



Making Science Public: Challenges and Opportunities

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Lead Institution: University of Nottingham
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HIGHLIGHTS FROM FINAL REPORT

Authors

Dr Sujatha Raman (Director, 2016-18; Deputy Director, 2012-16), The Australian National University (July 2018-present; formerly, University of Nottingham); Professor Brigitte Nerlich (Director, 2012-2016), Emeritus, University of Nottingham; Clio Cartelet (University of Nottingham); Dr Stevienna de Saille (University of Sheffield), Dr Eleanor Hadley Kershaw (University of Nottingham); Dr Sarah Hartley (University of Exeter); Dr Pru Hobson-West (University of Nottingham); Professor John Holmwood (University of Nottingham); Professor Vivien Lowndes (University of Birmingham); Dr Roda Madziva (University of Nottingham); Professor Paul Martin (University of Sheffield); Dr Carmen McLeod (University of Nottingham); Dr Kate Millar (University of Nottingham); Dr Alison Mohr (University of Nottingham); Dr Carol Morris (University of Nottingham); Dr Warren Pearce (University of Sheffield); Dr Susanne Seymour (University of Nottingham); Dr Alexander Smith (University of Warwick); Dr Adam Spencer; Dr Judith Tsouvalis (University of Sheffield)

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SUMMARY

This Programme investigated the relationship between science, politics and publics in the aftermath of an influential 2000 UK House of Lords Science and Society report. We conceptualised top-down initiatives promising greater transparency around the use of scientific evidence in policymaking and opportunities for public engagement around research and innovation agendas, as well as bottom-up instances of public mobilisation around science as an effort to *make science public*. In principle, such a movement seemed to speak directly to wider arguments for ‘opening up’ controversial domains of evidence and research to public scrutiny of framing, tacit assumptions, and alternative forms of expertise. Yet, these promises raised a number of dilemmas that we sought to examine in a range of cases.

Our research encompassed both publicly controversial interactions (ash dieback disease outbreak; the influence of religion on science/politics; laboratory use of animals; the use of evidence in migration policy; climate change; genetic modification technologies) and less controversial cases and institutional developments (antimicrobial resistance; the turn to inter/trans disciplinary in global environmental change research, food provisioning research and energy transitions research; the rise of responsible research and innovation agendas) in the relationship between science, politics and publics.

Our work challenges sweeping claims about a new openness at the science/policy/public interface, on the one hand, and more recent concerns about post-truth and the death of expertise, on the other – the two big reference points bookending this Programme. The first signifies a promise of ‘democratisation’ involving science while the second altogether rejects that promise, arguing that democracy has gone too far. The provenance of both claims lies in a narrative of crisis, to which the proffered response is either more openness or a return to a more closed past. But with the help of Programme-level funding, we were able to go beyond individual cases and conduct a detailed analysis which presents a more complex picture.

First, top-down initiatives to make science public are limited by the way they frame openness as a solution to perceived conflicts at the science/politics interface. This has tended to produce amendments in *processes* without sufficient attention to the *substantive* issues at stake. Rather than open up these underlying issues, initiatives in openness often reinforce prior institutional commitments and an understanding of conflicts as arising necessarily from a public rejection of expertise and evidence.

Second, from the substantive perspectives embodied in many cases of public mobilisation, the production and use of scientific knowledge is meant to be re-examined for a *purpose*. Sometimes this means a call to reconsider particular scientific practices and their evidentiary and ethical value, but in other instances it may mean stepping back from science altogether and focusing on what is needed for meaningful political and public action on shared societal problems.

Third, substantive perspectives at the science/politics interface are often not about opening up science *per se*, but about opening up wider economic, political, technological and innovation systems to critical scrutiny, and making space for alternatives. In this context, scientific research is sometimes implicated, but in other cases, science and other forms of expertise may well be allied with public efforts to open up such systems.

These findings suggest that processes intended to promote greater openness and diversity need to be designed so as to allow debate on substantive matters around science and politics to both happen and to have a chance to influence outcomes. This means going beyond the dominant crisis/controversy formula as the primary basis for diagnosing and intervening in the relationship between science, politics and the public. If opening up does not automatically lead to substantive conversations, new questions are needed to revitalize research on science/politics. One such set of questions for future work might be: what forms of evidence and innovation agendas are appropriate for addressing various national and global challenges; what are their implications for the design of institutions and public engagement; and how can their contributions to public value be assessed?

OVERVIEW OF THE PROGRAMME GRANT

The 'Making Science Public' Research Programme began on 1 May 2012 in response to a 2010 call from the Leverhulme Trust for research on 'science and politics' broadly conceived. At the time, a flagship House of Lords report published in 2000 was the main reference point for UK debates on the topic. It observed that public trust in the role of science advice to government had been rocked by BSE (mad cow disease), and there was public unease about emerging areas of research such as genetic modification (GM) and the institutions responsible for their governance. The report characterised UK science/society relations as being in a critical phase, famously highlighting a 'new mood for dialogue' with the public as a way forward. Since its publication, other high-profile challenges involving science continued to emerge, notably, around securing sufficient public consensus for the MMR vaccine. In their Programme call, the Trust called for systematic investigation of these complex issues linking 'society, scientific enquiry, and political direction', a challenge that we took up.

As the Programme drew to a close on 31 August 2018, ongoing political upheavals in Western democracies have loomed large in discussions around science and politics. Today, there are prominent concerns expressed in the media about 'post-truth', 'populism' and a 'death of expertise', casting doubt on the role of publics and the democratic virtues of dialogue. Our research brings much-needed context and moderation to such debates marked by increasingly polarised claims. Programme funding helped us nurture a number of national and international conversations on fundamental questions on the relationship between science, publics, politics and public (and private) institutions; and build enduring research capacity. We actively sought to engage with a wide range of scholars and open up new domains in both doing and communicating our research, as we detail in this report.

The Programme was publicly launched in February 2013 with a keynote by Professor Ulrike Felt (Vienna) entitled '*Science as a "Public Good" in search of a "Good Public"*', panel discussions, a poster event, and a debate on the motion, '*The privatisation of science is not in the public interest*'.

We held an international end-of-award conference in Nottingham in June 2016, by which time we had completed the majority of our projects. Professor Bob Antonio (Kansas), Professor Mark Brown (California State), Professor Alan Irwin (Copenhagen) and Dr Fern Wickson (Tromsø) discussed and responded to our findings at this event attended by a hundred people. The conference ended with a public panel in which Professor Sheila Jasanoff (Harvard), Professor James Wilsdon (Sheffield), Professor Brian Wynne (Lancaster) and Professor Charlotte Watts (Chief Scientific Advisor, Department of International Development) explored the question: '*What kinds of evidence do we need in a democracy?*'

2018 was marked by the publication by Manchester University Press (MUP) of an open-access volume edited by team members ([Science and the Politics of Openness: Here be Monsters](#), eds., Nerlich, Hartley, Raman and Smith). The book showcased our research, including new collaborations sparked by the Programme, and reflections by a number of leading scholars in the social studies of science, publics and policy. The book also contained chapters on open access (Professor Stephen Curry) and on the future of the public university (Professor John Holmwood and Dr Jan Balon) as these topics emerged as crucial to science/politics debates. A no-cost extension until the end of August 2018 gave us the opportunity to complete one of

the PhD projects that ran from September 2015-August 2018, and helped us pursue new avenues arising from conversations between our nine main sub-projects.

RESEARCH PROGRAMME OBJECTIVES

The 2000 House of Lords report set in motion a number of initiatives promising greater transparency around the use of scientific evidence in policymaking, and opportunities for public engagement around science and innovation research agendas. In addition to these developments from above, there was also evidence of public mobilisation from below to engage with science, innovation and policy agendas in diverse ways. We conceptualised these three strands as together representing an effort to *make science public*.

In principle, such a movement seemed to speak directly to arguments in the field of science and technology studies (STS) to 'open up' controversial domains of evidence and research to wider public scrutiny of framing, tacit assumptions, alternative forms of expertise and so on. Indeed, the language of openness was starting to be used by scientific and government institutions at this time. Openness and transparency around science were heavily framed in these initiatives as a possible *solution* to controversies and challenges to public trust. However, we identified a number of *dilemmas* (captured in Figure 1 used in our presentation to the Trust) which we sought to investigate.

One face of the effort to make science public seemed to promise openness in both scientific research and policy, and a vision of an engaged public. Yet these were countered by commercialisation imperatives around research, or efforts to politicise science in narrow, self-interested ways. Transparency could become a fig-leaf with enduring challenges hiding in plain sight. Public engagement efforts could perpetuate deference to experts and close down taken-for-granted issues rather than opening them up for debate. Together, these represented the other face of openness that needed systematic examination.

Making Science Public: Janus-faced?

Science is privatised and politicised

Transparency becomes a fig-leaf

Lay public simply defers to experts



Image credit:

[https://commons.wikimedia.org/wiki/File:Brooklyn_Museum_22.1488_Janus-Faced_Goblet_Miwonngntey_\(2\).jpg](https://commons.wikimedia.org/wiki/File:Brooklyn_Museum_22.1488_Janus-Faced_Goblet_Miwonngntey_(2).jpg)

OPEN SCIENCE

Open up data-sets and make methods and assumptions transparent

OPEN POLICY INSTITUTIONS

Guidelines for transparency of scientific advice and its use in UK government

ENGAGED PUBLIC

The public engage with open science & its use in public policy

Figure 1. Making Science Public: Janus-faced

Research Questions: In light of this Janus-face diagnosis, we aimed to bring together different academic disciplines and people with an interest in science/society as well as in politics/policymaking to explore tensions around efforts to make science public. We asked:

- What are the challenges involved in making science more public?
- How are attempts to do so changing the relationship between science, politics and publics?
- And what are the normative implications for problems relating to political legitimacy, scientific authority and democratic participation?

We proposed to address these questions through 9 sub-projects each representing a case study. Case studies were provisionally selected from three empirical domains representing topical areas for science/politics research as well as the area of social policy which does not normally figure in this field (though it represents a distinct area of research with similar challenges around evidence and expertise). As captured in the following Table (Figure 2), we anticipated that each case would represent *one* of the three thematic strands identified around making science public: science in policymaking (Theme 1), politics of science and public mobilisation (Theme 2), and public engagement around research and innovation (Theme 3). In practice, we found most cases offered insights on *more* than one such theme, thus underlining the value of our overarching concept - 'making science public' - for making sense of a dynamic interface between scientific evidence, policymaking, research and the public.

Key themes/ Topic areas for Projects	1. Transparency, expertise and evidence in policymaking	2. Science, publics and the making of politics	3. Public engagement, mediation and deliberation over S&T
* Food, agriculture & animals	1.2	2.2	3.1 PhD3
* Energy and environment	1.1	2.3 PhD2	3.2
* Health & social policy	1.3 PhD1	2.1	3.3
Synthesis	4. Making science public: normative implications for science & democracy		

Figure 2. Making Science Public: Overview of Themes and Projects

Our work challenges sweeping claims about a new openness at the science/policy/public interface, on the one hand, and post-truth and the death of expertise, on the other – the two big reference points bookending this Programme. The first signifies a promise of ‘democratisation’ involving science while the second altogether rejects that promise, arguing that democracy has gone too far. The provenance of *both* claims lies in a narrative of crisis, to which the proffered response is either more openness or a return to a more closed past.

But as Professor Stephen Turner characterises our work in his epilogue to the Manchester University Press volume:

The merit of detailed case studies is that they tell us something new. They tell us where old templates and expectations are wrong, and complicate the attempt to reduce novel phenomena to a simple formula (Turner 2018, p.326).¹

Case study choices

Our case study mix put us in a position to interrogate the science/politics/public relationship through a broader lens than is common in this research field. As planned, we focused in some sub-projects on domains where science and/or the role of publics around science had become controversial, drawing out some of their embedded institutional and system-wide qualities: the influence of religion on science/politics (2.1), laboratory use of animals (2.2), climate change (2.3), and GM technologies (3.1). But as we hoped to also bring in insights from non/less controversial cases, we retained our interest in the domain of antimicrobial resistance (AMR) whose public profile was low at the time (1.1, achieved through PhD collaboration with 3.1, and cross-cutting work with 1.2). To this mix, we refined other sub-projects to make use of PDRA and PhD student expertise, and grasp significant new opportunities to cast light on the dilemmas of openness.

¹ Turner, S. (2018) ‘Epilogue’ in B. Nerlich, S. Hartley, S. Raman and A. Smith (eds.), *Science and the politics of openness: here be monsters*. Manchester: Manchester University Press

First, a plant disease outbreak (ash dieback) provoked a public and policy controversy in 2012 with apocalyptic tales of non-native invasion featuring widely in the media and sparking a Cobra emergency response from the UK government. We built on Tsouvalis' expertise to focus project 1.1 on a 'live' episode of problematic interaction between science, politics, commerce and the public in an area of science that (much like AMR) had previously been largely invisible and under-studied (by contrast with animal disease such as BSE).

Second, migration policy has cast a long shadow in UK public debate, appearing to be shaped by emotion at the expense of evidence. Yet, the UK government expressed commitments to 'open up' migration policy to allow decisions to be transparent to the public and to be demonstrably shaped by reliable evidence. Interestingly, the politically novel development here was the appeal to evidence rather than the opening up of established (but narrow) evidentiary frameworks (as in cases involving science). Profiting from Madziva's expertise, we tailored the social policy project (1.3) to focus on this case.

Third, we synthesised questions about openness in the use of science in policy (Theme 1) and in scientific research (Theme 3) to identify an important new question: what are the challenges in *opening up scientific research systems and research projects to different disciplines?* We investigated the turn to 'inter/trans' disciplinarity and 'co-design' in three cases: food provisioning research (1.2, refined from our earlier focus on 'food security'); Future Earth, an iconic international programme in global environmental change research (PhD project linking 1.1 and 2.3); and energy transitions (3.2). The project on energy (3.2) was an innovative combination of participation in enacting co-design of research with different disciplines and community members, *and* a critical reflexive account of this research method. These projects allowed us to examine dilemmas of opening up embedded research practices and research governance beyond high-profile controversies.

Fourth, we conducted a significant body of work within and across different sub-projects (3.1, 3.3, plus cross-cutting) on a major new international and national initiative in research policy. This is variously described as 'responsible innovation' (RI) or 'responsible research and innovation' (RRI). In theory, RRI sought to extend principles of openness and engagement beyond the role of science in policymaking or controversial domains of research to the entire system of research and innovation. In common with all case studies, we sought to assess how this initiative has been working in practice.

Overarching Findings

Our approach to science and politics is captured by the metaphor of the 'monster' which framed the [Manchester University Press volume](#). The phrase 'here be monsters' or 'here be dragons' is commonly believed to have been used on ancient maps to indicate unexplored territories which might hide unknown beasts. We investigated openness initiatives around science as perhaps hiding metaphorical monsters, in the sense of dilemmas and pitfalls (the challenges in making science public and the impacts of attempts to do so, our first and second research questions). But the monster figure is double-edged in the sense of potentially stimulating new normative insights (our third research question). The findings summarised below represent both sides of this 'monster'.

First, institutional initiatives to make science public are limited by the specific way they frame openness as a solution to perceived conflicts at the science/politics interface. Openness as an organising framework has tended to produce amendments in *processes* without sufficient attention to the *substantive* issues at stake. Rather than open up these underlying issues, institutional commitments are often reinforced. So too is an understanding of conflicts as arising necessarily from a public rejection of expertise and evidence.

Second, from the substantive perspectives embodied in many movements and critiques across our cases, attending to the production and use of scientific knowledge is usually for a *purpose*. Sometimes this means a call to reconsider particular scientific practices and their evidentiary and ethical value, for e.g., around animal research or GM. But in other instances it may mean stepping back from science altogether and focusing on what is needed for meaningful political and public action on shared societal problems, for e.g., debates on the relevance of climate science for climate action.

Third, substantive perspectives at the science/politics interface are also often not about opening up science *per se*, but about opening up wider economic, political, technological and innovation systems to critical scrutiny, and making space for alternatives. In this context, some areas of science may be implicated, for e.g., where particular evidentiary or research commitments appear to support or fail to question established systems (e.g., around food, energy, agriculture). But there are other cases where forms of science, expertise and evidence are *allied* with normative attempts to open up such systems.

Fourth, our critique of a favouring of apparently democratic processes (openness) over substantive matters at the science/politics interface does not imply a rejection of efforts to 'open up' this interface. Nor does it imply that embedded institutional and systemic commitments are doomed to remain unchanged despite the best such efforts. Democratic processes need to be designed so as to allow debate on substantive matters to happen and to have a chance to influence outcomes. Research in science and politics can contribute in this regard through new concepts and approaches as well as through sober assessments of apparently novel phenomena. We now expand on how we have done this in our Programme.

Theme 1. Science and Evidence in Policymaking: Transparency and openness have had far less substantive impact than might be expected from a plethora of new initiatives.

In the case of ash dieback in Britain, a traditional technocratic approach was evident (Tsouvalis 2018). In European governance of GM animals, the framework for risk assessment was indeed opened up to public input but with little effect on expert judgments (Hartley and Millar 2014). At the same time, our work shows that in some domains of policy, 'evidence' appears in very different forms to the scientised versions that appear elsewhere. In migration policy, a highly visible and stylised object (the Go Home van) became both a way of provoking action from 'illegal' migrants and a powerful symbol offering evidence of government action to the public (Lowndes and Madziva 2016). By contrast, evidentiary judgments are routinely made within government on what constitutes adequate evidence for asylum claims and these are much harder to prise open (Madziva and Lowndes 2018). As our work on randomised-

controlled trial evidence in social policy suggests (Pearce and Raman 2014; Pearce et al 2015), institutional work is needed for evidence to be trusted. The credible interpretation and use of evidence itself requires expertise. Cartelet's PhD work on companion animal medicine shows that by contrast with prominent science/politics controversies mediated by contestation over the evidence, perceptions of a lack of relevant and quality evidence may be the bigger issue in some cases (Cartelet et al 2018).

Theme 2. Politics of Public Mobilisation: Amidst significant polarisation where science has become a battleground around high-profile issues, the need to recognise and cultivate the skills and practices of moderation is paramount.

In climate change, moderation does not always work for engaging with highly motivated publics who use religious metaphors to challenge mainstream science (Nerlich 2015). Paradoxically, these failures may underline the need for renewed attention to disciplined forms of moderation and ways of engaging between divided publics as work led by Pearce (e.g., Pearce et al 2017) suggests. Indeed, there is no better example to illustrate this potential than the case of Kansas which is widely assumed to symbolise the voice of an angry nativist public opposed to expertise and mainstream science. Smith's research (2018) highlights the power of moderation as exemplified in a host of everyday actions by Kansans successfully mobilising against extremism. Likewise, it was possible for alternative public meanings of migration to (at least temporarily) emerge, contesting the policy messages of the 'Go Home' van (Lowndes and Madziva 2016). Hobson-West's work (Davies et al 2016) is an example of how researchers can engage in principled ways with scientists and other stakeholders to develop collaborative agendas.

Theme 3. Public Engagement in Governance of Research and Innovation: Here, the impact of demands for openness is potentially more promising, albeit still mixed.

Evidence of openness to different forms of certified expertise including social science is only limited in the case of food provisioning research, but progress in this regard could help open up substantive questions around the role of trade and global agri-food systems (Morris et al 2018). In the governance of laboratory use of animals, the very rise of a transparency imperative is significant in itself, opening up possibilities for publics to engage with research practices in hitherto unexpected ways (McLeod and Hobson-West 2016). Elsewhere, the rise of RRI points to an emerging space for remaking science/society relations as does the incorporation of 'co-design and co-production' in an iconic international research programme on global environmental change, Future Earth (Hadley Kershaw 2018). In practice, this remaking potential has been curtailed to date by narrow perspectives on both responsibility and innovation (de Saille and Medvecky 2016; Hartley, Pearce & Taylor 2017; Raman 2015). But it may be more productive to treat attempts to transform research as experiments where participants co-exist despite their different understandings of what is at stake, but an openness to new ways of doing research is kept open (Hadley Kershaw 2018). Mohr's (2018) work offers such an example of how researchers can actively participate in co-design and keep issues of inclusion alive.

Further details of the research from which all of these findings arise are set out in the section on 'Research Activities'.

DETAILED REPORT ON RESEARCH ACTIVITIES

1.1. Models of Managing Science/Politics Boundaries

Judith Tsouvalis, Sujatha Raman

Aim: To explore how openness works in policymaking by investigating how boundaries between scientific expertise, commercial interests, policy judgements, political demands and publics are managed. **Methods:** A case study of the response to ash dieback, a plant disease that became a national emergency in the UK in 2012, was conducted with documentary analysis and 17 interviews with civil servants and government advisors; participation in a series of high-level conferences and a focus group helped inform the analysis.

Findings: Framed by the government as a problem of 'biosecurity', ash dieback was tightly managed through a narrow framework centring on one form of scientific expertise, i.e., risk assessment, and enrolling publics for citizen science monitoring of the disease in support of a surveillance agenda. Other forms of science could have been mobilised to 'open up' and politicise more complex commercial imperatives such as international trade in plants that help foster disease spread, but this did not happen. Such matters were excluded from the terms of reference of the expert taskforce assembled to address a biosecurity breach, with stakeholders, publics and even taskforce members having little input into this biosecurity framing and the ways in which the disease was consequently tackled.

1.2. Research agendas for food provisioning

Adam Spencer, Carol Morris, Susanne Seymour

Aim: To examine how research agendas in the area of food provisioning are being framed and developed in the context of increasing UK research council openness towards bringing different forms of disciplinary expertise together. **Methods:** A case study of the UK food provisioning research field was conducted, with mapping of the field, documentary analysis of institutional initiatives including the Global Food Security (GFS) Research Programme and university research clusters in this area, and 42 interviews with researchers and research managers.

Findings: The UK food provisioning research field is dominated by a 'food security' frame. This is predicated on a policy preference that takes improved trade relationships and an increase in global food production as central to food security, and promotes research that is imagined to support this aim. Alternative frames of food provisioning emphasising democratic control over food production and distribution systems ('food sovereignty') are marginalised or understood narrowly. Despite formal commitments to cross-disciplinary engagement, the research field is dominated by food sciences and animal sciences and is only selectively open to social sciences (mainly, economics). Expertise on institutional and systemic matters of relevance to food provisioning, including alternative framings, is therefore largely unrecognised.

1.3. Making evidence public in policy making

Roda Madziva, Vivien Lowndes

Aim: To study the use of evidence in public policy with particular focus on UK migration policy and the ways in which diverse publics are imagined, constituted, engaged and mediated.

Methods: Case studies involving analysis of Home Office documents, individual case reviews, 6 focus groups and 80 interviews with migrants and professionals were conducted to explore: 1.) the impact of the government's 2013 'Go Home Van Campaign' and 2.) the processing of asylum claims submitted by Christians from Muslim majority countries.

Findings: The adjudication of faith-based asylum seeker claims of Christians from Pakistan underlines the limits to recent claims to openness in UK migration policy. Evidentiary judgments by officials of religious persecution were heavily framed by biased, ethnocentric assumptions about religion as an 'observance' rather than an 'identity', and about Pakistani origin as a proxy for being Muslim. Second, the infamous Go Home Van campaign (where the government attempted to enforce its migration policy with mobile vans displaying stark messages intended for illegal migrants), highlights the limits of taking textual evidence (including scientific/technical information) as the main way through which governments aim to legitimise their policies and engage publics. Publics are mediated through symbolic objects as much as through 'text' or scientific and technical information. More than the words alone, the van itself became a way of constructing meaning while also provoking resistance and alternatives.

2.1. Science, religion and the making of publics in the US

Alexander Smith, John Holmwood

Aim: To explore how scientific controversies are being used to generate new political opportunities for religious claims and traditions. **Methods:** Ethnographic fieldwork and about 50 interviews with political and religious activists engaged with grassroots Republican Party politics were carried out in the greater Kansas City metropolitan area.

Key Findings: While the threats to both science and politics from extremism are real in the United States, this research highlights the importance of attending to the people and practices of political moderation. Crucially, this also means taking seriously politics beyond the high-profile central or federal levels preoccupying much commentary and debate. Kansas has been at the front line of US culture wars involving religion, creationism and the teaching of evolution in high-school science curricula. Yet, on the very day Donald Trump was elected President, a string of moderate Republicans and Democrats were elected to the state legislature. This was made possible by the ordinary, less visible activities of everyday political participation which ought to feature more strongly in scholarly accounts of science, politics and public engagement.

2.2. Animals and the making of scientific knowledge

Carmen McLeod, Pru Hobson-West

Aim: To explore how 'publics' might contribute to the governance and regulation of the use of animals in scientific research. **Methods:** Key stakeholder interviews and documentary analysis.

Findings: In 2011 the government launched a public consultation on the transposition of an EU directive on this subject into UK law. We found that submissions from stakeholder groups, as opposed to individual citizens, played a central role in the process. Second, the 3Rs framework (Replacement, Reduction and Refinement) has become a vital symbol of 'good' science and welfare practices, yet the applications of this principle within experimental research design are not generally open to public engagement. Third, transparency is increasingly embraced by the animal research community but its implications for practice are ambiguous and in the making. Furthermore, a comparison of the UK Concordat on Openness on Animal Research, and the Swiss 'Basel Declaration' suggests that transparency is being framed as a promissory panacea to improve public trust in animal research. However, the very 'slipperiness' of transparency discourses opens up the potential for transforming public engagement with animal research. For example, the requirement to make non-technical research summaries public means that interested citizens can, in theory, scrutinise regulatory decisions; whether this can happen in practice needs further research.

2.3. Science, scepticism and politics Warren Pearce, Brigitte Nerlich

Aim: To: (a) map the emergence, spread and contestation of 'scepticism' in the wake of controversies surrounding climate change science and politics, and (b) identify rhetorical resources and framing devices used to create public meanings of climate change. **Methods:** Quantitative and qualitative including digital methods, discourse analysis, metaphor and social representations analysis.

Findings: Climate change communication, especially on the internet, remains polarised, but with some institutions and individuals functioning as bridges between social groups and social movements in the UK and Europe. Deficit models of communication remain common but participatory and deliberative approaches have also begun to increase. Labels such as 'denier', 'contrarian' and so on are still being used to structure group identities around climate politics. At the other end, we detected the rising use of religious metaphors to denigrate climate science. Both types of rhetoric tend to foster unproductive conversations. Overall, trying to secure public legitimacy for climate action through expositions of scientific consensus may not be the most fruitful strategy as key tensions remain between scientific and public meanings.

3.1. Risk, regulatory governance and innovations in agricultural biotechnology Project 1: Sarah Hartley, Kate Millar

Aim: To examine efforts to 'open up' the expert domain of risk assessment to publics and alternative experts in agricultural biotechnology governance. **Methods:** A case study of the establishment of a European risk assessment framework for GM animals was conducted with documentary analysis and 24 interviews with key EU actors.

Findings: Opening up risk assessment to public input has had very limited impact on European regulatory decision-making. Within EU processes, regulators restrict the type of knowledge publics are able to contribute and expert value judgements are largely cloaked from public scrutiny.

Project 2: Sarah Hartley, Brigitte Nerlich

Aim: To examine agricultural and global health biotechnology governance in the context of responsible innovation. **Methods:** Case studies were conducted using elite interviews and documentary analysis of the regulatory approval of the GM diamondback moth in New York State, GM mosquito in Florida and the GM mosquito in Brazil.

Findings: In NY, regulators rejected public concerns about governance as 'generic opposition' to GM and approved the release of the GM moth. However, the permit was later withdrawn and the application resubmitted. In the second approval, the regulator broadened consideration to include public concerns. In Brazil, the political will for public health solutions meant support for GM mosquitoes was strong and the insect was commercialised. In Florida, public opposition was strong and the decision on whether to release was placed on the presidential ballot, reflecting the highly politicised nature of the controversy.

3.2. Making energy public/s: The role of intermediaries in transitioning to low carbon futures

Alison Mohr

Aim: To investigate the role of intermediaries in opening up energy transitions research to community engagement. **Methods:** Case studies of intermediaries - transitions research, public dialogue; life cycle assessment (LCA) – were conducted in Bangladesh and Kenya (key policy actor interviews; focus groups in two communities in each country; community energy governance workshops).

Key Findings: This project was a collaboration between Mohr and researchers at the Universities of Loughborough and Oxford, United International University (Bangladesh) and INTASAVE (Kenya). Rather than study a scientific research project from the outside, it involved social scientists collaborating with engineering researchers to 'co-design' low-carbon energy transitions in energy impoverished rural communities in the global South. Co-design was a response to the limitations of established global North-centred frameworks for energy transitions research that neglect matters of distributive justice. Yet, community consultation methods showed that opening up transitions research in this way through co-design with communities has its own challenges. Tensions between different social groups mean that communities, much like 'the public', cannot be seen as internally cohesive. Opportunities for different members to participate in shaping their energy futures need to be created if co-design is to be truly inclusive.

3.3. Publics and the Making of Socially Responsible Research and Innovation Stevienna de Saille, Paul Martin

Aim: To investigate the emergence of 'Responsible (Research and) Innovation' (RI) as a policy framework for the direction of scientific research. **Methods:** Ethnographic work with an activist group in the UK, stakeholder interviews, and policy analysis.

Findings: There is increasing dissatisfaction amongst the R(R)I community with its implementation via the European Commission as a tool for stimulating GDP growth, rather than enabling socially useful innovation. However, the values underpinning RI, particularly to

do with public involvement, are slowly being taken up by the university sector, particularly in the UK, where it may produce different results. 'The public' is still neither engaged with, nor generally aware of RI in the UK, although ethnographic work with an activist group suggests a strong alignment with the underlying values of its original formulation as a counterbalance to GDP-driven innovation policy. The limits of the current RI paradigm demands more attention to the '4th quadrant' where 'Responsible Stagnation' includes the challenges of creating truly useful, environmentally-conscious innovation in stagnating economies. Using steady state economics to formulate an a-growth RRI paradigm allows us to identify a number of innovations in this sector.

PhD studentship: Future Earth and the ambiguities of co-production (Supervisors: Raman and Nerlich)

Eleanor Hadley Kershaw (PhD viva in January 2018: successful, with no corrections)

Aim: To explore meanings and practices of co-production and transdisciplinarity in global environmental change research governance. **Methods:** A case study was conducted of a major international research initiative, Future Earth, comprising documentary analysis, observation of Future Earth meetings and events, 2 focus groups and 10 interviews with key actors.

Findings: Co-production and transdisciplinarity were ambiguous and sometimes contested terms in Future Earth, with varying definitions motivated by different rationales for increased (or limited) involvement of non-academic stakeholders in research governance and conduct (from ensuring relevance to democratising expertise to preserving the objectivity or independence of science). These notions of appropriate engagement were underpinned by diverse conceptions of the value of research (as a service to society, site of democratic deliberation, or public good), reproducing (and challenging) established models of science and democracy. Visions of Future Earth's broader identity, form, and function were also varied and ambitious. However, these ambiguities and tensions are not necessarily problematic; in viewing Future Earth as an ongoing experiment, space remains for co-existence, openness and flexibility.

PhD studentship: Antimicrobial resistance and responsibility in the context of Companion Animal Medicine (Supervisors Millar, Hobson-West, Raman)

Clio Cartelet (Fieldwork completed & in writing-up year in 2019)

Aim: To open up the role of professional practice in debates around evidence-based policy, this PhD explores how companion animal veterinarians construct their responsibilities around antimicrobial resistance and antimicrobial stewardship. **Methods:** Semi-structured interviews were conducted with 25 companion animal veterinarians in the UK.

Key Findings: The lack of certainty when making clinical decisions and the critical importance of antimicrobials when practising any kind of medicine (including veterinary) create inescapable ethical challenges when trying to tackle the problem of AMR. Evidence-based practice is prized as an ideal, but in reality, everyday practice is constrained by limits on the quantity and quality of evidence relevant to veterinary practice.

CONCLUSION: SCIENCE AND POLITICS - NEW UNDERSTANDINGS AND FUTURE RESEARCH

Our work casts doubt on the crisis/controversy formula as the primary basis for diagnosing and intervening in the relationship between science, politics and the public. Institutions tend to respond to crises with actions intended to smooth over real and imagined instabilities. (They may not necessarily succeed, as the ongoing response to Brexit indicates, but the point remains). As we have highlighted, this has led to a process-centric response of initiatives promoting openness but with limited impact on substantive matters. What then are the implications for the field of research on science and politics?

The normative imagination of this field has also been heavily structured by a vision of 'opening up' science, albeit for a different purpose to institutional commitments to taming conflict. For researchers, crises have long represented opportunities for opening up substantive questions that have been closed down or taken for granted at the interface of evidence and policy, or of research and innovation. Encountering a gap between openness and dialogue as imagined in theory and as institutionalised in practice, researchers have more recently turned to the concept of 'performativity' as a way of accounting for this phenomenon.²

Our work as a Programme suggests that if substantive conversations do not automatically emerge from a process of opening up, we need more than such concepts for explaining the gap between theory and practice. Rather, new research questions are needed in order to revitalize research on science/politics. For example: *What forms of evidence and innovation agendas are appropriate for addressing various national and global challenges; what are their implications for the design of institutions and public engagement; and how can their contributions to public value be assessed?* This calls for a broad-ranging inquiry that would start from investigating the nature of specific problems and assessing a range of different responses rather than fixing on a narrow research-led but contestable solution at the outset. Conventional funding opportunities make it difficult to ask this type of question as they tend to be driven by specific areas of scientific or technological research.

Team members have contributed a number of substantive concepts and thematic approaches representing significant pathways for future research. These are not reliant on science/politics controversies, though they are capable of engaging creatively with those that do emerge.

First, on responsible research and innovation (RRI), our work offers institutional and system-wide perspectives that help address the limitations of the conventional focus on scientific projects in controversial domains. Hartley and Pearce pioneered the idea that the university has a key role to play in integrating RRI into practice, in turn enriching Hadley Kershaw's PhD training; de Saille's work (2016 and forthcoming, with external colleagues) on 'responsible stagnation' promises to transform RRI thinking by integrating heterodox economic thought into the field; Raman made a plea for taking innovation seriously in RRI by diversifying the concept of novelty; Nerlich and McLeod began a novel conversation on responsible communication around RRI; and Millar and colleagues drew attention to the relationship between RRI and

² Horst, M., & Irwin, A. (2010). Nations at ease with radical knowledge: on consensus, consensusing and false consensusness. *Social Studies of Science*, 40(1), 105-126.

existing cultures of responsibility. In a field dominated by a focus on high-tech research in the global North, Mohr (2018) with external colleagues (Cloke et al 2017), and Hartley and McLeod (forthcoming) pioneered novel pathways on RRI in the context of energy transitions and community engagement in the global South.

Second, on evidence and policy, the connections we made between studies of science policy, public policy and the professions helped us likewise identify a range of under-studied themes. The politics of evidence and its use in policy and practice is not always and everywhere defined by contention over this evidence. In some cases, evidence may be perceived to be altogether lacking or inadequate (Cartelet, Hobson-West, Raman & Millar 2018). Alternatively, evidence that is newly coming into being may require significant attention to institutions and expertise through which it can be mediated and made credible (Pearce & Raman 2014; Pearce et al 2015). The role of bureaucratic judgment and symbolic objects as evidence (Madziva and Lowndes 2018; Lowndes & Madziva 2016) also deserves further attention.

Our work on openness around scientific research also shows that framing the science/society relationship entirely in terms of openness to publics is insufficient. In the case of food security research, openness to social science expertise is an important question in its own right especially in light of research funders embracing aspirations for inter/transdisciplinarity. Here, our work shows that the role of social science is currently imagined in narrow ways, inhibiting the development of better ways of addressing the challenges of food security (Morris, Raman & Seymour 2018). Social scientists can bring substantive concepts such as distributive justice (Mohr 2018) and principled moderation of conflict (Smith & Holmwood 2013)³ to bear on strategies for transformation in different domains. As cross-cutting work led by Pearce (et al 2018) suggests, we need alternatives to consensus messaging as the default response to science/politics controversies.

Across all of these spheres, how we understand, represent and imagine 'the public' and the public interest in relation to 'open policymaking' or indeed, open research, is of paramount importance. Our work across the programme highlights ways in which publics are plural and dynamic. Yet we have found ways to creatively conceptualise commonalities across difference – for example, our work on publics (Mohr et al 2013) while acknowledging differences between campaign groups, civil society and latent publics, drew attention to the potential for diverse publics to come together around visions of the collective interest. Indeed, new imaginations of what is in the collective public interest in and around science may sometimes be opened up by minority groups who are able to mobilise wider alliances (Raman, Hobson-West, Lam & Millar 2018). As we reckon with contemporary dilemmas of populism and post-truth, this capacity to find ways to hold plural things together without falling apart will become increasingly important. The role of public institutions especially the university (Holmwood & Balon 2018) will be critical in this regard.

³ Smith, A.T.T. and Holmwood, J., 2013. Sociologies of moderation. *The Sociological Review*, 61, pp.6-17.

OUTPUTS

List of Publications (Published)

Cartelet, C., Hobson-West, P., Raman, S., & Millar, K. (2018). Antimicrobial resistance and companion animal medicine: examining constructions of responsibility. In S. Springer & H. Grimm (eds.), *Professionals in food chains: ethics, roles, responsibilities*. Wageningen: Wageningen Academic Publishers

Cloke, J., Mohr, A., & Brown, E. (2017). Imagining renewable energy: Towards a Social Energy Systems approach to community renewable energy projects in the Global South. *Energy Research & Social Science*, 31, 263-272

Davies, G.F., Greenhough, B.J., Hobson-West, P. et al. (2016) Developing a collaborative agenda for humanities and social scientific research on laboratory animal science and welfare. *PLoS One*, 11 (7), e0158791

Davies, G., Greenhough, B., Hobson-West, P., & Kirk, R.G.W. (2018) Science, Culture, and Care in Laboratory Animal Research: Interdisciplinary perspectives on the history and future of the 3Rs. Editorial in *Science, Technology and Human Values*, 43 (4), 603-621

de Saille, S. (2015). Dis-inviting the Unruly Public. *Science as Culture*, 24(1), 99-107

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de Saille, S., & Medvecky, F. (2016). Innovation for a steady state: A case for responsible stagnation. *Economy and Society*, 46 (1), 1-23

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de Saille, S., Medvecky, F., van Oudheusden, M., Amanatidou, E., Albertson, K., Birabi, T., & Pansera, M. (Forthcoming 2020). *Responsibility Beyond Growth: The fourth quadrant of Responsible Innovation*. Bristol University Press.

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- Hartley, S., Pearce, W., & Taylor, A. (2017). Against the tide of depoliticisation: the politics of research governance. *Policy & Politics*, 45 (3), 361–377
- Hartley, S., McLeod, C., Clifford, M., Jewitt, S., & Ray, C. (2019). A retrospective analysis of responsible innovation for low-technology innovation in the Global South. *Journal of Responsible Innovation*, 6(2), 143-162
- Helliwell, R. Hartley, S. and Pearce, W. (in press). NGO perspectives on the social and ethical dimensions of plant genome-editing. *Agriculture and Human Values*
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Raman, S. (2015). Responsive Novelty: Taking Innovation Seriously in Societal Research Agendas for Synthetic Biology. *Journal of Responsible Innovation*, 2 (1), 117-120

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Stelmach, A., & Nerlich, B. (2015). Metaphors in search of a target: the curious case of epigenetics. *New genetics and society*, 34 (2), 196-218.

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Programme Blog (<http://blogs.nottingham.ac.uk/makingsciencepublic/>)

Programme Director Nerlich maintained the widely read Making Science Public Blog for which she was nominated for a University of Nottingham Knowledge Transfer award.

Over 370 blogposts were published on the blog, the majority by Nerlich (her posts, organised by topic are available at <https://wakelet.com/@BNerlich>)

Some blogposts were republished elsewhere in original/edited formats, while team members also contributed new posts to other sites: *Sciencewise-ERC blog* (Mohr; Raman); *LSE Impact of Social Sciences Blog* (Nerlich; Pearce & Raman; Smith; Tsouvalis), *iScience Magazine* (Nerlich); *People & Science* (Nerlich), *British Science Association* (Nerlich); and several in *The Conversation* (Hartley; Nerlich; Raman & Pearce; Smith). A post on L'Aquila earthquake (Nerlich) was mentioned positively in [The Guardian](#) and is cited in a *Reuters Institute* (Oxford) report. Pearce also maintained a [curated newsfeed and archive](#).

Programme Website & Newsletter

Programme Manager, Dr Selvadurai, maintained a dedicated website for Making Science Public. She also coordinated a newsletter containing highlights from our work which was sent to almost 200 people, including several active in science/politics debates at national and international levels.

Conference Organisation & Outputs

Videos from the *Launch* conference (Feb 2013) are available at:

https://www.youtube.com/playlist?list=PLpRE0Zu_k-BypCrXijS8GqgfdhI9ul8t

A video of the public debate at the launch conference is available at: [The privatisation of science is not in the public interest](#)

A report on the *End of award* conference (June 2016) by Hadley Kershaw for the EASST Review is republished here:

<http://blogs.nottingham.ac.uk/makingsciencepublic/2016/10/06/making-science-public-opening-closed-spaces/>

Team members (Hadley Kershaw; Nerlich; Pearce; Spencer; Tsouvalis) organised the 2013 annual *Science in Public* conference in Nottingham, with the proceedings edited by Adam Spencer available at: <http://eprints.nottingham.ac.uk/32360/1/SIP13%20Proceedings.pdf>

Team members (Hartley, Holmwood, Mohr, Pearce, Nerlich) contributed significantly to the organisation of two major international, interdisciplinary conferences funded by the University of Nottingham's Science, Technology & Society Research Priority Group and co-sponsored

by the Making Science Public Programme, one in 2014 (*Circling the Square: Research, Politics, Media and Impact*) and the other in 2015 (*Circling the Square: Universities, the Media, Citizens and Politics*). Outputs from these are available at: <https://www.nottingham.ac.uk/conference/fac-sci/circling-the-square/index.aspx>

A report from the *Responsible Research and Innovation (RRI) 2015 Workshop* organised by Hadley Kershaw, Hartley and Pearce is available at: http://eprints.nottingham.ac.uk/28680/1/Hadley%20Kershaw%20et%20al_RRI%20Workshop%202015.pdf