CHAPTER 9

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INSERTING THE PUBLIC INTO SCIENCE

Over the past decade, attention has been increasingly focused on the problems of public participation in technical decision-making. The reasons for this attention are many: technical decision-making has become a locus of controversy in our political institutions; public dissatisfaction with these decisions seems only to rise; at the same time, experts continue to hold public opinions about these decisions in low regard. In the U.S., the Congress has attempted a legislative response to some of these issues, passing the Data Quality Act in 2001. In this act, the Office of Management and Budget is asked to ensure the integrity and objectivity of the science to be used in policy-making. It is doubtful that this effort will end the 'sound science'/'junk science' debates that have pervaded science-based policy-making. That the assurances of the Data Quality Act will quell public contention of policy-making appears even more doubtful. Yet scientists see little reason to think that increasing the involvement of the public in the development and evaluation of the science to be used in policy-making would improve the process and ease the debates. However, in this paper I will argue that, under some circumstances, it can do precisely that.

I am certainly not the first to offer the possibility of public involvement as a potential solution to debates around science in policy-making. Calls for increasing the quality and quantity of such involvement extend back at least 20 years. In the past decade, there has been an increase in the number of empirical studies of such processes, with attempts to determine what has been successful and what has not. Yet the literature seems to be plagued with two problems: 1) What evaluation structure should be used for these empirical studies is an open debate; and 2) Many authors still complain of the lack of empirical work in general. In this paper, I address both of these problems. First, I propose a basis for evaluating public participation in these processes, one that is grounded in a philosophical understanding of scientific knowledge and that aims to transcend the debates over which democratic ideal we should pursue. Second, I collect (and evaluate) empirical studies of public participation in technical decision-making from the past decade.

Why propose yet another normative measure with which to evaluate public participation processes? Several yardsticks for evaluating public participation have been proposed over the past decade. They include evaluating whether public participation has made a final decision more acceptable in practice (instrumental considerations), examining the substance of decisions to see whether more information is incorpo-

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rated into the decision-making (substantive issues), and considering whether citizen involvement has improved the democratic legitimacy of a decision (normative issues) (Fiorino 1990; Laird 1993). In practice, these yardsticks often translate into functional considerations such as: evaluating the process by which the public is involved for attributes of fairness, determining whether the public has any actual impact on the decision, and whether the public (and sometimes the experts) learn anything in the process (Rowe and Frewer 2000; Renn et al. 1994). The normative rationales for these various yardsticks generally center on ideals of democracy. However, there are competing ideals in the literature as to what democracy should entail (Laird 1993; Fischer 1993). For example, depending on whether one ascribes to a 'direct' democracy ideal or a 'liberal' democracy ideal, very different standards for adequate public participation arise. In addition, neither ideal provides a clear rationale for why the public should be involved not just with the policy decisions, but also with the performance and evaluation of scientific studies on which the policy is to be based. Yet so often, policy disputes center on whether or not public actors accept or reject the scientific basis for policy-making.

Working from a philosophy of science perspective, I articulate a rationale for public participation in the development and interpretation of science to be used in policy-making. Because ethical values are needed in the practices of science throughout the research process, some accountability for those values is also needed. Regardless of which democratic ideal one holds, the values used to do scientific analyses that then inform public policy should reflect public values. Different processes can then be evaluated by the extent to which they allow citizens to inform the values used in doing the relevant technical analyses, and I examine several prominent and promising mechanisms for achieving a productive interaction between experts and the public.[1] In essence I ask: Has citizen involvement helped to bring citizen values into the heart of technical judgment? The extent to which this can be achieved undergirds the instrumental, substantive, and normative yardsticks mentioned above.

THE PHILOSOPHICAL PERSPECTIVE: VALUES IN SCIENCE AND POLICY-MAKING

The role of values in science has been a source of steady controversy in the philosophy of science over the past fifty years. The standard position has settled into the following: while values invariably creep into science (because scientists are human), scientists should make every effort to limit values to the external aspects of science (choice of research problems, application of science and technology). The exception to this normative rule is that epistemic values (i.e., concern with empirical accuracy, scope, simplicity, fruitfulness, internal consistency, and explanatory power) are acceptable throughout science. (Kuhn (1977) provides a classic account of epistemic values; Lacey (1999) attempts a defense of the standard position.) This norm prevails in realms beyond the esoteric halls of philosophy of science. It is this norm that underpins the widely held view of science as a value-free affair, that supports particular pedagogical approaches to teaching science (the 'answers in the back' approach), and that in part undergirds efforts to clearly define a realm for science distinct from the realm of policy-making, where values are recognized as necessarily pervasive. Under this view, the belief is that if only we can more carefully construct the border between science and policy, we can reaffirm the value-free nature of science. (Rosenstock and Lee (2002) provide a similar argument; Douglas (2004b) argues against having a value-based border between science and policy.)

As I have argued elsewhere, however, the norm of value-free science is a bad norm (Douglas 2000). Scientists must make a series of choices throughout the scientific process. Once they have framed a problem, they must decide upon a methodology to address it. When collecting data, they must decide how to record unexpected or borderline results. They also must decide when to reject data as unreliable because of some uncontrolled factor in the experimental process. They must then decide how to interpret their data. Only then can the results be used in a policy-making process or applied in some context. While scientists may hope for little need of judgment in their choices, disagreements among scientists concerning the appropriate methodologies, the quality of data, and the correct interpretations of data belie the need for such judgments. Clearly there are differences of expert opinion on how to best perform studies, particularly in developing areas of research or on the 'cutting edge.' Where such differences exist, judgment is needed. Because much of the science needed to make policy falls into these developing areas of science rife with contention among scientists, such science is also rife with the need for scientists' judgments.

How should scientists make these judgments? As noted above, the standard answer in philosophy of science is that scientists should consider only 'epistemic' values.[2] However, this answer is based on the assumption of scientific isolationism, i.e., that scientists operate in an enclave that is largely separate from society at large, taking in resources from society and, when scientific consensus is achieved, revealing answers to society. The actual practice of scientists in advisory roles in the past fifty years and the importance of tentative results in shaping public debate are in direct contradiction with this view. If we reject scientific isolationism for the fiction it is, there is no reason to restrict the basis for scientific judgment to 'epistemic' values only. Indeed there is good reason to require the consideration of ethical values throughout the scientific process. Although it may go against the current norms of scientific practice, I have argued (Douglas 2000) that if we are to hold scientists to the same moral norms as the rest of us, scientists must consider ethical consequences of error in their work. And I have also argued that we should hold scientists to the same moral norms as the rest of us (Douglas 2002). Thus, in policy contexts with uncertain science, scientists must use ethical values in their work.

To see this necessity, consider a situation in which there are extra-scientific consequences of error. If a scientist makes a judgment and gets it wrong, who (outside of the scientific community) gets hurt? And if he makes a different judgment and gets it wrong, who else is harmed? The values one places on the costs of error beyond science are ethical values. Because we all share the moral responsibility to consider potential consequences of error in our daily lives (Douglas 2002), scientists need to use ethical values to determine which errors in their work they should be more careful to avoid (e.g., false positives or false negatives). Only if one thinks there are no consequences of error in science beyond the enclave of science can one suggest that scientists need not weigh those consequences in making choices. Because that position is clearly false (particularly in science used for policy-making), we are forced to the view that scientists *must* use ethical values in the process of making judgments while doing science. If scientific methodologies improve and predictive accuracy increases (a boon to policy-makers hoping for effective actions), scientists may need to worry less about potential consequences of error as the chance of error decreases.[3] But because some uncertainty is ineliminable, there is no complete removal of this need. When there are choices to be made in science and there are ethical consequences of error, there must be ethical values.

Whose values should they be? This question raises the specter of democratic concerns. Regardless of which theoretical ideal of democracy one might hold, it is not acceptable for a minority elite to impose their values on the general populace. If scientists can make these judgments in private, not disclosing them in their published work, and thus shape public policy through these judgments with no possible avenue for public accountability, any standard of democracy will have been violated. Thus minimally, scientists need to be more explicit in their work concerning where judgments are made and how they made them, including a discussion of values used. While many might think such behavior would threaten 'scientific objectivity,' I have argued elsewhere that this need not be the case (Douglas 2004a). Clear discussion of legitimate value judgments, e.g., those that are needed to weigh the consequences of error among multiple sound methodologies, need have no harmful repercussions for objectivity *per se*. The problem for values and objectivity arises, rather, when values take the place of evidence, or when values lead one to simply ignore evidence that runs contrary to a desired outcome. Proper and necessary consideration of ethical values in places of needed scientific judgment pose no threat to objectivity as such.

While disclosing the judgments made in science and the values used to make those judgments is a good first step, that does not resolve the problem of whose values should guide judgments made in science and in science-based policy-making. An ideal situation would be to have a public debate over contested values, resolve the debate, and then ensure that scientists employ those values when making their judgments in practice. However, many of the value disputes have only recently surfaced and are just becoming defined, much less resolved. For example, debate continues to rage over what our obligations are to future generations as opposed to current ones in less-developed areas, whether we have rights to be free of health risks or whether some risks can be imposed on all for the greater good, whether gaining some degree of economic benefit is worth losing some degree of health for humans or ecosystems, and further which is worse for human health: reduced wealth or increased chemical exposure. While we may hold out hope that some good public debates guided by sound ethical argumentation will help resolve these disputes, or at least narrow the range of plausible positions, we should not wait for this outcome. In the meantime, we can develop better processes, ones that allow citizens to help direct the science used to make policy and to help interpret that science for policy, and ones that allow scientists to better understand the value concerns of citizens. Developing these processes may in the end also promote the needed ethical debates.

The need for improved processes has been widely recognized. Grass-roots calls for more public involvement and greater public control of technical decision-making are prolific (for example, O'Connor 1993). Political theorists (as noted above) have provided a range of reasons for increased involvement. Most surprising, however, are calls for improved processes from bastions of science. A prominent example can be found in the 1996 U.S. National Research Council's (NRC) *Understanding Risk* (also known as the 'orangebook'), which redefined the risk analysis process through its discussion of risk characterization. This example is surprising in part because an earlier NRC report, *Risk Assessment in the Federal Government*, the canonical 1983 'redbook,' argues for a strict separation (as much as possible) between the expert work of risk assessment and the citizenry involvement with risk management. In the redbook, the NRC attempted to conceptually distinguish and to practically differentiate the risk assessment process (which was to be as scientific and value-free as possible) from the policy-laden and value-laden risk management process. The point of risk characterization in the redbook was simply one of summarizing the scientific results of risk assessment into a useable form for risk management (NRC 1983: 20; Stern and Fineberg 1996: 14).

When the 1996 NRC panel was asked to provide a closer examination of risk characterization, the authors redefined risk characterization from a brief transition between risk assessment and risk management to a process that should "determine the scope and nature of risk analysis" (Stern and Fineberg 1996: 2). Risk characterization became the framework for the entire risk study and decision-making process. The NRC panel then defined risk characterization as an 'analytic-deliberative process,' with potential roles for both citizens and scientific experts. Analysis is defined as the use of "rigorous, replicable methods, evaluated under the agreed protocols of an expert community." Deliberation is defined as "any formal or informal process for communication and collective consideration of issues" (Stern and Fineberg 1996: 4). While these processes are defined as distinct, they are conceived by the NRC as being in a continual state of interaction throughout the assessment and regulatory process. Both are always needed: "deliberation frames analysis, and analysis informs deliberation" (Stern and Fineberg 1996: 30). Rather than ghettoizing the public to the end stage of decision-making, the NRC now appeared to provide support for the public's involvement throughout the process. What this looks like in practice can now be explored.

PUBLIC PARTICIPATION IN SCIENCE AND POLICY-MAKING

As noted above, there have been increasing numbers of empirical studies focused on public participation in the past decade, with an accompanying proliferation of potential techniques for evaluating the success of these various mechanisms. Given the theoretical considerations I mention above, I propose another possible evaluation measure: the extent to which a process maximizes the interaction between citizens and experts, and maximizes the influence they have on each other. If deliberation is truly needed to inform analysis, and analysis to inform deliberation, experts and citizens need to be working in close contact to address our most difficult science-based policy questions.

To understand what this would mean in practice, consider the standard model in which experts and the public rarely interact. On the one hand, we have those processes in which citizens have a great deal of interaction amongst themselves, with strong deliberative processes, but little interaction with or impact on experts. Experts may be brought in as a source of information, but are not expected to take away from that experience anything important for their own work. Examples of this may include (depending on the details of the process) citizen consensus conferences or citizen panels where the expert analytical work is already complete. In these processes, there is a good range of public views and values being discussed, but little influence on experts. On the other hand, we have those processes composed primarily of expert work, complex analyses performed without public input, that are then placed before the public for formal approval and use. Citizens perform little deliberation and the process is dominated by analysis and deliberation among experts only. There is little assurance that an appropriate set of values has informed the expert work. Examples here may include expert panels accompanied by public hearings or referenda. With both these types of processes, the analyses (and/or expert deliberation) are performed separately from the public.

What is needed, given the theoretical concerns articulated above, is to integrate these types of processes, to maximize citizen-expert interaction. If citizens were more fully involved with expert deliberations, the public could be assured that the values used to shape the technical analyses would be appropriate ones. For example, citizen panels could assist with the direction of scientific studies conducted to inform policy-making. The analytic and deliberative elements would be interconnected.

Getting the public involved directly in the study of technical issues by having them assist in guiding research has been called participatory research or collaborative analysis (or some similar combination). The theoretical advantage of such ‘analytic-deliberative’ processes has been described above. There are also practical advantages. When citizens provide input at the stage of regulatory decision-making, it is unclear whether such participation can move beyond what Boiko et al. calls the ‘tokenism’ level of citizen participation to the level of ‘citizen power’ (Boiko et al. 1996: 247). Beholden to legislatures, regulatory authorities cannot really share decision-making power with citizen *or* expert groups. However, that is true only for the final regulatory decisions made. Where citizens can have direct power (and where experts already have direct power) is in the technical studies and analyses that are performed to inform and support a regulatory decision. Citizen input here can have binding authority, if the study designers and officials allow this to take place.

Here I give a brief survey of three examples from the past decade in which citizens have been given the opportunity to direct technical analyses to be used in regulatory decision-making. As we will see, there seem to be three distinct ways in which citizen input to technical assessments and analyses can be valuable: 1) Citizens can help to better frame the problem to be addressed. (Are the appropriate range of issues and potential solutions being considered? Is the scope of the analysis appropriate?) 2) Citizens can help provide key knowledge of local conditions and practices relevant to the analyses. 3) Citizens can provide insight into the values that should shape the analyses. (How do citizens weigh the potential consequences of error? What kinds of uncertainties are acceptable or unacceptable? What assumptions should be used to structure the analyses?) This last point of input is both crucial and often overlooked. Because values are needed to shape analyses, whose values is important. Traditionally, the values have been both hidden and those of the experts making the judgments. Many experts think that citizens are unable to understand the technical complexities of analyses, much less provide guidance at points of expert judgment. Yet the examples below suggest ways in which citizens can do precisely that, with the result that experts think the analyses are strengthened *and* the citizenry trusts the study's results.[4]

ANALYTIC-DELIBERATIVE PROCESSES: COLLABORATIVE ANALYSIS IN PRACTICE

In this section, I will discuss three examples in which a collaborative analysis approach has been attempted. Not all of them were equally successful. The first is focused at the local level, with very successful results. The second is focused at a national level, with also successful results. Finally, I discuss a local attempt with less successful results, but which illustrates the need for care in the construction of the processes of collaborative analyses.

Valdez, Alaska and the Marine Oil Trade

In his detailed study of disputes concerning the marine oil trade in Valdez, Alaska, Busenberg compares a period in the early 1990s characterized by 'adversarial analysis' (i.e., competing experts utilized in disputes marked by a lack of trust and that are generally unsolvable) with a later period characterized by 'collaborative analysis' (Busenberg 1999). Drawing from Ozawa (1991) for his account of these two forms of interaction over policy disputes, Busenberg's account of collaborative analysis in Valdez is both intriguing and promising. The two opposing groups, a community group called the Regional Citizen's Advisory Council or RCAC (formed in 1989 after the Exxon Valdez oil spill) and the oil industry, had a history of distrustful and confrontational relations. By 1995 they both seemed to realize the impasse to which this generally led, and resolved to find a way around these difficulties. The dispute at that time centered around what kinds of tug vessels should be deployed in the Prince Williams Sound to help prevent oil spills. Instead of doing competing risk assessments to influence the policy decision, the RCAC, the oil industry, and the relevant government agencies decided to jointly sponsor and guide the needed risk assessment (Busenberg 1999: 6).

The risk assessment proceeded with a research team drawn from both industry and RCAC experts. The project was funded by the oil industry, RCAC, and the government agencies. The steering committee had representatives from all of these groups, and met regularly (fifteen times) to direct the study. Not surprisingly, members of the steering committee learned much about the intricacies of maritime risk assessment. More surprisingly, the research team found the guidance of the steering committee to be very helpful. As one quoted in Busenberg (1999) noted, the process "increased our understanding of the problem domain, and enabled us to get lots of data we didn't think was available ... the assumptions were brought out in painful detail and explained" (Busenberg 1999: 7f.). The additional data was needed when the committee decided that "existing maritime records were an insufficient source of data for the risk assessment models" (Busenberg 1999: 8). The steering committee then assisted the researchers in gaining more detailed data needed to do an adequate risk assessment. In sum, Busenberg's discussion suggests that all three of the ways in which citizen input can assist with a technical study were met: 1) the scope of the problem was better defined, 2) data quality was increased, and 3) assumptions and uncertainties were properly examined and weighed. The final risk assessment was accepted as authoritative by all parties, and one of the new tug vessels was deployed in the Sound in 1997 as a result (Busenberg 1999).

This example shows the promise of analytic-deliberative techniques when deployed at a local level to address local environmental issues. Where there are clearly defined stakeholders (both with some resources), they can decide to collaboratively design, fund, and direct research that can help resolve technically-based disputes. Crucial to the process is an equal sharing of power among the parties, made possible in part by the joint funding of the research. The public values find voice in the directing of the research, by helping to critically examine and shape the scope and guiding assumptions of the analysis. The next example examines whether this is possible at the national level.

Chemical Weapons Disposal Methods

As Futrell describes in his 2003 paper, how to dispose of chemical weapons has engendered a debate in the U.S. at both national and local levels. Throughout the 1980s, the controversy between the army and local citizen groups intensified as citizens became disenchanted with the army's perfunctory attempts at citizen input (Futrell 2003: 459–464). Citizens felt that key decisions, such as whether alternatives to weapons incineration would be seriously considered, were made prior to any opportunity for their input. By the late 1980s, citizens at eight disposal sites around the U.S. had banded together to form the Chemical Weapons Working Group. They pressed their case for serious consideration of alternatives to incineration, and succeeded in gaining national attention for the issue in the early 1990s (Futrell 2003: 465). By 1997, Congress ordered the Department of Defense to establish a new effort separate from the army's incineration program, called the Assembled Chemical Weapons Assessment (ACWA) program. The ACWA, with its independence from the incineration program, developed what Futrell calls a "participatory approach to decision making" (Futrell 2003: 466). The ACWA brought in an independent (private sector) mediator to manage a "Dialogue on Assembled Chemical Weapons Assessment" (Futrell 2003: 466). This Dialogue process consisted of a series of meetings at multiple sites around the country involving the local citizens, state regulators, national activists, and relevant federal officials. As Futrell describes it: "In face-to-face consensus meetings, Dialogue participants developed criteria against which alternative technologies would be assessed and provided input into each stage of the actual technical assessments" (Futrell 2003: 466). These criteria, Futrell notes, reflected the concerns that had been raised by citizens since the beginning of the controversy. The alternative technologies that came out of the ACWA are now under further evaluation and may be instituted at several sites (Futrell 2003: 468).

As with the Valdez example, the collaborative approach allowed for citizen values to be reflected in the technical analyses that followed. The Dialogue process enabled citizens to influence the criteria under which various technologies would be judged, and these criteria reflected citizen concerns and values. The collaborative approach also altered the framing of the issue, away from an 'incineration only' approach. It is less clear, however, that citizen input assisted with the collection of local data, although many early concerns of citizens focused on a lack of site specific risk assessment by the army. Even if all three benefits of citizen participation are not met in this example, the process did produce a "mutually acceptable study of chemical weapons disposal aimed at technically safer and more politically legitimate decisions" (Futrell 2003: 472). Whether the study's suggestions are fully utilized remains to be seen.

In my last example, a history of mistrust overwhelms the attempt at collaborative analysis. The analytic-deliberative process falls apart, in large measure because of process failures and a lack of commitment by the lead government agency.

Hanford, Washington and the Legacy of Plutonium Production

Hanford, Washington, became the first plutonium production site in the world in 1944. Plutonium production ended at Hanford in the 1980s, but it left Hanford one of the most contaminated sites in the United States. Because of its mission (the production of weapon-grade plutonium), a shroud of secrecy had always been drawn over the activities of Hanford. When citizens pushed for greater access to information about the site in the 1980s, they were appalled by what they found in released documents. From radioactive wastes stored in aging leaking tanks to intentional releases of radioactive iodine (the 'Green Run' of 1948), the actual state of the site was far different from the reassuring press releases the public had been fed for forty years. (Gerber (1997) provides a complete account of Hanford's history.) Area citizens have been involved with health assessment and clean-up efforts since the late 1980s, and the Department of Energy has been attempting to rebuild trust with these citizens (Kaplan 2000). Unfortunately, efforts have not gone well.

For example, one area of concern involves the contamination of groundwater at Hanford and the potential for subsequent contamination of the Columbia River. To help address this concern, the Department of Energy (DOE) initiated an assessment of the risks, the Columbia River Comprehensive Impact Assessment (CRCIA) (Kinney and Leschine 2002). As described in an analysis of the CRCIA process, it "was not a typical technical analysis, however. Tribal and stakeholder representatives had seats on the CRCIA Project Management Team and, in the parlance of NRC's analytic-deliberative process, participated as 'equally valid contributors'" (Kinney and Leschine 2002: 87). Unfortunately, Kinney and Leschine describe a process that falls apart as the citizen stakeholders attempt to shape the risk assessment. As the stakeholders pushed for a more comprehensive assessment that would more successfully address their concerns, the DOE split CRCIA into two parts, one to design and conduct a 'screening assessment' which would determine where the most serious risks would lie, and the other to design the more comprehensive assessment sought by the stakeholders. While the DOE contractor was conducting the first part, with full support from the DOE, stakeholders were investing their energies in the second part, which the DOE eventually repudiated.

The DOE's gradual withdrawal from and rejection of CRCIA Part II was unfortunate, because it would have provided an excellent example of collaborative analysis at work. The stakeholders working on Part II designed a process which would have allowed a high level of public involvement in the assessment process, with heavy emphasis on 'predecisional participation.' Kinney and Leshine describe this further:

> The type of predecisional participation the authors speak of is an oversight role in the day-to-day work of conducting risk assessments. Were their ideas to be implemented by the DOE, the management of risk assessment work would be carried out by a board composed of representatives from the socioeconomic groups who are affected by Hanford's clean-up and disposal decisions. This citizen management board, called the CRCIA Board, was envisioned to eliminate the need to make 'arbitrary assumptions' during the course of an assessment, as CRCIA Board approval would be required before any assumptions were incorporated into an analysis. In addition, the CRCIA Board would develop its own standards for data quality and maintain final authority over decisions relating to assessment protocols (Kinney and Leschine 2002: 89).

What had been proposed would have been a quintessential collaborative analysis. Recognizing the need to make choices and assumptions in the course of a technical assessment, the stakeholders wanted to have a say in those choices, to be able to shape those choices with their values. Unfortunately, the DOE has not accepted this plan. Indeed, the whole CRCIA process was fraught with problems. The DOE never clearly articulated its goals for the CRCIA Project Management Team (Kinney and Leschine 2002: 88). There were no clear process rules for the Team's meetings nor were any formal mechanisms used for dispute resolutions, and as a result, discussions among members were hampered (Kinney and Leschine 2002: 95). Finally, the DOE did not fully support the CRCIA process and was free to reject any outcomes, which they did. All of these factors led to a feeling of frustration and dissatisfaction among participants. An opportunity for collaborative analysis, and for a rebuilding of trust in the DOE, was lost.

NEIGHBORS OF COLLABORATIVE ANALYSIS

The preceding examples are ones that attempted to maximize the public-expert interaction, and thus suggest that involving the public in science done for policy can work in practice. In the (successful) examples discussed above, citizens worked closely with experts to design and run a scientific or technical analysis relevant to policy-making. Other models of public participation with technical decision-making focus less on expert-public interaction. These 'neighbors' of collaborative analysis help to highlight the strengths and limitations of collaborative analysis.

Science Shops

Begun in the 1970s in the Netherlands, the idea of 'science shops,' an outreach institution within a university that makes its scientific expertise available to the public, has spread beyond its country of origin. Both Irwin (1995: 156) and Sclove (1995: 226) mention the growth of science shops in Western Europe, and both authors hold out science shops as a potentially promising technique for getting citizens better access to scientific expertise. A more recent analysis by Wachelder (2003) suggests difficulties with the science shop program as a result of social and economic changes in the Netherlands. More telling for my purposes, however, are the issues raised by Irwin in his earlier discussion of science shops. Irwin notes the inherent difficulties (aside from institutional resource constraints) that one should expect with science shops. He brings attention to the problem of whether citizens' questions and inquiries can be translated into a form that scientists find recognizable, and whether scientists' results can be effectively utilized by citizens. He notes, for example, that science shops seems to have had little effect on the general research agendas of scientists, although some commentators still think there is a good possibility for this to occur (Irwin 1995: 159; Sclove 1995: 226). More problematic are the issues arising in the framing of research, which Irwin sees as having been hampered by "the impossibility of achieving a workable dialogue" between citizens and scientists (Irwin 1995: 161). Yet Irwin also describes an example where this problem appears to have been surmounted, from the Northern Ireland Science Shop. In one case, citizens seem to have taken an active role in helping to determine the methodologies employed by the students at the science shop in researching a question using a survey. As Irwin describes:

> The survey was conducted with the assistance of a group of university students. However, rather than following the usual academic model, the survey contents were very much the subject of negotiation between community representatives and the students. We see here the emergence of a new style of 'scientific' inquiry—one which attempts to negotiate with the concerns and problem definitions of the concerned groups (Irwin 1995: 164).

As Irwin's discussion shows, this example verges on the model of collaborative analysis. In addition, it is clear that this is not the usual model of operations for science shops, and Irwin sees it as being relatively new and untested. If science shops are to maximize the citizen-expert interaction (and thus the reflection of citizen values in the science), this kind of collaboration and negotiation would have to become the norm.

Yet allowing this kind of negotiation between clients and scientists presents additional problems. Because the science shops are petitioned by particular groups (increasingly, industry or commercial groups according to Wachelder (2003)), the values shaping the studies would not be representative of citizens as a whole. With the collaborative analysis examples above, an array of stakeholders (and value positions) were involved with shaping studies. Such would not be the case in science shops, and thus allowing the client to shape the study could lead to charges of cooptation and a decrease in the credibility of the science shop. It seems that the strength of science shops lies in their ability to provide access to traditional scientific results with traditional scientific legitimacy that can then be used in political arenas. Whether we would want to perpetuate that purpose given the theoretical considerations discussed above remains an open question.

Citizen Planning Efforts: Locally Focused Discourse

In many local contexts, there has been an increased effort to involve the citizenry more directly in planning efforts. In this section I will discuss two recent examples, both of which provide clear promise for citizen involvement. The examples, however, provide very different models for the kind of interaction one might want between experts and the public. In the first example, Renn's 'cooperative discourse,' there is no *direct* interaction between expert groups and the public (Renn 1999). In Fischer's example from Kerala, India, there is no expert knowledge until the communities, in cooperation with experts, generate it (Fischer 2000: 157–167).

Renn's model for *cooperative discourse* divides the decision-making process into three parts: 1) A consultation with stakeholder groups to determine general concerns with an issue and the possible values at stake, resulting in a 'value-tree'; 2) A consultation with experts to rate various policy options and their consequences with respect to the values in the value-tree;[5] 3) A discourse aimed at choosing a policy option generated among randomly selected local citizens using the results from the expert consultation (Renn 1999: 3050f.). In this highly structured model, stakeholder values feed into expert views, which then help inform the final selection of policy options accomplished in the discourse among selected citizens. Renn describes several contexts in which this model has been used, and notes its successes (particularly in the European context). The model seems to be able to overcome some of the most stubborn problems of local planning and siting issues. As Renn noted in one case, the participants overcame the NIMBY syndrome: "The most outstanding result was that panelists were even willing to approve a siting decision that would affect their own community" (Renn 1999: 3052). In another case, Renn noted that complete agreement was achieved: "The most remarkable outcome was that each panel reached a unanimous decision" (Renn 1999: 3052). Thus, this method can produce a high degree of consensus among the citizen groups for particular policy options, overcoming even the resistance to siting undesirable facilities in one's own community. However, it does not allow for direct interaction between experts and the public, thus preventing local knowledge from playing a role in expert analyses. Nor is it clear to what extent expert analyses are actually shaped by public values. Whether new analyses are done in the light of public concerns is not mentioned. These differences highlight how cooperative discourse diverges from collaborative analysis in practice. Finally, citizen recommendations in these cases are for actual policy choices. Because the citizens are not elected officials (or accountable to elected officials), these choices are non-binding – and in some of the cases they are ignored (Renn 1999: 3052). Despite these difficulties, the structured approach of cooperative discourse may be particularly useful for some contexts in which direct expert-public interaction is not feasible.

Fischer's discussion of Kerala's planning efforts provides a very different model for how citizens and experts can work towards well-informed decisions, one that is much closer to collaborative analysis. Among the poorest of states in India, Kerala is an area that has a tradition of left-wing politics (Fischer 2000: 158). The local leadership decided that a general planning effort would be the best way to improve the lives of the population while involving the local citizenry in governmental decision-making. In line with this view, the State Planning Board devolved over a third of the planning efforts (and resources for those efforts) to the local level (Fischer 2000: 159). However, much of the local information needed for good planning (e.g., current land uses, soil types, etc.) had never been gathered. Thus began a genuine effort of 'participatory research' to produce resource maps that could then inform planning efforts (Fischer 2000: 161). Local volunteers were trained by appropriate experts to gather the requisite information (Fischer 2000: 165). By the end of that work, sets of detailed maps that could serve as a well-informed basis for planning discussion and decision-making were in hand. With these maps, local communities could develop 'action plans' that would encompass both the current state of the community and what the community wanted to change. Note how much closer this model comes to collaborative analysis, with experts working in tandem with local citizens to generate needed knowledge. (Because the amount of expert analysis needed in this example is not clear, I have not considered it a definitive example of collaborative analysis.)

In sum, discourses locally focused on planning efforts can take on some of the characteristics of collaborative analysis. They can draw extensively from local knowledge, while generating clear discussions of local needs and values. What is unclear in these examples is the degree to which citizens have the ability to direct experts in the performance of analyses useful to their deliberations. To the extent that citizens have this capacity, the process becomes an example of collaborative analysis.

Consensus Conferences: Discourse Beyond the Local Context

Consensus conferences have come to the fore in the past decade as a promising technique for increasing citizen input into complex policy decisions. Developed most thoroughly in Denmark, consensus conferences recruit average citizens for an intensive experience of education in an issue, group deliberations, further questioning of expert panels, and ultimately a drafting of a consensus statement on the issue (Joss and Durant 1995). The strengths of the approach are well documented: citizens involved learn a great deal about an issue; the group deliberation is often revealing of deep issues; and the consensus document often reflects well what the citizenry as a whole would think after similar depth of exposure (Sclove 2000). In the Danish context, where the consensus conferences are sponsored by the government, Joss (1998) has shown that they have had a positive impact on policy-makers (most notably legislators). In the American context, Guston's analysis (1999) suggests that the policy impact was negligible. This is not surprising given that the U.S. government has had little involvement with sponsoring or promoting consensus conferences.

Consensus conferences thus provide an interesting and potentially valuable technique for fostering careful deliberation concerning science and technology-based policy issues. However, it must be noted that consensus conferences do not currently provide for a way in which citizen deliberation can actually direct or shape analyses central to these issues. Citizens use already completed analytical work (presented to them by experts) to deliberate on the contentious issue. In the standard model, they do not direct any new work by the experts they question; the experts are there solely to help answer citizen questions.

This lack of mutual influence may suggest a new direction for consensus conferences. Because citizens are drawn from a random sample (or drawn randomly from interested citizens), no decision-making authority can be legally given to consensus conferences addressing policy choices. The 'moral authority' of the consensus conference can have a substantial political influence (Joss 1998), or not (Guston 1999).

But the power of consensus conferences to influence policy directly remains weak. However, consensus conferences that address value issues that arise in technical analyses could have a strong influence on later analyses. A general consensus on how to make trade-offs between economic gains and human health risks, for example, could be used to determine the statistical strength needed to say a correlation is 'significant.' The difficulty with using consensus conferences to reflect on the assumptions needed in analyses is that, depending on the context of a particular analysis, different assumptions may be warranted. How much a general consensus on a general set of issues would be of use to specific analyses that need to be performed remains to be seen.

The strength of consensus conferences may lay with the general level at which they function. By addressing fairly broad policy issues (e.g., genetic engineering, communications policy, global climate change), the consensus panels have the potential to broaden the scope of public debate generally, and may bring to light concerns experts and policy-makers had not previously considered. This interaction is not close enough to be called collaborative analysis, but it is highly beneficial nevertheless.

In sum, the three near neighbors of collaborative analysis I have discussed, science shops, local planning efforts, and consensus conferences, all exhibit some of the traits of analytic-deliberative processes. Yet, as I have noted, the interaction between experts and the public is not as intensive as it is with collaborative analysis. In general, the influence of the public on the experts remains muted. This need not be the case (as noted in the examples that verge on being collaborative analyses), but to alter that aspect of these processes may damage some of their other strengths. Whether the strengths of collaborative analysis are sufficient to counter potential losses remains to be determined.

CONCLUSION: STRENGTHS AND LIMITATIONS OF ANALYTIC-DELIBERATIVE PROCESSES

Following the theoretical considerations presented in the first section, values are needed to inform scientific and technical analyses. Yet the need for value judgments in these analyses may not be obvious at the start of an investigative process; even less obvious is the nature of concerns that might arise and which values should be used to make key judgments. An interactive process in which a range of citizens can help guide analyses as they move forward, an analytic-deliberative process, seems an ideal solution to this problem. Collaborative analysis provides a workable model of this process. In the (successful) examples discussed, citizens were able to inform the scope of the analyses, provide local knowledge to improve data quality, and ensure that appropriate values shaped important judgments. Because citizen involvement was prior to policy decision-making, their input on these points could be binding. Thus collaborative analysis has the potential to short-circuit many of the chronic problems in policy-making, including lack of public trust in technical work, lack of empowerment of citizens, and access to reliable data.

Yet problems remain for analytic-deliberative approaches. For example, one of the issues I have not discussed above is the selection of participants for analytic-deliberative processes. In my examples, the citizens involved with the process are those who recognize that they have an interest in the issue. The citizens involved with the Valdez dispute, chemical weapons disposal issues, and the Hanford site were not randomly selected, but had been concerned about the issues for a long time before collaborative analysis became an option. Whether this will present problems of legitimacy remains to be seen.

In addition, it may be difficult to conduct collaborative analyses on issues at a national scale. While Futrell's study gives some hope for this prospect, there were clearly defined local groups and national organizations with which to work. For more widely applicable public policies, there may be too many (or too diffused) interested parties for this to work. In these cases, consensus conferences may be needed to give a sense of the general public concerns that need to inform analyses. However, guidance on specific issues or problems that may arise in the process of research and analysis will be lacking.

I have also not addressed here the intricacies of process. Yet all the work that has been done thus far makes clear the importance of the details for how a process goes forward. How do participants get involved? How is their role delineated? Is there a mediator and how does s/he function? Who gets to set the agenda? The list of process issues is nearly endless and the details are often context dependent. Yet which process one uses should be shaped at least in part by the goals one embraces. By having a clear goal of maximizing public-expert interaction, ways in which to constructively support that interaction will hopefully become more apparent.

Finally, one might wonder whether there is a real possibility scientists will want to invite citizens into collaboration for policy-relevant analyses. As noted above in the discussion of science shops, part of the authority of science arises from the use of traditional scientific methods. Scientists must maintain a disciplinary integrity if they are to maintain some of science's authority in the policy realm. How are they to do this if the public is helping to guide their analyses? The answer lies in part in the philosophical discussion above: values should not replace evidence but rather should help make decisions under uncertainty. This, in practice, is a fine distinction, but it can be upheld through the use of a traditional scientific practice, peer review. If collaborative analyses are peer reviewed and found to uphold the expected high standards for methodological soundness, the authority of science, even in collaboration with the public, should not be undermined.

The need for contexts in which citizens can constructively debate scientifically-informed policy-making has never been greater. We need forums in which values relevant to these decisions can become clarified. As Futrell wrote: "It is through the expression of multiple concerns that we come to understand the common good of a diverse community that is central to good social decisions" (Futrell 2003: 475). Yet an expression of values that is not informed by the scientific or technical details is often just as irrelevant to decision-making as an expert's expression of personal values. Good community discourse is helpful, but it is even more helpful when it is soundly informed. Collaborative analysis has the added benefit that involved citizens gain an increased appreciation for the intricacies of scientific study and the analyses relevant to their communities. It is with these hopes that scientific experts may be persuaded to open the doors to the realm of science for increased public scrutiny *and* collaboration.

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NOTES

[1] By ‘public’ here I follow Dewey’s notion that a public constitutes itself only when citizens recognize that they have an interest in something and thus come to form a public. When citizens recognize that there will be consequences that will affect them, a public constituency is formed. (Dewey 1927, chap. 1)

[2] Another critique of that standard view, that epistemic values cannot be clearly delineated from non-epistemic values, has been made by Rooney (1992) and Longino (1996).

[3] If methodologies don’t improve, the judgments needed to do science often become ‘standard practice,’ thus erasing the appearance of the need for value considerations. Yet the values that shaped the initial judgments remain an influence through the practices accepted as standard.

[4] The NRC does not suggest that citizenry take up the charge of performing studies, data collection, or statistical analyses themselves, in contrast with the example of ‘popular epidemiology’ from Woburn Massachusetts (Fischer 2000: 151–7).

[5] As Renn describes it: “The objective is to reconcile conflicts about factual evidence and reach an expert consensus via direct confrontation among a heterogeneous sample of experts” (Renn 1999: 3050).

REFERENCES

Boiko, P., R. Morrill, J. Flynn, E. Faustman, G. van Belle, and G. Omenn (1996), ‘Who holds the stakes? A case study of stakeholder identification at two nuclear weapons production sites’, *Risk Analysis* **16**, 2: 237–249.

Busenberg, G. (1999), ‘Collaborative and adversarial analysis in environmental policy’, *Policy Sciences* **32**: 1–11.

Dewey, J. (1927), *The Public and Its Problems*, Athens: Swallow Press.

Douglas, H. (2000), ‘Inductive risk and values in science’, *Philosophy of Science* **67**: 559–79.

Douglas, H. (2002), ‘The moral responsibilities of scientists: Tensions between autonomy and responsibility’, *American Philosophical Quarterly* **40**, 1: 59–68.

Douglas, H. (2004a), ‘The irreducible complexity of objectivity’, *Synthese* **138**, 3, 453–73.

Douglas, H. (2004b), ‘Border skirmishes between science and policy: Autonomy, responsibility, and values’, in G. Machamer and P. Wolters (eds.), *Science, Values, and Objectivity*, Pittsburgh: University of Pittsburgh Press, forthcoming.

Fiorino, D. (1990), ‘Citizen participation and environmental risk: A survey of institutional mechanisms’, *Science, Technology, and Human Values* **15**, 2: 226–43.

Fischer, F. (1993), ‘Citizen participation and the democratization of policy expertise: From theoretical inquiry to practical cases’, *Policy Sciences* **26**: 165–87.

Fischer, F. (2000), *Citizens, Experts, and the Environment: The Politics of Local Knowledge*, Durham: Duke University Press.

Futrell, R. (2003), ‘Technical adversarialism and participatory collaboration in the U.S. chemical weapons disposal program’, *Science, Technology, and Human Values* **28**, 4: 451–82.

Gerber, M. (1997), *On the Home Front: The Cold War Legacy of the Hanford Nuclear Site*, Lincoln: University of Nebraska Press.

Guston, D. (1999), ‘Evaluating the First US Consensus Conference: The impact of the citizen’s panel on telecommunications and the future of democracy’, *Science, Technology, and Human Values* **24**, 4: 451–82.

Irwin, A. (1995), *Citizen Science: A Study of People, Expertise, and Sustainable Development*, London: Routledge.

Joss, S. (1998), 'Danish consensus conferences as a model of participatory technology assessment: An impact study of consensus conferences on Danish parliament and Danish public debate', *Science and Public Policy* **25**, 1: 2–22.

Joss, S. and J. Durant (eds), (1995), *Public Participation in Science: The Role of Consensus Conferences in Europe*, London: Science Museum.

Kaplan, L. (2000), 'Public participation in nuclear facility decisions', in D.L. Kleinman (ed.), *Science, Technology, and Democracy*, Albany: SUNY Press, pp. 67–83.

Kinney, A. and T. Leschine (2002), 'A procedural evaluation of an analytic-deliberative process: The Columbia River comprehensive impact assessment', *Risk Analysis* **22**, 1: 83–100.

Kuhn, T. (1977), 'Objectivity, value, and theory choice', in T. Kuhn (ed.), *The Essential Tension*, Chicago: University of Chicago Press, pp. 320–39.

Lacey, H. (1999), *Is Science Value Free? Values and Scientific Understanding*, New York: Routledge.

Laird, F. (1993), 'Participatory analysis, democracy, and technological decision-making', *Science, Technology, and Human Values* **18**: 341–61.

Longino, H. (1996), 'Cognitive and non-cognitive values in science: Rethinking the dichotomy', in L. Hankinson-Nelson and J. Nelson (eds.), *Feminism, Science, and the Philosophy of Science*, Dordrecht: Kluwer, pp. 39–58.

National Research Council (1983), *Risk Assessment in the Federal Government: Managing the Process*, Washington, D.C.: National Academy Press.

O'Connor, J. (1993), 'The promise of environmental democracy', in R. Hofrichter (ed.), *Toxic Struggles*, Philadelphia: New Society Publishers, pp. 47–57.

Ozawa, C. (1991), *Recasting Science: Consensual Procedures in Public Policy Making*, Boulder: Westview Press.

Renn, O. (1999), 'Model for an analytic-deliberative process in risk management', *Environmental Science and Technology* **33**, 18: 3049–55.

Renn, O., T. Webler and P. Wiedemann (eds), (1994), *Fairness and Competence in Citizen Participation: Evaluating Models for Environmental Discourse*. Boston: Kluwer.

Rooney, P. (1992), 'On values in science: Is the epistemic/non-epistemic distinction useful?', in D. Hull, M. Forbes and K. Okruhlik (eds.), *Proceedings of the 1992 Biennial Meeting of the Philosophy of Science Association*, **2**, East Lansing: Philosophy of Science Association, pp. 3–22.

Rosenstock, L. and L. Lee (2002), 'Attacks on science: The risks to evidence-based policy', *American Journal of Public Health* **92**, 1: 14–18.

Rowe, G. and L. Frewer (2000), 'Public participation methods: A framework for evaluation', *Science, Technology, and Human Values* **25**, 1: 3–29.

Sclove, R.E. (1995), *Democracy and Technology*, New York: Guilford.

Sclove, R.E. (2000), 'Town meetings on technology: Consensus conferences as democratic participation', in D. Kleinman (ed.), *Science, Technology, and Democracy*, Albany: SUNY Press, pp. 33–48.

Stern, P.C. and H. Fineberg (eds), (1996), *Understanding Risk: Informing Decisions in a Democratic Society*, Washington DC: National Research Council, National Academy Press.

Wachelder, J. (2003), 'Democratizing science: Various routes and visions of Dutch science shops', *Science, Technology, and Human Values* **28**, 2: 244–73.