

Public Engagement as a Means of Restoring Public Trust in Science – Hitting the Notes, but Missing the Music?

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Key Words

Mistrust of science · Public deficit models · Science policy

Abstract

This paper analyses the recent widespread moves to ‘restore’ public trust in science by developing an avowedly two-way, public dialogue with science initiatives. Noting how previously discredited and supposedly abandoned public deficit explanations of ‘mistrust’ have actually been continually reinvented, it argues that this is a symptom of a continuing failure of scientific and policy institutions to place their own science-policy institutional culture into the frame of dialogue, as possible contributory cause of the public mistrust problem.

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Introduction

The UK House of Lords Select Committee on Science and Technology 2000 influential report ‘Science and Society’ [1] was an emphatic official acknowledgement of a sense of widespread crisis of public mistrust of science used (as it is, increasingly) as supposed public policy authority. Inevitably, given its contemporary prominence in both human health and agriculture-food domains, and

despite variations in public attitudes and reactions, genetics or genomics has featured centrally in these problematic developments. These problems and corresponding policy responses have not been confined to the UK with its particularly tortuous history of scientific advisory fiasco through the 1990s. In their own ways, and through a variety of issues, the European Union and other international science-policy processes have also manifested official concerns about the loss of public authority for or ‘trust in’ science. In Europe, for example, the 2001 White Paper on Governance of the then-President of the Commission, Mr. Prodi, contained a chapter devoted to science and citizens in which the public trust issue was central. An ‘EU Action Plan 2001–2006 on Science and Society’ reflected the same concerns [for more global dimensions, see ref. 2].

In considering this so-called public mistrust problem, we should reject the conventional wisdom that until the infamous 1996 UK mad-cow disease fiasco, publics trusted science and scientists. This ‘creation myth’ is now the standard conventional view of the public mistrust of science problem [3; for a more historical perspective on public mistrust of technical experts, see ref. 4]. We should also reject the widespread supposition that members of the public have a unitary and singularly meaningful object of their experience and attitude towards ‘science’, other than towards a generic symbol like ‘motherhood’ [5]. Indeed, in general, there are so many different prac-

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tices, discourses and cultures which are referred to under the 'science' title that it becomes virtually meaningless without further qualification. Nevertheless, it remains true that institutional science in many domains, from new technologies to public health, environment, and policy across the board, does indeed suffer from association in public experience with problematic and sometimes downright provocative institutional conditions, practices, assumptions, purposes and inconsistencies; and *these are conducted in the name of science*, normally with silent acquiescence, or positive support, from scientific institutions.

In assessing where the salient problems lie, we should not overlook how much 'science' has been increasingly extensively used as an attempted means of public authority. Thus, instead of thinking of the issue as one in which publics have withdrawn a previously substantial trust, we might be able to recognize just how much this historical process has placed ever-increasing demands on public credulity and trust in institutions, practices, commitments, reassurances, promises and predicted impacts, all justified in the generic name of 'science'. This point is usually overlooked in the incessant agonizing about the 'public mistrust of science' problem. Keeping it in focus, it might productively encourage more reflection and discussion about the ways in which institutional science is itself implicated in the 'public mistrust of science' problem, instead of repeatedly projecting the blame onto incompetent publics, irresponsible and misinforming media, and non-governmental organizations, as well as other convenient scapegoats. This would have to include the ways science is institutionalized, owned and controlled – a dimension of the public understanding of science issue which has long been recognized by social scientists [6] but neglected by scientific institutions themselves.

I argue below that this lack of open institutional self-reflection, the condition of inadvertent but evident institutional denial which it engenders, and the associated exaggeration of the powers of scientific knowledge of understanding and control, are the major reason for the quite specifically focussed and selective forms of public alienation from science which do exist. There is no general, indiscriminate public mistrust or rejection of 'science'; indeed, there is lots of enthusiasm for it – but this is discriminating enthusiasm, even if the discrimination is of course fallible. Even where there are as yet no explicit forms of public concern or hostility to what is done or said in the name of science, such as in many public health-related issues, so-called 'red' genomics, these social conditions of public ambivalence combined with in-

stitutional presumption and a tendency to denial, harbour a very fragile context for future development unless they are understood. This is particularly true since the 'objective' representations of the issues which scientific institutions perform also embody normatively weighted public projections – performances – of 'the public' itself. To the extent that these are based on presumptions and misunderstandings of public concerns and responses, and denied by their authors, they are themselves provocative and alienating.

First, I review the continual reinvention of new deficit models of the public and its reactions to institutional behaviors performed in the name of science. Then, I address why this state of affairs – in which the deficit model is buried with great self-congratulatory ceremony, then almost in the same breath reincarnated in some new form – appears to be so persistent. I conclude by discussing what the implications might be for processes of public engagement with science and for the more robust grounds of public confidence or trust in science which I take to be a shared aspiration across all relevant disciplines and sectors.

Public Dependency and Tacit Ambivalence

It is hardly surprising that what I have before called the reluctant acquiescence of the public in its knowingly inevitable, and relentlessly growing, dependency upon expert institutions (thus ambivalent 'as-if trust') [3, 7] has been stretched beyond breaking point, in some contexts at least. It may be misleading to look for some discontinuous events or conditions which have suddenly produced this apparently dramatic change of public attitude, because no such dramatic change may have actually occurred. Well before the 1996 UK-EU mad-cow fiasco, there were copious examples of overt public mistrust of science, and even more of public ambivalence, without mobilized dissent to scientific endorsements of policy or commercial commitments [8, 9].

Since the landmark 2000 statement of the UK House of Lords [1], it has become a mainstream international commitment by scientific and policy institutions using science to encourage and cultivate two-way 'public engagement with science' as a means of alleviating this crisis of public mistrust. However, the House of Lords report not only recognized the crisis of public mistrust of science, it also explicitly abandoned the long-criticized but established 'public deficit model' explanations [1] of the problem of repeated public refusals to accept scientific

policy endorsements. Whether this overt abandonment of the deficit model has been more apparent than real is a key focus of this paper.

It is important to recall that original critiques of the deficit model by Wynne [6, 9, 10] took for granted the existence of information or understanding deficits; however, they rejected the convenient use of this normal reality – a universal condition, also amongst scientists – as the supposed *explanation* of public opposition to those policy commitments like nuclear power, chemical pesticides and food additives, and more recently, some aspects of genetic technologies, justified in the name of science.

The huge ferment of new millennium ‘public engagement with science’ activities has been based, albeit ambiguously on closer inspection, on replacing the previous deficit model’s primitive one-way assumption about educating an ignorant public into ‘(scientifically) proper attitudes’ with an alternative two-way dialogue – a change of culture – as advocated by the 2000 House of Lords report. The driving assumption, on the face of it reasonable, has been that this supposedly *mutual* education, including scientific learning from its encounters with publics, will be the means of regenerating a failing public trust. I want to suggest that this institutional scientific learning about its own culture and its embodied assumptions about ‘the public’ has so far largely failed. In this basic sense, existing claims and appearances, which are difficult to dismiss as anything but sincerely intended, patch over a degree of institutional self-delusion.

A solid phalanx of eminent scientific or scientifically dependent and scientifically resourced bodies has followed the 2000 House of Lords proposals, from the London Royal Society to the European Commission. This same philosophy was emphatically endorsed in the UK government’s major July 2004 policy statement for science ‘A Ten-Year Framework for Investment in Science and Innovation, 2004–2014’ [11]. It not only committed to a four-fold real funding growth for science in this period, but devoted a full chapter to public engagement with science, expressing the aims of cultivating more new recruits to science careers and more positive public attitudes to science, especially to creating public trust: ‘the government’s science and society agenda encompasses achieving public confidence and engagement in science.’

While this commitment seems unproblematic, and while public confidence in science and its institutional forms should be taken for granted as a necessary condition for modern society, the whole relationship between the new enterprise of public engagement with science,

and public confidence in science, deserves more careful and critical attention. First of all – and something not often in evidence – before defining what public engagement with science should involve and what it can be expected to produce, there is a need for enlightened and reflective diagnosis of the possible nature and causes of the problem of ‘public mistrust of science’. If it does prevail, then of what precisely is there mistrust? Under what conditions and in what contexts – and for what reasons? Unless we understand these questions, we are in no position to respond constructively and effectively to the problem. So far, scientific institutions have managed to avoid facing the possibility that they themselves are part of (not exclusively) the original cause.

As I show below, the established institutional reflexes, stretching back to the public controversies over nuclear power in the 1970s, despite ample unsought-for opportunities to engage in institutional learning, have remained troublingly resistant to achieving an understanding of the causes of the overt public mistrust of science problem. We have meandered blindly from nuclear power in the relatively early post-war years of institutional science advice for policy, through a dense variety of other imbroglios involving scientific knowledge as supposed public policy authority, including thalidomide and other pharmaceuticals, chemical pesticides, food irradiation, chlorofluorocarbons, whooping cough and later MMR triple vaccines, radioactive waste management and disposal, waste incineration, oil and gas rig environmental risk assessment and disposal, BSE, high-voltage power lines, and other electromagnetic fields. Yet institutional science and policy bodies dependent on them have persisted, despite major post-crisis inquiries in some cases, in a culture of denial of the inevitable contingencies in their own scientific (typically risk assessment) knowledge by which policy statements and commitments are justified to their publics. Moreover, exacerbating the public alienation problems, these same authorities have (1) presumed and imposed un-negotiated science-centred meanings on these publics, (2) failed to recognize the ever-increasing demands which are being imposed on public credulity by science as assumed public authority, and (3) continued to project responsibility for the related difficulties of public controversy around scientific ventures and assurances onto anyone but themselves.

This is the unpromising cultural context into which genomics has had to develop its various social-technical presences. The suggestion that this unreflexive institutional culture of science and policy itself may be a central part of the very problem from which those institutions

are trying to escape, is still apparently impossible to contemplate, even though it has been proposed since the 1970s [12, 13].

Public Deficit Model(s) as Institutional Alibi

What is typically called ‘public rejection of science’ is properly described as public rejection of commitments based on value commitments that are misunderstood and misrepresented by scientists and policy experts as if solely scientifically determined. The same entrenched cultural assumption gives rise to the deeply problematic habit of describing public issues involving scientific questions as ‘scientific issues’ (or ‘risk issues’, and public responses as ‘perceptions of risk’). This culture of scientism, or institutionalized idolatry of science, is bound to treat public rejection of those things done in the name of science, as rejection of science, because it has already so falsely narrowed its moral imagination to the idea that support for the policy stance is determined by scientific fact, and that no alternative is left. Thus, some kind of public deficit model explanation of public rejection or mistrust ‘of science’ is almost preordained as a function of this scientific, culturally entrenched premise about the basic meaning of the issue at hand.

Although it has existed as a cultural reflex for much longer, the first explicit statements of the idea that public rejection of a commitment made in the assumed name of science were due to public ignorance of science came during the waxing public opposition to nuclear power in the 1970s [14]. At that time, the difference between ‘objective’ (or ‘real’) risk and ‘subjective’ (or ‘perceived’) risk was born, with the belief that whereas scientists naturally understood the real risks of nuclear power, the fearful public only knew and acted on their misunderstandings and misperceptions, emotively fuelled and misinformed as these were taken to be. In this view, the deficit-stricken public exaggerated the real risks of nuclear energy, which falsely inspired their opposition [15]. A repeated scientific lament was that the public exaggerated the real risks because of their misunderstanding of the scientific knowledge that risks to human health from typical public radiation exposures from routine nuclear power plant emissions are smaller than many familiar accepted everyday risk activities like driving a car or cycling.

Thus, the scientific-institutional assumption was reinforced that their own artificially framed scientific definitions of ‘risk’ from nuclear power – namely risks of human death from radiation exposures due to routine

Table 1. Public deficit models for mistrust of science – abandoned, but reinvented (ca. 1990 to the present)

I	Public ‘deficit’ of understanding of scientific knowledge (e.g., non-GM tomatoes also contain genes)
II	Public ‘deficit’ of trust in science – more information, transparency, or explanation will restore trust (via ‘understanding our motives’)
III	Public ‘deficit’ of understanding of scientific process – science cannot <i>be expected to</i> give certainty or zero risk [see, for example, ref. 22]
IV	Public ‘deficit’ of understanding that ‘real’ science has no ethical/social responsibility for its applications or impacts
V	Public ‘deficit’ of knowledge of the benefits of ‘science’ [see, for example, ref. 28]: GM crops in the UK will help feed the global starving and avoid armageddon for British science
I–V	Public responses are emotional, dependent, epistemically empty, gullible to manipulation; no questions about ‘our’ scientific-institutional culture and its assumptions

environmental discharges from nuclear power plants only – equated with a universal, independently existing risk object. However, this overlooked that their imposed ‘scientific’, ‘objective’ – actually socially constructed – definition of the object excluded many salient dimensions of legitimate public risk concern, such as morbidity, environmental damage, cumulative ultra-long-term waste disposal risks, uranium mining risks, plutonium and nuclear weapons risks, risks to civil liberties, and other salient questions such as how much more than a single plant might be involved as a risk generator anyway, and why would the institutions in charge never address this question, instead dismissing it as ‘unscientific’ and ‘emotive’? Instead of recognizing these complications embodied in the provocative and alienating way the institutional science was being deployed as social authority, the public’s misunderstanding of the ‘scientific contents of risk knowledge’ (deficit model version I) (table 1) was instead constructed as alibi for avoidance of these self-directed (or ‘reflexive’) questions. This was the context for the 1990s emergence of public genomics, where the same institutional responses to public conflict occurred [16].

The London Royal Society 1985 report on ‘Public Understanding of Science’ [17] expressed the more general institutional scientific anxiety that these kinds of public ignorance of science are a threat to modern science-dependent society, preventing citizens from making ma-

ture rational decisions in support of scientifically dependent policies. The embedded assumption was that no rational and properly informed person could possibly disagree with the desirability of whatever science endorsed – nuclear power, chemical pesticides, chlorofluorocarbons, thalidomide and other pharmaceuticals, food irradiation, electromagnetic fields, and more recently, genetically modified (GM) crops and foods. Although this stance was criticized by social scientists as a self-indulgent, counter-productive (because dogmatically authoritarian and arrogantly self-centred) and *mistaken* deficit model explanation of public concerns about such technologies and their modes of promotion, these institutional criticisms were instead redescribed by scientists, as a much safer form of collective self-critique – of individual scientists' unwillingness to communicate with publics [10, 18].

These early 'public deficit model' explanations of why scientific assertions about the acceptability of a given technology were suffering public rejection were based upon the public's supposed misunderstanding of the *cognitive contents* of scientific knowledge. In the 1990s, with severe European public opposition to GM crops and foods, the Eurobarometer surveys of public knowledge of genetics found that more than 30% of the public appeared to believe that only GM tomatoes contain genes [19]. This association occasioned the same kind of reasoning as for nuclear power two decades earlier, that no scientifically informed person could possibly object to GM crops, and therefore, the cause of public opposition could only be scientific ignorance, or even worse, deliberate anti-science. The later welcome social scientific recognition that there are public ethical concerns as well as risk-related ones [20] still reflected the implicit assumption that these were individualized emotional concerns (like 'playing God') which neatly concealed public concerns about the ethical dimensions of the prevailing institutional scientific culture [21].

This institutional reasoning reflected the unquestioned premise that the public issue of whether, and if so under what conditions, we should have GM agriculture and food was only a scientific propositional question: is it safe? Thus, the public issue was, falsely, deemed a scientific risk issue, and crucially, the risks were assumed objectively to be those selectively defined by institutional regulatory science. The fact that these scientific definitions of the object to be assessed changed ad hoc and unpredictably, thanks to public controversy inputs more than to regular scientific accumulation of knowledge, was conveniently overlooked in this scientific self-reinforce-

ment. Consequently, the underlying reasons for public mistrust continued to be ignored. The UK House of Lords 2000 report [1] argues that public mistrust might not result from public misunderstanding of science, but from its resentment at having its other legitimate concerns and definitions of what the issue means to them dismissed by the scientific and policy institutions in charge.

Starting from this misconceived scientific premise, it was impossible for scientific institutions to understand public responses in any other way than as a rejection or misunderstanding of science; but this perfectly sound reasoning did not make the conclusion any more valid when the premise itself was false. Despite the explicit alternative suggestion of the House of Lords committee, scientific policy advice has continued to develop a string of new versions of the original *cognitive* deficit model. The chief scientific adviser of the UK government and eminent international scientific mouthpiece, Robert May [22], gave a new version:

There is now an erroneous expectation that life can be 'risk-free', and faith in the system tends to be further undermined every time this proves not to be the case. Science education in schools focuses too much on facts, rather than process, leading to the misleading impression that science ... deals in certainties rather than, as is more often the case, conclusions based on the balance of probabilities after evaluation of the available evidence. Many policy decisions, for example on GM crops, have to be made while there are still significant ... degrees of uncertainty. Debate among scientists on these issues, which is an essential part of the process ... can be perceived as vacillation and weakness.

Robert May's alleged public demand for zero risk is a largely evidence-free assertion – a functional myth propagated by institutional science. It can be seen in tabloid newspaper headlines, but these are not accounts of public attitudes and expectations. It can also be read into public assertions of zero trust in institutions trading on scientific authority, like those asserting in the 1990s that according to sound science there were no human risks from BSE – when one does not trust an agent then one may reasonably demand that they enjoy zero discretion, or require certainty over their accountability. But it is simplistic to read these accounts as a typical public misunderstanding of scientific process and a false, deficit-founded expectation of certainty from science. Indeed, the evidence about typical public expectations of science is just the opposite of this supposed deficit of process understanding; that is, the public usually takes for granted that things are not as predictable as scientific knowledge claims them to be and is skeptical about scientific claims to certainty. Thus, public concerns over such things as GM

crops or MMR vaccines are more about what is seen to be their exaggerated and untrustworthy institutional promotion than their future impacts fully predicted and controlled by scientific risk assessment [23, 24; M. Leach and J. Fairhead, pers. commun.].

Thus, public mistrust of science is not due to the fact that science shows uncertainty, as May wants us to believe. Indeed, quite the opposite, it appears to be due to public awareness of unpredicted future consequences which the scientific institutions effectively *deny* by referring only to risk assessment as an attempted means of public reassurance. There is ample evidence from relevant empirical social fieldwork which uses open-question methods as distinct from closed-question survey methods [23–25]. This research shows how people typically focus not on scientifically described risks, which by definition are known effects, but (inter alia) on *unpredicted* effects coming from domains of inevitable scientific ignorance. Yet because of their recognition of this lack of scientific control – which is denied by the scientific institutions in their repetition of risk assessment discourses – people do not then say that the innovation in question should be stopped. Instead, typically, they demand (1) acknowledgement of this predicament, rather than the more usual denial by default of any acknowledgement, (2) an accountable contingency plan for such surprises (including their own assessment of the trustworthiness of the institutions which will be in charge), and (3) an accountable process of debate and negotiation over the upstream driving interests, purposes and expectations – usually wholly unaccountable and private, and shrouded in the ideology of scientific determinism – shaping the innovation trajectory from which downstream risks and unpredicted impacts will eventuate. To convert this reasonable cluster of issues and questions – and in the absence of any institutional response, objections – into supposed public fear of uncertainty is hardly likely to engender public trust in scientific institutions.

Table 1 schematically shows the multifold reinventions of the public deficit model explanation for public alienation from institutional science as pressed into service on behalf of commerce, technology and policy. This family of models operates as a repertoire of possible alibis which prevent honest institutional-scientific self-reflective questioning, in public; and as an inadvertent alibi for the continued presumptive imposition of assumed scientific meanings on public issues. This evasion chronically undermines what could be vigorous, mutually educative and more humanly as well as technically intelligent innovation and science. These reinventions of the original

Table 2. Scientific deficits of understanding of publics

1	Public mistrusts science because it is ignorant of science (it is ignorant, but this is not a cause of ‘mistrust!’)
2	Public is scared of ‘uncertainty’
3	Public is only concerned about threats to own safety (risk)
4	Public is incapable of having its own independent valid meanings of the issue
5	Public behaviour equals public attitude (ambivalence unrecognized)
6	Public has no epistemic substance/agency
7	Public is either unambiguously pro- or anti-technology
8	Public is only concerned about <i>our</i> (scientific) object concerns, not institutional relations or conditions
9	Public does not understand ‘facts’ of benefits (which science of course ‘understands’, i.e. <i>presumes</i>)

deficit model have been seen since the early 1990s, and they continue.

We can note here a gaping lacuna in the treatment of the ‘public mistrust’ problem. This is the repertoire of evident scientific misunderstandings of typical publics, which do not receive quite the attention given to public misunderstandings of science. Perhaps, this asymmetry might be due to the usefulness of the latter (which of course exists, as most public respondents are first to recognize) as a supposed explanation (which is false) of public refusal of scientific normative definitions of proper public response. Table 2 shows some of these scientific myths.

One might say that the issues are really about what is considered salient, as questions and as knowledge – that is, about different meanings. It also includes the typical lack of recognition of this basis for difference, which reflects different cultural worlds, not differences of correct knowledge in some supposed one-dimensional propositional frame of meaning. As Latour [26] puts it, these are ontological questions. They are not just epistemic ones about ‘how to get them to believe what we know to be right?’ This recognition would be a first step towards engendering constructive dialogue and relations between science and its publics [27].

Bearing in mind the institutional reflexes (table 1) of continual reinvention of what is effectively an alibi projected onto others, and given the ab initio judgement of public mistrust of ‘ourselves and our own’ as unjustified,

hence somehow misinformed, one can understand how this persistent institutional projection and reinvention occurs. Since it appears to be so creatively resistant to simple empirical contradiction, it has to be seen as reflecting a deep institutional-cultural need rather than a deliberated deception. It has been cumulatively entrenched over decades and energized by profoundly emotive feelings and insecurities about power and authority, emotions whose denial by reference to reason only make it all the more alienating and incoherent. One is drawn to this interpretation by the emotive weaving together and confusion by leading scientific spokespersons such as the ex-Chair of the UK Scientific Advisory Committee on Novel Foods and Processes of in principle factual assertions about risks from GM crops, with apocalyptic assertions about scientific collapse, unless the UK proceeds with commercialization as fast as possible [28]. The latter are presented as factual scientific truths, just like an accepted biological fact. Yet the implications of this authoritarian institutional-cultural style for corroding public mistrust are nowhere even remotely entertained as possible institutional responsibilities.

Scientific Institutional Culture – Denial and Unaccountable Performance

Scientific institutions not only inform but, by default of informed political responsibility, also *define* regulation and policy in many areas of modern society. Indeed, this is built into existing institutional arrangements for regulatory decision making worldwide, as social benefits are simply assumed by dint of someone's wish to advance a product for approval through the regulatory process. By definition this means a benefit, under existing assumptions routinized into the institutional culture (that is, no longer deliberated upon, just practised as habit). Thus, risks and not benefits have become the defining issue, even when benefits are much disputed in society at large. It is thus unsurprising that science has problematically assumed a defining role over such issues. Yet this provocatively exaggerated role for science as provider of public meaning and not only informant has not been understood by anyone it seems, least of all by the scientists involved.

There are several distinct issues on which these prevailing scientific policy actors misunderstand or ignore their own responsibilities as causal agents of the public mistrust problems which prevail. I do not mean as individuals, but as inadvertent agents of the reproduction of

an established set of institutional reflexes and habits (like deficit model explanations of public refusal of the scientific moral-political worldview) which inadvertently create public alienation. The first and most general is simply the state of institutional scientific denial of its own lack of predictive control and of the limits and contingencies of scientific knowledge which are an endemic condition of scientific knowledge. The second is the associated tendency to impose its own tendentious and debatable definitions of public meanings onto the public, then misreading the reasons for negative or sceptical public reactions from within the same unquestioned (science- or risk-centred) premises about public meaning, rather than recognizing that the original premises may be worth revising – such as the premise that publics are concerned only about 'risk' and not, for example, about upstream (usually unaccountable) driving human visions, interests and purposes in the science and innovation itself.

It is further worth remembering that public reactions to genetics science, whether commercial GM agriculture or clinically based genetics, are not based on individual scientific motivations but on institutional relations, processes and experiences. Thus, an individual scientist's motivations and intentions may be as pure as the driven snow, yet if the context of institutional arrangements is inappropriate, for example driven by sketchily policed commercial interests before the public interest, this may still engender reasonable public mistrust, hostility or alienation. For example, when people are concerned not just about known risks, but also about how to deal with unknown and unpredicted – thus unspecifiable – effects, it is no use repeating risk assessment mantras as if this will address those concerns. On the contrary, and however inadvertent this may be, it *denies* those concerns, thus treating them as of no importance.

Elsewhere, I have explained how even enlarged institutional discourses which recognize public ethical as well as risk-related concerns only serve to exacerbate public alienation and mistrust if, as they usually do, they impose their own definitions of what counts as an ethical issue [21], rather than recognizing the ethical concerns which people typically express for example about being subject to private commercial priorities buried in 'basic science' rather than to accountable public interest ones. In these respects, the practices so far developed for public engagement with science fall well short of the needed mark. For all their fashion-following language of upstream public engagement, they remain rooted in attention only to downstream impacts, and not to making upstream driving purposes, about the *human ends* of

knowledge, not only its instrumental consequences, more accountable and humane. As an example, the UK government ‘Ten-Year Science and Innovation Investment Framework 2004–2014’ quoted earlier states the following [11]:

[HMG will] enable [public] debate to take place ‘upstream’ in the scientific and technological development process, and not ‘downstream’ where technologies are waiting to be exploited but *may be held back* by public scepticism brought about through poor engagement and dialogue on issues of concern ...

To better understand concerns, efforts will be focussed on enabling public fora where the ethical, health, safety and environmental *impacts* of new science and technologies can be debated (my italics).

Not only can we notice here the systematic exclusion from public engagement with science of any accountable debate and negotiation of the driving purposes and expectations shaping innovation and knowledge, we can also note how this asserts and imposes an unquestioned presumption that the public’s concerns – which we are supposed to be investigating and learning to understand – are only instrumental concerns about impacts (and that these can be identified, and represented, adequately by scientific risk assessment). Moreover, consistent with its arbitrary blackboxing of technology and science, as if just given and free from human shaping commitments which could produce different viable forms of technology, this officially stated framework provides no recognition of such human influences, thus choices and responsibilities at work inside such artificially blackboxed innovation processes, in the upstream phases. The only social options left for this supposedly enlightened and rational framework are the binary opposites, of indiscriminate acceptance, or refusal. There is no room left for constructive negotiation of possible alternatives, multiple trajectories, and different technologies, including of different social ends. Nor is there room for negotiation of the proper conditions under which an otherwise unacceptable technology might be acceptable – and which need to be ensured consistently in practice.

This monolithic and blackboxed deterministic framework is hardly enlightened and democratic. Yet it is important to note that this is imposed upon society, without deliberate intent, but no less rigidly so, by the prevailing institutional scientific culture in virtually all international innovation and regulation processes. Yet sadly, this occurs in the name of avowedly post-deficit model, enlightened public engagement with science.

Thus granted specific exceptions and variations, we find a dominant long accumulated and gradually en-

trenched institutional culture of science for policy with assumed and taken for granted habits of thought, modes of operation and practice. These routines are not questioned as the *objects* of reasoned deliberation, but constitute the prevailing *framework* of such reason and practice.

A key feature of this entrenched and, to its practitioners, *unseeable* culture is the way it unwittingly performs its other, namely its publics. As the philosopher John Dewey [29] stated in 1927, ‘the public’ is a construct – real, but in a substantive sense an *imagined* public. In Dewey’s own vivid terms:

Is the public much more than what a cynical diplomat once called Italy: a geographical expression? Just as philosophers once imputed a substance to qualities and traits in order that the latter might have something in which to inhere and thereby gain a conceptual solidity which they lacked on their face, so perhaps our political ‘common-sense’ philosophy imputes a public only to support and substantiate the behaviour of officials. How can the latter be public officers, we despairingly ask, unless there is a public?

As Dewey proposed we understand it, the public is imagined, constructed and projected, in reflection of the unspoken needs of the institutionally powerful.

I suggest it is in these terms that we can understand the prevailing scientific and policy institutional culture and its creative construction of a stream of ‘public deficit’ versions of why publics mistrust ‘science’. The imagined object, ‘the public’, as deployed in public discourse could not just be anything – it would have to adequately represent real properties of the public ‘out there’; but this relationship between representation and social reality is a complex, interactive, contingent but tacitly normative one which reflects tacit dimensions of power and culture. These need to be problematized to induce a positive shift.

Conclusions

This paper is about ‘public engagement with science’, which has become an international concern in science and policy, as well as regulation [2]. However, this paper differs from much of the literature in that my primary interests in these processes are about the ways in which science in its various institutional and intellectual forms can respond constructively to the experience of public engagement, invited or not, and be changed by them in more ways than just by conventional addition to its knowledge. In particular, I suggest that the conventional

participation or engagement literature tends to ignore how scientific knowledge unwittingly *performs* its imagined publics in normative ways and reflects its imagined publics, its commercial reference groups and meanings in its own culture. If public engagement can help render these dimensions of science more self-aware and accountable, so much the better; but much of that conventional public engagement literature seems to assume that publics (1) are keen to take part in ‘scientific decision making’ and resentful at being excluded, and (2) are entirely capable of doing so.

The unacknowledged problem which seems to beset our contemporary scientific institutional culture of science in policy, suffering as it does an increasingly tenuous hold on public trust and legitimacy, is its persistent routine externalization and projection onto others of its own possible responsibility for public disaffection or disagreement. In this regard, I have suggested at least two aspects: first, a lack of recognition of the increasing strains on public credulity and trust in which science itself has been an agent, as increasingly intense and extensive dependencies have been created for publics in an almost indiscriminately innovation-craving ‘global knowledge economy’; and second, reflecting the apparent dearth of awareness of this alternative way of understanding the manifestations of public refusal to identify unambiguously with such processes, their largely unaccountable human visions and purposes, and their demands on public quiescence and alignment, an apparent institutional lack of ability to imagine that public concerns may be based on reasonable questions that are not being recognized and addressed, rather than being rooted in ignorance and misunderstanding.

As several philosophers have suggested [30–33], and as Dewey [29] also implies, until a social agent, collective or individual, is able to place their own ‘self’ into the frame of questioning in interaction with others, it will not be in a position to genuinely hear those others, because it is instead determinedly if inadvertently imposing its own projections of the imagined other into the inauthentic ‘listening’ relationship. Thus, while the correct notes may be played, the music somehow fails to appear, and it does not take specialist musicians to notice the difference.

To take seriously the kinds of public concern and meanings described above as likely factors of the ‘public mistrust of science’ issue would require institutional changes to policy and regulation involving science, technology and innovation. These changes would include reconsideration of the huge historical shift entrenching the assumptions that the primary meaning of science is com-

mercial private exploitation. Indeed, it would require recognition of domains of policy responsibility not yet even imagined to be amenable to ‘policy’. This is a part of the uncharted future implied by the accepted challenge of ‘cultural change for science’ [1]. For example, it would mean an internalized debate within and outside of science, of the proper ends and purposes of knowledge, and the proper conditions of distribution, ownership and control of the capacity for and practice of scientific knowledge production. It would also involve a socially and ethically informed debate about the relations between scientific knowledge and other legitimate forms of knowledge and practice, for example with respect to health care, agriculture and food, indeed, all areas where scientific innovation impinges on society. To what extent for example should the newly fashionable field of systems biology be defined intellectually, in terms of which causal pathways are salient and worth exploring, by the assumed purpose of pharmaceuticals therapeutic intervention, which in turn is allowed to define ‘public health’ [34]?

The institutional changes yet to be explored would reflect a more avowedly open and indeterminate future, thus more recognition of contingency within scientific knowledge, and less claims on power and control by science. This would naturally entail changes in forms of governance involving science. I deliberately claim no more than to suggest their bases, and not to describe them as institutional design, which would require more situationally distributed, collective and grounded examination and negotiation. But as a matter of principle, the exchange of a false pretence of control for greater public respect and responsibility would be worthwhile. The steps towards this more constructive and robust, but by definition not wholly designable or predictable future, would be a response to what are in principle reasonable and legitimate public questions and concerns over modes of innovation, for example over exaggeration of predictive control by those supposed to be acting in the public interest, hyped promises of social benefit, and over commercial expectations and pressures on science regardless of whether ostensibly ‘public’ or ‘private’.

Perhaps an appropriate final observation in this context is to note the intrinsic futility of trying instrumentally to engender public trust in science, whether by ‘public engagement’, dialogue, or any other means. This express objective or expectation usually informs such ventures. Yet, it is a contradiction in terms to instrumentalize a relationship which is supposed to be based on trust. It is simply not possible to expect the other in a relationship to trust oneself, if one’s assumed objective is

to manage and control the other's response. The only thing which one can expect to control, and to take responsibility for, is *one's own trustworthiness* – but this cannot encompass the reaction of the other in the relationship. Instrumentalism itself is not the problem, but the assumption and imposition of the terms of this imagined instrumental outcome on the other participants while deceiving oneself into thinking that one is genuinely listening to them. Institutions could cultivate their own trustworthiness, as the closest they could *guarantee* to get to public trust, by being openly self-aware and questioning – 'self-reflexive' even if always to an imperfect degree – about their own imaginations and assumptions of science (which would include lack of control) and of pub-

lics. This would also help dissolving the odour of denial (of lack of control and of responsibility) which flavours current public senses of institutional trustworthiness. As Taylor [32] and Appiah [33] acknowledge, this task cannot be assigned only to those institutions involved, as I have critically assessed them here. It needs, and they need, appropriate politics engaging them; however, this far from relieves them, and their political and commercial paymasters, of the primary responsibility. Scientific institutional actors and the policy officials they advise seem unable to recognize these basic points, as the epistemic culture of instrumentalism and control which defines modern scientific knowledge has been allowed to pervade and latterly to define public science-policy institutional culture.

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