



THE (RE)PUBLICS OF SCIENCE:
CHANGING POLICY AND PARTICIPATION

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Established in early 2011, and building on a tradition of leading environmental social science research at UEA, we are a group of faculty, researchers and postgraduate students taking forward critical social science approaches to researching the social and political dimensions of environment and sustainability issues.

The overall aim of the group is to conduct world-leading research that better understands, and can potentially transform, relations between science, policy and society in responding to the unprecedented sustainability challenges facing our world. In doing this our approach is:

INTERDISCIPLINARY, working at the interface between science and technology studies, human geography and political science, as well as linking with the natural sciences and humanities;
ENGAGED, working collaboratively with publics, communities, civil society organisations, government and business; and REFLEXIVE, through being theoretically informed, self-aware and constructively critical. Our work is organised around five interrelated research strands:

KNOWLEDGES AND EXPERTISE
PARTICIPATION AND ENGAGEMENT
SCIENCE, POLICY AND GOVERNANCE
TRANSITIONS TO SUSTAINABILITY
SUSTAINABLE CONSUMPTION



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3S researchers working across these strands focus on a range of topics and substantive issues including: climate change, energy, emerging technologies (such as biotechnologies and geoengineering), natural hazards, responses to the economic and financial crisis, and grassroots actions and social movements on sustainability.

ABSTRACT

Changing visions of science and the characterization of scientific expertise have been co-produced with imaginations of 'the public' and its proper role in science policy-making. Since the middle of the twentieth century, visions of science as the product of an isolated community devoted to free intellectual inquiry have largely been replaced by the recognition both of scientists' reliance on public support and of the far-reaching societal consequences of scientific and technological innovation. Consequently, publics have been increasingly brought in to science policy-making and its institutional machinery. Yet simultaneously the practice and theory of public participation in science policy have faced fierce critiques. It has been claimed that the shift towards public dialogue has been merely rhetorical, whilst old visions of the autonomy of scientific progress remain strong and the instrumental imperatives of science policy-making threaten emerging modes of decision-making. This paper explores these developments as an introduction to the new and developing *critical public engagement* literature, which seeks to constructively engage with these new interactions between scientific expertise, publics and science policy-making. Future pathways for the literature and science policy-making are then suggested.

Keywords: Public participation, Constructions of publics, Scientific expertise, Critical public engagement literature, Republic of science

3S Strands: Participation and Engagement, Knowledges and Expertise

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1 INTRODUCTION

Writing in the first issue of the science policy studies journal *Minerva* in 1962, Michael Polanyi theorized a 'Republic of Science'. Here scientists could exercise autonomy over their own work within a community operating according to free-market logic, insulated from a wider society of policy-makers and the public. For him scientists had no responsibility to serve the 'public interest', rather they were to practice 'free scientific inquiry' (Polanyi 1962). The early 1960s were also characterized by the height of tensions in the Cold War, accompanied by increasing debate and civil society resistance around the moral dimensions of emerging military technologies. In the following decades, opposition to nuclear power was expressed through social movements in Western Europe and North America in the early 1970s, whilst activists were vocal in questioning the widespread usage of industrial pesticides. Such developments were cited in support of nuclear scientist, Alvin Weinberg's, 1972 argument that certain *trans-scientific* problems could not be solved through scientific rationality alone. Emphasizing the inherent uncertainty and value-laden nature of many decisions involving science and technology, and in contrast to Polanyi's thesis, Weinberg (1972) suggested that the republic of science should recognize its reliance on public support and occasionally open itself up to other actors.

The story of Polanyi's 1962 paper could also be told as one of competing theories of scientific republicanism (cf. Fuller 2000). Polanyi's account is republican in that it theorizes scientists as an elite, holding power over the rest of society; yet he does not acknowledge how this power is conferred onto scientists because of their status as representatives of nature, publics and other actors, such as businesses. Whilst Polanyi saw science as the ultimate ideological authority, other theorists have argued that the authority of science rests on its relationship to citizens and political elites (e.g. Brown 2009). Thus far from operating in a detached and isolated space, scientists have a responsibility to acknowledge difference and diversity within their community in their engagement with other interest groups (Fuller 2000). More recent contributions describe expertise as contested and shifting, necessitating the creation of groups of different representatives or expertises coalescing around the same science policy problem (Fuller 2000). In contrast, Polanyi's concept of expertise as differentiated by domains of inquiry would suggest that there are individual experts competent to deal with each specific policy problem; furthermore "[t]here is ample evidence that science policy thinking remains stuck in Polanyi's pseudo-republican mentality" (Fuller 2000: 31). It can be seen that certain kinds of scientific republicanism can be compatible with certain kinds of democracy or citizen involvement, but this has not always been the case over the last half century.

The above accounts present just two strands of a broader narrative of changing imaginations of science's publics and republics; continually made and remade in response to diverse influences and through changing organisations and assemblages. This paper focuses specifically on the evolution of approaches to engaging publics with science and technology policy, but this must be explored in the context of changing ideas about the appropriate role of science in society and the best process of science policy-making. With consequences for science policy and public participation, science has been conceptualized variously as: an autonomous republic (Polanyi 1962); a driver of innovation (e.g. Shils 1968); the servant of society (e.g. Weinberg 1972); something to be democratized (e.g. Nelkin 1975); one amongst many forms of situated, partial knowledge (e.g. Wynne 1996); and a fundamentally social process (e.g. Jasanoff 2004). Meanwhile publics are seen variously as: detached from the republic of science (Polanyi 1962); a barrier to scientific and technological progress (see

Stirling 2008); ignorant of science and its methods (see Wynne 2006); technology users and consumers (see Burgess and Chilvers 2006); and as vital actors in processes of knowledge creation (see Bull et al. 2008). Crucially, such visions are co-produced: publics are defined in opposition to accepted notions of scientific expertise and authority (Blake 1999) and performatively brought into being by institutional imaginations (Wynne 2006). Furthermore, visions of the appropriate role of publics and scientists in making science policy have changed not only through the arguments and actions of academics and policy-makers, but also in response to civil society movements like public protest – though this influence is rarely acknowledged.

Over the last half century arguments for public involvement in science and technology decision-making and governance have been increasingly accepted and put into practice. Contemporary scientific challenges, from climate change to nanotechnology and radioactive waste and to the global spread of HIV/AIDs, are diverse and mounting; each highlighting different tensions and linkages between the roles of publics and scientific expertise, and each presenting new challenges for participation and policy. This proliferation of participation and engagement has also been accompanied by several waves of critiques, however. One prominent contemporary critique is the *critical public engagement literature* (Chilvers 2009a), which has emerged over recent years with the project of making a constructively critical contribution to participation theory and practice. Significant challenges to the embedding of more participatory modes of science policy-making arise partly from the persistence of beliefs about the inevitably progressive nature of science and technological innovation (see Stirling 2008), and assumptions of a linear science policy-making process (see Jasanoff & Wynne 1998). The close relationship – material and imagined – between economic concerns and the development of science and technology can be traced through policy responses. In contrast, collective experiments (Rabeharisoa & Callon 2004) and other processes arising in ‘uninvited’ spaces of participation (Leach et al. 2005), involving diverse actors with evolving goals, have also subtly influenced policy choices and more formal mechanisms of inclusion around science policy.

In what follows I do not set out to construct a grand, teleological narrative of the increasing scope and success of public participation in science policy. Rather I seek to sketch out a more complex and messy tale of conflict and antagonism, with visions shifting through processes of learning and forgetting. Furthermore, the story I weave is mediated by my particular vantage point as an early-career environmental social scientist, working in an interdisciplinary department within a British university. This paper will begin by discussing the emergence of participatory approaches to science policy from the 1960s onwards, with a particular focus on their significant expansion in the 1980s and 1990s in North America and Western Europe. This will be followed by an exploration of the subsequent institutionalization of participation and the fierce critiques which accompanied it. Thirdly, the current state of the new critical public engagement literature will be described. The paper will end by suggesting possible future directions for this story of science and technology policy and associated academic work. Here I highlight the promotion of organisational reflection and reflexivity and the possible future of what I have labeled the ‘landscape’ perspective of public engagement, encompassing diverse participatory experiments; and finally I consider theoretical resources that the discipline might draw on to advance the project of constructive, critical study around public engagement.

2 BRINGING PUBLICS IN

In response to diverse motivations publics have been increasingly included in science and technology policy-making over the last 50 years. Civil society movements, such as the anti-nuclear and anti-roads protests in Western Europe and North America, often translated into local planning conflicts in the 1960s and 1970s, with the development of formal modes of public participation in planning; described by Sherry Arnstein in the 1960s as 'nothing new' (Arnstein 1969). Significant events like the Chernobyl disaster, Brent Spar and the UK's food safety controversies of the late nineties have been cited as possible roots of the 'crisis of trust' in scientific authority in Britain and further afield; yet Dorothy Nelkin suggested in the 1970s that lay hostility towards expertise was common and often necessary in social protest and planning conflicts (Nelkin 1975). During the 1990s and early 2000s, social protests against genetically modified organisms (GMOs) in Germany and the UK (Jasanoff 2005) and against nanotechnology in France, stimulated a proliferation of organised participatory forums around emerging technologies.

Many of the primary rationales for bringing publics in to science policy-making would be described as *instrumental* under Fiorino's (1990) oft-quoted typology, serving the interests of powerful actors such as policy elites by seeking to improve public trust or even achieving pre-ordained outcomes. Yet experiments in participatory science policy-making, from the controversy surrounding the effects the Chernobyl fall-out on UK agriculture to more formal engagement processes around GMOs, have also highlighted the *substantive* importance of lay knowledge. In this case, the contribution of locally specific knowledge of land and soils of Cumbrian farmers (Wynne 1996), and broader discussions of the moral, political and economic dimensions of emerging technologies (Irwin 2001) respectively were central to the policy outcomes. For many, especially participation practitioners, *normative* arguments stressing the moral need to involve publics in the process of making science-related decisions which are likely to affect their lives is a key motivation.

The emergence of new *technologies* or methods of public participation in science policy (cf. Laurent 2011) can also be traced back to earlier approaches to public engagement through communication campaigns and science education. These approaches were concerned with 'the Public Understanding of Science' (PUS), a primary focus of much Government science policy and academic work in Western Europe and North America for most of the twentieth century (Irwin 2001). The PUS project constituted an instrumental response to public opposition to the scientific orthodoxy, from nuclear power to healthcare. This response was based on the assumption that if people understood science and its methods better, they would come to accept scientific authority and science-related decisions taken by science and policy elites (Owens 2000). The PUS movement was codified in the UK through the Bodmer Report (Royal Society 1985), which created the UK Government-related Committee on the Public Understanding of Science (CoPUS), offering grants to science education projects over a 20-year period. Yet this model of public engagement has been negatively labeled the 'deficit model' (Owens 2000) with its view of publics as empty vessels with nothing to contribute to rational debate, needing to be filled with scientific knowledge (Wynne 2006).

As the proliferation of public controversies and protest movements around issues related to science and technology in the 1990s suggests, the PUS movement was not wholly successful in winning public support for science and science policy. Thus many of its advocates began to turn to more interactive modes of public engagement, such as participatory decision-making or deliberation, to

improve the legitimacy of science policy institutions and decisions (Wilsdon & Willis 2004). Yet despite this seeming shift away from deficit model imaginations of publics, it has been argued that deficit models have been consistently remade by policy organisations, in this case moving only from a perceived deficit of public understanding to a new deficit of public trust (Irwin, 2001). Crucially, this suggests an absence of institutional self-reflection with respect to questions about the appropriate role of publics and scientific expertise in science policy-making, strengthened by the dominance of self-interested, instrumental imperatives (Wynne 2006).

Several theories have been put forward to account for the changing nature of scientific problems and the growing antagonism, controversy and dissent around science policy; making radical epistemological and ontological arguments, stimulated in part by social movements and protests in uninvited spaces of participation. Weinberg's (1972) *trans-science* thesis was an early theoretical contribution, arguing that certain questions transcended science's capacity to answer them. This call for an extended peer-community for science policy was further strengthened by the concept of *post-normal science*, which applied in cases where "facts are uncertain, values in dispute, stakes high and decisions urgent" (Funtowicz and Ravetz 1993: 744). This gave potential legitimacy to the involvement of publics in knowledge production and science policy-making; also undermining scientific expertise by suggesting it might be too reductionist to deal with uncertainty and moral questions around scientific and technological risks (Funtowicz & Ravetz 1993). The distinction between *normal* and *post-normal* science broadly parallels the characterized shift from *mode 1* to *mode 2* science (Gibbons et al. 1994); where *mode 1* science represents an imagined time of scientific autonomy and theoretical/experimental hegemony in knowledge production, whereas *mode 2* science is recognized to be socially distributed, trans-disciplinary and accountable to multiple actors (Nowotny et al. 2003). These theories rest on a recognition of the inevitably situated and partial nature of scientific knowledge and expertise. This is not to suggest that consequently all knowledges are equal and can be granted the same level of authority in processes of knowledge production and decision-making. Rather it opens science policy-making up to alternative voices, such as locally specific or applied lay knowledges (Wynne 1996), and requires a level humility from scientific experts (Jasanoff 2003).

The observable shift towards more participatory modes of science policy-making has been visible in local planning contexts, healthcare arrangements, decision-making around emerging technologies, such as nano-technology, genetics and the internet, and more recently in deciding research priorities for academics. This shift has been theorized within academic disciplines, such as planning (e.g. Owens et al. 2004), risk management (e.g. Stirling 1998), health research (e.g. Rabeharisoa & Callon 2004), science communication (e.g. Macnaghten et al. 2005), and technology assessment (e.g. Burgess & Chilvers 2006). Much of these contributions and many other significant inputs to the field of public participation in science policy-making have come from science and technology studies (STS). STS has contributed to normative and substantive arguments for increasing public involvement (e.g. Irwin 1995), the evaluation of participation processes (e.g. Petts 2004), and most recently the development of more critical studies of public participation (e.g. Stirling 2008).

STS studies of participation are underpinned by diverse theoretical contributions. Significant amongst these is the idiom of co-production (Jasanoff 2004), which proposes that ways of knowing and representing nature and society are inseparable from ways of living, and thus knowledge

practices are co-produced with institutions and ways of governing. Consequently, in a democratic society publics should be involved in both processes of policy-making and knowledge production. Actor-network theory (ANT) (e.g. Latour 1987) has also been significant in highlighting the construction of agency in scientific problems through networks of expert, official, lay and non-human actors; thus emphasizing the enrolment of diverse actors in participatory experiments. Finally, situated studies have emphasized the valuable substantive contribution of lay knowledge; for example, Wynne's study of Cumbrian sheep farmers (1996) or amateur naturalists contributing to biodiversity research and policy in the UK (Ellis & Waterton 2005).

More broadly, work on public participation has drawn on democratic theory to elaborate the distinction between the representative democracy found across Western Europe and North America, and experiments with forms of direct or deliberative democracy (e.g. Munton 2003). Critical theory has also contributed to work on deliberative democracy. Particularly significant is the work of Jürgen Habermas which emphasizes the potential to reach consensus through rational, ideal speech and communicative action between actors (Habermas 1984). Such ideals have frequently formed the basis for the design of participatory processes and policy, through the mainstreaming of consensual technologies of participation, such as consensus conferences, focus groups, citizens' panels and deliberative forums. Theoretical foundations and latent critiques have also been expressed in literatures of environmental ethics (e.g. O'Neill 2001), political science (e.g. Dryzek 2005), and development studies, where participatory methods and their critiques generally appeared earlier (e.g. Chambers 1983; Cooke & Kothari 2001).

3 UNREST IN THE NEW REPUBLIC

The story of the 1990s and early 2000s in much of Western Europe and North America is one of the increasing institutionalization of participation in science and technology policy. In the UK this institutionalization was strengthened by the politics of the 'Third Way' (Thorpe 2010), with New Labour's utilization of focus groups and a series of pamphlets from the think tank Demos which promoted a participatory science policy agenda (e.g. Wilsdon and Willis 2004; Stilgoe et al. 2006). In 2000 the House of Lords Science and Technology Committee called for the embedding of public participation in all aspects of science and technology policy-making, in a report labeled *Science and Society*. Participation's growing prominence was organisationally realized through the creation of several arms-length bodies – the AEBC and CoRWM, for example – responsible for commissioning public deliberation processes on behalf of Government departments, such as the Department of Health and the Department for Business, Innovation and Skills. In higher education, the National Co-ordinating Centre for Public Engagement began supporting six Beacons of Public Engagement in University across the UK, encouraging academics to engage with publics through colleges, art galleries, charities and other media. UK research councils like the Biotechnology and Biological Sciences Research Council (BBSRC) and the Engineering and Physical Sciences Research Council (EPSRC) increasingly included technologies of public participation in their institutional machinery (Doubleday and Wynne 2011). The institutional picture is similar in much of Western Europe and North America, with varying levels of embedding of participatory modes of science policy-making within government and with different foci for engagement (Sciencewise 2010).

Yet the mushrooming of participatory practice, theory, experts and institutions has been accompanied by strong critiques, which suggest that public participation in science policy is not fulfilling its promise. A broadly accepted proposition is that participatory science governance is not a radically new form of science policy-making, rather it represents a mix of old and new assumptions about science, publics and governance (Irwin 2006). The invasion of the elite republic of science has not led to the wholesale democratization of science policy and knowledge production, rather a new republic has been created. This time it consists not only of those with scientific expertise, but also policy elites and the new 'experts of community' (Rose 1999). The institutionalization, commercialization and professionalization of public participation has resulted in what has been referred to as an emerging elite *epistemic community* of participation practitioners from academic, community development, policy, and increasingly, market research backgrounds (Chilvers 2008). These new mediators or experts have been granted immense power to stage-manage participation processes and to speak on behalf of publics in policy arenas (Elam et al. 2007), risking the exclusion or manipulation of certain publics (Braun & Schultz 2010). Furthermore, old structures of science policy-making have been unevenly retained in this new regime (Doubleday and Wynne 2011), with a strong adherence to imaginations of the old objective and autonomous republic of science. These visions are evidenced through recourse to rhetoric of sound or robust science (Irwin 2001) and dogmatic belief in the paramount importance of scientific and technological progress in policy rhetoric (Stirling 2008).

Critiques of public participation in science policy have generally employed post-structuralist arguments, conceptualizing power as diffuse and often unintentionally exercised through discourse. Such perspectives challenge the consensual ideals promoted by deliberative democratic and critical theorists, as participation processes can be subtly manipulated when consensus rather than diverse outcomes are anticipated (Stirling 2008). For example, an early critique of modes of collaborative planning attacked the procedural bias of Habermas' theory of communicative action and rationality, which ignored both the potential for powerful actors inside planning processes to force outcomes in their favor, and also the practical implications of initial framing of planning processes by institutions and mediators (Tewdwr-Jones & Allmendinger 1998). Furthermore, the personal commitment of policy elites to normative Habermasian ideals was called into question (Tewdwr-Jones & Allmendinger 1998). Similar critiques emerged in development studies at the same time, highlighting the potential for seemingly neutral participatory processes to dominate, exclude and oppress (Cooke & Kothari 2001). Habermas has also come under attack in studies of participatory technology assessment (e.g. Pellizzoni 2003).

These theorizations have been extended by STS critiques of participation in science policy, which emphasize the role of external power to frame processes, set decision-making timescales, and even use public participation to legitimize pre-determined policy decisions (e.g. Irwin, 2001). Crucially, in common with expert-analytic modes of science policy-making, participatory-deliberative processes can be employed to 'close down' the range of policy options, reflecting the consensual ideals of deliberative theory (Stirling 2008). An alternative would be to 'open up' the range of potential policy outcomes in decisions about science and technology to inevitable indeterminacy and the exercise of human agency (Stirling 2008).

The challenges described above hint at unresolved institutional problems at the heart of science policy-making. Challenges to the old republic of science have repeatedly resulted in the creation of add-ons to conventional policy-making, rather than the re-designing of policy organisations and processes. Such a response fails to engage with the deeper philosophy of many of the original justifications for increased public involvement (cf. Kesby 2007); instead viewing participation as a new method for instrumentally legitimizing policy decisions and organisations. This dominance of instrumental motivations for bringing publics in to science policy-making is related to long-standing beliefs in the inevitably progressive and economically vital nature of scientific and technological innovation (e.g. Irwin 2001; Stirling 2008). Yet such views would be more at home in Polanyi's republic of science. Learning amongst science policy elites and within related organisations about the nature of science and publics has occurred on an instrumental level, merely taking on new information and learning to carry out clearly delineated participatory methods. This shows a lack of organisational self-reflection or reflexivity, as deeply held assumptions and identities remain unchallenged (Wynne 2006).

As a consequence, unreflective imaginations of the publics – included or excluded – of science policy have been continually and performatively projected onto society (Wynne 2006). This might partly explain the persistence of the deficit-model, whether the deficit imagined is one of scientific knowledge or trust, as publics are defined as a function of the scientific interpretation of policy problems (Wynne 2006). For example, the policy response to public controversy has often been to seek out and engage with imagined 'innocent citizens', with no pre-formed interests or opinions with regards to the decision under discussion (Irwin 2006). This was illustrated strikingly in the landmark 'GM Nation?' process carried out in the UK in 2003, where activists and campaigners were explicitly excluded from formal decision-making processes (Lezaun & Soneryd 2007). This shows the performative power of certain visions of publics to include and exclude certain actors (Braun & Schultz 2010). In this case, a view of citizens close to what might have been defined in Greek democracy as an 'idiot' was promoted; imagining the archetypal public as lacking knowledge and perspectives on important policy issues prior to policy-making (Lezaun & Soneryd 2007).

However, the performative and dynamic nature of constructions of publics also grants publics agency to resist and re-make constructions of themselves; as has been shown in the context of public participation in Austrian science policy (Felt & Fochler 2010). Thus uninvited spaces of participation and within-process subversion by participants have contributed towards changing visions of publics and new designs of participatory processes. For example, Epstein (e.g. 1995) has documented how AIDS activists in the US were able to constitute themselves as credible participants in knowledge construction around AIDS treatment. Crucially, the activists did not only utilize political arguments to increase their representation on important decision-making bodies, but were also able to engage in epistemological debates, transforming definitions of what counted as credible scientific knowledge around AIDS treatment (Epstein 1995). In another case, gradually erosive dissent, antagonism and open protest prompted the Biotechnology and Biological Sciences Research Council to recognize the legitimacy of public opposition to GMOs (Doubleday & Wynne 2011). Thus critiques of participation have not just followed internal developments within the academy, but have been strongly influenced from outside (cf. Doubleday & Wynne 2011).

Perhaps more difficult to subvert are visions of publics created through a strong Governmental belief in survey methods (Irwin 2001), and a desire to elicit opinions representative of the 'pure public' (Braun & Schultz 2010) or 'public in general' (Michael 2009). Statistics created about the 'general public', though heavily mediated by dominant assumptions about and visions of emotive, ignorant and gullible publics (e.g. Wynne 2006), are presented as objective facts about public opinion and understanding (Irwin 2001).

Much research on public participation has failed to engage with these emergent challenges of science policy-making, preferring instead to focus on generating new methods for public engagement or evaluating discrete participation events. This literature has provided constructive insights for participation practice and theory, emphasizing the occurrence of social learning within participation processes (e.g. Webller et al. 1995), the importance of context in understanding and evaluating processes (e.g. Burgess & Chilvers 2006), and in influencing science policy processes (Irwin 2006). However, though such work was vital in the initial promotion and quality control of public participation in science policy (Chilvers 2009), it fails to address broader institutional and governance challenges for science policy, or to acknowledge the significance of uninvited spaces of participation.

4 CRITICAL STUDIES OF CRITICAL PUBLICS

Over recent years, however, there have been signs that parts of the academy are beginning to respond to criticism and the clear practical problems of current approaches to public participation in science policy-making. One such promising development has been the emergence of the *critical public engagement* literature, labelled as the third wave of academic work on participation by Chilvers (2009a), and inspired by Alan Irwin's call to action which suggested that participatory science governance could be considered "a legitimate object of study *in itself*" (Irwin 2006: 310, original emphasis). This literature was consolidated and explicated in the UK through a series of five seminars, funded by the Economic and Social Research Council (ESRC) and organised by social scientists working in interdisciplinary science policy-related University departments. The Critical Public Engagement (CPE) seminar series¹, which ran between April 2009 and February 2011, explicitly sought to extend the discipline and bring together an interdisciplinary field of constructively critical work (e.g. Chilvers 2009b). Crucially, this project aimed to describe an increasingly complex landscape of science policy-making, where technologies, institutions and experts of participation are explored in context.

A significant feature of this young literature is what I shall label the 'landscape perspective' on participatory governance. This perspective extends beyond the narrative provided by the Demos pamphlet *See-through science* (Wilsdon & Willis 2004), which theorized a linear movement from the Public Understanding of Science (PUS), towards the broader project of the Public Engagement with Science (PES). The narrative continued with calls for *upstream* engagement with science and technology, responding to concerns about framing effects within participation processes and the constraints of making decisions about technologies where there had already been considerable

¹This UK-based seminar series was organised by Dr Jason Chilvers, Professor Jacquie Burgess, Dr Matthew Kearnes, Professor Judith Petts, Dr Sigrid Stagl & Professor Andy Stirling, and supported by the ESRC. See <http://www.uea.ac.uk/env/esrcsems>

investment and development (Burgess & Chilvers 2006). Despite the radical promise of the original academic interventions which sought to promote upstream participation in science policy-making, the concept has been narrowly translated in policy contexts as a way to instrumentally enhance public acceptance of new technologies. The new landscape perspective of public participation seeks instead to promote a more reflective and reflexive approach to public participation in theory and in practice. It acknowledges the significance of diverse participatory experiments or 'ecologies of participation' (Chilvers, 2010) occurring within and outside formal science policy-making, allowing for more emergent and potentially transformative policy outcomes.

In contrast to the technocracy of participatory science policy-making in the UK, described above as 'the new republic', where technologies of participation are instrumentally and unreflectively learnt and applied in different policy contexts, the CPE literature conceptualizes participation as a matter of broader science-society relations (e.g. Irwin 2006). Thus a more systematic analysis of change at the interface between science and society is required (Hagendijk 2004). Metanarratives of science and technology in the media (Hagendijk 2004) and uninvited spaces of participation (cf. Leach et al. 2005), have been increasingly acknowledged and linked to policy and organisational changes, or formal engagement processes (e.g. Doubleday & Wynne 2011). Furthermore, institutional (Bickerstaff et al. 2010), policy (Burgess & Chilvers 2006) and national (Horst & Irwin 2010) contexts are considered crucial to a critical understanding of individual participatory experiments.

One approach within the landscape perspective of participation in science policy-making theorizes an emerging regime of *collective experimentation*, which is contrasted with the currently hegemonic regime of *economic techno-scientific promise* (Felt & Wynne 2007) – evoking the prevalence of unwarranted levels of optimism about scientific progress. Collective experiments can be both spontaneous and planned, guiding socio-technical innovation through a reconfiguration of relationships between publics, experts and policy-makers (Felt & Wynne 2007). Thus publics are reconceptualized as 'co-researchers', where loose assemblages of different actors come together to try out or experiment with new social and material technologies, and to engage in processes of mutual learning (Felt & Wynne 2007). Far from being pre-framed or designed according to instrumental policy imperatives, collective experiments evolve with shifting goals and constitutions (Irwin & Michael 2003); at any one time there is likely to be a landscape of diverse experiments around a particular issue of public concern, from climate change (Latour 2011) to muscular dystrophy (Rabeharisoa & Callon 2004).

The vision of a varied landscape of participatory science policy-making and governance is also enriched by an increasing focus in the CPE literature on the organisational contexts in which participatory experiments are situated (e.g. Wynne 2006). Responding to the organisational challenges of participatory science policy-making, outlined above, this work explores how organisations' understandings, for example of publics, shape participation processes and science governance (Doubleday & Wynne 2011). Evidence that science and policy organisations lack the capacity to reflect on their own imaginations of publics, science and scientific expertise has prompted studies of complex processes of institutional learning (Bickerstaff et al. 2010; Doubleday & Wynne 2011). A study of the UK's Royal Society – a science organisation undertaking public engagement projects – emphasized the messiness and complexity of fragile and often contradictory internal organisational learning processes (Bickerstaff et al. 2010); where deep epistemic and

cultural assumptions hindered more genuine engagement with publics and transformative responses to the results of public forums. Doubleday and Wynne's (2011) study of the BBSRC instead emphasized the dialectic dimension of organisational learning; as the BBSRC's attitude towards publics and participation was influenced by external events.

Visions of publics and science are conceptualized in the CPE literature as collectively, messily and ambivalently evolving through diverse and shifting assemblages of actors (Horst 2007). One of the theories used in this context is the concept of an *ethno-epistemic assemblage* (Irwin & Michael 2003), which challenges the common dualism created between experts and lay publics by focusing instead on heterogeneous groups of actors, including scientists, policy-makers, publics, and even non-human actants. This highlights both the situatedness and fluidity of alternate visions of particular scientific issues and their publics, and the knowledge claims that are made (Irwin & Michael 2003). A further crucial element of the *ethnoepistemic assemblage* is that academic social scientists are conceptualized as an active part of the assemblage (Scott & Du Plessis 2008), influencing expectations of policy-making and forming knowledge claims. For example, the power of social scientists and participation practitioners as experts or mediators within the new participatory governance has been examined, as discussed above. Furthermore, it has been recognized that mediators commonly transcend the formal definitions of their roles, leading to calls for greater self-reflection and humility (Gisler & Schicktanz 2009).

In contrast to earlier waves of work on public participation in science policy-making, the CPE literature's theoretical foundations celebrate diversity, difference and antagonism rather than uniformity, rationality and consensus. This has prompted the critique that current work on science participation has been dislocated from its original theoretical basis in deliberative democratic theory, without the rigorous theoretical elaboration or empirical evidence for its new foundations (Lövbrand et al. 2010). The emerging academic acceptance of oppositional and dialectic approaches to participation has also caused tensions in interactions with participatory practitioners who tend to adhere to a more consensual understanding of participation; indeed this tension between academics and practitioners emerged as a significant fault line during the ESRC seminar series (e.g. Chilvers 2009b). Yet this criticism is perhaps not wholly warranted, as the new celebration of diversity, difference and antagonism emerges in part from the post-structuralist arguments which were used to critique consensual modes of participation (e.g. Cooke & Kothari 2001). For example, activism and social protest can be seen as an assertion of agency in the context of science policy-making, trying to challenge discursively embedded power relations and stimulate social transformation (Kesby 2007). Whilst visions of antagonistic democracy can be found in democratic theory (e.g. Mouffe 2000), the focus of the CPE literature on antagonism can also be read as an empirical reflection on the many sites of public controversy, dissent and social process which have been observed (cf. Felt & Wynne 2007). Though deliberative democratic theory might dismiss or hide the significance of diverse public antagonism, from climate skeptic bloggers to activists destroying GMO field trials, the new theorization allows academics to study these developments as an important aspect of science policy-making and governance.

The ESRC seminar series included contributions from a wide variety of disciplines, such as technology assessment and planning, though the CPE literature has mainly emerged from STS approaches. A vital contribution has been the novel application of the co-productionist idiom (Jasanoff 2004), to aid

consideration of the construction of the subjects – publics – and objects – methods and issue-definitions – of participation in science policy-making. Several contributions have examined how publics are constructed within certain participation processes, framing the process and tacitly enabling and foreclosing certain outcomes (e.g. Braun & Schultz 2010). Thus, far from being neutral, constructions of publics or ‘scientific’ issues are brought into being by science policy organisations when they seek to engage with ‘the public’ (Marres 2007; Wynne 2006). With reference to the co-productionist idiom (Jasanoff 2004), this work has been extended to emphasize the mutual constitution of participation’s subjects and objects through messy and complex processes and within diverse assemblages of actors. Consequently, a particular technical definition of an issue of public concern, such as emerging nanotechnologies in France (cf. Laurent 2011), simultaneously brings into being certain visions of publics and necessitates certain ways of engaging with these publics. This is also relevant at the landscape level of participatory governance, with the concept of public engagement with science and technology being labelled a ‘category error’ (Wynne 2007). A specific vision of the definition of ‘science and technology’ has been consistently and unreflectively constructed through discourse about participation, influencing visions of publics and how they should be engaged with.

BEYOND REPUBLICS?

In the context of science and technology policy-making changing visions of science, scientific expertise and publics throughout the last 50 years have been explored. Increasing levels of uncertainty, controversy and concerns about the risks associated with scientific and technological innovation have called the authority of scientific expertise into question. This created opportunities for lay people and social scientists, with new kinds of expertise, to be enrolled in processes of knowledge production and science policy-making. Yet these changes to conventional science policy-making have also been fraught with practical challenges in various contexts and are threatened by deeply held assumptions about the appropriate role and practice of science. The CPE literature has sought to confront these new governance challenges directly, developing novel approaches to the academic study of participation and suggesting alternative modes of science policy-making. However, the literature is still in its infancy and the future for this narrative in the academy and in science policy-making remains to be told.

An urgent project for the CPE literature is the theorization of the academic ‘turn’ it has initiated, and a statement of the field’s goals and research agenda – though this was addressed to an extent in the ESRC seminar series. This will be a particular challenge given the interdisciplinary or even transdisciplinary nature of the research, involving contributions from a diverse set of social scientists, scientists, policy-makers, participation practitioners, and publics. What was referred to above as the landscape perspective on participatory governance has lacked a recognizable label. Yet the approach could potentially have far-reaching impacts on academic research and policy with its acknowledgement of the importance of diverse processes and relationships in shaping science policy.

A related feature and possible future trajectory of the CPE literature is likely to be its experimentation with applying the tools of STS and other ways of studying science and scientists, onto the study of social science. Indeed the language of the CPE literature, writing of *collective*

experiments and *technologies* of governance, evokes the earlier emphasis in STS on laboratory studies or ethnographies, and suggests that such objects might provide fertile ground for further research just as material experiments and technologies are studied. Future work may: focus on the impact of social and organisational context on social experiments; look at how technologies of governance travel through space and are translated differently in different contexts; study networks of human and non-human actors around participatory experiments; or trace the genealogy of particular participatory technologies and methods (cf. Lezaun 2007). This development also broadens working policy definitions of science, to include the work done by social scientists; thus opening up what has been traditionally conceived of as science policy to comparisons with economic policy (e.g. Callon, 2007) or other instances where social scientific work and actors are enrolled in policy processes. Comparisons might be drawn between socio-scientific collective experiments (Latour, 2011) and other uninvited spaces of participation, like the 'Occupy' movement or developments in the 'Arab Spring'.

In terms of the theoretical resources drawn upon in the CPE literature over the coming decades, the emerging novel application of the co-productionist idiom (Jasanoff 2004) offers a promising trajectory. Exploring the messy and dynamic constitution of the objects and subjects of science policy, this approach has the potential to radically disrupt working assumptions of a linear policy process, where objective science or the academy 'speaks truth to power' (cf. Jasanoff & Wynne 1998). Another promising resource for the CPE literature, given the (often implicit) performativity (cf. Butler 1990) in CPE interpretations of participatory science policy processes, is the growing body of work around non-representational theories (NRT) (e.g. Thrift, 2008). There are other fertile synergies between CPE and NRT, including the emphasis on fluidity and open-endedness in social processes, and most importantly in their prescriptions of new roles and methodologies for social scientists (Dirksmeier & Helbrecht 2008). In common with the CPE literature NRT warns against over emphasis of the detachment of the researcher and endorses humility about the limits of social scientific knowledge (Dirksmeier & Helbrecht 2008). A fruitful extension to these ideas in NRT has been to advocate a move away from the focus on representation, challenging the power of the social scientists to speak on behalf of others, towards 'messy methods' of research which seek to focus on experience and practices (Thrift 2008). Furthermore, as a perspective emerging from human geography, NRT emphasizes the spatiality and materiality of such practices.

Impacts of the CPE literature in practice, may come from the call for humility on the part of scientific experts (e.g. Jasanoff, 2003), which might also be extended to the experts of participation. This should promote a more reflective and reflexive practice of social science and policy-making; encouraging academics and practitioners to question how they engage with publics and policy-making, or how they perform different roles. Some social scientists are beginning to engage more directly with policy organisations and participation practice, pushing for greater experimentation and self-reflection around publics and policy-making. In this emerging interdisciplinary field, tensions between practitioners and social scientists will be challenging to address. Yet it seems that social scientists are becoming more willing to get their hands dirty again, rather than merely to critique from the sidelines. This might involve projects like the conscious design of new collective experiments as a new form participatory action research (cf. Felt & Wynne 2007). Longer term more ethnographically informed research has been called for to improve understanding of organisational dynamics around public participation in science policy-making (Bickerstaff et al. 2010), and to

promote organisational reflection and reflexivity in practice. As is evident in organisations such as UK Research Councils, some future organisational changes will focus on the deeper embedding of public participation in decision-making structures. A related but more radical project would be to attempt to organisationally embed the potential for reflexivity and experimentation. Responding to insights from the CPE literature and other critical social science, science policy organisations may reflect more deeply in future on their assumed linear models of innovation or the relationship between science and policy, and their imaginations of passive, ignorant publics. The CPE literature has challenged the technocracy of participation (see above), thus it might be hoped that academic engagement with policy organisations and practitioners might serve to level fundamental challenges at the currently institutionalized approach. In the policy realm the future of the story will also be mediated through new and as yet unpredicted and unimagined environmental challenges, which inspire new forms of social organisation and science policy-making. Given the importance of national context in influencing participatory processes and visions of publics, science and policy-making (e.g. Irwin & Horst 2010), broader national and geopolitical developments will have a bearing on forms of participatory science policy-making. Current economic challenges have had a mixed impact on public participation in the UK, forcing the closure of some public engagement bodies – like the Department of Health’s Public and Patient Experience and Engagement division – but also in some cases promoting more decentralized forms of decision-making and community action through the rolling back of certain state functions.

Beyond changes within the current organisations of science governance and decision-making, there is broader potential for an emerging landscape of new configurations of relationships between certain publics, experts and policy-makers. Such assemblages might fit with the idea of a new regime of collective experimentation, with more open-ended and responsive governance mechanisms, necessitating novel forms of engagement and participation. Following emerging academic theorizations of public participation in science policy-making as a process necessarily characterized by diversity, difference and antagonism, perhaps new approaches to engagement will also be more accepting of some degree of conflict and even controversy. It might be hoped that newly formed and reformed science and policy organisations will openly acknowledge and sometimes reflexively engage with uninvited spaces of participation, in recognition of the diverse landscape of experiments, as opposed to a detached and exclusive republic of science.

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