

Converging citizens? Nanotechnology and the political imaginary of public engagement in Brazil and the United Kingdom

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This paper offers a comparative analysis of two public engagement exercises, conducted concurrently in the UK and Brazil. Following an account of how public engagement is situated in the political imaginary of the UK and Brazil, we set out a theoretical framework for such comparison, highlighting questions of narrative, political culture and civic epistemology. We then set out key differences in response, considering Brazilian citizen responses as prototypically more positive of (nano)technology, and as more amenable to and accepting of Enlightenment master narratives of technoscientific progress. UK citizen responses, by contrast, were more tragic, and more informed by resistant narratives of technoscientific failure. Although such distinctions are not absolute, they are nevertheless significant. We conclude by pointing to a set of analytical and normative challenges for how the science and technology studies analyst is to understand the politically contingent character of public engagement in the governance of science and technology.

Keywords: cross-national research, Enlightenment, nanotechnology, narrative, political imaginary, public engagement

1. Introduction

Institutional programmes of public engagement now constitute an integral and strategic ingredient in the new scientific governance, either as routes to better policy decisions, democratic renewal, citizen empowerment or as a technique aimed at greater citizen trust in governance and policy (Council for Science and Technology, 2005; European Commission, 2002; Gavelin et al., 2007). However, while the democratic aspirations tacit within such initiatives have become commonplace, only in recent years has science and technology studies (STS) research developed a more critical and reflexive style of inquiry, analytically sceptical of public engagement as a tool of governance (see Irwin 2006, 2008), and equally inquisitive of public engagement methodologies as eliciting a particular and highly situated form of talk and citizen (Horst and Irwin, 2010; Macnaghten, 2010).

Nevertheless, notwithstanding this move, there remains an absence of research aimed at comparative understanding of public engagement as a technique of governance across

different national and international settings (notable exceptions include Jasanoff, 2005; Lezaun and Soneryd, 2007). How do the ideal and promise of public engagement respond to different national and epistemic contexts? To what extent can we presume that assumptions derived from the situated context of one set of places can translate easily to another? What happens when there is no pressure from the public to participate, or when governmental institutions are not taking any initiative, or when the scientists prefer to keep their research “as usual”? And perhaps most importantly, how do we as analysts understand and conceptualise different national and institutional styles of thought and address their implications for global debates on scientific governance?

The focus of this paper is to speak to this gap through a qualitative comparative evaluation of two public engagement exercises aimed at understanding public perceptions in-the-making, conducted concurrently in the UK and Brazil. By comparing these two cases we endeavour to advance a socio-political analysis of public engagement as a situated – and, so, not easily generalisable – technique of contemporary governance. Before setting out the research we develop a broad comparative look at how public engagement in science and technology has been imagined and constituted politically in both the UK and Brazil, followed by a section setting out theoretical resources necessary for such comparison.

2. The political imaginary of public engagement in the UK and Brazil

The desire to engage lay views has been depicted as representing a new orthodoxy in the governance of technoscience, and spectacularly so in a UK and European context (see Irwin, 2006; Irwin and Michael, 2003; Lezaun and Soneryd, 2007). However, this desire to listen, to enter into dialogue, to elicit even “hard to reach” voices that are commonly excluded from public debates, is a remarkably recent invention and one that speaks to a specific and in some respects very British/European context.

In the UK, the cumulative inability of the State to anticipate adverse public reaction to technological risk issues has been posited as one of the more telling examples of institutional failure in recent decades. Following the dramatic failure of the British State to anticipate the political controversy and adverse public reaction to genetically modified (GM) foods and crops in the late 1990s, and following the equally corrosive handling of mad cow disease and of the uncertainties surrounding the link between bovine spongiform encephalopathy (BSE) and Creutzfeldt–Jakob disease (CJD), a number of influential policy reports were written, all calling for, *inter alia*, more proactive public involvement and deliberation in debates about the social and ethical dimensions of science and technology (Department of Trade and Industry, 2000; HM Treasury et al., 2004; House of Lords, 2000; Royal Commission on Environmental Pollution, 1998; Wilsdon and Willis, 2004).

Perhaps it is not surprising that nanotechnologies have been presented as a key site for experimenting with novel forms of “upstream public engagement.” Here is a technology with substantial promise of radical transformation seen as in danger of running up against comparable adverse public reaction to that experienced with genetically modified foods and crops. The publication in July 2004 of the Royal Society/Royal Academy of Engineering report on nanotechnologies signalled a significant moment in the evolution of these debates on anticipation (Royal Society/Royal Academy of Engineering, 2004). Learning from recent experience with biotechnology, policymakers and scientists have now begun to look to the social sciences for improved insights on the likely future impacts of nanotechnologies, and on the role of public engagement to help fashion more socially robust technologies (see Macnaghten et al., 2005). These commitments to more “upstream” forms of public engagement in processes of

scientific-technological innovation are a significant move in the UK polity and speak to a distinctive context. More generally, across UK government departments and intermediary bodies, public participation and consultation has become an integral resource and component for contemporary governance and policymaking.

The context in Brazil could not be more different. Key distinctions include: the lack of a significant public technological risk controversy; the high regard in which science and scientists are held in public opinion; the perception that when risk issues emerge, this can be blamed on corrupt individuals or companies rather than seen as an instance of systemic failure; general apathy and distrust in enforcement; and similar distrust in politicians and civil servants (Almeida, 2007; Domingues, 2001; Guivant, 2001; Souza 2001). Against such a context it is not surprising that science and scientists tend to be seen as far removed from downstream risk events and thus far from any associated responsibility.

One case study in which these differences can be drawn out lies in how the controversy over genetically modified crops was handled and understood in Brazil. Unlike in the UK, where the risk controversy was understood institutionally as evidence of the need for more inclusive and transparent forms of scientific governance, including the need to open up processes to wider stakeholders, in Brazil the debate had a different provenance. The Brazilian debate on GMOs exposed a polarisation between heterogeneous coalitions, with national and international alliances on each side, both in favour of (largely scientists, government representatives and industry) and against (predominantly environmental and consumer non-governmental organisations) GMO release (Lacey, 2002). Although those who opposed GMO agriculture justified such a stance through endorsing the “precautionary principle,” and those in favour of it made justification through the principle of “sound science,” both sides resorted to a standard linear model of science as providing authoritative, objective and universal knowledge, and as providing the unquestionable basis for decision-making. Indeed, even on those rare occasions where the coalition against the liberalisation of GMOs called for public debate, it is highly arguable whether the participatory exercises that subsequently emerged, such as the 2001 and 2004 regional juries on GMOs organised by NGOs ActionAid and ESPLAR, facilitated in effect genuine open-ended and participative deliberation (Guivant, 2008).

Thus, to summarise, in Brazil there is as yet little perceived institutional need to engage society in debates on scientific governance, nor to open up processes to wider stakeholders, nor to integrate such considerations back into scientific research programmes. The silence about public participation in Brazil, notwithstanding the noisy confrontation of both coalitions in the GM controversy, has arguably had the effect of strengthening the traditional and standard model of science as the indisputable basis for public policy (Guivant, 2006). More generally, in so far as Brazil has engaged in experiments aimed at extending public participation and social activism to domains hitherto controlled by small “trusted” elites (such as science policy), these have rarely extended beyond established interests to represent wider public and civil society (Caubet, 2000; Souza, 2009).

3. Theoretical framework

How are we to compare public responses to emerging nanotechnologies? What theoretical resources are required? To answer these questions we develop a line of thinking aimed at examining the *conditions* under which technoscientific concerns emerge in-the-making (see Grove-White et al., 2000; Macnaghten, 2004, 2010). Rather than seeking to reveal *a priori* attitudes, for example through the use of opinion surveys, our preferred orientation has been towards an exploration of the social and political contexts through which attitudes emerge in

group talk, and how such attitudes emerge in negotiation with how the technoscience is being imagined in real-world circumstances by its various constituents. This avowedly more experimental and contextual orientation is especially relevant to understanding public responses to nanotechnology given the unfamiliarity of the term (Gaskell et al., 2005; Hart Research Associates, 2007), and its largely noumenal, future-oriented and promissory character (Nordmann, 2005, 2007).

A key category of analysis is that of narrative and cultural resourcing. Given that people were generally unfamiliar with the term we paid particular attention to the narrative forms and structures that were used to guide public talk and imagination, to how these reflected dominant and historically resilient styles of thought (Fleck, 1979), and to how these rendered the unfamiliar familiar. These are “master narratives” or “arch stories” in Agnes Heller’s sense:

A master narrative can be termed an “arche” of a culture in both interpretations of the Greek word. The “arche” stories are stories to which we always return, they are the final, or ultimate foundations of a type of imagination. Yet as the guides of imagination they also rule, control, and are vested with power. Direct or indirect references to master narratives provide strengths and power to new stories or new images, they lend them double legitimacy: legitimacy by tradition and by charisma, for in case of master narratives tradition itself is charismatic. References to a shared tradition are not just cognitively understood but also emotionally felt, without footnotes, without explanation or interpretation. (Heller, 2005: 257)

Following the European Commission report *Taking European Knowledge Seriously* (Felt and Wynne, 2007), in previous research we articulated the master narratives that tend to underpin nanotechnology science policy, including the values embedded in them, and how these tended to be challenged by our lay publics in their more critical deliberations on the nanotechnological gaze (Macnaghten, 2010). In this paper we extend this analysis, focusing on differences in response across national contexts, how these appeal to different narratives of science and technology and of its relationship to social progress, and how such narrative differences are themselves illustrative of nationally distinctive styles of thought.

Secondly, we apply Jasanoff’s concept of civic epistemology to our findings (Jasanoff, 2005). Rather than appeal to a linear model of public understanding of science in which the public is presented as deficient in knowledge, or in its place to an equally problematic and romantic model of lay wisdom, the notion of civic epistemology seeks to contextualise public responses to science and technology as historically and culturally embedded, and as framed through deep-seated styles of political governing. Operational criteria used by Jasanoff include: styles of participation in decision-making, devices for holding policymakers and experts to account, demonstration practices, the social constitution of expertise and the visibility of expert bodies. According to Jasanoff, it is through these kinds of criteria that we can foster explanation of why in progressive, rational, Enlightenment societies, the same scientific and technological developments are experienced in different ways – in her case the differential public and policy responses to biotechnology across the UK, Germany and the USA. One key concept in her analysis is “political culture” and this concept, amended from its earlier and predominantly static usage in 1980s political science research (see, for example, Vogel, 1986), allows her to extend an analysis beyond narrow appeals to national interests, policy priorities, or levels of development.

In the UK, for example, in the field of nanotechnology governance we can identify a political culture that rhetorically supports and embraces inclusive forms of participation in decision-making, open to various stakeholders and to the uncertainties underpinning technological innovation (see, for example, Royal Commission on Environmental Pollution, 2008;

Royal Society/Royal Academy of Engineering, 2004). The participative forms of these initiatives can be seen as part of a project of governance aimed at building trust and expert credibility in the wake of public scepticism following the highly damaging scientific risk controversies of BSE and GM foods. Both the aforementioned Royal Commission and Royal Society reports, for example, were avowedly consensual in tone, pluralist in composition, and were written by experts that extended beyond technical and industrial expertise to include social scientists, lawyers, environmentalists, as well as a broad array of public inputs.

In Brazil, by contrast, nanotechnology is far from being an issue of public debate. This situation, we suggest, can be understood in the context of two arguments. First, there is no political tradition of public engagement in science and technology and little perceived need for more plural forms of participation in decision-making. Expert committees thus tend to be technocratic, assuming science as a neutral field, responding only to national interests, with limited scope for wider stakeholder or public representation. A clear example is the highly technocratic National Technical Committee on Biosafety (CTNbio), linked to the Ministry of Science and Technology, created in 1995 as the main governmental body to provide expert, technical opinion on the biosafety of GMOs prior to commercial release. And second, nanotechnology, as a potential social problem, sits low on the priority list when compared with other risk issues (such as violence, impunity of corruption, social and economic inequalities) competing for public attention and definition in the Brazilian context. Using Hilgartner and Bosk's (1988) "public arenas model," we can identify nanotechnology as a social problem that has yet to undergo a process of collective definition in Brazil.

Accountability is a further criterion. While in the UK policymakers need to appeal to inclusiveness and accountability as virtues that need to be stated in the face of a sceptical public, little such need presents itself in Brazil. The practice of science is seen as virtuous in itself – as opposed to politics, for example, which is commonly seen as tainted and corrupted – and thus does not have to explain itself or to justify its decisions (Vogt and Polino, 2003). Indeed, even in connection with the debate on embryonic stem cells, where one might have expected a reaction from the church and wider society, the debate was generally positive, leading to an approval of research by the Supreme Court in May 2008 (Jurberg et al., 2009). Scientific controversy is thus seen as removed from public life, with most Brazilians trusting of the process through which science and technology permeates everyday life, including the people and the institutions behind it (Guivant, 2006).

The implication of this conceptual framework is to seek to situate public responses in the context of a general structure of opportunities and the avenues it offers to be an active citizen in a variety of domains. Not only do the potential risks of nanotechnology need to be understood in the context of an overall constellation of risks, but more generally, their perceived chances of effecting change need to be considered in the context of a wider set of perceptions of government, modernity, democracy, progress and the future. The research methodology was designed with precisely this point in mind.

4. Methodology

The research was conducted through a focus group methodology applied concurrently in the North East of England and subsequently in Florianopolis, Santa Catarina State, Brazil. Each group was made up of between six and eight (non-scientist) participants from a range of backgrounds. None of the participants had specialist knowledge or expertise in the field of nanotechnology. Groups were selected around commonalities of lifeworld experience seen as likely to be of relevance in creating positions on nanotechnology and where arguments about

nanotechnology could be jointly developed. While we did not seek representativeness (being interested more in the range and variability of meanings in the population at large), we nevertheless aimed to tap into significant fractions of society, and at the fault-lines out of which public responses to nanotechnology were likely to develop. We thus selected groups around commonalities likely to be of relevance to the discussion of nanotechnology. Based on previous research, relations to the body, environmental issues, social movements, technology, governance, notions of limits and moral boundaries, and a sense of personal agency were all seen as likely to be key in structuring responses to nanotechnology (Kearnes et al., 2006), and groups were selected around relationships to these factors, alongside more standard demographics of age, socio-economic class and gender.

The UK participants included a group of church attenders (recruited from a single church) – UK Group 1; a student environmental group (recruited from the organisation People and Planet) – UK Group 2; a natural health group (users of organic produce and natural health techniques) – UK Group 3; a confident believers group (positive towards technology and its governance) – UK Group 4; a local involvers group (actively involved in the local community) – UK Group 5; an authority figures group (drawn from business leaders and the professions) – UK Group 6. The Brazilian groups, although fewer in number, and while attentive to local circumstance, were designed to have broadly comparable attitudinal and demographic characteristics to the UK groups. Thus, Brazil Group 1, the faith and natural health group (all attending Catholic and evangelical churches and users of natural therapies and organic produce), corresponded to UK Groups 1 and 3; Brazil Group 2, the local involvers and social movement group (drawn from members of ecological, feminist and neighbourhood organisations) corresponded to UK Groups 2 and 5; while Brazil Group 3, the authority figures and confident believers group (drawn from business leaders and the professions and all positive towards technology and its governance) corresponded to UK Groups 4 and 6.

The group discussions were designed to enable participants to develop their understanding of what nanotechnologies were, of how they were being developed in “real-world” circumstances, and of the issues they were seen to pose by different stakeholders. Given the complexity and unfamiliarity of the topics under discussion, the groups lasted for up to 3 hours and included substantial preliminary discussion on general understandings of the experience of technology in everyday life, on the ways in which it is contributing to “social” questions and dilemmas, and on what people sensed to be the key issues for the future. Following this general discussion, we introduced the concept of nanotechnology using definitions from governmental reports and setting out domains of application in medicine, materials and information technology. This was followed by information on levels of funding in nanotechnology, in both the public and private sectors, and on its future economic and market potential. Using a set of concept boards as stimuli, people subsequently discussed current social debates on nanotechnology, one on the uncertain risks posed by nanomaterials on human health and the environment, the other on wider social and ethical issues including those of privacy, enhancement and the potential for nanotechnologies to extend state and corporate control. To ensure consistency, the lead researcher (Macnaghten) moderated all the groups, in the UK and Brazil, in both English and Portuguese.

5. Analysis

We now set out a comparative analysis of public responses to nanotechnology in the UK and Brazil: first we analyse differences and commonalities in how the technology was represented in relation to Brazilian and UK master narratives of science and technology, followed by a

section in which we examine how these master narratives structured respective responses to the risks and issues posed by the technology. At the outset, however, we advise a note of caution. In the analysis that follows we do not attempt at an overarching analysis. Rather, and for the purposes of this paper, we choose to pay attention to the common threads that ran through the group discussions and to overarching differences that we witnessed between and across the different national contexts. In so doing we inevitably impose a sense of order from our focus group data that does not fully correspond to talk that was messy, complex and at times chaotic. Indeed, in focusing on the converging and prominent narrative constructions we unavoidably pay only partial attention to the diversity that occurs within particular narratives and to the presence of counter-stories to them. Notwithstanding this caveat we were struck nevertheless by highly divergent citizen responses in the UK and Brazil focus groups and it is these we examine and theorise in the following sections.

Brazilian master narratives of nanotechnology

Enlightenment thinking can be characterised as involving ideals that include, *inter alia*: the belief in reason, criticism, freedom of expression, the value of science, the pursuit of progress, and the battle against tyranny, ignorance and superstition. Central to such thinking is the master narrative that conflates general societal progress with technoscientific advance, that gives science a future-oriented orientation, and one that not only grows over time but also improves. Although this model of technoscientific advance has been powerful ever since the time of Francis Bacon, where efforts aimed at an ever-increasing instrumentalisation of the natural world have been equated *ipso facto* with human betterment, it is possible to locate nanotechnology as in some ways representing an *intensification* of such dreams of reason through its metaphysical project of control and improvement (Dupuy, 2007).

For our Brazilian groups, and notwithstanding its potential both to liberate and to “enslave,” the idea of technology tended to be seen, by and large, as the source of salvation and social betterment rather than as the creator of risks and manufactured uncertainty. For our authority figures group, technology was presented as enabling Brazil to enter into modernity, to benefit from globalisation, and to become a more democratic and open society. For our local involvers group, technology for most still had a positive appeal, as enabling them to fulfil their ambitions of creating a more equal society and as providing solutions to environmental and social problems. Even for the spiritual group, who were perhaps most sceptical of the values of an increasingly technological and consumer-oriented society, the response was to advocate voluntary simplicity and to appeal to religious faith rather than to develop a collective or political response. Such master narratives provided the shared reference points and guides of imagination upon which participants developed their responses to nanotechnology. Below are two passages in which participants express their optimism for nanotechnology:

- Renata: I believe in technology. And because of this I believe that nanotechnology will help solve everything.
- Moderator: Can I understand your position some more?
- Renata: ... We do not need to resolve this [now] because our knowledge has not reached this stage. But it will resolve everything for us. This feeling provides you with a sensation, a little bit like, confidence. ...
- Rosali: Despite not having much knowledge about how it happens, I am extremely optimistic about it [nanotechnology and scientific progress]. Because this is how things advance, just as Antonio was saying in relation to the 18th Century and the industrial revolution. I think it's an inevitable process, I

think it is a process that will benefit humanity. And I agree with Antonio when he says that it is up to the individual human being whether this will be used for good or ill. Do not shoot those who have responsibility for governing, because governments are made up of people and people have choices. And I think that this [nanotechnology] will come and it will bring benefits for humanity. I am extremely in favour.

(Brazil Group 1)

Antonio: I'm totally optimistic. I think that technological development is the solution. If we have resources in nanotechnology to prolong our life I think this is something very nice. Imagine a little robot working inside me to cure a disease I have!

Cristina: I also have an optimistic view. The risks – We have to take enough risks with existing technologies. I think it [nanotechnology] will not increase the risk, the risk is already there. I believe it will be a positive thing!

(Brazil Group 3)

The profound sense of optimism highlighted above is prototypical of our participants' faith in science and technology as the source of human betterment and social progress, legitimated by historical precedent (Rosali's reference to the industrial revolution), the plausibility and seductiveness of the technology's promise (Antonio's appeal to the image of self-healing robots), the background assumption that technology tends to mitigate rather than manufacture risk (the source for Cristina's optimism), or simply due to an unconditional sense of trust in the technoscientific project (important for Renata). For our Brazilian participants more generally, there was little critique of technology as a system, and thus little sensed need to scrutinise or critique the actors involved in its social production. Scientists were seen as on the side of the angels and as part of a still to be realised process of social improvement. From the perspective of the participants, owing to the socio-technical system seen as itself self-correcting, there was little sensed need for oversight, either by government or by techniques of public engagement. In other words, there was little evidence of the kind of widespread public unease with science and technology that has been experienced and reported in Europe (Felt and Wynne, 2007; Horst and Irwin, 2010), and little expressed mistrust in the motives of scientists or with the system through which innovation and research and development folds into life at the everyday.

UK master narratives of nanotechnology

In our UK groups we identified a similar dynamic whereby participants moved between optimism and pessimism in their responses to nanotechnology. However, without exception, all our UK group discussions ended in tragedy, offering the opinion that under real-world circumstances nanotechnology would generate profound and complex dilemmas that were predicted to exceed our ability for collective control and negotiation. To justify this position, our UK groups appealed to five complex and intersecting narratives: that nanotechnology would constitute a "Pandora's Box" of secrets that, once opened, would release a whole host of human evils; that the technology had the potential to severely "mess with nature" and disrupt what it is to be human; that while the technology held desirable promises of perfection and improvement we need to "be careful what we wish for"; that people felt that the technology would exacerbate existing inequalities; and that in relation to all these dynamics people felt impotent and "kept in the dark" (for more detail on these narratives, see Davies et al., 2009).

Deployed in all of our UK focus groups as a way of expressing what is "at stake" at the level of human ontology, nanotechnology came to be represented in the role of a temptress

with its seductive but false appeals to eternal youth, control over nature, perfection, excess and desire. Thus, reinforced by driving visions apparently endorsed by government and corporate actors, nanotechnology was presented as in danger of intensifying existing trends of individualism (UK Group 1), conspicuous consumerism (UK Group 1), sloth (UK Group 4), and insularity (UK Group 5). Below is one exchange on the socially disruptive consequences seen as likely to result from nanotechnological innovation:

Mary: Whatever they throw at us we'll all have it. So it's just finding more new things to sell. It's quite divisive. It's just more and more that we want – different things that we want and the people who have it are those who can afford it. It's divisive in terms of individuals, communities within a country and internationally.

Chris: The presumption is that we want more, more and more. We just get swept along with all these things.

Lynn: It's like removing the human soul, isn't it? It's removing what makes us individual and replacing it with ...

David: Convenience

Lynn: A technology that says "don't worry, I know what you want, I know what you need, I know what you fancy."

(UK Group 1)

Here the discussion centres on the imagined dynamic through which nanotechnology will permeate everyday life and its likely long-term and unforeseen consequences. Mary locates the technology as propagating yet more intense forms of consumerism, which are seen as likely to exacerbate existing divisions in society. Chris concurs and adds how the seductive appeal of the technology will ensure that "we just get swept along." Lynn then adds a more ontological point, articulating how this process will make us less human through removing "the human soul" which David adds will be replaced with "convenience." The salient feature of this exchange lies not simply in what people say but with the ease at which all members of the group interact, embellish and add to this narrative form, illustrating the salience of the narrative and its potency in resourcing public responses.

Financial drivers also were seen to play a formative role in contributing towards such pessimistic scenarios. Unlike the Brazilian groups, where there was little expressed concern or interest in the dynamics underpinning the technoscientific system, for the UK participants there was more vocal discussion on the actors and their associated interests. Consumption was seen not only as a driver of the system but also as the cause of unsustainable and socially disruptive pathways. The participants themselves were frequently critical of this, but at the same time acknowledged its power and its lure. Not surprisingly, this kind of concern reflected wider and more systemic mistrust of those driving and funding the technology, such as national governments, big business and the military. What are their motivations? How will they affect how the technology will be used? Are they looking after the long-term? Responsibility thus tended to be oriented towards distant and un-get-at-able actors and with their (in)ability to govern or control a "runaway" world (Giddens, 1999). Again this contrasted to the more optimistic outlook of our Brazilian participants who were more hopeful in their own agency and who located, ultimately, responsibility at the level of the individual, the family, institutions (as made up of individuals), or in the essential "goodness" of the human spirit.

Catastrophe, nature and the social treatment of uncertainty

Many of the UK participants thought that disaster of some kind – whether environmental, social, or moral – was inevitable. This was not the case for our Brazilian participants. In

important respects this difference arose from the ways in which the category of nature was deployed across these two national contexts.

For our UK groups the appeal to nature and the natural, including accounts of our human nature, constituted a particularly powerful and shared normative foundation to public responses. In other research we have examined the appeal to nature in structuring public responses to biotechnologies, arguing how the appeal to nature represents a kind of “valuable fiction” in which people can wrestle with deeply unfamiliar and potentially disturbing questions surrounding the physical manipulation and transgression of boundaries, hitherto regarded as fixed in nature (see Grove-White et al., 1997; Macnaghten, 2004). The same dynamic was present in conversations on nanotechnology as people reflected on what was “at stake” in our nanotechnological future. Nanotechnology was seen as likely to “mess with nature” not only through the social production of new risks and harms, or through what one participant termed “accelerating the evolution of disasters,” but also, and perhaps more fundamentally, through the technology’s ability to blur boundaries which provided a moral ordering and compass to everyday life. Thus, nature provided a category in which to question the wisdom and integrity of technological visions to increase lifespan (“We’re designed to live this certain lifespan, aren’t we? We’re not designed to go on forever and forever” – UK Group 3), that extend control over life (“Mother Nature should control your life, not a scientist” – UK Group 5), and that would encourage those with power to manipulate us for their own purposes (“Whoever controls it is always going to manipulate it to their benefit” – UK Group 4); a category that enables you to appreciate diversity and beauty in life as it is (“Variety and difference is what nature’s about, every plant would be exactly the same if we didn’t have diversity” – UK Group 1).

In the case of the Brazilian groups, by contrast, nature had a different resonance. When presented with debates on the current level of uncertainty that characterised nanotechnology and its indeterminate effects on the environment and human health, participants understand such processes in a different register. These tended to be presented as part of an inevitable process of maturation, which would be overcome once the technology matured, enabled through normal processes of research and development and legal oversight. The exchange below sets out this logic: not only would the uncertainties be ironed out through the normal process of development, but, more ideologically, it would be a mistake to try to intervene or control the “natural” progression of innovation processes:

- Moderator: So, do you think that in the future these uncertainties will be resolved?
 Ricardo: Ah, this is undoubtedly so.
 Antonio: Yes, for sure – this is the process.
 Ricardo: It is one of maturing ... The process is inevitable. People will want it or it will not become part of daily life. I think we simply need to provide the right information to consumers. That is all ...
 Moderator: Can you imagine that it is possible to change the direction of a technology?
 Ricardo: It is not possible!
 Moderator: Why is the process inevitable?
 Rosali: For eight years the Bush government sought to stop stem cell research. It delayed it for eight years. Now it will start again. Can you hold it back?
 No, it is not possible.

(Brazil Group 1)

The exchange above reflects the dominance of an Enlightenment narrative of technoscience as the inevitable and unambiguous provider of progress and social betterment. However,

it also speaks to a different cultural register of the power of the idea of nature and naturalness. Whereas nanotechnology's potential to blur boundaries, and to "mess with nature," conflicted with UK sensibilities, for our Brazilian participants this was less the case. Life was seen as inevitably risky; nature was presented as that which had in part constrained and enslaved everyday life in the recent past; technology had been experienced as liberating people from necessity (e.g. through domestic appliances); and nanotechnology was seen as potentially fulfilling this process.

6. The politics of public engagement and the development of societal debate

We conclude by offering some reflections on the focus group methodology as a technique for eliciting public opinion, focusing on its performative role as it translates across national contexts as a subtext for discussing wider questions on the politics of public engagement. In the UK groups, participants expressed both a sense of powerlessness in the face of nanotechnology's development coupled with a feeling that they had been left unaware of the technology's existence and potential. This, we termed, the "kept in the dark" narrative. When presented with information on current levels of funding of nanotechnology R&D, as well as of projected future market share, many people expressed surprise and on occasions, outrage. Why had they not been told about the technology? Who was driving these developments and for whose benefits? Where was it taking us? Would it be for the good of mankind or alternatively, would it lead to social division and yet more consumerism? And even when they presented concerns, they felt they had no way of having any impact on it.

What perhaps is more surprising is the fact that UK participants felt able and willing to present themselves as "kept in the dark" in the focus group setting. Lezaun and Soneryd (2007) have developed a critique of the forms of sociality that underpin public consultations, including focus group methodologies of the type deployed in this research, arguing that it tends to reproduce a stable and malleable image of "the public" that is conducive to government control and management. However, by contrast, our UK groups were able to constitute an assemblage in which lay technoscientific citizens could be produced, be able to offer opinions, discuss the issues and reflect on future politics and their contingencies (Michael, 2006). The research thus contributed to a tradition of policy-oriented research that uses small groups as a deliberative space where lay publics can share their experience and develop positions, and where social scientists can bring recognition of such local knowledge in the hope of making decision-making more socially robust.

Among the Brazilian groups we experienced a different dynamic. Even though people felt generally impotent in the face of nanotechnological futures, there was less surprise and even less outrage. Partly this can be accounted for by the lack of a shared problem definition. Since technology was seen as internally directed towards social amelioration there were no public concerns in-the-making, and thus little sense as to the merits of widening public participation in such discussions. In addition, and as a consequence of Brazil's own political and culture context, there was simply less expectation that they had rights as citizens to engage in such a process. This can be related to the fact that Brazil is a young democracy. Whereas techniques of (upstream) public engagement are premised on a model whereby policymaking becomes more socially robust through the inclusion of public voices, this model failed to reflect everyday perceptions of social change and mobilisation in a Brazilian context.

Thus, the challenges for promoting successful societal debate on nanotechnology are likely to be determined in different ways in the UK and Brazil. In the UK, in the face of a public sceptical with the political economy of science and with its capacity to inculcate a

better future, public deliberation is a necessary element in shaping a more socially robust science. Scientists and policymakers need to engage with the narratives of technoscientific failure and the conditions under which they endure in the public realm. In Brazil, by contrast, the debate requires a different configuration of actors and assemblages. We need to consider what can happen in a context where neither the scientists, nor the politicians, and even less the public identify themselves as having a “stake” in the debate. Is it still valid for science and technology scholarship to speak in favour of public deliberation per se, or is a more nuanced treatment required of the contribution of “engaged citizens” in the new scientific governance (Irwin, 2008)?

More generally the lesson from this research is that if we are to continue to speak of public engagement as a public good, we need to talk not in global and universal terms, but in ways that remain sensitive to the political culture of the particular sites where public engagement is to be enacted. This may require new forms of learning. Just as STS scholarship may have made genuine contributions to opening up spaces of reflection and deliberation on the societal and ethical dimensions of new science and technology, the analysis of political cultures in other places may have important lessons for STS. What are the conditions under which emergent coalitions and alliances can materialise in the collective definition of a technoscience as a social problem? Who are they to be drawn from? And, in the context of emerging economies and democracies, what is the role of the STS scholar as an active player in their co-construction?

Acknowledgements

The authors would like to acknowledge support from the CNPq (Brazilian National Council for Scientific and Technological Development) for the grant awarded to Prof. Philip Macnaghten to spend 6 months (February–August 2009) to develop the research here presented with Prof. Julia S. Guivant at the Federal University of Santa Catarina, Brazil, and, in addition, the European Commission for the project “Deepening Ethical Engagement and Participation in Emerging Nanotechnologies” (DEEPEN) out of which this analysis was developed. Also we would like to thank the following people: Ana Carolina Cassiano, Tade-Ane Amorin, Marília David and Juliana Mezzomo from the IRIS (Institute of Research on Risk and Sustainability), for their contribution and support in the Brazilian research and comparison; DEEPEN colleagues Matthew Kearnes and Sarah Davies for their thoughtful and productive commentary; and two anonymous reviewers for their observations. Remaining problems are of course our own.

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