain people doesn't really mean that certain goals are achieved' (Aus_p22; Gillard).
Climate impacts (esp. UK/US cohorts)	Flood aerial view	---	----	<u>0</u>	Helpless, overwhelmed	<ul style="list-style-type: none"> 'the natural disaster images just make me feel a bit helpless and overwhelmed' (Aus_p8; 'impacts' image group).
	Cracked earth	--	---	-		'drop in the ocean'
	Flooding map	---	=	==		<ul style="list-style-type: none"> 'I feel like there's been a lot of damage already done which can't be corrected, so it makes me feel like I can't do anything to fix what's already happened and it makes me feel like I can't really do anything really about it' (UK_p2; cracked earth).
	Coral atoll	--	--	-		<ul style="list-style-type: none"> 'that makes me feel like I can't do anything because the destruction is so immense [...] Like that seems like an almost impossible task' (UK_p25; flood aerial view).
	Ice sheet Glacier	---	-	0		

highly ranked in the saliency Q-sort, with the *flood aerial view* photograph consistently ranked as the image making climate change seem most important (Table 1). Common reasoning for highly ranking was that the immediate impact of climate change was obvious, personal, and threatening. Some image placements linked climate change to unusual weather occurrences, with some participants attributing recent extreme events to climate change (whilst also acknowledging the presence of non-anthropogenic climatic variability). Other impact imagery placements focused on the emotive nature of these images, or alluded to ecosystem goods and services. Yet, some images which ostensibly pictured climate impacts (including *bushfire* and *coastal erosion*) were consistently not highly ranked for saliency.

Other images which promoted feelings of saliency centred on climate pollution, or scientific evidence. The *smokestacks* (and to a lesser extent, *traffic jam*) images were linked by participants to a discourse of pollution, characterised by feelings of disgust and distress. Often (especially for the smokestacks image), these feelings are levelled at industry and government. The *temperature graph* image was also salient, though to a lesser extent. Those who found it salient found it an authoritative scientific image representing rapid and frightening change.

There is also considerable consistency across country cohorts in ranking the least salient images – overwhelmingly, images of identifiable people (*David Cameron*, *Julia Gillard*, *Barack Obama*, *Prince Charles*, *Rajendra Pachuri*, *Bob Geldof*, *Richard Branson* and *Al Gore*). Participants commented on how they saw little connection between the political leaders, business leaders and public figures pictured and climate change. A lack of trust, lack of leadership and a lack of decisive and transparent policy action were levelled at the politicians pictured. Within this trend, of all the politicians, Obama was ranked higher than others, especially in the US. This was often in regard to his charisma as a leader for change; but participants also commented more broadly on the leadership role the US could play and on the state of climate politics in the US.

The images of *Bob Geldof*, *Prince Charles* and *Richard Branson* were selected from the image concourse as representations of public figures who have been linked to the climate issue (note that very few such images were available in the newspaper image concourse). Whilst some participants found these public figures inspiring, far more found them guilty of ‘greenwash’, or simply deemed their contributions ineffectual.

The *church congregation* image was consistently ranked as the image which had the lowest image saliency. Participants were often confused why the image appeared in the sort. Even participants who expressed a religious affiliation found the image unimportant.

3.2. Which imagery promotes self-efficacy?

Compared to the similarity in sorts for issue saliency, the discourse surrounding self-efficacy (*‘this image makes me feel I can do something about climate change’*) is more fragmented. However, broad patterns do emerge. A group of images depicting energy futures are most efficacious. To a lesser extent, lifestyle mitigation choices that could be made at the individual level also promoted feelings of self-efficacy. The images which attenuate self-efficacy differ significantly across the study sites. In the Australian cohort, identifiable people were consistently ranked as less efficacious; whilst in the US and UK cohorts, it was images of climate impacts that made participants feel that there was nothing they could do about climate change (Table 2).

The *solar panels*, *wind farm*, *electric car*, *home insulation*, *traffic jam* and *fuel pump* images were often grouped together by participants as (often highly) efficacious images. Participants reasoned that these images provided examples of how they could

personally undertake (or were already undertaking) meaningful mitigative actions through their energy choices. A number of participants also linked a set of broader lifestyle choices to the feeling that they could do something about climate change. This included political actions (through the *climate protest* image), food consumption (*red meat*), sustainable housing (*ecohouse*) and travel choices, including using carbon offsetting (*planes*). This discourse was not as strong as the ‘energy futures’, however. Some participants commented that they did not understand the relevance of these images to climate change; and others noted that the images represented deeply-held values that were hard to change, or actions that were ineffective or unappealing.

Identifiable people consistently ranked as less, rather than more, efficacious. It is particularly notable though that whilst the UK and US cohorts ranked UK Prime Minister David Cameron and US President Barack Obama respectively on the right hand side of the sort grid (that is, as more rather than less efficacious), the Australian cohort did not place any of the people, including Australian Prime Minister Julia Gillard, on this side of the sorting grid (supplementary material Fig. 3b and c). The differences in Q-sorts between country cohorts are significantly different when ranking political leaders of other countries (*Obama* and *Cameron*), with the Australia cohort placing both of these images at the far left (least efficacious) side of the sort grid, compared to the US and UK cohorts placements in the middle of the grid. Whilst political apathy and feelings of powerlessness were still evident in some UK and US participant responses, it was noticeably more apparent in the Australian interviews (Table 2).

Instead of ranking identifiable people imagery as least efficacious, the US and UK sorts indicated that it was climate impacts imagery that most undermined self-efficacy: the *flood aerial view* image ranked very low for both the UK and US (Table 2; supplementary material Fig. 2a and b). And across all the cohorts, there was little discussion of climate change adaptation from any of the participants in response to the impacts images.

4. Discussion

This research reports three key findings, as elaborated in the bullet points below. These findings should be viewed in the context of this research as a first step towards understanding engagement with climate imagery, bearing in mind the non-representative nature of the study:

- Impacts imagery promoted saliency (but undermined self-efficacy)

Images of climate impacts, and images of climate change as pollution, appeared to be able to successfully capture peoples’ attention and drive a sense of importance about the issue of climate change. It is notable that the *flood aerial view* image ranked highest for saliency across all three cohorts. Despite the high saliency of the impacts images though, these same images also tended to be the ones that (in the UK and the US at least) were less efficacious – the *flood aerial view*, for example, is the most salient but one of the least efficacious images. Although these images made climate change seem important, they also distanced and disengaged participants, as they struggled to comprehend how they could be empowered to act on climate change. These findings echoed the earlier UK-based findings of O’Neill and Nicholson-Cole (2009).

- Energy futures imagery promotes self-efficacy

Images picturing different energy futures appeared to strongly enhance feelings of self-efficacy. Other personal mitigative actions such as reducing red meat consumption (*red meat for sale*), using less energy in the home (*ecohouse*) and

changing travel behaviour (*planes at airport*) also featured. This imagery supports a core dimension of what Whitmarsh et al. (2011a,b) term 'carbon capability' – a way of understanding the situated meanings of carbon and energy in everyday life. Here, energy futures and lifestyle choice imagery supports feelings of self-efficacy in the behaviours and practices people undertake related to carbon.

A further core dimension of being carbon capable though is engagement beyond individuals' practices and behaviours; with an extension into engagement with systems of provision and governance, which may be manifest through protest and voting. There is some evidence that the *climate protest* image promotes self-efficacy in this component of carbon capability; but this should be contrasted with the lack of self-efficacy surrounding political behaviour expressed by the UK and US cohorts (and indeed, the undermining of self-efficacy in the Australian cohort) of the political figures imagery, as discussed in the final key finding below.

Whilst most participant interviews discussed mitigative behaviours and practices in some detail, very few participants mentioned climate adaptation. When adaptation was mentioned, it was generally in the context of adaptation to water stress through the *dry reservoir* image; with very little discussion of climate adaptation arising on, for example: agricultural practices (potentially through the *tractor on farm* image); building and planning (*coastal erosion, flood map*) or migration (*coral atoll*); or household adaptation e.g. to temperature extremes (*home insulation*) or bushfire (*ecohouse*).

- Politicians and celebrities undermine saliency (and self-efficacy for the Australian cohort)

Images of identifiable people (including politicians but also public figures including a business leader, scientist, a celebrity and a member of the British Royal Family) made participants in this study feel quite strongly that climate change was unimportant. This was a consistent finding across all three country cohorts.

Whilst the UK and US cohorts did not find identifiable people promoted a sense of issue importance, these images had little impact on feelings of self-efficacy. The situation is rather different in the Australian cohort though, where images of identifiable people are those which most strongly undermined self-efficacy, and disempowered participants. This may be indicative of the extremely politicised nature of the climate issue in Australia, where debates over climate policy contributed to a Prime Ministerial leadership spill in June 2010, where mainstream climate science is routinely challenged in the media, and where the dominant visualisation of climate change in newspapers is of political figures (O'Neill, 2012).

The results also shed more light on the role of celebrities as actors helping shape the cultural politics of climate change. In 2007, an internet poll asked participants to vote for the celebrity they thought would be the most influential person to champion climate change. The celebrities to top the list in each country were Al Gore (30% of the vote in the US, 28% in Australia) and Richard Branson (23%, UK), with Bob Geldof also garnering substantial support in the UK (18%; AC Nielsen 2007; results re-printed in Boykoff and Goodman, 2009). These three celebrities all featured in this image study, but compared to the other images presented, none of them increased issue salience or efficacy. Platt and Retallack (2009) comment that climate communications should draw on more locally-resonant public figures in order to raise awareness and engagement in climate change, people who garner trust 'as peers rather than higher-ranking celebrities' (2009, p. 8). So along the lines of their argument, perhaps it is not that

individual internationally-recognised celebrities diminish efficacy, but rather that climate communication efforts are currently drawing on sub-optimal choices of public figures.

5. Conclusions, implications and further research

There are implications for climate communication, drawing on the three key findings discussed above. It seems imagery can play 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. Communications strategies should assess the purpose of their message, and choose to employ images accordingly.

Viewing these results in regard to current media representations of climate change reveals a somewhat bleak situation. Despite the very low levels of issue saliency (and low efficacy) prompted by images of identifiable people, newspaper coverage of climate change routinely pictures of identifiable people, particularly politicians – and this is especially so in Australia (O'Neill, 2012). This research would suggest that these images, far from engaging people with climate change, are instead having the opposite effect. Conversely, although images of energy futures or individual mitigative actions are highly efficacious, O'Neill (2012) found that less than 7% of images attached to newspaper articles about climate change featured adaptive or mitigative solutions.

This research opens up avenues for further enquiry into how people engage with climate change imagery in the public domain. An area of immediate interest would be to test the findings from this in-depth study in a nationally representative study (as well as to investigate how climate imagery is perceived in non-Anglo-phone countries). Further work can also assess how multiple criteria of evaluation – from deep-seated ideological perspectives to ephemeral influences of mood – can shape responses. Another fruitful area of enquiry could be to investigate the role of impact imagery in reporting extreme events. Flood imagery was highly salient across all three cohorts, yet did not promote self-efficacy. Yet in contrast, research from the UK indicates that highlighting links between local extreme weather events and climate change can both increase concern, and promote willingness to engage in climate change mitigation behaviours (Spence et al., 2011). This relationship between perceived experience of climate-changed extreme weather, saliency and efficacy should be explored further in the UK context and elsewhere.

This research was formulated in response to calls from scholars in communication studies (Hansen and Machin, 2008), sociology (Anderson, 2009), cultural studies (Doyle, 2011) and geography (Moser, 2010) to attend to a research gap in the visual representations of climate change. We have shown the importance of understanding public engagement with visual representations of climate change in the mass media, because these encounters with climate imagery shape the perceived spectrum of policy support and possibility. This analysis sheds light on how images, as artefacts in communication processes, play an active and vital role in the cultural politics of climate change.

Acknowledgments

This research was partly supported through a Melbourne University Early Career Researcher Grant (1044015). Thanks to the participants who shared their views in the Q-workshops; and to those who helped run the Q-workshops: Tom Lowe, Lorraine Whitmarsh, Michael Min (Australia); Alex Lee, Anika Norheim, Sarah Erskine, Bradley Fontanese, Solana Kaercher, Brad Hahn (US); Citty Williams and Helen Band (UK); and James Screen (all sites).

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.gloenvcha.2012.11.006.

References

- Anderson, A., 2009. Media, politics and climate change: towards a new research agenda. *Sociology Compass* 3, 166–182.
- Barry, J., Proops, J., 1999. Seeking sustainability discourses with Q methodology. *Ecological Economics* 28, 337–346.
- Bauder, D., 2010. *Arresting Images of Oil Spill Help Drive the Story*. Associated Press, New York.
- Bell, A., 1994. Media (mis)communication on the science of climate change. *Public Understanding of Science* 3, 259–275.
- Bingham, S., 2007. Climate change: a moral issue. In: Moser, S., Dilling, L. (Eds.), *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*. Cambridge University Press, Cambridge (Chapter 9).
- Boykoff, M., 2007. From convergence to contention: United States mass media representations of anthropogenic climate change science. *Transactions of the Institute of British Geographers* 32, 477–489.
- Boykoff, M., 2011. *Who Speaks for the Climate? Making Sense of Media Reporting on Climate Change*. Cambridge University Press, Cambridge, 240 pp.
- Boykoff, M.T., Goodman, M.K., 2009. Conspicuous redemption? Reflections on the promises and perils of the 'celebritization' of climate change. *Geoforum* 40, 395–406.
- Brown, S.R., 1980. *Political Subjectivity: Applications of Q Methodology in Political Science*. Yale University Press, New Haven.
- Carvalho, A., Burgess, J., 2005. Cultural circuits of climate change in UK Broadsheet newspapers, 1985–2003. *Risk Analysis* 25, 1457–1469.
- Carvalho, A., 2007. Ideological cultures and media discourses on scientific knowledge: re-reading news on climate change. *Public Understanding of Science* 16, 223–243.
- Cosgrove, D., 1994. Contested global visions: one world, whole Earth and the Apollo space photographs. *Annals of the Association of American Geographers* 84, 270–294.
- DiFrancesco, D.A., Young, N., 2011. Seeing climate change: the visual construction of global warming in Canadian print media. *Cultural Geographies* 18, 517–546.
- Doyle, J., 2007. Picturing the clima(c)tic: greenpeace and the representational politics of climate change communication. *Science as Culture* 16, 129–150.
- Doyle, J., 2011. *Mediating Climate Change*. Ashgate, Farnham.
- Dryzek, J.S., 1994. Australian discourses of democracy. *Australian Journal of Political Science* 29, 221–239.
- Dryzek, J.S., Niemeyer, S.J., 2008. Discursive representation. *American Political Science Review* 102, 481–494.
- Epstein, S., 1994. Integration of the cognitive and psychodynamic unconscious. *American Psychologist* 49, 709–724.
- Fairweather, J.R., Swaffield, S.R., 2001. Visitor experiences of Kaikoura, New Zealand: an interpretative study using photographs of landscapes and Q method. *Tourism Management* 22, 219–228.
- Hansen, A., Machin, D., 2008. Visually branding the environment: climate change as a marketing strategy. *Discourse Studies* 10, 777–794.
- Henwood, K.L., Pidgeon, N., 2006. Grounded theory. In: Breakwell, G., Hammond, S.M., Fife-Schaw, C., Smith, J.A. (Eds.), *Research Methods in Psychology*. Sage, London.
- Hobson, K., Niemeyer, S., 2011. Public responses to climate change: the role of deliberation in building capacity for adaptive action. *Global Environmental Change* 21, 957–971.
- Hobson, K.P., Niemeyer, S.J. "What sceptics believe": the effects of information and deliberation on climate change scepticism. *Public Understanding of Science*, doi:10.1177/0963662511430459, in press.
- Kymlicka, W., 1993. Group representation in Canadian politics. In: Siedle, F.L. (Ed.), *Equity and Community: The Charter, Interest Advocacy, and Representation*. Institute for Research on Public Policy, Montreal.
- Leiserowitz, A., 2006. Climate change risk perception and policy preferences: the role of affect, imagery, and values. *Climatic Change* 77, 45–72.
- Linder, H., 2006. Cashing-in on risk claims: on the for-profit inversion of signifiers for 'global warming'. *Social Semiotics* 1, 103–132.
- Lorenzoni, I., Nicholson-Cole, S.A., Whitmarsh, L., 2007. Barriers perceived to engaging with climate change among the UK public and their policy implications. *Global Environmental Change* 17, 445–459.
- McKeown, B., Thomas, D., 1988. *Q Methodology*. Sage, Newbury Park.
- Moser, S., Dilling, L. (Eds.), 2007. *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*. Cambridge University Press, Cambridge.
- Moser, S., 2010. Communicating climate change: history, challenges, process and future directions. *WIREs: Climate Change* 1, 31–53.
- Nicholson-Cole, S.A., 2004. *Imag(in)ing climate change: exploring people's visual imagery, issue salience and personal efficacy*. Unpublished PhD Thesis. School of Environmental Sciences, University of East Anglia, UK.
- Niemeyer, S., Petts, J., Hobson, K., 2005. Rapid climate change and society: assessing responses and thresholds. *Risk Analysis* 25, 1443–1456.
- O'Neill, S.J., 2012. *Image matters: climate change imagery in the US, UK and Australian mass media*. In: *Culture, Politics and Climate Change Conference*, Boulder CO, 13–15 Sept, University of Colorado-Boulder.
- O'Neill, S.J., Boykoff, M., 2010. Climate denier, skeptic or contrarian? Proceedings of the National Academy of Sciences of the United States of America 107, E151.
- O'Neill, S.J., Nicholson-Cole, S., 2009. Fear won't do it: promoting positive engagement with climate change through imagery and icons. *Science Communication* 30, 355–379.
- Painter, J., 2011. *Poles Apart: The International Reporting of Climate Scepticism RISJ*. Oxford University, Oxford.
- Platt, R., Retallack, S., 2009. *Consumer Power: How the Public Thinks Lower-Carbon Behaviour could be made Mainstream*. Institute for Public Policy Research, London, UK.
- Robbins, P., Krueger, R., 2000. Beyond bias? The promise and limits of Q method in human geography. *Professional Geographer* 52, 636–648.
- Smith, N.W., Joffe, H., 2009. Climate change in the British press: the role of the visual. *Journal of Risk Research* 12, 647–663.
- Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K., Tignor, M., Miller, Jr., H.L. (Eds.), 2007. *Climate Change 2007: The Physical Science Basis, Summary for Policymakers*. Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge.
- Spence, A.L., Poorringa, W., Pidgeon, N., 2011. The Psychological distance of climate change. *Risk Analysis* 32, 957–972.
- Watts, S., Stenner, P., 2012. *Doing Q Methodological Research: Theory, Method & Interpretation*. Sage, London.
- Whitmarsh, L., Seyfang, G., O'Neill, S.J., 2011a. Public engagement with carbon and climate change: to what extent is the public 'carbon capable'? *Global Environmental Change* 21, 56–65.
- Whitmarsh, L., O'Neill, S.J., Lorenzoni, I. (Eds.), 2011b. *Engaging the Public with Climate Change: Communication and Behaviour Change*. Earthscan, London.