Science, Technology and Democracy on the STS Agenda: Review Article*

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ABSTRACT *Irwin's 'Citizen Science' and Sclove's 'Technology and Democracy' represent two important recent attempts, from different precincts of the field of Science and Technology Studies (STS), to explore the democratization of science and technology. Irwin suggests that policies for democratizing science and technology should avoid the pre-definitions of science of experts. Sclove promotes the utilization of democratic design criteria to inhibit the unanticipated negative effects of technology on democracy. Despite their differences both texts address similar political questions and display some theoretical convergence. These similarities suggest that Sclove's claims that there is a clear division, according to their theoretical orientation between studies in STS which are concerned with the politics of science and technology and those which are not, are overstated. Both texts possess considerable merits but tend to romanticise 'lay knowledges' and oversimplify the politics of expertise.*

Keywords: citizenship, democracy, design criteria, public understanding of science.

Democratizing Science and Technology and the Emergence of STS

In the introduction to the recent *Handbook of Science and Technology Studies* David Edge suggests that the urge to explore the democratization of science and technology can be identified as one of the three main strands combining to initiate the emergence of the field in the 1960s.[1] In more recent times, with the fragmenting of political visions of post-modernism, and the trend for methodological exploration to outrun the application of theory to policy, the issue of the democratization of science and technology, whilst not vanishing from the STS agenda has tended to be relegated to the background. Alan Irwin's *Citizen Science* and Richard Sclove's *Technology and Democracy* represent two important recent attempts, from two different 'precincts' of the field, to return debate about the democratization of science and technology to a central position on the STS agenda.

Alan Irwin's *Citizen Science*: The Double Edged Nature of Public Experiences of Science and Technology

Irwin[2] sets out the aims of his book in the following terms:

> ... to consider the part played by science and scientific expertise in our everyday lives, to review practical initiatives aimed at bringing the 'public' and science closer

*Review article of Citizen Science by Alan Irwin (Routledge, London, 1995) xiii + 198 pp., AU$35.95. ISBN 0415-13010-7 (pbk), and Technology and Democracy by Richard Sclove, (The Guilford Press, New York, 1995) xiv + 338 pp., AU$29.95. ISBN 0-89862-861-X (pbk).

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> together, to consider the possibilities for a more active 'scientific citizenship', to link these issues into public policy for risk and environmental threat. (p. 2)

To address these aims Irwin draws on a large body of literature combining insights from, the sociology of scientific knowledge (SSK), Beck on the 'risk society', and literature harking back to the 1970s, such as the OECD's *Technology on Trial*, a report which explored the institutional and regulatory challenges to public participation constituted by the spread of new technologies.[3] The question of whether or not these different bodies of literature can be successfully combined will be returned to shortly.

Irwin's discussion of the nature of citizen science is built on three conceptual foundations:

- *The recognition of the double edged nature of public experiences of science and technology.* Irwin suggests that the public perceives science and technology as a frightening and 'immutable power' beyond their control but also, as a source of mastery and problem solving. Following from this, public scepticism towards images of scientific progress should not be interpreted as an example of the public being scientifically and technically illiterate or 'anti-science', as is often done by scientific commentators, nor should scepticism about science lead to hazy romanticism about the living conditions in less scientifically technologically orientated times. According to Irwin the double edged nature of scientific and technological progress requires 'science' to develop a greater degree of self reflection in relation to its linkages to progress and that scientific institutions need to explore different patterns of knowledge generation and dissemination.
- *The critical analysis of what is meant by 'technological culture' and 'citizen culture'.* Irwin suggests that we should follow Raymond Williams in acknowledging the 'authentic diversity and complexity of any people' and that we should avoid addressing participation and the public understanding of science from the vantage point and pre-definitions of science held by experts. Instead we should 'consider science from the citizens side rather than from that of the scientific establishment' (p. 5). In particular, if citizens are to achieve an effective voice in scientific and technical decision making the issues of 'knowledge, trust, and identity' need to be addressed.
- *The avoidance of a 'global discourse' of science in the emergent debate on ecologically sustainable development.* Irwin suggests that such a discourse prevents the expression of more localised understandings and expertises and risks focusing on the state at the expense of the broader public (p. 7). According to Irwin, facilitating forms of social learning between science technology and the broader public will encourage equity and participation to become more socially sustainable and that this will assist strategies addressing longer standing environmental challenges to also become more sustainable.

Democracy and the Public Understanding of Science

Of the themes noted above the role of the public understanding of science is given the greatest emphasis. Irwin considers a number of case studies of the public perception of risk, these include *2,4,5-T*, *BSE* ('*Mad Cow Disease*'), and the '*Information Provisions of the Control of Major Hazards Regulations (1984)*'. He challenges the traditional science centred approaches which have often been used to explain these cases. Such approaches have traditionally refracted analysis through a model of:

> ... *public ignorance*, that science improves the *decision making process*, that science is a *force for human improvement*, that it is *value free*, that citizens are impoverished by their

> *exclusion*, and that greater *scientific understanding* amongst the public will lead to *greater acceptance and support* for science and technology. (p. 26 italics in original)

Contrary to such 'public deficit' models of the public understanding of science, Irwin argues that local lay knowledges can in many contexts offer a richness and diversity not possessed by traditional scientific perspectives. He also suggests that in many cases such perspectives also share a sensitivity to the institutional and social context in which science is constructed and that such sensitivities conform with views of the nature of science promoted by the sociology of scientific knowledge (SSK).

In the case of *2,4,5–T* Irwin juxtaposes the understanding of the health risks of the official body the Advisory Committee on Pesticides (ACP) to the understanding of health risks of farm-workers' organisations. The ACP attempted to legitimate its position by appeals to the independence of its information base and its reliance on established medical and scientific knowledge. According to the ACP, miscarriages and birth defects were 'natural' occurrences and could not be scientifically linked to *2,4,5–T*. Such a connection was made by farmers because they had fallen into the 'psychological trap' of searching for a source to blame. *2,4,5–T* became the obvious culprit because of repeated, 'but ill informed' negative publicity attached to pesticides. The farmer lobby groups formed alternative views of potential risks. In particular they critiqued the 'totally unrealistic image held by the ACP of the real world conditions in which pesticides were used. The farmers described a totally different social model of farming which took into account factors such as spraying in thick undergrowth or from the top of a ladder, long distances from toilets and cleaning facilities and exposures to third parties. Calls for banning *2,4,5–T* were linked to farmers experiences of ill health and were:

> ... constructed in terms of an inherently uncontrollable technology and of a messy and heterogeneous 'real world'. The advisory committee's insistence on 'recommended conditions made little sense within this social and technical model of pesticide administration. Instead, the workers' understanding of pesticide usage was swept aside by the apparent requirement for scientifically established 'proof' (p. 113)

Science and Technology on Trial

Near the end of his book Irwin draws from the seminal 1979 OECD report *Technology on Trial*. This report outlined a number of social experiments that have been undertaken to attempt to enhance public participation in science. Such experiments have included: study circle mechanisms; public information campaigns; science education programmes; initiatives for improved coverage of science and technology in the media: public inquiries (and other mechanisms for informing policy makers); innovative legal processes; and forms of collaborative decision making. Whilst many of these experiments have enhanced public participation in science and technology they have frequently failed to achieve consensus. Because of the ubiquity of 'top-down' consensus models, failure to achieve consensus has inappropriately been mistaken as evidence of their more general failure.

Moving beyond his discussion of *Technology on Trial* Irwin provides support for more recent initiatives such as Constructive Technology Assessment (CTA). He notes that CTA offers the advantage over traditional attempts to assess technology by trying to positively shape technologies as early as possible in the process of development, before they become increasingly inflexible (p. 155). Irwin also provides a brief case study of Science Shops. Whilst he acknowledges that Science Shop experiments have sometimes experienced difficulties he is generally very positive about their potential:

> Science shops are in a position to provide technical advice but also to serve as an important actor within a 'self-help network'—putting groups in touch with others with similar experiences and problems, drawing science students and researchers into an awareness of social problems, influencing research agenda through the suggestion of important questions for investigation, assisting groups to develop and enhance their own expertise, enabling various groups to 'put science into perspective' (i.e. getting away from the notion of science as the universal problem-solver). (pp. 157–158)

In his conclusion Irwin outlines in very general terms the 'new social and knowledge relations' which are needed for a Citizen Science. He describes five interlocking features of such relations:

- a willingness to engage with non-scientifically generated understandings and expertise;
- utilisation of a plurality of knowledge forms rather than trying to impose any kind of unitary consensus;
- engagement in problem situations which do not attempt to filter out citizen concerns as non science from science;
- reflexivity about scientific uncertainties but also awareness of the 'constructive possibilities for science within everyday life'; and
- institutional flexibility, support from powerful institutions is needed but such institutions must be willing to be responsive to considering their own practices. (p. 167)

Romanticising Lay Knowledges?

From this overview it might be expected that *Citizen Science* would contain detailed discussion of theories of democracy and environmental and science and technology policy. This is not, however the case. Whilst these topics are constantly in the background, the central messages of the book are the importance of social constructivist approaches to the public understanding of science and a sketch of how such approaches might have relevance for policy debates. A reader interested in the public understanding of science and an outline of its policy relevance will find the book particularly valuable, forming a good companion to Irwin and Wynne's edited collection of case studies *Misunderstanding Science*.[4]

In attempting to satisfy his aims Irwin engages in a number of conceptual balancing acts. His main challenge involves attempting to maintain balance in his analysis of lay versus expert knowledges. To be consistent with his SSK aspirations, the social construction of both lay and scientific knowledges should be emphasised. In a number of places Irwin denies that he is trying to romanticise lay knowledge. Despite this, there is still a strong tendency throughout *Citizen Science* for expert knowledges to be deconstructed to emphasise their 'incompleteness' and their inability to fulfil their rhetorical claims and for lay knowledges to evade such critical scrutiny and be interpreted as somehow more vital, socially accountable, and authentic.

One of the by-products of this (inadvertent) romanticisation of lay knowledges is that there is a tendency for a dichotomy between lay and expert knowledge to re-enter Irwin's analysis: a dichotomy that Irwin suggests we should avoid. This ambiguity/inconsistency can in part be explained by Irwin's attempt to link more micro-sociological styled analysis typical of SSK with the more macro-sociological theorising of writers such as Beck. In the later approaches expertise is most often interpreted as an extension of technocratic or bureaucratic rationality and as something intrinsically at loggerheads with lay knowledges. Many SSK approaches provide a less homogeneous image of the

relationship of lay knowledges and expertise.[5] Rather than take bureaucratic and scientistic ideologies and boundary working rhetoric[6] on their face value there has been investigation of the more complex relations between such ideologies and the actual decision making practices of individuals, institutions and differentiated publics 'in situ'. The consistency of Irwin's arguments would have benefited from a deeper analysis of the continuities and layering of expert and public knowledges, and acknowledgment of the numerous functions fulfilled by scientistic rhetoric, and images of the public understanding of science, for not only scientists and technocrats but also the public.[7]

Irwin also risks oversimplification when he implies that the incorporation of lay and expert understandings will result in a more 'complete' socially sustainable science, this overlooks the way in many existing intransigent scientific controversies opposing sides have already developed competing positions built on combinations of lay and expert understandings of the issues at hand.[8] The dichotomy of expert versus public understandings also underplays the development of specifically 'attentive' segments of the public[9] and the role of 'hybrid' lay/experts, who generate and utilise contextually richer tacit knowledge as part of the extension and application of scientific/technical knowledge systems.[10]

Despite these ambiguities and oversimplifications, Irwin's work still constitutes an important contribution to the debates on science technology and democracy. His text is highly readable and clearly organised, and his call for policy discussions on science technology and democracy to avoid being prefigured by unexplicated considerations of 'top down' models of the appropriate scientific understanding is important and provocative. Such approaches to the public understanding of science have stimulated debate along one of the 'fronts' of the so called 'Science Wars'[11] and encouraged other research attempting to re-orientate policy in matters as diverse as the role of lay juries evaluating complex matters of science and technology in legal contexts[12] to evaluating public attitudes to biotechnology.[13]

Richard Sclove's *Technology and Democracy*: Two Parables of Modernity

Sclove[14] provides a roving survey drawing from countless examples and a wide variety of literature. He begins his exploration of democracy and technology by introducing 'two parable's' of modernity (p. 3). The first involves the introduction of fresh water into the houses of the small Spanish village of Ibieca. This seemingly innocuous technological change had far reaching repercussions for the Ibecian community. The public fountain and wash basin had previously been an important site of social interaction. The advantages of running water nevertheless had the unanticipated cost of decreasing opportunities for such interaction. Sclove suggests the introduction of many new technologies have followed such a pattern. Whilst decision makers sometimes consider questions involving economic costs and benefits, their distribution, and environmental health and risks, they have normally failed to ask the deeper structural questions involving effects to the day to clay texture of life and culture.

Sclove's main critique of the shortcomings of current approaches to technological decision making have some similarities to Irwin's. Sclove identifies six main problem areas:

- Lay citizen's are excluded from all but a trivial role.
- Questions are normally raised too late along a path of decision making after many broader structural decisions have already been made.
- There is a tendency to evaluate technologies on a case by case basis.

- New or 'cutting edge' technologies are focused on to the virtual exclusion of emerging and existing technologies.
- There is a tendency to explore the ostensibly intended purposes of such cutting edge technologies at the expense of exploring broader deeper unintended social consequences.
- There is a failure to explicitly address the question of the technologies structural effect on democracy. (p. 240)

To understand our failure to address the deeper questions surrounding democracy and technology Sclove evokes the image of our unconscious collective actions governing waking reality. He takes for granted that current society is inept at guiding technological change.

As an alternative to Ibieca, Sclove refers to his second parable of modernity, the Amish. Sclove believes the Amish provide us with a insight into a better form of the political assessment of technologies. He describes the essence of the Amish approach in the following terms,

> ... each local Amish Community—acting collectively rather than as a set of discrete individuals—asks itself how the adoption of a technology would effect the community as a whole. Innovations that would tend on balance, to preserve the community, its religion, and its harmonious relation with nature are permitted: those that appear to threaten the community and its values are rejected. In either case, the decision is reached through a process of public discussion and democratic ratification. (p. 6)

Comparing the parables, Sclove suggests that the challenge to democracy constituted by modern technologies (rather than their complexity) follows from our absence (unlike the Amish) 'to evolve institutions which we could begin to act upon appropriate questions' (p. 7). Sclove suggests that a much more holistic approach is required, one that is fully cognisant of the way that technologies help constitute the present social order.

Two important factors contribute to the failure to ask the right questions about technology and democracy. The first of these, is that technologies are (to use Sclove's term) Polypotent, which means that they have effects beyond their ostensibly intended or Focal effects. The second factor is that technologies are best interpreted as a species of social structure. Technology like laws, are able to be shaped but get more difficult to shape over time, importantly though, where people expect laws to shape society this aspect of technology as a social structure is regularly overlooked.

These factors are integrated into Sclove's call for technology compatible with 'strong democracy'. Strong democracy for Sclove entails direct citizen representation ahead of representative structures, drawing from Kant's 'categorical imperative'[15] (pp. 34–35) it entails a 'substantive standard' or moral obligation on all citizens:

> ... in their political involvements citizen's ought whatever else they do, to grant precedence to respecting any important concerns or interests common to everyone. Above all, they should perpetuate their society's basic character as a strong democracy. (p. 26)

Sclove goes on to outline his prescriptive theory of democracy and technology in the following terms:

> *If citizens ought to be empowered to participate in determining their societies basic structure, and technologies are an important species of social structure, it follows that technological design and practice should be democratised.* Strong democracy's complementary procedural and substantive components entail furthermore, that technological democratisation

> incorporate two corresponding elements. Procedurally, people from all walks of life require expanded opportunities to shape their evolving technological order. And substantively, the resulting technologies should be compatible with citizens' common interests and affinities—to whatever extent such exist—and particularly with their fundamental interest in strong democracy itself. (italics in original. pp. 26–27)

Contested Democratic Design Criteria

Sclove also suggests that to move beyond technology and strong democracy as more abstractions, specific guidelines for technological design, 'democratic design criteria', must be derived and applied. Sclove also notes that such criteria must be seen as contestable 'because the process of generating and refining design criteria cannot be finalised' (p. 32).

The main features of Sclove's 'contestable design criteria' for democratic technologies are listed under nine categories, the first four are the most abstract and the most important. Sclove lists them as follows:

> Seek a balance among communitarian/cooperative, individualized, and transcommunity technologies. Avoid technologies that establish authoritarian social relations ...
>
> Seek a diverse array of flexible schedulable, self actualizing technological practices. Avoid meaningless, debilitating, or otherwise autonomy impairing technological practice ...
>
> Avoid technologies that promote ideologically distorted or impoverished beliefs ...
>
> Seek technologies that can enable disadvantaged individuals and groups to participate fully in social, economic, and political life. Avoid technologies that support illegitimately hierarchical power relations between groups, organisations, or polities. (p. 98)

The other five points involve: limiting negative side effects of technologies to local political jurisdictions; the promotion of local self reliance; compatibility with global awareness: ecological sustainability; local technological flexibility; and global technological pluralism (p. 98).

Whilst Sclove goes on in later sections of the text to provide examples of how these criteria might work in practice, much of the terminology used to define them rely on romanticising past technological/social orders and lay knowledges and is frequently rather vague.

For instance in his third criteria we are exhorted to 'avoid technologies that promote ideologically distorted or impoverished beliefs'. Sclove explains here that he is referring to the tendency towards reductionism in current human perception as opposed to the potential for more holistically based perception based on the forms of life surrounding traditional technologies (pp. 96–98).

In his other criteria Sclove frequently alludes to finding 'happy mediums' such as, the balance between 'communitarian/cooperative, individualised and transcommunity technologies', the balance between illegitimate vs. legitimate hierarchical power relations and the balance between global vs. local. Sclove's use of such vague terminology may well capture the 'shades of grey' that are important to emphasise if one is to move beyond technological determinism but still see technology as socially determinative. Nevertheless this sense of openendedness throws a serious question mark over the value of the whole process of trying to obtain such a thing as a set of contestable design criteria for

technologies in the first place. To recognise that technology is akin to a social structure. such as the law, does not necessarily imply that it would be possible to generate, even at an abstract level, all the criteria that would make laws or other social structures democratic. Part of the problem then, for Sclove, is that in places he proceeds with a model, not of technology as a species of social structure, but of technology as the key fundamental underlying or in a sense 'meta-social' structure. The task he sets himself of exhaustively analysing the implications for democracy of technology, once technology is so broadly defined, begins to resemble something of an analytical version of 'the law of diminishing returns'. The more all encompassing the definition of technology the more general and qualified analysis of the implications for democracy become.[16]

Schemes for Enhancing Technology and Democracy

Sclove also devotes considerable attention to discussing various experiments and proposals for enhancing technology and democracy. At this more 'nuts and bolts level' he provides a huge number of examples. With some cross referencing back to his design criteria he comments favourably on schemes such as:

- *Cohousing experiments*—such as Trudesland in Copenhagen where housing and the layout of public space are designed to encourage community interaction including shared ownership and use of resources as diverse as tools workshops cars and kitchens (pp. 72–73);
- *Workers Co-operatives*—such as Boimondau in France which featured the rotation of workers in the organisations 'representative hierarchy' according to periodic elections (pp. 70–71);
- *Citizen sabbaticals*—encouraging people to take leave from their local community and normal work at regular intervals (pp. 43–44);
- *Science Shops*—and other supportive institutions for grass roots orientation of scientific and technical research (pp. 225–229);
- *Social and Political Impact Statements (SPIS)*—emphasising integrative and comprehensive assessment of the broadest possible social implications of new technologies (pp. 219–221); and
- *Social trials*—observing technologies on a trial basis in selected communities (pp. 56–55).

Citizen Science vs *Technology and Democracy*? (STS versus ST and S?)

Sclove's aims have to be set against what he has recently highlighted as a growing division between *science and technology studies* and *studies of science, technology and society*.[17] He cautions against the tendency for the former to be depoliticised, pre-occupied with intellectual critique ahead of the development of any kind of more thoroughgoing political program. For support, he cites the example of the lack of attention in journals such as the *Social Studies of Science* given to Scandinavian and Dutch experiments with democratizing science and technologies through the development of Science Shops. It is perhaps a little ironic that Irwin's work which would probably fit into Sclove's category of *Science and Technology Studies* does in fact devote attention to the Science Shop concept and that the more activist orientated Sclove has probably provided a text less accessible to the lay reader than Irwin. In particular, the middle and later sections of *Technology and Democracy*, whilst fascinating, rely on a number of neologisms and convoluted, though sophisticated chains of argument.

Political rhetoric aside, the more substantive differences between Irwin and Sclove lie in the fact that whilst Sclove is interested in the public understanding of science and technology these issues are merely smaller preoccupations subordinated to the broader challenges of re-orientating attitudes and social structures involving technological decision making. *Technology and Democracy* provides a synthesis of a number of approaches which operate beyond technologically determinist and technocratically orientated approaches to the questions surrounding technology, but also explore the structural, socially determinative, potential of technology. Much of Sclove's analysis echoes with the resonances of writers such as Schumacher, Illich, Mumford, Dickson and Winner. Sclove, like Irwin, attempts to cover a huge range of literature and even more than Irwin draws on a huge number of examples to illustrate his central philosophical theses. For those who fatigue at following through the interlinked chains of Sclove's arguments, the countless examples are still a valuable resource.

Sclove writes with passion but perhaps as a reflection of the philosophical orientation of his work tends to proceed by composing large lists of enumerated points. Whilst he 'cross references' these, and painstakingly outlines the logic of his case, his style tends to become rather unwieldy and repetitive. This doesn't detract from the text being a 'tour de force', as a sensitive synthesis of a huge amount of literature on the 'politics of technology', but does limit the works accessibility and value as a textbook, and dilutes the impact of its central propositions.

The other central differences between Sclove and Irwin follow from the former's focus on technology ahead of science. Sclove often draws from different literature and emphasises different themes in relation to questions of the epistemological status of science and technology. Whilst Sclove in numerous places notes the social construction of technologies he tends to avoid the stronger more overtly epistemological relativist views of science and technology that preoccupy Irwin. Irwin is interested in 'peeling back the sources of legitimation that might prohibit public involvement in the creation of 'bottom up' scientific knowledge and tends to leave the question open as to the actual content and substance of a more democratic science and technology. Sclove works more prescriptively, his image of democracy dictates a particular form of participation in science and technology (strong democracy), and whilst there is room for some flexibility in how such criteria are satisfied, his 'contestable design criteria', aim to provide a check list according to which the democratic potential of technologies can be evaluated.

Despite these differences there is an important area of convergence in the approaches of Sclove and Irwin. This convergence can be observed in the challenges both face when they attempt to extend their theoretical frameworks beyond customary boundaries. For instance. Irwin sets out much of his analysis within the micro-sociological framework of the sociology of scientific knowledge (SSK) and then experiences challenges linking this with broader macro-sociological themes such as technocracy and the 'risk society'. Sclove in a sense approaches the question the other way around, he commences with macro-sociological theorising on technologies, especially those studies emphasising the risks to democracy of technocratic ideologies, and then grapples with the challenges of articulating the more micro-sociological philosophical details concerning the ways such 'technocratic ideologies' may be overcome. Whilst neither approach grapples with these problems with complete success, this area of convergence reflects the important similarities in Sclove and Irwin's aims, and represents an important area where more theoretical attention in STS should be devoted.

Both Irwin and Sclove also share a tendency to oversimplify and reify expertise and lay knowledges, consistently casting the former in a negative and the latter in a positive light. In both texts the subtleties involved in the politics of disagreement between experts.

allegiance between experts and public groups, the social construction of lay knowledges, the politics of experts as representatives of interest groups and questions involving the accountability of experts should have been devoted more attention.[18]

In all, both texts, because of their comprehensive scope and desire to engage with the complex task of linking sophisticated theories of science technology and society to policy, constitute valuable contributions to recharging debate in STS on the democratization of science and technology. Also, whilst both texts draw from different secondary literature and provide differing emphasises, the fact that both texts are preoccupied with similar questions and share many similar assumptions about ways science and technology should be analysed, suggest that Sclove's contention that there is an intrinsic divergence of aims between Science and Technology Studies (STS) and Science Technology and Society (ST and S) may ultimately reflect more on questions of intellectual and political style, than substance.

Notes and References

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13. A. Davison, I. Barnes and R. Schibeci, 'Problematic publics: a critical review of surveys of public attitudes to biotechnology', *Science Technology and Human Values*, 22, 3, 1997, pp. 317–348.

14. Richard Sclove is the founder of FASTnet (the Federation of Activists on Science and Technology Network) and executive director of the Loka Institute an organisation set up to promote the democratic politics of technology, e-mail loka@amherst.edu
15. Kant's 'Categorical Imperative' was expressed in the following terms: 'Act so that you treat humanity, whether in your own person or that of another, always as an end and never as a means only', cited in Richard Sclove, *Technology and Democracy*, The Guilford Press, New York, 1995, p. 34.
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