Museum Management and Curatorship
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/rmmc20

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Version of record first published: 26 Sep 2012.

To cite this article: Fiona R. Cameron (2012): Climate change, agencies and the museum and science centre sector, Museum Management and Curatorship, 27:4, 317-339

To link to this article: http://dx.doi.org/10.1080/09647775.2012.720183

Museum Management and Curatorship
Vol. 27, No. 4, October 2012, 317–339

Routledge
Taylor & Francis Group

MANAGEMENT

Climate change, agencies and the museum and science centre sector

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(*Received 24 November 2011; final version received 19 April 2012*)

Climate change is a vast, complex phenomena impinging on biological and social life, economics, politics, and culture, stretching disciplines beyond current limits and inviting a new, critical examination of the roles and capacities of museums and science centres in these complex ecologies.[1] In this article, I present a section of the research findings from Australian Research Council Linkage grant, 'Hot Science, Global Citizens: the agency of the museum in climate change' pertaining to the current and potential roles and agencies of natural history, science museums and science centres in climate change within Australian and US contexts. Through the analysis eight strategic positions and role changes emerge for the different forms of the museum with a greater emphasis on collective action, networking and building more critical information on climate change as a complex issue and governing subject. Within the Australian sample a stronger emphasis was placed on political advocacy and critique.

Keywords: climate change; museums; science centres; agencies; governance; complexity; social responsibility

Introducing Hot Science, Global Citizens: the agency of the museum sector in climate change interventions

Climate change is one of the most serious global threats facing the world (Stern 2006). Despite the fact that scientific research clearly indicates that earth's climate is warming (Intergovernmental Panel on Climate Change 2007, 2), controversy continues regarding the scale and pace of future impacts and what regulations, policies and investments might mitigate damage locally and globally. Because climate change affects the whole planet, viable solutions on what to do must include dialogues and decision-making with communities across the globe.

This article presents research on the roles and agencies of natural history, science museums and science centres around climate change, generated by the Australian Research Council research project, *Hot Science, Global Citizens: the agency of the museum sector in climate change interventions.* Hot Science is an international, interdisciplinary project that interrogated the roles of cultural institutions in climate change as places to provide information, activate and broker discussions and decisions around climate change issues, locally and trans-nationally.[2]

The study used qualitative and quantitative methods. This included a demographic survey involving 2100 participants (1500 in Australia and 600 in New York

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ISSN 0964-7775 print/ISSN 1872-9185 online

http://dx.doi.org/10.1080/09647775.2012.720183
http://www.tandfonline.com

City, Jersey City and the State of New Jersey), and focus group research with museum and science centre audiences in Sydney, Melbourne and Jersey City, involving six groups of older and younger families and six groups of adults (single income no children, 35–60 years; double income no children 25–30 years). This research was complemented by one-on-one interviews with CEOs and staff [visitor services staff, curators, science communicators and educators from the five partnering institutions (Australian Museum, Museum Victoria, Questacon, Powerhouse Museum in Australia and the Liberty Science Center, Jersey City, US)].

In this article, I draw on 12 positioning statements I developed and tested through quantitative and qualitative methods as a way of framing both current and potential agencies for natural history, science museums and science centres in climate change.[3] The survey asked for responses to each statement according to a five-point Likert scale from strongly agree to strongly disagree. Focus group discussants were then asked to comment on the statements. One of my goals was to test perceived institutional performance associated with role enhancements and changes in Australian and US contexts. Agencies tested ranged from more established roles as places to communicate science and individual behaviour change, research and resource provision to activism and advocacy, collective action, decision-making and policy critique, lobbying and the formation of trans-national networks to promote discussions and decisions. Through a gap analysis using SPSS (Statistical Package for the Social Sciences) and the analysis of percentage differences between current, perceived and desired roles, a series of nine strategic positions, role extensions and changes were identified for the different forms of the museum (Table 1 and Figures 1–4).

Framing

Eight frames were used to interpret the findings and to detail the nature of the gaps between current and potential roles, how points raised in the manifesto might be instituted, and how institutions might adapt and think in new ways about their roles, agencies and capacities around climate change.

Deliberative democracy

Deliberative democracy refers to processes of public consultation whereby participants are presented with the range of opinion and information on a matter for public policy-making that may take the form of a deliberative poll or citizen's assembly (Cameron and Deslandes 2011). Deliberation on policy proposals is enacted through citizen involvement in decision-making processes by providing them with 'a range of experts and as much information as they need' to make a decision (Carson 2010). Crucially, in such a deliberative space, 'all interests, all perspectives should be available to participants – all barrows should be wheeled into the room' (Carson 2010). Impartial facilitators help the group reach its own judgement (Carson 2010).[4,5]

Global risk, cosmopolitics, object-orientated democracies

Global risk and 'world risk society', concepts developed by theorist Ulrich Beck (1999) draw attention to the limited controllability of the dangers of climate change that we have created for ourselves. The main question is how to take decisions when

Table 1. Top key role changes for science centres and museums – gaps between current and desired roles.

	Australia	USA
Museums	Critical examination of climate change as a cultural, political, technological, economic and scientific issue (29%)	Communicate the up-to-date science of climate change (24%)
	Communicate the up-to-date science of climate change (25%)	Acting as part of networks for individuals, communities and organisations with an interest in climate change (22%)
	Provide a forum for discussion and debate for individuals, communities, organisations locally and globally to express views (25%)	Provide a forum for discussion and debate for individuals, communities, organisations locally and globally to express views (21%)
	Present a range of views on climate change issues (e.g.) scientists, government, economists, industry leaders and diverse communities (23%)	Promote collective action by bringing the sectors – government, business, scientific organisations, media and non-government organisations together with citizens to make decisions (21% gap)
	Promote collective action by bringing the sectors – government, business, scientific organisations, media and non-government organisations together with citizens to make decisions (22% gap)	Critical examination of climate change as a cultural, political, technological, economic and scientific issue (20%)
	Acting as part of networks for individuals, communities and organisations with an interest in climate change (22%)	Provide access to a range of resources on climate change (19%)
	Provide access to a range of resources on climate change (22%)	
	Take a critical stance on climate change policy and decisions (20%)	
	Lobbying on climate change (19%)	
Science centres	Promote collective action by bringing the sectors – government, business, scientific organisations, media and non-government organisations together with citizens to make decisions (25% gap)	Acting as part of networks for individuals, communities and organisations with an interest in climate change (28%)
	Lobbying on climate change (24%)	Promote collective action by bringing the sectors – government, business, scientific organisations, media and non-government organisations together with citizens to make decisions (24% gap)
	Acting as part of networks for individuals, communities and organisations with an interest in climate change (23%)	Provide a forum for discussion and debate for individuals, communities, organisations locally and globally to express views (18%)
	Take a critical stance on climate change policy and decisions (23%)	
	Present a range of views on climate change issues (e.g.) scientists, government, economists, industry leaders and diverse communities (22%)	
	Critical examination of climate change as a cultural, political, technological, economic and scientific issue (21%)	
	Communicate the up-to-date science of climate change (20%)	

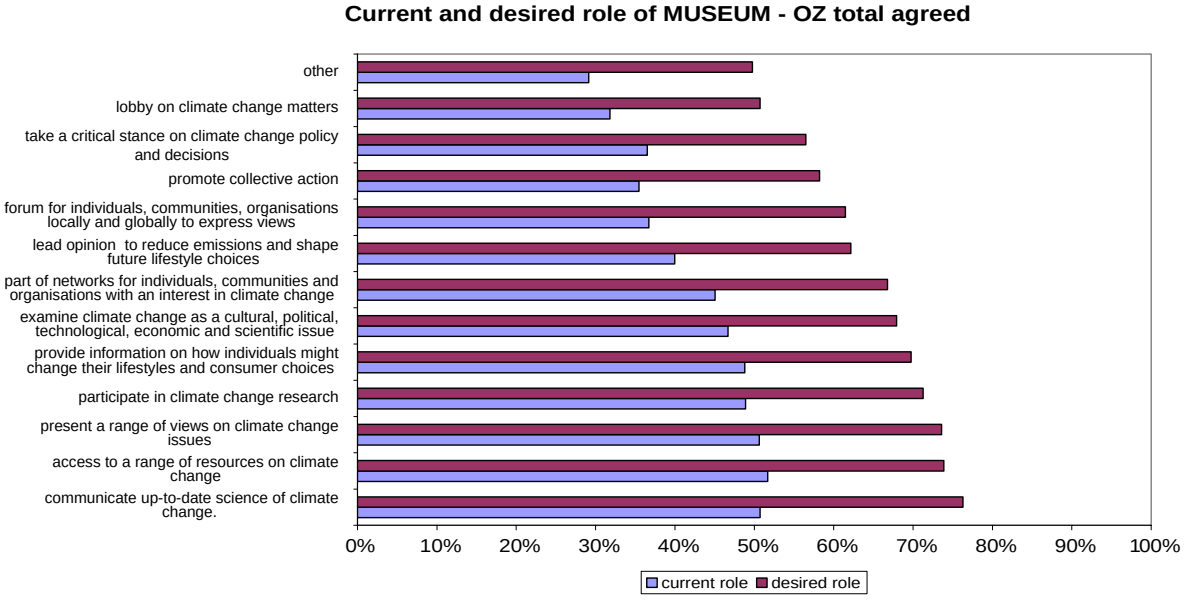

Figure 1. Perceptions of current and potential/desired roles of museums – Australian total agreed sample.

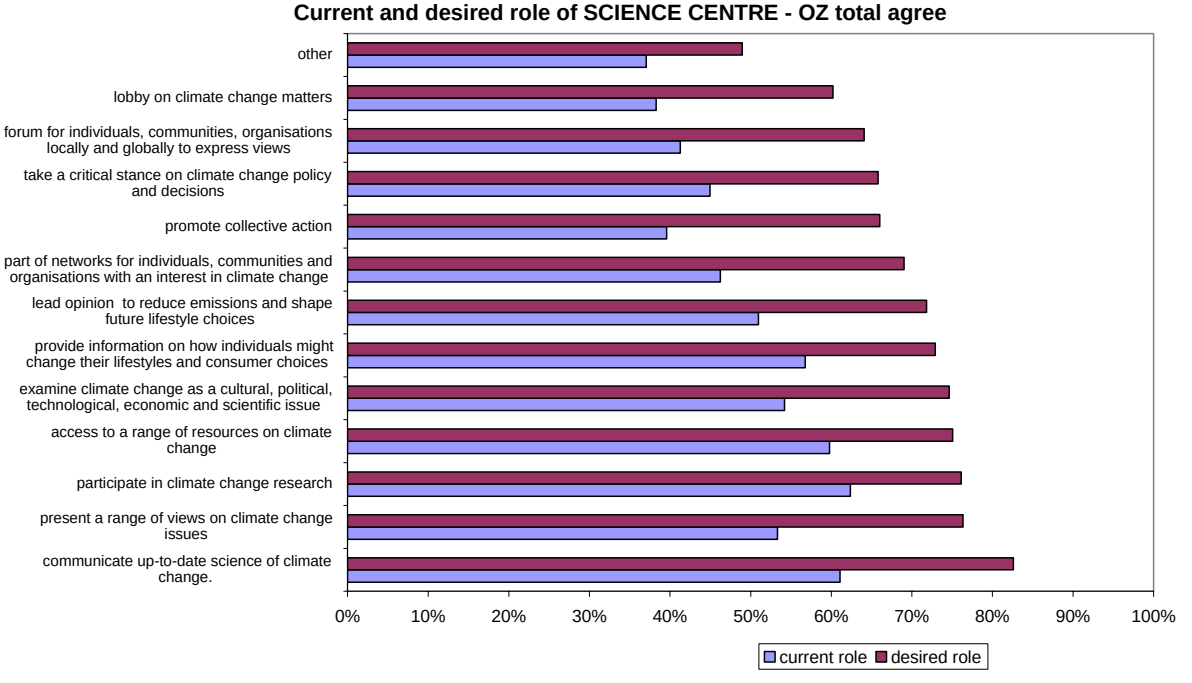

Figure 2. Perceptions of current and potential/desired roles of science centres – Australian total sample agreed.

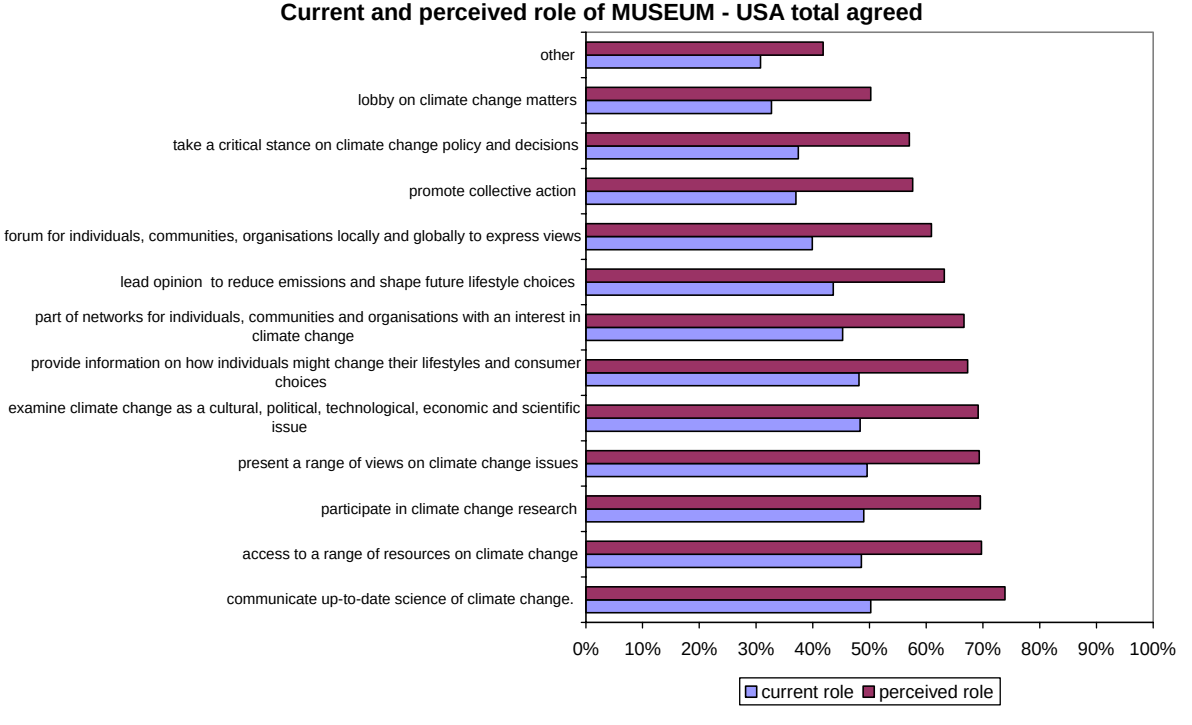

Figure 3. Perceptions of current and potential/desired roles of museums – US total sample agreed.

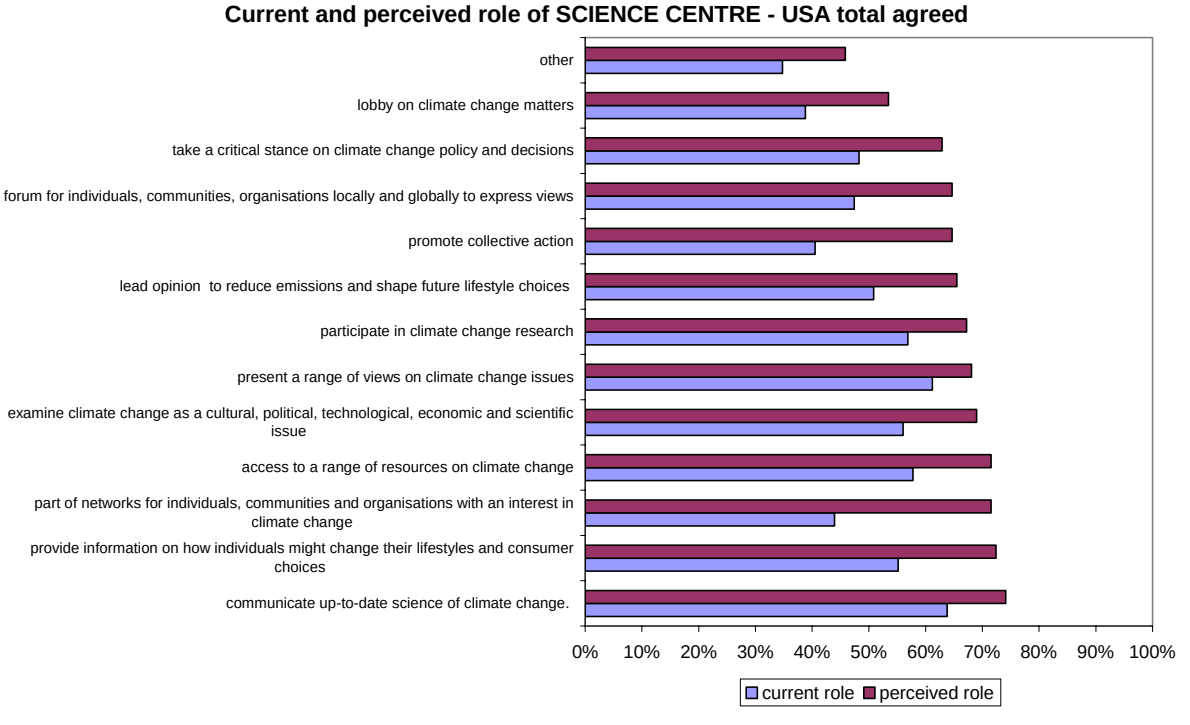

Figure 4. Perceptions of current and potential/desired roles of science centres – US total sample agreed.

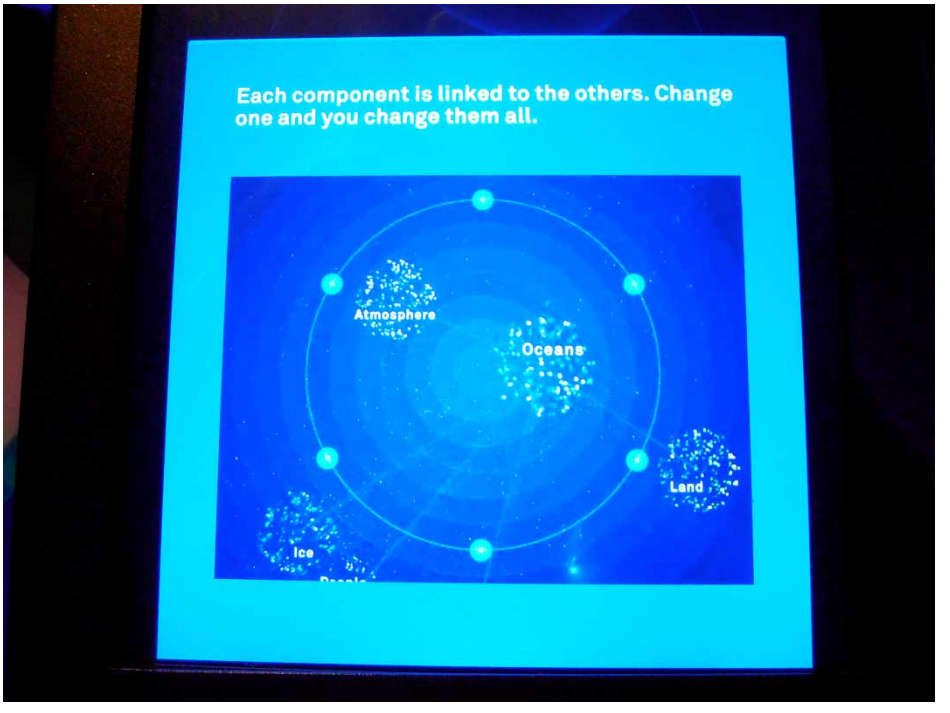

Figure 5. Atmosphere exhibition, Science Museum London.

the knowledge base is not only incomplete, but more and better knowledge often means more uncertainty (Beck 1999, 6).[6]

Cultural theorist Bruno Latour's (2004, 2005a), concepts of cosmopolitics and object-orientated democracies are useful tools for imagining a different type of space, the cosmopolitical museum, for assembling diverse groups of people for decision-making on climate change (Cameron and Mengler in press). A cosmopolitical frame enlarges the field of potential interpretations of climate change thereby promoting a capacity to engage many and diverse viewpoints and enabling them to interact within the space of the museum thereby mobilising people's creative potential to formulate new governing projects to manage climate risk (Cameron 2008).

Science and technology studies, actor networks and new materialisms

New ways of framing the relations between the human and non-human world through actor networks (Latour 1993) and new materialism (Bennett 2010) open up innovative opportunities for thinking about climate change. These frames view the issue as an entangled socio-political and biophysical phenomenon involving complex interactions between the non-human and the human, where cultural responses and nature act on each other, and where the human and non-human are both actors/actants. According to this view, museums and science centres might compose a world that we all, humans and non-humans, come to share (Dibley 2011), as opposed to the prevailing human-centred vision that dominates current thinking and policy.

How might our responses to climate change be affected if we seriously consider the agencies of the non-human, such as coal, carbon dioxide and ice, and their interactions with humans?

New institutional forms

The literature on new institutional forms is used in this article to compare and contrast the museum as a networked organisation (hierarchical and centralised despite their democratic claims) with newer organised networks (cf. open source culture, autonomous education centres and art spaces that are horizontal, collaborative and distributive). Organised networks organise social relations dramatically different from networked institutions, posing a challenge for existing forms of governance and outmoded representational practices (Rossiter 2006, 14). Comparing these two institutional forms shows how museums and science centres might extend their networks, institute new non-representative democratic processes, and facilitate and institute new and alternative modes of governing.

Collective intelligence

Collective intelligence, a concept developed by philosopher Pierre Levy (1999), describes a shared, group intelligence that emerges through communication, collaboration and competition among many individuals. Levy argues that 'universally distributed intelligence' leads to better strategising and decision-making than would ever be possible for a lone individual.

Agencies: gap roles and the positioning statements

Places that communicate the up-to-date science of climate change

The research confirms the pivotal role museums and science centres have in communicating up-to-date science, but respondents felt they should be doing more.[7] There was a strong demand for knowledge about new science to inform personal positions and actions.[8] Many discussants stressed the political importance of science, and the role of science in solving the climate crisis and formulating governing strategies involving technology and behavioural change (see Barry 2001).[9] They saw museums as places for disseminating information so people can: 'learn all about the science behind climate change . . . what science is actually doing towards solving the problem'.[10]

For many respondents, museums and science centres are sites for presenting the full range of scientific opinion including opposing scientific positions on the climate crisis. In instances of uncertainty or conflict between different expert opinions and future predictions, the contextualisation of those positions was important: 'you've got to take both sides into consideration . . . you can't unequivocally say one's right and one's wrong, you've got to lend different weights to different theories'.[11]

The underlying scientific rationale informing science communication, expressed by staff, CEOs and audiences alike, was that science can make discoverable objective facts that are socially and politically neutral. Science was also seen as a discipline that could adjudicate between competing claims to truth, and determine the causes of

climate change and climate sensitivity (see Hulme 2009, 73). This belief perpetrates the view that science can produce definitive statements about what is and what not is dangerous for societies, and ways to solve the ecological crisis (Hulme 2009).

Because debates move quickly and are often conflicting, audiences cited the need for judgements about the relative credibility of sources, as new institutional forms of quality assurance as opposed to hard, authoritative, objective content with a strong disciplinary tone (Cameron 2011). Here audiences appear to conceive an institution's potential in media and communication networks as part of systems of peer review, expressing a new formulation of institutional trust and credibility in the 'to be informed mode' as peer reviewers (Pöschl 2010):

> I have a certain amount of confidence in the information . . . there's a certain way it is researched, they've got to confirm where they've got their information from and to get it to a point it had to go through so many different educated professors and specialists in their field that there's a certain amount of credibility that goes along with it . . .[12]

Systems of peer review in the museum context contribute to the research assessment process through a two tiered procedure. The first procedure involves the presentation of climate change as a complex, social, cultural scientific and economic issue. The second procedure is the contextualisation of the research informing these debates. This involves: reviewing the evidence and credibility of the debates/research in regard to their history; how knowledge underpinning the debate is produced; and weighting the various debates and sources, their levels of acceptance and what is at stake for each of the actors (Cameron 2011).

Science knowledge production can also be subject to a reflective process. Such a process can illustrate: how science and scientific practices have changed; the types of science and science production processes that are used to form views; how these are linked to the emergence of different world views and differing governing strategies; how scientists weight and deliberate; practices of expert deliberation around climate change and deep uncertainty; and how scientific knowledge gets used in society (Cameron 2011; see Hulme 2009). As a result of this reflection, scientific understanding becomes just one of many kinds of partial, conditional and uncertain knowledge informing climate change action and public policy debate (Hulme 2009).

Public and peer reviews can work together in new forms of science education. These processes can lead to richer and thicker dialogues that can then be fed into the review, weighting and quality assurance processes. In this context, the notion of a museum communicating climate change science would be compatible with its role as a place for facilitating public deliberation. Latour's (2004, 2005b) cosmopolitics and object-orientated democracies can reframe museums and science centres as cosmopolitical spaces that encourage assemblies of peer review that express alternative visions of the future, competing centres of authority and what is at stake for particular interest groups.

New formulations of climate science in museums, through peer and open review, have the potential to promote the idea of climate change as the entanglements of nature, social relations and human subjectivity (opinions, values and ideologies), and for audiences to be encouraged to think along these lines.

In turn, a new materialism frame (Bennett 2010) can be used to acknowledge relations between the human and climate change as vital forces, where the non-human,

such as the atmosphere, pollution and extreme weather, operates as an actant enfolded with the human with the potential to disrupt human projects. New formulations of science and society along these lines are important innovations in dealing with the social and ecological complexity of climate change (see Ang 2011).

Places to present a range of views on climate change issues (e.g., the views of scientists, government, economists, industry leaders and diverse communities)

This positioning statement was one of the most important gap roles particularly for Australian museums and science centres.[13] Focus groups participants understood climate change as a complex and highly controversial battleground of different ideologies and philosophies of life, each having a profound influence on attitudes and courses of action:

> there's so many variants . . . everyone's got different views . . . some views are more idealistic than realistic . . . It's hard to get what's actually going on.'[14]

For these reasons participants expressed a desire to hear about differing views, practices and courses of action. They wanted to know about the competing interests and agendas that cross cultural divides, sectors, scales and disciplines, and for institutions to weight these views and values as part of peer review process:

> don't just show me your point of view, show me all the points of view . . . show me the ones that matter.[15]

Many felt that these views must be presented in a way that leaves space for visitors to come 'to their own decisions'[16] thereby enabling them to formulate their own values, moral positions and emotional responses to the topic. Impartiality and balance, therefore, are reworked within this deliberative frame as a range of views to be expressed (Cameron 2011). Yet, it was also seen as important that the museum expressed their own position on any contesting representations.

The public understanding of the science framework used in many museums and science centres and the blind faith that people apply to science often works to displace other knowledge systems and may weaken civic action (Salazar 2011). The notion of cognitive justice, as reflected in the dialogue between different knowledges and perspectives and the right for different forms of knowledge to coexist without being marginalised by official, state-sponsored forms, may help create and develop processes of public engagement and climate justice (Salazar 2011). Here the museum moves from a pre-occupation with matters of fact as expert scientific opinion, to one of matters of concern and interest.

Places that take a critical stance on climate change policy and decisions

This role statement caused some concern among respondents. It challenged their conception of the museum as a place for unbiased information.[17] The concern was to maintain the separate functions of the museum and the state, in which decisions on climate change policy through voting should be left up to the individual: 'Let me vote for the government . . . I make that decision.'[18] While some saw this role as too

political, many suggested, including politicians I interviewed, believe that it was important for institutions to critically review policy but at a distance and in the context of generic scenarios rather than specific policy: 'I think rather than actually saying the government could decide A but we did B, I think they could say best science thinks we should do A and people realise the government's done B'.[19, 20] In this sense the institution would itself be a legitimate contributor to discussion as a 'secondary association' in 'instituting policy deliberation' (Cameron and Deslandes 2011).[21] Here, museums and science centres were seen as akin to new institutional forms in their roles as critics of dominant modes of governance (see Rossiter 2006). This gap role was significant for Australian museum and science centre respondents with females polling higher than males in role support.[22]

Places that lobby on climate change matters

This statement mobilised a range of views about the relation of the museum to grassroots movements and government. While respondents were divided as to whether a lobbying role was desirable, strong support was evident from Australian museum and science centre respondents.[23]

Participants were not generally averse to museums playing a more active role in public debate, but stressed the importance of institutions remaining impartial. Many saw museums and science centres as places that could gather the views of their audiences that are both diverse and opposing, advocating on their behalf without taking sides. Such a role was seen as an action that had the potential to mobilise a range of policy responses, with inputs that go beyond those formulated according to economic or scientific expertise.

For those who affirmed this role, two forms emerged. The first was the museum as a collection point that could advocate to government on behalf of audiences by canvassing their views: 'I think it would be good for us to make decisions . . . what we feel is important to us and then they gather that information . . . and we say "Listen we think this is a problem"'.[24] Institutions such as science centres and museums are seen as less political and, therefore, better information providers, informing the private sector, grassroots movements and government alike. This was evident in the second form, which involved re-positioning the institution in grassroots contexts in an extended informational role: 'Providing information to a grass roots agency so that they can go lobby the government, that's exactly what the museum should be doing'.[25] Deliberative processes are charged with a similar task to the former proposition. That is, navigating the range of perspectives on matters of public importance without actively guiding participants' or in this case agencies viewpoints in any particular direction.

These findings are consistent with the new institutional forms literature (see Rossiter 2006), with the museum acting as a distributed and collaborative network to activate non-representative demographic processes. That is, first operating as a cosmopolitical collection point for views and opinions and as intermediary between government and communities, assisting processes of collective intelligence through information: 'When you go to a museum people are coming from all over, so you're getting all their opinions'.[26]

Places that provide a forum for debate and discussion for individuals, communities, organisations locally and globally to express their views on climate change

This statement represented one of the key gap roles across all Australian and US samples[27] and was strongly affirmed by focus group participants: 'That's a terrific idea'.[28] Respondents saw museums and science centres as having agency in networking and connecting communities across large distances. Frequently, participants noted that they wanted to hear not only differing views and practices but also different courses of action based on different ways of framing climate change: '"when you go to a museum people are coming from all over, you're getting all their opinions. Everybody has their own situation, it's a good meeting place".[29] The potential for such connections was also affirmed by participants who noted the worthiness of museums in sharing their local knowledge and experience internationally'.[30]

Participants also felt that international connections could generate the broadest range of scientific research and cultural debate with their local publics, thus providing greater opportunities for the empowerment of museum audiences through the information they receive. The networked potential of the museum sector was acknowledged in two forms. The first mode was geographic dispersal, as the sharing of local knowledge and experience across globally scattered institutions: 'They could just explain how it is affecting them . . . Museums are placed all around the world . . . they can see how collectively it's affecting everyone'.[31] The second mode was as a cosmopolitan congregation – the assembling of peoples from many different national and cultural backgrounds within a particular institution.[32] The entry of the museum into dialogues as a cosmopolitical space (through the use of social media) has the potential to institute the more radical versions of Cameron's (1971) forum. This would entail critiquing established modes of governance based on science and economic frames, thereby facilitating the establishment of new subject positions and hence new forms of governance.

Places that act as part of networks for individuals, communities and organisations with an interest in climate change

This statement was seen as one of the key gap roles across all samples.[33] Focus group participants frequently cited climate change as an issue that demanded collective action, coordinated through networks. If, as Beck (1999) contends, this involves making public the 'manufactured uncertainties' of late modernity then, institutions are required to become nodes in the networks through which trans-national 'risk communities' come to congregate. An example of this is the international network of science centres and programming initiatives that formed around the IGLO (International Action on Global Warming).[34]

In their role as nodes in networks, museums and science centres were seen as places to disseminate information on which decisions might be made, by clarifying, synthesising and presenting options through peer and open review processes; by building grassroots movements and strengthening collaborations with other organisations such as schools and communities; and by providing a platform for conversations and decision-making. These networked relations were frequently framed as having a twofold benefit: (1) impacting on individual behaviour and (2) empowering communities. Potential interventions ranged from the activist: 'spread

the word and get people actively involved in making a change',[35] to the therapeutic: 'it's being with the community, trying to understand what particular concerns there are, and providing them with options'.[36]

Places that provide access to a range of resources on climate change

Survey and focus group participants strongly affirmed this statement as a significant gap role for Australian and US museums.[37] Focus group participants expressed feelings of frustration and confusion around the conflicting and highly mobile nature of the debates and their inability to get clarity and access to sources that detail and weigh the range of opinions, and present clear information on what to do.[38] The imperative that museums provide access to a range of resources was linked to these feelings and manifested broadly as three forms. The first mode was for museums and science centres to play a greater role as a reference base on climate change matters: 'if current issues come up, having a source that you can go to'.[39] The second mode was the coordination of resources across sectors and scales: 'It needs to be a coordinated effort . . .'[40], and mapping and linking reliable sources as systems of peer review: 'If you are made aware of where to get information this is a win, win'.[41]

The third and fourth modes were as places of documentation, collecting and archiving: 'museums are places where hard evidence for example biodiversity loss is kept'.[42] Others referred to museums as contemporary civic documentation sites: 'documenting everything that's happening in recent times . . .'.[43]

Some participants viewed museums as key sites in raising awareness of climate change and informing decision-making; empowering the individual to weigh the options, make their own informed decisions and in facilitating broad-based mobilisation:

> You start to educate yourself and you start to educate your family and everybody moves together in that way . . . it's our nature, it kind of comes automatically. We want to work together in this way so then we can have a sustainable life for everyone.[44]

Others were more circumspect with regard to the effectiveness of education, drawing a distinction between knowing about something and doing something about it in a context where self-interest prevails.[45]

Institutions were also seen as places that can provide different perspectives than the media, opening up debates to include other points of view beyond mainstream positions.[46,47] This illustrates how new forms of quality assurance, trust and legitimacy can be framed around an institution's agency as a resource base in systems of peer review, and as expert reviewers along with others in complex debates[48] (Cameron 2011).

Places to critically examine climate change as a cultural, political, technological, economic and scientific issue

This position represents one of the largest gap roles particularly for Australian, US museums and science centres.[49] Many interviewed acknowledged that this new subject matter was inherently complex and political. Focus group participants also noted that the cultural, political, technological, economic and scientific dimensions

of climate change were contingent on each other: 'They are all parts of climate change; they are intertwined, so you can't really look at one without examining the others'.[50]

Participants noted that institutions should offer a more critical and deeper contextualisation of climate change debates by presenting the historical background and a contextualised view: 'by 'show[ing] the process, the background and how conclusions are made, it teaches you step by step how they got to that process . . . how they came to that conclusion and how to get it to work'.[51] Focus group participants struggled with how institutions might deal with this complexity.

The notion of critical assessment also maps onto Hulme's (2009) view that climate change, as a metaphor, has done its work and now offers an opportunity to connect with the deeper ideological issues, values and power relations about what is at stake for the various actors, as a means to make progress. These critical, reflective roles for contemporary museums and science centres are reflections of a 'cosmopolitical space' oriented towards social change by facilitating new ways of thinking about climate change.

Places that promote collective action by bringing the sectors – government, business, scientific organisations, media and non-government organisations together with citizens to make decisions about climate change matters

Promoting collective action in climate change debates and decisions was one of the key gap roles for institutions across all samples, thereby expressing new forms of agency beyond individual behavioural reform.[52]

Participants welcomed the idea of museums facilitating exchanges of views and opinions from different social locations, be it science, government, business: 'it would be great if that would happen. It would be amazing'.[53] A range of opinions and cross-sectoral views was seen as a means of accessing significant ideas and a range of options from which negotiations can be made: 'to see quite a few different views will make people think . . . why do these people have these views, why do the scientists have these views . . . a whole range of views from different backgrounds'.[54] Discussions of this nature were also seen to allow a range of creative options to emerge: '. . . all these parties have good ideas you can collect to give them an option'.[55] This advances Levy's (1999) idea that collective intelligence can lead to better strategising and decision-making: 'They can collect ideas from the communities or individuals and then they can respond [and] maybe develop a plan or policy'.[56] Broadly speaking, this goal entails museums being 'employed [as] a platform' for parties to perform these conversations and decision processes, whilst being careful not 'to come out too heavily on either side'.[57]

In their roles as deliberative, performative platforms, museums and science centres have the task of negotiating and mediating among various, diverse and interconnected networks and multi-party stakeholders including communities, government and businesses. The refashioning of expertise along plural lines opens up a space to consider climate change as a contemporary social, cultural condition from diverse governmental positions. Within these cosmopolitical spaces, climate change moves from a matter of fact and matters of concern and to matters of agency in which the museum promotes and facilitates reflective and creative processes (see Cameron 2011) through critical analysis and imaginative thought. According to

political theorist Chris Ford (2011), inputs into cross-sectoral conversations of this kind can be transformational, contributing to the cognitive fitness of policy over time as well as bringing about changes in lifestyles, relations, visions for the future and political forms.

Social media and alternative reality gaming network technologies can be used to assemble the ideological positions and interests of stakeholders and audiences, activating systems of peer review around debates and positions in conjunction with systems of public review through interactive discussions that can be fed into the review, weighting and quality assurance processes (Ford 2011).

Museums need to reject the basic distinction between nature and culture and the separated chambers of science and politics, the human and non-human world. Cross-sectoral collective action through Latour's actor networks and new materialism has the potential to shift the museum from an older mode of reform and classification, to new political or judicial frameworks involving assemblies of humans and non-humans. According to this framing, deliberative, performative platforms can be reworked according to Latour's 'Parliament of Things', as congregations of humans and non-humans things where the non-human is seen as having agency, forces and capacities. This would mean bringing things such as the atmosphere, oceans and ice into museum programming and forums as stakeholders and actants entangled with human designs and governing strategies (see Lash 1999).

Conclusion

The preceding discussion articulated a series of nine strategic role changes and role enhancements across the sample. For Australian museums current perceived roles focussed on the provision of resources; communicating science; the presentation of a range of views; research and individual privatised action. In regards desired roles, a greater emphasis was placed on the critical examination of climate change as a complex phenomenon; science communication; a greater emphasis on network building and provision of forums; the facilitation of collective action and critical positions on policy and lobbying. The current perceived roles for US museums were somewhat similar and included: communicating science; the presentation of a range of views; research; individual behavioural reform and resource bases with a greater emphasis on the critical examination of climate change as a complex phenomenon than Australian museums. Role changes were articulated as a greater emphasis on science production and communication; networks; collective action and more critical content.

For Australian science centres, current perceived institutional roles were as places for research; as information sources and resources; as places that promote individual attitudinal behavioural change; and communicating climate science. In regards desired roles and adaptations, collective action was predominant involving first collective mobilisation; developing networks; building trans-national communities of risk; the facilitation of a range of views, lobbying; providing critical information for reflexive analysis and to do more in regards climate change science.

The current perceived roles of US science centres were somewhat similar to Australia and were in this order: communicating science; presenting a range of views; research; resource bases; individual behavioural reform and again with the notable exception in comparison to the Australian science centres, the critical examination of climate change as a complex phenomena. In terms of role changes a greater emphasis

was placed on building networks and facilitating collective action. The desire for institutions to promote collective action, metropolitan New York City participants were much more likely to endorse this position than participants from New Jersey or New York State.

Generational differences were significant in regards role changes with older respondents (55–65 year olds) generally having stronger views across all samples. Older respondents in the Australian and US museum sample strongly supported more climate science; forums and access to resources. The presentation of a range of views was strongly supported by this age group for Australian museums and in regards lobbying for Australian science centres. The desire for critical information scored highly for both the 35–54 and 55–65 year olds in the Australian science centre sample with the 35–54 sample strongly supporting collective action across all samples.

The data showed a noticeable difference between males and females in all samples. Female respondents, somewhat more than males, favoured an activist/politically engaged role for museums and science centres. Overall the findings showed a greater emphasis on networks and collective action, and for political advocacy and building trans-national communities of risk in Australia.

In summary these findings[58] challenge museums and science centres to:

- adapt their operations and responses rapidly across different scales and to form new cross-sector allies;
- build new relationships with many stakeholders and audiences who have differing views and responses;
- extend networks bringing together diverse people, ideas and institutions across social and geographical distances;
- institute new complex and thick modes of communication and interpretative practices;
- deal more effectively with complexity, dissent and conflict that crosses sectors and scales in trans-national, cosmopolitan contexts and involves many people and ideas;
- re-consider ways of producing knowledge beyond science that acknowledge the entanglements and agency of both human and non-human forces;[59]
- bring the past–present and future together as a focus for concern and new forums for formulating creative thought and action.

Acknowledgements

This article is an output from the Australian Research Council funded Linkage project, *Hot science, global citizens: the agency of the museum sector in climate change interventions*, led by the author. Special thanks to Dr Ben Dibley and Dr Ann Deslandes for their contributions to focus group data analysis and Carolyn Meehan for quantitative gap role analysis.

Notes

1. See Hodge (2011).
2. The project Hot Science, Global Citizens: the agency of the museum sector in climate change interventions was is led by Fiona Cameron as lead – Chief Investigator with Chief Investigators, Bob Hodge; Brett Neilson and Juan Salazar from the Centre for Cultural

Research, Jann Conroy from the Centre for Plant and Food Science and David Karoly from Earth Sciences, University of Melbourne with Ph.D. candidate Scott East. Research support staff included Ben Dibley, Carol Farbotko, Teresa Swirski, Ann Deslandes and Anne Newstead. Institutional and representative partner investigators include Museum Victoria and audience advocate Carolyn Meehan; Australian Museum with Lynda Kelly, Manager Web and Audience Research; the Powerhouse Museum with Sebastian Chan. Head of Digital; Questacon (the national science centre, Canberra) and director, Graham Durant; Liberty Science Center, Jersey City, New Jersey, USA and Wayne LaBar, Vice President, Exhibitions; and Richard Sandell, Head, School of Museum Studies, University of Leicester, UK.

3. The series of 12 positioning statements tested through quantitative and qualitative research across the Australian and US sample include the following using a five-point Likert scale (strongly agree to strongly disagree):
   Places that communicate the up-to-date science of climate change
   Places to present a range of views on climate change issues (e.g., scientists, government, economists, industry leaders and diverse communities)
   Places to critically examine climate change as a cultural, political, technological, economic and scientific issue
   Places that provide a forum for debate and discussion for individuals, communities, organisations locally and globally to express their views on climate change
   Places that act as part of networks for individuals, communities and organisations with an interest in climate change
   Places that provide access to a range of resources on climate change
   Places that promote climate change action by providing information on how individuals might change their lifestyles and consumer choices
   Places that take a critical stance on climate change policy and decisions
   Places that lobby on climate change matters
   Places that promote collective action by bringing the sectors – government, business, scientific organisations, media and non-government organisations together with citizens to make decisions about climate change matters
   Places that lead opinion on ways to reduce emissions and shape future lifestyle choices
   Places that participate in climate change research (e.g., science, new technologies)
4. There has been much made of the potential for museums to operate as spaces of deliberative democracy from programming for scientific citizenship (Bandelli 2010) and for holding citizen consultations in the museum itself (as in the role of Cité des sciences de l'Industrie, Paris).
5. WWViews on Global Warming was an international effort to gather public input for The United Nations Climate Change Conference in Copenhagen, Denmark (COP15). In the words of its organisers: 'With the participation of more than 4,000 ordinary citizens gathered in 38 countries worldwide, WWViews was the first and only initiative taken to produce a trustworthy, detailed and in-depth snap shot of the global public opinion of the climate negotiations at COP15'. See http://www.wwviews.org/
6. Places to communicate the up-to-date science.
   This agency was seen as one of the largest gap roles for Australian and US museums with 51 and 50 per cent, respectively, agreed that institutions currently communicate the up-to-date science, while 76 and 74 per cent, respectively, believed museums should be taking on this role. (In Australia, 52 per cent of males agreed that museums currently communicate the up-to-date science of climate change, while 50 per cent of females did so.) In terms of ideal roles, 70 per cent of males and 76 per cent of females agreed that museums should be communicating the up-to-date science of climate change. Eighty per cent of Australian and 79 per cent of US respondents aged 55–65 with 78 per cent of females as opposed to 74 per cent of male respondents agreeing that Australian museums should be playing this role, $N = 1041$, $p = .003$**. Support for this statement was stronger in the older age groups and by gender in the Australian sample. Across different locations in Australia, there were different perceptions as to whether museums currently communicated up-to-date science of climate change. Fifty-seven per cent of those in Melbourne, 55 per cent of regional Victoria visitors, 53 per cent of those in Brisbane, and 52 per cent in Sydney and

52 per cent in Perth agreed that museums are places that communicate the up-to-date science of climate change.

7. There were different perceptions of how science centres currently related to this role of communicating science, which was agreed to by 75 per cent of those in regional WA, 74 per cent of those in Perth, 65 per cent in Sydney, 63 per cent in ACT, 62 per cent in Melbourne agreeing, dropping slightly to 56 per cent in regional Victoria, 55 per cent in Brisbane and 45 per cent in regional QLD, $p = .200$, $N = 602$. (In terms of gender differences in perception, 45 per cent of males and 56 per cent of females agreed that natural history and science museums currently are places that communicate the up-to-date science of climate change, while 70 per cent of males and 77 per cent of females thought that museums should be playing this role. In terms of age differences, 52 per cent of the youngest respondents agreed that museums currently communicate the up-to-date science of climate change, compared with 42 per cent of the middle age group and 58 per cent of the older age group. In terms of geographical differences, 52 per cent from New Jersey State agreed that museums currently communicate the up-to-date science of climate change, 44 per cent from NY State agreed and 58 per cent from New York City agreed that museums should play this role).
8. HSGC Focus Group Transcript, AM#2.
9. HSGC Focus Group Transcript, AM#4.
10. HSGC Focus Group Transcript, AM#1.
11. HSGC Focus Group Transcript, AM#3.
12. HSGC Focus Group Transcript, AM#1.
13. Places to present a range of views on climate change issues including those of scientists, government, economists, industry leaders and diverse communities.
    Fifty-one per cent of Australian museum and 54 per cent of science centre respondents agreed that museums currently present a range of views on climate change issues, while 74 and 76 per cent, respectively, agreed that institutions should be taking on this role. Generational differences in desired roles are also evident in the Australian samples with 81 and 85 per cent of older Australian respondents (55–65 years) stating museums and science centres should take on this role. Gender differences were significant in the Australian museum sample with 76 per cent of the female respondents as opposed to 71 per cent of males agreeing that museums in Australia should play this role, $N = 1041$, $p = .000$***.
14. HSGC Focus Group Transcript, AM#2.
15. HSGC Focus Group Transcript, AM#2.
16. HSGC Focus Group Transcript, MV#3.
17. HSGC Focus Group Transcript, LSC#4.
18. HSGC Focus Group Transcript, LSC#2.
19. HSGC Focus Group Transcript, AM#2.
20. HSGC Interview Transcript, FP#1.
21. See Elstub (2007).
22. Places that take a critical stance on government climate change policy and decisions.
    This was the strongest gap role for Australian museums and science centres with 37 and 45 per cent, respectively, stating that institutions currently take a critical stance on climate change policy and decisions, while 57 per cent and 68 per cent of the samples said that they should be doing so. Australian Museums: 54 per cent male; 59 per cent females; $N = 1041$, $p = .01$**. Australian Science centres: 64 per cent male; 68 per cent females; $N = 485$, $p = .081$.
23. Places that work with grassroots agencies to lobby government on important climate change matters.
    Sixty-eight and 61 per cent of the Australian museum and science centre sample disagreed that institutions currently, while 51 and 54 per cent agreed that museums and science centres should be lobbying on climate change matters. Within the Australian science centre sample 57 per cent of respondents aged 18–35 years, 62 per cent of respondents aged 35–55 years and 64 per cent of respondents aged 55–65 years agreed that science centres should lobby on climate change matters, $N = 485$, $p = .19$. Considerable differences are evident by gender in the Australian museum sample with 54 per cent of females as

opposed to 47 per cent of males supporting this role, $N = 1041$, $p = .018$*. Similar gender differences are evident across the science centre sample with 62 per cent of females as opposed to 58 per cent of males in Australia and supporting this role, $N = 485$, $p = .048$*.

24. HSGC Focus Group Transcript, LSC#4.
25. HSGC Focus Group Transcript, MV#4.
26. HSGC Focus Group Transcript, AM#1.
27. Places that provide a forum for debate and discussion for individuals, communities, organisations locally and globally to express their views on climate change.
    In the online survey, 37 per cent in the Australian and 40 per cent in the US samples agreed that natural history/science museums currently function as places that provide a forum for debate and discussion for individuals, communities, organisations locally and globally to express their views on climate change. Sixty-two per cent in the Australian and 61 per cent in the US samples agreed that museums should play this role. Similarly 47 per cent in the Australian and US samples and agreed that science centres currently provide a forum for debate and discussion, while 64 and 65 per cent in Australia and the US, respectively, agreed science centres should perform this role, $N = 486$, $p = .001$***. Levels of agreement were higher for those aged 55–65 years with 71 and 72 per cent, respectively, in Australia and the US agreeing that that science centres should provide such a forum, $N = 116$, $p = .169$. In Australian and US museums gender differences are significant with 64 per cent of Australian and 100 per cent of US females in the sample as opposed to 59 per cent and 87 per cent of males, respectively, agreeing that this role is important. Similar differences were evident in the science centre sample with 67 per cent and 89 per cent of Australian and US females, respectively, as opposed to 61 and 82 per cent of males seeing this role as important, $N = 485$, $p = .067$; $N = 116$, $p = .5$.
28. HSGC Focus Group Transcript, MV#3.
29. HSGC Focus Group Transcript, LSC#2.
30. HSGC Focus Group Transcript 1, MV#1.
31. HSGC Focus Group Transcript, MV#4.
32. HSGC Focus Group Transcript, LSC#2.
33. Places that act as part of networks for individuals, communities and organisations with an interest in climate change.
    In the online survey, 45 per cent in the Australian and 46 per cent in the US samples agreed that natural history and science museums 'currently act as parts of networks', while 67 per cent and 68 per cent, respectively, said that museums should be playing this role. Gender was a significant factor with 70 per cent of females as opposed to 64 per cent of males, $N = 1041$, $p = .031$* and the US 96 per cent of females as opposed to 88 per cent of males seeing this role as important, $N = 486$, $p = .003$**. In the science centre sample, 44 and 46 per cent in the Australian and US samples agreed that science centres currently perform this role, while 72 per cent and 69 per cent, respectively, agreed that science centres should be playing this networking role. In the science centre sample similar gender gaps were evident in the Australian sample with 74 per cent of female as opposed to 65 per cent of males, $N = 485$, $p = .037$* and the US sample 94 per cent of females and 90 per cent of males seeing this role as important, $N = 116$, $p = .6$.
34. International Action on Global Warming http://astc.org/iglo/
35. HSGC Interview Transcript, LSC#1m.
36. HSGC Interview Transcript, MV#4m.
37. Places that provide access to a range of resources on climate change.
    Fifty-two per cent of Australian and 50 per cent of US respondents currently perceived museums as places that provide access to a range of resources on climate change with 74 per cent and 69 per cent, respectively, suggesting they should do. Levels of agreement in desired roles for museums were highest in the older age group with 79 per cent and 78 per cent of 55–65 year olds in Australia and the US, respectively, for museums $N = 485$, $p = .08$. Gender differences were significant with a higher percentage of females 77 and 98 in Australia and the US compared to 71 per cent and 89 per cent of males seeing this role as important, $N = 1041$, $p = .041$*.
38. HSGC Focus Group Transcript, AM#3.
39. HSGC Focus Group Transcript, AM#1.

40. HSGC Focus Group Transcript, AM#1.
41. HSGC Focus Group Transcript, AM#1.
42. HSGC Focus Group Transcript, AM#4.
43. HSGC Focus Group Transcript, AM#1.
44. HSGC Focus Group Transcript, AM#1.
45. HSGC Focus Group Transcript, AM#3.
46. HSGC Focus Group Transcript, AM#1.
47. HSGC Focus Group Transcript, AM#1.
48. HSGC Focus Group Transcript, AM#2.
49. Places to critically examine climate change as a cultural, political, technological, economic and scientific issue.
    In Australia, 47 per cent and 49 per cent in the US agreed that natural history and science museums currently are places that critically examine climate change as a complex cultural, political, technological, economic and scientific issue. More than three-quarters, 76 per cent of the Australian sample and 69 per cent in the US thought that museums should be playing this role. Fifty-four per cent of Australian science centre respondents agreed that science centres currently have this role whereas 75 per cent said they should do so. Generational differences were marked in the Australian science centre sample with 80 per cent of younger respondents aged 35–55 years in Australia and 82 per cent of older respondents aged 55–65 years agreeing that institutions should be playing this role. Moreover, 78 per cent of females as opposed to 72 per cent males saw this role as important, $N = 485$, $p = .05$*.
50. HSGC Focus Group Transcript, MV#3.
51. HSGC Focus Group Transcript, AM#1.
52. Places that promote collective action by bringing the sectors – government, business, scientific organisations, media and non-government organisations together with citizens to make decisions about climate change matters.
    In the online survey, 35 and 37 per cent agreed that natural history or science museums currently promote collective action through cross-sectoral engagement on climate change matters, with 57 and 58 per cent in Australia and the US, respectively, saying that museums should do so. Forty per cent of Australians and 41 per cent of the US sample agreed that science centres currently perform this role with 65 per cent of respondents in Australia and the US expressing the view that science centres should be performing this role. Generational differences are apparent with 77 per cent of respondents aged 35–55 years strongly supporting the proposition, $N = 116$, $p = .09$. Similarly differences are evident by gender and between the samples, with 93 per cent of females in the US and 61 per cent in Australia and the US as opposed to males in which, respectively, 86 and 55 per cent seeing this role as important, $N = 1041$, $p = .023$*. In regards the science centre samples similar differences are noticeable between the genders and the samples with 89 per cent as opposed to 68 per cent of females in the US and Australian samples and 92 per cent of males in the US sample and 64 per cent in the Australian sample seeing this role as important, $N = 485$, $p = .023$*, $N = 116$, $p = .5$.
53. HSGC Focus Group Transcript, AM#3.
54. HSGC Focus Group Transcript, 1 AM#1.
55. HSGC Focus Group Transcript, 4 AM#4.
56. HSGC Focus Group Transcript, 1 AM#1.
57. HSGC Focus Group Transcript, LSC#2.
58. See Hodge (2011); Cameron, F.R. B. Hodge, S. Salazar, B. Dibley. 2011. Manifesto for museums and science centres in climate change. Hot Science, Global Citizens Insights Report. unpub mans, Institute for Culture and Society, University of Western Sydney.
59. See Bennett (2010).

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References

Ang, I. 2011. Navigating complexity: From cultural critique to cultural intelligence. *Continuum* 25, no. 6: 779–94.

Bandelli, A. 2010. Engagement tools for scientific governance. *Journal of Science Communication* 8: 2. http://jcom.sissa.it/archive/09/02/Jcom0902(2010)C01/

Barry, A. 2001. *Political machines: Governing a technological society*. London: The Athone Press.

Beck, U. 1999. *World risk society*. Cambridge: Polity.

Bennett, J. 2010. *Vibrant matter: A political ecology of things*. Durham: Duke University Press.

Cameron, D. 1971. The museum, a temple or a forum. *Curator* 14, no. 1: 11–24.

Cameron, F.R. 2008. Object-orientated democracies: Conceptualising museum collections in networks. *Museum Management and Curatorship* 23, no. 3: 229–43.

Cameron, F.R. 2011. From mitigation to complex reflexivity and creative imaginaries – Museums and science centres in climate governance. *Museum and Society Special Issue: Hot Science, Global Citizens: The agency of the museum sector in climate change interventions* 9, no. 2. http://www.le.ac.uk/ms/museumsociety.html

Cameron, F.R., and A. Deslandes. 2011. Museums and science centres as sites for deliberative democracy on climate change. *Museum and Society Special Issue: Hot Science, Global Citizens: The agency of the museum sector in climate change interventions* 9, no. 2. http://www.le.ac.uk/ms/museumsociety.html

Cameron, F.R., B. Hodge, S. Salazar, and B. Dibley. 2011. Manifesto for museums and science centres in climate change. Hot Science, Global Citizens Insights Report. Unpublished manuscript, Institute for Culture and Society, University of Western Sydney.

Cameron, F.R., and S. Mengler. in press. Cosmopolitics, border crossings and the complex museum. *International Journal of Heritage Studies*.

Carson, L. 2010. Growing up politically: Conducting a national conversation on climate change. *Australian Policy Online*. http://apo.org.au/commentary/growing-politically-conducting-national-conversation-climate-change

Dibley, B. 2011. Museums and a common world: Climate change, cosmopolitics, museum practice. *Museum and Society Special Issue: Hot science, global citizens: The agency of the museum sector in climate change interventions* 9, no. 2. http://www.le.ac.uk/ms/museumsociety.html

Elstub, S. 2007. Overcoming complexity: Institutionalising deliberative democracy through secondary associations. *The Good Society* 16, no. 1: 14–22. http://130.102.44.245/journals/good_society/v016/16.1.elstub.pdf

Ford, C. 2011. Policy making at the edge of chaos: Musings on political ideology through the lens of complexity. Paper presented at workshop, Is Complexity the new framework for global life? University of Western Sydney, 18–20 January 2011, Australia.

Hodge, B. 2011. Climate change & the museum sector: 10 reflections from the 'Hot Science, Global Citizens' symposium. http://ccr.uws.edu.au/2011/05/18/climate-change-the-museum-sector-10-reflections-from-the-hot-science-global-citizens-symposium/

Hulme, M. 2009. *Why we disagree about climate change: Understanding controversy, inaction and opportunity*. Cambridge, UK: Cambridge University Press.

Intergovernmental Panel on Climate Change (IPCC). 2007. The physical science basis: Summary for policymakers. http://ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm

Lash, S. 1999. Objects that judge: Latour's parliament of things. http://eipcp.net/transversal/0107/lash/en

Latour, B. 1993. *We have never been modern*. Trans. Catherine Porter. Hertfordshire, UK: Harvester Wheatsheaf.

Latour, B. 2004. Whose cosmos, which cosmopolitics? Comments on the peace terms of Ulrich Beck. *Common Knowledge* 10, no. 3: 450–62.

Latour, B. 2005a. *Reassembling the social: An introduction to actor-network-theory*. Oxford: Oxford University Press.

Latour, B. 2005b. From realpolitik to dingpolitik or how to make things public. In *Making things public: Atmospheres of democracy*, ed. B. Latour and P. Weibel, 14–43. Cambridge, MA: The MIT Press.

Levy, P. 1999. *Collective intelligence: Mankind's emerging world in cyberspace*. New York: Basic.

Pöschl, U. 2010. Interactive open access publishing and peer review: The effectiveness and perspectives of transparency and self regulation in scientific communication and evaluation. *Liber Quarterly* 19, no. 3/4: 293–314.

Rossiter, N. 2006. *Organized networks: Media theory, creative labour, new institutions*. Rotterdam: NAi Publishers and Amsterdam: Institute of Network Cultures.

Salazar, J. 2011. The mediations of climate change: Museums as citizens' media. *Museum and Society Special Issue: Hot science, global citizens: The agency of the museum sector in climate change interventions* 9, no. 2. http://www.le.ac.uk/ms/museumsociety.html

Stern, N. 2006. Stern review on the economics of climate change. http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm