

Constitutional Moments in Governing Science and Technology

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Abstract Scholars in science and technology studies (STS) have recently been called upon to advise governments on the design of procedures for public engagement. Any such instrumental function should be carried out consistently with STS's interpretive and normative obligations as a social science discipline. This article illustrates how such threefold integration can be achieved by reviewing current US participatory politics against a 70-year backdrop of tacit constitutional developments in governing science and technology. Two broad cycles of constitutional adjustment are discerned: the first enlarging the scope of state action as well as public participation, with liberalized rules of access and sympathetic judicial review; the second cutting back on the role of the state, fostering the rise of an academic-industrial complex for technology transfer, and privatizing value debates through increasing delegation to professional ethicists. New rules for public engagement in the United States should take account of these historical developments and seek to counteract some of the anti-democratic tendencies observable in recent decades.

Keywords Academic-industrial complex · Bioethics · Public engagement · Science and democracy

Democracy has never been an easy form of government, and it is not getting any easier. The need to involve more people more intensively in governing themselves grows more urgent each year as distances shrink and connections thicken among the world's insistent self-assertive cultures. Many of those connections, moreover, are enabled through science and technology, so much so that scholars in science and

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technology studies (STS) see technological systems as important sites and objects of governance (Hackett et al. 2007; Jasanoff 2006). At the same time, the information needed to make sound policy expands, creating a demand for intertwined expert knowledge about the biological, material and social worlds. How can democracy be maintained in any meaningful sense in technology-infused societies, where knowledge is specialized, values are at odds, producers are often far removed from consumers and end-users, and the lack of common languages and norms makes a fantasy of the classical public sphere inhabited by Jürgen Habermas's (1984) "ideal speech community"? How, more particularly, can the trajectories of technological innovation be directed so as to take on board both the increased understanding of complex systems, often deriving from interdisciplinary fields such as STS, and the needs and preferences of global multitudes? These are some of the dilemmas that this piece addresses.

Problems begin with the ambiguity of the thing to be achieved: democracy itself. In an influential 1956 essay, the philosopher W. B. Gallie offered democracy as an example of what he called an "essentially contested concept" (Gallie 1956). Such concepts, in his view, are both evaluative (that is, they convey value-laden judgments about elements we want, or do not want, to build into social order) and internally complex (that is, their definition incorporates multiple, irreducible constitutive elements). Disagreements arise and persist over the meaning of such concepts because people may rank, weigh, and interpret these elements quite differently. What strikes one observer as perfectly democratic may seem inadequate to another in salient respects, even though both agree that something called democracy exists, that there are certain core principles that define it, and that it is eminently worthwhile to incorporate these principles into political practice. Contestation centers on whether particular ways of organizing politics offer good enough versions of democracy; adversaries may never reach consensus because they disagree at the meta-level about how to weigh different factors whose relevance, but not whose relative importance, is agreed upon by all parties. Ideology matters in such contests. Thus, a diehard free-market enthusiast may view a welfare state's collectivizing practices as too intrusive, whereas a committed socialist may object to distributive inequities resulting from innovation that is inattentive to important collective norms, such as environmental sustainability, national security, open access or poverty alleviation.

As if building consensus on the meaning of democracy were not hard enough, added complexity comes from the fact that the preconditions for democracy in any of its flavors are daily changing through the innovative practices of science and technology (S&T). These innovations produce new material objects and associated forms of life that call for public engagement on several levels. Some may require regulation so that they do not unreasonably infringe on human rights and values, nor endanger health, safety or the environment. Most of the signal technological breakthroughs of the twentieth century came with physical, social, or ethical risks attached, risks that became apparent only over time: modern transportation systems, pesticides and pharmaceutical drugs, information technologies, instruments of visualization and surveillance, genetic engineering, and very recently nanotechnologies. Further, many S&T innovations disrupt or render problematic old ways of

understanding and ordering the world, so that the legal, political and other analytic categories needed for good government have to be rethought in the light of new, technologically mediated possibilities. Thus, the US Constitution protects equal opportunity, but what equality means in practice has changed with biological and social understandings of human nature and the preconditions for its flourishing. In the eighteenth century, it was acceptable to deny the vote to women and persons of African descent on the basis of then current biological understandings; a century later, those ideas of human capability no longer stood up to scientific tests and were abandoned. In part, too, the increasing penetration of science and technology into all aspects of human life has fragmented knowledge and made even the most informed citizens ignorant about mundane elements of their world. To make the most trivial decisions—such as which carton of milk to buy or when to cross the street—we all depend on the wisdom of strangers. Experts, acting in unseen places, according to little known rules of the game, necessarily control much of how we conduct our lives; but experts, too, operate with partial vision, comprehending only thin slices of the complex systems they are asked to help govern. All this places considerable strains on any straightforward conception of government of, by, and for the people.

Calls for responsible innovation and greater public engagement in the development of new and emerging technologies are a recent response to these challenges. Among science policymakers, and even in some quarters of science and industry, there are misgivings about the widening gaps between what people want, what experts know, and what is achievable through publicly funded scientific research and development (R&D). These gaps can lead, at the extreme, to popular resistance, as in the widely discussed case of the rejection of American-made genetically modified crops and foods by European consumers. Agricultural biotechnology is still reeling from that unexpected revolt, and the proponents of nanotechnology and the still more recent convergent technologies have no wish to see such a marketing debacle repeated. All across the Western world, efforts are underway to make innovation more responsive to complex demands and to “engage” publics further upstream in the R&D process. The forms and forums for achieving these goals are multiplying. Some effort to make sense of this latest turn in the wheel of democracy is a worthy subject for science and technology studies. Indeed, it would be a major admission of defeat if STS were not able to provide fresh insights into—and also pragmatic advice on—developments that so intimately link the affairs of science and technology with those of states and societies.

But what shape should these contributions take, and what experiential and conceptual foundations should they build on? The approach I suggest here is both place-based and historically grounded. Taking US democratic politics as the example, I focus on what the legal scholar Bruce Ackerman has called “constitutional moments” (Ackerman 1983, 1991, 1998). These are brief periods in which, through the unending contestation over democracy, basic rules of political practice are rewritten, whether explicitly or implicitly, thus fundamentally altering the relations between citizens and the state. To this definition of constitutional change, STS scholars have added an important further dimension: namely, that constitutional moments may encompass the relationship between experts, who underwrite almost all contemporary state action, and citizens, who are collectively

subject to the decisions of states (Jasanoff 1990, 2003). Today's constitutional changes necessarily involve renegotiating the manner in which states and other authoritative institutions employ the power of expertise, and contests over those processes have become a fixture of modern democratic politics. Public engagement is but the latest discursive rubric under which that contestation is played out, and understanding its historical and cultural antecedents is a must if we are to make good use of the opportunities afforded by this new development.

To do justice to the democratic governance of science and technology on a global scale, the approach outlined here would have to be substantially enlarged, both horizontally through space, encompassing more places and cases, and vertically in time, to take account of longer social histories of the public sphere. Even protracted journeys, however, begin with modest steps, in scholarship as in life. This essay is one such.

A Role for Science Studies

There are three possible roles, analytically distinct yet practically interconnected, for STS scholars concerned with turning points in science-state-society relations: instrumental, interpretive, and normative. Easiest to grasp and implement perhaps is the instrumental role. If science and the state both have a stake in soliciting wider public input, and if their efforts are to be attentive to democratic values, then what practices of governance can best serve those goals? As experts on the production, dissemination, and reception of science and technology in society, STS researchers can reasonably be called upon to answer that question, offering their recommendations on institutional and procedural design on the basis of detailed knowledge about science-society interactions. A second, less obvious role is interpretive. The primary aim of STS scholarship, after all, is not to intervene directly in public disputes, nor blindly to serve the state's interest in placating citizens with rituals of participation. Rather STS should provide analytic and reflective resources with which to make better sense of such proceedings. As science and society evolve together, in a partnered dance of co-production (Jasanoff 2004), it is the responsibility of STS to provide up-to-date concepts and discourses with which to analyze what is happening. The third and in some ways most difficult role for STS is normative. If STS is to speak meaningfully to power (as distinct from science's self-determined role of "speaking truth to power"), then the field's pronouncements have to address political power's most basic questions, those questions that power *must* ask if it wishes to remain responsible in its uses of science and technology: what makes innovation responsive to the needs of society; how can the relations between science, technology and society be managed so as to meet those needs; are we making progress in linking changes in S&T to changes in democratic expectations; how can one tell; and can we do better?

Ideally, all three roles should be attended to in any attempt to advise political authorities about public engagement, and many STS scholars have performed all three. Yet, each tends to draw on different areas of knowledge and expertise, and serving all three at once is often cumbersome in practice. On the whole,

instrumentalism tends to operate with little regard for history or social theory, whereas interpretive and normative enterprises often do not link their insights to the events and concerns of the present. Instrumentalists do not necessarily question pre-existing policy framings, preferring to concentrate on the most efficient means of meeting policymakers' proclaimed goals. That approach allows STS advisers to speak a language that policymakers understand ("public engagement" is itself such an example), a desirable enough aim in itself; but such discursive assimilation risks being historically and theoretically shallow, and it dangerously reduces the analytic distance between adviser and advice seeker, turning the former from energetic critic to pliant and unquestioning consultant.

Interpretivists, by contrast, do not feel constrained to take current policy framings as given, and those who lean toward social theory may bring to their task an awareness of relevant concepts from STS or other social sciences that make visible the dominant narratives of power. For example, the sociological concepts of boundary organizations,¹ boundary work,² and boundary objects³ have all proved productive in explaining how lines are drawn and maintained between science and politics in processes of public engagement. Those interested in the normative dimensions of such proceedings, however, sooner derive their insights from fields that question the values embedded in present-day policies—for example, moral and political philosophy, law, history, and comparative studies of decisionmaking. For normative analysts, it is not enough to identify broad trends and display basic social processes at work, still less to recommend specific instrumental ways of conducting the state's business. It is more important to ask what is at stake in such initiatives, who defines the good or sanctions the bad, according to what principles, who thereby loses, and who wins.

To attain recognized status as a new discipline among the social sciences, STS has to adopt all three of these roles—instrumental where appropriate, always interpretive, and where possible normative—showing how today's problems affecting science and technology in society can helpfully be addressed through the field's distinctive blend of empirically grounded, theoretically sophisticated, and constructively critical analysis. This introduction offers a bare sketch of what such an analysis might look like as applied to contemporary democratic practices of public engagement. It is no more than a sketch, not only because it is short, but because the analysis is based largely on developments within a single country, the United States, over the past seventy or so years. It is also schematic rather than deeply historical, in that it seeks to identify broad patterns and trends at the expense of the thick social intercourse, contradictory movements, and multiple, competing beliefs and practices that make up political reality in any actual moment.

¹ "Boundary organizations" are organizations that sit at the boundary between science and politics, and thus both manage and are constrained by the needs of these two institutions (Guston 2000).

² "Boundary work" is the work done by social actors to delimit socially important categories from one another; it has been used by STS scholars to refer specifically to the work that actors do to separate science from politics (Gieryn 1999; Jasanoff 1990).

³ "Boundary object" is a sociological term used to describe an object that retains some common meaning for different social groups and yet is defined differently to suit different local needs and constraints (Star and Griesemer 1989).

Below, I situate the current US interest in public engagement in the context of two constitutional moments, each initiating a long, generational cycle of attempts to reform citizen participation in decisions related to science and technology. The first cycle, comprising roughly the period from 1940 to 1980, expanded the public sphere, enlarging the numbers of issues, viewpoints, and actors represented in formulating regulatory policy, and making the debates themselves more formal and visible. Pluralist in inspiration, it presumed that interested actors were best positioned to represent their normative as well as cognitive claims, and it cast the state as the ultimate articulator of collective values. The second cycle, running roughly from 1980 to the present, institutionalized some participatory practices but contracted others, reducing entry points for the injection of public values as well as possible bases for challenging the state's reasoning. At the same time, ethics came to the fore as a new mode of public reasoning, reinforcing a split between facts and values. Mere administrative rule changes at one level, the procedural shifts that shaped these two periods reached deep into the dynamics of American democracy: in effect, they reconfigured the terrain of regulatory politics and altered the meaning of democratic government. These cycles rewrote the relations between citizens, experts, and the state profoundly enough to be seen as constitutional changes. They can be used as guideposts for commenting on events that, today, may herald another moment of fundamental democratic reordering in the United States and, through the dynamics of globalization, the world.

Reimagining the Public Sphere: 1940–1980

Public participation has been a part of American political discourse since at least the 1940s, but neither “public” nor “participation” has stayed still in meaning. Two historical eras are worth distinguishing: the first, from the 1940s to the 1980s, beginning with the enactment of the earliest and still most significant US law relating to the administrative process, and ending in the 1970s with the expansion of both the regulatory state and the publics it presumes to serve; the second, the retreat from liberal regulatory politics in the 1980s and the rise of a new discourse of ethics in the 1990s, introducing a calculus of individual moral values but to some extent backgrounding the state and diminishing the accountability of S&T in the public sphere. This is the historical backdrop against which current public engagement initiatives should be critically evaluated.

Taming Bureaucratic Power

The New Deal introduced by the administration of President Franklin D. Roosevelt vastly expanded the power and reach of the US nation-state, but in catering to more public problems it also paradoxically increased the distance between government and the people. Specialized agencies sprang up to control all kinds of goods and services: the safety of food and drugs; the management of fisheries and federal lands; routes and rates for railroads, telephones, telegraphs, and postage; the rules of business competition; fair labor standards; and the price of securities, to name just a

few. As federal agencies multiplied, the transparency of government diminished, and so did the sense of civic control over the workings of the state. The 1946 Administrative Procedure Act (APA), conceived during the late Roosevelt years but, like the atomic bomb, brought to fruition only after the president's death, attempted to navigate this divide by fostering greater uniformity and accountability in the administrative process. One author describes it as "the bill of rights for the new regulatory state" (Shepard 1996, p. 1558). But whose rights did the APA protect?

The APA from the start was a balancing act. On the one hand, New Deal agencies wanted room to implement their legislative mandates with minimum disruption and maximum efficiency. On the other hand, as the Attorney General's Committee on Administrative Procedures acknowledged in 1941, regulated parties reasonably claimed the "opportunity to present facts and arguments to those in authority for the purpose of enlightening or persuading them toward this or that choice among many alternatives" (US Department of Justice 1941, p. 2). The pro-New Deal Justice Department blandly represented public participation as one of the APA's four main purposes, along with providing information about agency procedures, securing uniformity in administrative proceedings, and restating the scope of judicial review. The act's legislative history indicates, however, that APA proponents organizing under the rhetorical banner of "individual rights" were chiefly business interests wishing to thwart what they perceived as a burgeoning administrative dictatorship (Shepard 1996). At stake was the widespread fear that government bureaucracies would become too overbearing, intrusive, and burdensome. APA proponents believed that judicial review in an era when courts still retained their anti-New Deal bent would hold agencies to the potentially demanding standard of "substantial evidence." Public participation would create a record that would allow courts to apply that disciplining standard meaningfully.

Implicit in the participatory thrust of the APA is a suspicion of bureaucratic knowledge as a potentially closed epistemic world, captive to its limited cognitive capacities and restricting the range of administrative imagination and action. A 1947 Justice Department manual on the APA noted that regulatory agencies were served by in-house experts and hinted that this could lead to tunnel vision: "[T]he purpose of the rule making proceeding is to determine policy. Policy ... is formulated by the agency heads relying heavily upon the expert staffs which have been hired for that purpose" (US Department of Justice 1947). Input from interested parties, the APA's conservative supporters assumed, would broaden the palette of facts and expert judgments on the basis of which regulatory alternatives would eventually be formulated. In later decades, the APA came to be seen as an instrument for securing inputs from wider publics, but the idea that the law opens up administrative reasoning to critical countervailing readings was present from the act's inception.

Judging in the Public Interest

If in 1946 public participation under the APA meant expanding the access of regulated businesses and industries to government agencies and courts, then a significant rethinking of the concept of participation came about in 1969, with the

passage of the National Environmental Policy Act (NEPA). That law's best known provision was the requirement that any federal agency undertaking a major action significantly affecting the quality of the human environment had to prepare an environmental impact statement (EIS). NEPA's text makes it clear that the law intended to protect the social and cultural as well as the natural environment, that its concerns were long-term and extended beyond national borders, and that its scope included both present and future generations.

In succeeding decades, NEPA was interpreted by the Council on Environmental Quality (CEQ),⁴ other federal agencies, the courts, and leading environmental groups as demanding close consultation with communities affected by federal projects, even if such communication delayed or even derailed development. A 1998 policy paper from the Department of Energy (DOE) explained that the term *public* would be broadly defined for purposes of public participation: "to include any and all interested or affected parties. The 'public' includes: interested or affected private citizens; state, local, and tribal governments; environmental groups; civic and community organizations; business and labor groups; and independent experts from the scientific, technical, and academic communities" (US Department of Energy 1998). With this all-embracing definition, the DOE paper put forth a vision of democracy that values the expression of non-technical views and preferences, acknowledges the agency's duty to explain its decisions, communicates technical information to the public, and gives interested persons an opportunity to influence policy outcomes.

Critical to the development of participatory politics in the post-NEPA years was a battle over the appropriate relations between courts and administrative agencies. The judiciary's prerogative to supervise both Congress and the executive is one of the most distinctive features of US politics. As executive agencies (the "fourth branch" of government) began playing a decisive part in channeling power, new questions arose about the degree to which their actions should or should not remain insulated from judicial review. Courts in this period of liberal activism construed themselves as guardians of the public interest, with a commitment to ensuring that agencies had honestly considered the public good and were not taking refuge in unchallenged claims of expertise. In other words, political capture even more than epistemic insularity became a dominant concern for the courts. Judges, however, recognized that they, as generalists without much technical training, were not necessarily better positioned than laypeople to probe the intricacies of huge, highly technical agency dockets. Reflections on the role of judicial review by judges themselves indicate something of the changing flavor of participatory politics in the 1970s.

An instructive division of opinion developed on the Court of Appeals for the DC Circuit, which hears the bulk of cases dealing with federal regulation, and thus (despite being a court of general jurisdiction) functions as the closest thing the United States has to a specialized administrative court. The debate occurred between two liberal judges, David Bazelon and Harold Leventhal, and it centered on

⁴ CEQ was established by NEPA and entrusted with overseeing and coordinating federal agency implementation of the EIS process, as well as providing environmental advice to the president.

the appropriate role of a judiciary uninformed about the technical details of much agency decisionmaking, but responsible nevertheless for controlling abuses of administrative authority. Addressing this dilemma, Bazelon adopted a procedural approach, arguing that judges should feel free to demand additional process from agencies that had not fairly considered the issues before them. Leventhal opted for a more substantive approach, calling on judges to take a “hard look” at the agencies’ reasoning and use of evidence.⁵ Later decisions of the Supreme Court, beginning with Justice William H. Rehnquist’s influential opinion in *Vermont Yankee Nuclear Power Plant v. Natural Resources Defense Council*,⁶ largely rejected Bazelon’s approach in favor of something closer to Leventhal’s insistence on reviewing the substance as well as the process of administrative decisionmaking. From the standpoint of participation, however, the major debates of the 1970s took for granted that agency expertise should be held open to public skepticism, especially where positions protective of public welfare were apparently not considered; and that it was appropriate for judges to act as surrogates for the public’s eyes and ears in ensuring that there would be adequate opportunity for external inputs.

Expertise Resurgent: 1980–2010

The flavor of participatory politics changed in the 1980s, setting in motion another cycle of tacit constitutionalism. The first year of that decade brought the election of Ronald Reagan as President of the United States and the last year saw the fall of the Iron Curtain. In between, dissatisfaction grew with the regulatory state as inherited from the New Deal. Political forces gathered under the banner of deregulation and a movement began to reduce state involvement in many aspects of public life, including regulation in the name of health, safety, and the environment. Accompanying the overtly deregulatory moves was an acceptance of the idea that government, if needed at all, should attempt to imitate private sector behavior, ruling through market-friendly mechanisms such as tax incentives, information, and public–private partnerships. These moves culminated in a political sea change in 1994, when the Republican Party scored a landslide victory in national legislative elections and gained control of the House of Representatives for the first time in 40 years. The victors’ agenda, framed by to-be House Speaker Newt Gingrich’s inspired slogan of a “Contract with America,” appealed to the ever popular US political imaginary of direct democracy at the national level, with government answerable to the people, unmediated by and unmired in Washington’s “politics as usual.”

⁵ The debate entered the judicial record most explicitly in the opinions written by these two judges in a landmark environmental case of the 1970s, *Ethyl Corp. v. EPA*, 541 F.2d 1 (DC Cir. 1976). For further discussion of this case and the Bazelon-Leventhal debate, see my *Science at the Bar: Law, Science and Technology in America* (Jasanoff 1995). Krotoszynski (2006) has written a nuanced retrospective on the Bazelon-Leventhal debate, showing how neither judge rigidly adhered to one position or the other.

⁶ *Vermont Yankee Nuclear Power Corp. v. NRDC*, 435 US 519 (1978).

The Receding Regulatory State

Imperceptibly, but with gathering force, ideas of responsibility for scientific and technological innovation, and with that of the public's role, also began shifting. The 1970s, as we have seen, were a time when the state's obligation to keep innovation within safe bounds—physically, environmentally, morally—was unquestioned, and proactive courts took the rules of participation into their own hands to safeguard what they saw as essential for maintaining the democratic public sphere: procedural fairness and rules of reasoning designed to hold government agencies accountable to the people. With the receding of regulation, ideas of how publics should engage with science and technology also altered, and new boundaries were drawn. In particular, increasing deference by the state to science, technology, and expertise closed down some of the earlier channels by which citizens had expressed concerns about the direction and pace of technological change. Courts took a relative back seat, and science received a green light, especially in the rapidly developing field of biotechnology.

Events in three loosely related areas—regulation of the life sciences, judicial review of administrative decisions, and regulatory peer review—point to a new order in which agency expertise was insulated against public challenge, the autonomy of science was reinforced, and the fact-value distinction was written into public deliberation in ways that are deeply antithetical to the findings and tenets of STS. In effect, the “social contract with science” hatched in the 1940s was rewritten, with the state ceding primary power to the market to deal with both the direction of innovation and the risks of possible failure (Jasanoff 2005a). A few examples will illustrate these points.

In 1980, the passage of the Bayh-Dole Act placed an affirmative obligation on universities and other non-profit institutions to patent results from federally funded research and thus take steps toward commercialization.⁷ Critics of the provision argued that the law eroded an important wall between disinterested basic science and interested commercial applications, thereby depriving the public of an important critical resource in debates on science and technology without demonstrably furthering the cause of socially responsible innovation (Krimsky 2003). In the same year as Bayh-Dole, the Supreme Court held in *Diamond v. Chakrabarty*,⁸ its landmark ruling on intellectual property law, that living organisms could be patented without any restrictions, a decision that allowed life itself to be commodified by anyone with the technological means to construct novel organisms.

During the early 1980s, too, the US government, in contrast to many European states, decided that the new biotechnologies, driven by advances in recombinant DNA research, did not require comprehensive federal regulation. The process of genetic engineering, federal policymakers determined, carried no new risks worthy of public concern. Instead, government policy elected to treat biotechnology as simply introducing new products into an already well regulated market.

⁷ 35 USC. §§200–212. For the text, see http://www.law.cornell.edu/uscode/35/usc_sup_01_35_10_II_20_18.html (visited July 2011).

⁸ *Diamond v. Chakrabarty*, 447 US 303 (1980).

Controversies, such as the public outcry over organic labeling of foods and more recently over cloned foods, centered mainly on the adequacy of existing agency regulations and oversight (Jasanoff 2005a). These *laissez faire* choices were consistent with the scientific community's expressed desire to see a frontier-shifting area of research develop with minimal regulatory intrusion, but the absence of legislation also meant that public opinion on the social and ethical aspects of biotechnological innovation remained inchoate and inarticulate. What emerged out of these loosely related decisions, or more properly non-decisions, was a new formation—an academic-industrial complex⁹ to advance civilian science—with the state restricting itself primarily to providing start-up funds to keep the engines of innovation running.

Meanwhile, beginning in the late 1970s, the US Supreme Court initiated a retreat from the open dialogue between agencies and the public that had marked the early years of environmental litigation. The rejection of Judge Bazelon's procedural approach in *Vermont Yankee*, noted above, put a stop to that kind of judicial creativity, on the ground that Congress and not the courts should determine how much process is needed to secure the virtues of public participation. In *Chevron USA, Inc. v. Natural Resources Defense Council, Inc.*,¹⁰ the Court affirmed an agency's right to construe its statutory mandate without fear of judicial reversal, so long as its reading was deemed to be a permissible interpretation of the law. This meant that inadequacies in an agency's treatment of the evidence before it could not, in and of itself, serve as an argument for more process, although it could at the limit result in a remand to the agency for better reasoning.

The 2007 decision in *Massachusetts v. Environmental Protection Agency*¹¹ can be seen as running counter to the trend toward deference, since it showed that even a conservative court will override agency discretion under exceptional circumstances. That case involved a challenge to EPA's decision not to regulate greenhouse gas emissions as a pollutant endangering human health under the US Clean Air Act. On its face, the case reaffirmed the power of the courts to second-guess an agency's reasoning and to demand more substance, consistent with Judge Leventhal's interpretation of the role of judicial review. It is worth noting, however, that the lead petitioners in this case were states and cities, not solely environmental groups or members of the public. Against a backdrop of growing anxiety over climate change, the Court's judgment can be seen as a vindication of the principle of federalism to counteract a widely perceived failure of national leadership. This, too, bears on our understanding of democracy in America, as a constitutional system in which local prerogative is always in tension with the power of the nation-state, but *Massachusetts v. EPA* did not reinforce democracy in the sense of accountability to the people that is commonly associated with the idea of public participation.

⁹ I am making a conscious analogy here to the "military-industrial complex"—a phrase made famous in US politics through President Eisenhower's warning against it in his farewell speech to the nation in 1961.

¹⁰ *Chevron USA, Inc. v. Natural Resources Defense Council, Inc.*, 467 US 837 (1984).

¹¹ *Massachusetts v. Environmental Protection Agency*, 415 F. 3d 50 (2007).

Concurrent with redrawing the court-agency boundary in the 1980s was a reassertion of the authority of science in opposition to claims of legitimacy based mainly on administrative expertise. As I have argued in detail elsewhere, calls to strengthen the scientific basis of agency decisionmaking gathered steam in the 1980s, side by side with calls for deregulation (Jasanoff 1987, 1990, 1992). Frequently expressed as a demand for “good science,” these attacks on the expertise of regulatory agencies moved the politics of science into what I have called the “fifth branch” of government: the dense and influential network of expert advisory bodies attached to the administrative fourth branch (Jasanoff 1990). A common and persistent criticism was that agencies do not subject their scientific determinations to adequate peer review, although who counts as a proper peer varied with the political standpoint of the group or institution levying this particular complaint (Jasanoff 1987, 2005b). The striking point for this discussion is the extent to which the discourse of *public* participation and *judicial* review current in the 1960s and 1970s yielded in later decades to the more technocratic discourse of *scientific* peer review.

From an interpretive STS standpoint, the settlements of the 1980s with respect to basic science, peer review, and judicial review can be seen as taking issues of epistemic uncertainty largely out of the dynamics of popular democracy. At the front end of innovation, with federal lawmaking out of the picture, a new academic-industrial complex, through its emphasis on intellectual property rights and rapid dissemination of research, became the place where private actors privately worked out how to deal with risk and uncertainty. Of course, decisions to bring scientific advances to the market remained fraught with many longer-term questions—technical (will it work?), economic (will it find a consuming public?), equitable (will it alleviate distributive inequalities?), and moral (will it be ethically acceptable?). But with regard to the life sciences all these questions were placed in important ways outside the reach of formal democratic processes. And at the tail end of innovation, in the application of regulatory standards for example, the retreat of the courts left expert administrative agencies as the near-final arbiters of how to resolve scientific and technical uncertainties in the public interest.¹²

Who then was responsible for framing, let alone regulating, innovation’s risks and adverse consequences? American politics created a relatively permissive environment for the development of biotechnology, with the private sector determining how innovation should proceed. But how, when innovation ran into unexpected resistance, did the architects of that system account for the technology’s failures in the global marketplace? One solution was to blame the resisting public for its ignorance of science, according to the “deficit model” that retains a powerful presence in US public discourse, although STS scholars have effectively criticized it for years.¹³ Authoritative US public bodies, including those representing the sciences, have not sufficiently acknowledged the bankruptcy of this approach,

¹² Ironically, during the administration of President George W. Bush (2001–2008), a persistent pattern of ignoring expert advice meant that administrative agencies acquired power unchecked by either democratic accountability or expert reason (Mooney 2005).

¹³ See, for example, Steven Pinker’s review of Natalie Angier’s (2007) *The Canon* in the *New York Times*, May 27, 2007. The review begins with a litany of common public misunderstandings of scientific facts. Against this, however, see Wynne (1995) and Corburn (2005).

which unjustifiably puts scientific knowledge on a higher pedestal than all other knowledge and reduces what citizens should know to meaningless litanies of facts. A more constructive approach was to acknowledge that innovation does indeed raise ethical as well as technical questions that should be addressed before products reach the marketplace, and so to build ethical deliberation into processes of technology assessment. This move, however, created its own deficiencies and problems.

From Politics to Ethics

Instructively, the waning of public debate on technological risks in the 1980s coincided in the United States with the rise of ethics as a lens for examining the limits of technological manipulation. Particularly in relation to the life sciences, but also in connection with varied engineering projects, most recently nanotechnology, the abbreviation ELSI (“ethical, legal and social implications”) took root as an essential analytic framework for assessing the benefits of new and emerging technologies. ELSI’s origins were in the context of the Human Genome Project, where public anxiety about possible discriminatory and intrusive uses of genetic knowledge was most pronounced. The point to note, however, is that the turn to ethics split the analysis of scientific and technological advances into a domain of facts about health, safety and environmental consequences, largely committed to technical experts in administrative agencies, and a domain of values increasingly delegated to ethics committees with presumed expertise in moral reasoning.

A paradoxical effect of the ethical turn has been to privatize the public sphere with respect to the life sciences, turning the deliberative instinct inward in two ways: first, by encouraging personal introspection as an analytic move, thereby downplaying the role of communal or intersubjective norms and public welfare writ large; and, second, by conducting ethical debate in closed forums, out of public view. In bioethics committees, ethical reasoning is seen as lying beyond the competence of untrained minds, with the result that most bioethical deliberation today is conducted by expert bodies behind closed doors, with little or no accountability to wider audiences. Members representing various well-recognized constituencies have an opportunity to assess scientific research in terms of their individual, deep-seated, private understandings of the good. For example, the highly contentious issue of research with human embryonic stem cells is regulated in the United States neither by federal law nor by an open administrative process. Instead, with public funding for such research at first heavily restricted for political reasons, privately funded research came to be supervised through a system of voluntary controls, by Embryonic Stem Cell Research Oversight (ESCRO) committees, constituted pursuant to voluntary guidelines of the National Research Council and Institute of Medicine (2005). Like the Institutional Review Boards that oversee research with human subjects, ESCRO committees enjoy wide procedural and substantive latitude in carrying out their supervisory duties. In these expert bodies, members act for the public good by imagining how other people would feel if they knew as much as the members do. One sees here little of the unruliness and raw contestation of democratic debate. Rather, ethics committees engage in a polite process of opinion formation, oriented toward elite consensus-building, in which the

values and sensibilities of a very few, highly educated, articulate individuals stand in for the untrained, and allegedly uninformed, preferences of the multitude.

A subtle transformation occurs in the dynamics of deliberation when research is subjected to ethical reflection rather than political debate. Ethical expertise imperceptibly gets subordinated to technical expertise, so that those with privileged understanding of the scientific subject matter under discussion come to be seen, and also to see themselves, as the best representatives of the public's moral commitments. Indeed, for many scientists, "understanding the science" and "understanding how science works" serve almost as threshold tests for the right to speak about the ethical dimensions of emerging science and technology. The following comments in the *New York Times* by Olivia Judson (2008), a biologist and science journalist, exemplify this pervasive but little analyzed phenomenon:

When, a couple of years ago, I first imagined putting a nucleus from one animal into the egg of another, I found the idea unsettling. But that was because I was imagining something different: I had in mind the growing of animals, not the creation and swift destruction of a clump of cells. I worried that animals produced this way might not be normal. But then I learned more about the procedure and how it is done. Also, in the course of making a television program about biotechnology, I visited laboratories working with stem cells, and I was impressed by what we have already managed to achieve.

Now my discomfort has gone away. It's been replaced by wonder.

Clearly, Judson wants her audience to see the facts of nuclear transfer as she does, and equally to judge their normative valence as she does—as if seeing and norms-making are part of a single unbroken epistemic continuum. The substitution of the eye of the scientist-observer for the "eye of everyman" that takes place in this text is akin to a move that has been noted in courts of law: there, the judge's privileged epistemic position becomes the standpoint from which are evaluated not only the reliability of factual claims but also normative questions of how, and by whom, facts should be represented (Jasanoff 1998). In the interpretive language of STS, such moments are episodes of co-production, in which ontologies (things as they are) and their legitimate representation (things as they ought to be) are jointly constituted. For normative analysis, however, what matters at such junctures is that one person's private evaluative gaze becomes the surrogate for the eyes of many—and it is allowed to do so because the substitution appears to be warranted on epistemic grounds. Judson's inarticulate "discomfort" is replaced by enlightened "wonder" because she *knows* what is involved here is "the creation and swift destruction of a clump of cells." If everyone knew what she knows, then presumably all discomfort would disappear and there would be no basis left for ethical disagreement.

Without privileging the scientific viewpoint, however, it is unclear why Judson's "wonder" should be entitled to any higher moral status than the much criticized "wisdom of repugnance" advocated by the former presidential ethics adviser Leon Kass (1997; also see Tribe 1998). Kass, it is widely held, abandoned reason for emotion when he urged caution with respect to research that evokes an instinctive "yuk reaction"—as when human and animal cells are mixed to produce a chimera.

Yet, there is a palpable asymmetry in criticizing one person's disgust but not another person's wonder. Both are normative judgments, and both are rooted in affect, not reason. The characterization of the lab-created entity Judson discusses is not, after all, morally neutral. Decades of debate have centered on the right way to think about the early stages of embryonic development, and democracies around the Western world have approached the problem through different institutional mechanisms, yielding substantially different answers to that very ontological question (Jasanoff 2005a, pp. 152–168).

In asserting a biologist's privilege to name this entity (e.g., as a "clump of cells," not a "cybrid"), Judson is at the same time putting forth a prescriptive vision of moral reasoning: let the scientist first decide, and name, the facts of the matter, and only then let everyone else's moral instincts come into play. If the thing in question is determined to be a clump of cells, then it is by definition of no moral concern. An "is" tacitly dictates an "ought." That conforms to the assumption of pre-given fact-value distinctions and an associated linearity of reasoning that is consistent with Enlightenment thought. If we know what the world is like, then we will also know how to behave with respect to it. That logic of "facts first-values after" fails, however, in complex worlds such as those fashioned around the contemporary life sciences, where hybrid cognitive-normative-discursive entities such as human-animal chimeras continually come into being through messy processes of co-production.

It is precisely at such moments of co-production, a normative STS analyst would argue, that informed public engagement might best serve the interests of democracy. For that is when normative commitments get black-boxed into how we know and name nature or how we design artifacts, and those commitments subsequently stay hidden and removed from further contestation. Yet, the turn from politics to ethics in the past few decades has tended to take such issues as the right way to characterize the novel mix of human and animal cells—both scientifically and morally—out of the public sphere as it was constituted in mid-century America. Consensual ethics has replaced contested politics to a significant degree. An unplanned consequence is to make individual value judgments by media-endorsed ethical spokespersons, such as Olivia Judson and Leon Kass, disproportionately more influential than they could possibly have been in the formal, open, skeptical public sphere constituted by the rules of the 1946 APA and its legislative descendants.

Reevaluating Public Engagement

"Upstream public engagement" has emerged as the favored formula for governing science and technology in the early years of the twenty-first century in Europe and to some extent also in the United States. Keeping in mind the three roles of STS scholarship, what can we say, instrumentally, about how the idea of public engagement might be practically implemented; interpretively, about how these buzz words should be construed; and normatively, about how in the light of the US history sketched above we might discern and critique the conceptions of democracy associated with particular participatory mechanisms? For starters, such formulas should be evaluated against a given political culture's historical commitments to

public debate and public process with regard to advances in S&T. Reform proposals only make sense if we understand what abuses—widely imagined and accepted, or ideologically shaped and actively contested—such changes aim to redress.

Taking the longer temporal view into account, one can discern in the US administrative process two cycles of dissatisfaction that led at different constitutional moments to basic modifications in the rules of public engagement. Both responded to worries about technology and feared abuses of state power, but the nature of the abuse and of the public interests to be served were articulated differently in the two eras, conditioned by then dominant ideological trends. The first period of state expansion did not distinguish between cognitive and normative uncertainty, but in a bow to pluralism allowed a multiplicity of voices to challenge perceived failures of regulatory judgment by government agencies and their expert advisers. Courts in that period of procedural liberalism stood in for the lay public and held the state to higher standards of responsibility. The Bazelon-Leventhal debate indicates how judges sought to advance the quality of public reasoning even when they could not agree on the precise balance of judicial-administrative relations to further that purpose.

The second period of neo-liberalism diminished the state's regulatory role in technological innovation, even as it increased deference to the executive's authority to deploy technical expertise, subject only to shifting rules of peer review. The uncertainties deemed most relevant to public debate were relegated largely to the value side of an institutionally redrawn fact-value boundary and, under the rubric of "ethics," value concerns were entrusted to largely non-accountable committees of elite moral analysts. The result was to encourage introspection more than open critique, and broad issues of collective social valuation, such as the political economy of pharmaceutical drug development or the ethics of factory farming, were mostly removed from the agenda of public debate. The focus on public engagement at the turn of the century can be seen as a reaction to the resulting deficiencies in the workings of liberal pluralist democracy, to which the United States retains an ongoing, if ambivalent, commitment.

How, then, should the procedural templates for public engagement be conceived in coming years by instrumentally minded STS analysts? US administrative history, as reviewed through the lens of STS, points to the need for a twofold expansion. First, in the interest of doing justice to the full range of uncertainties surrounding technological innovation, something of the openness of the APA era should be restored to public regulatory processes, so that democracy's disorganized skepticism can again shine in on insulated and non-accountable claims of moral as well as technical expertise. The Supreme Court's decision in *Massachusetts v. EPA* to open up the EPA's reasoning with respect to the regulation of greenhouse gases was a small but welcome step in this direction.

Second, normative STS scholars have a particular obligation to insist on a reevaluation of the boundary work that demarcates facts from values and produces asymmetries of power with respect to classifying the novel objects and sociotechnical systems that science and technology produce in such profusion. A goal of any new public engagement practices should be to restore communication between the domains of emotion and intellect, affect and reason, imagination and argument that

recent procedural trends have separated in practice. The path of bureaucratizing technical reason, privatizing values and emotions, and committing both kinds of judgments to specialist experts was tried with signal non-success in the case of agricultural biotechnology. The same approach may work for a time in connection with biomedical innovations such as cloning, stem cell research, human-animal hybrids, and nanotechnologies, if only because public acceptance of promised medical breakthroughs rests on a firmer social consensus. In the long march of democracy, however, it does not pay to sequester away from open debate issues and uncertainties that should be the common property of all concerned and reasoning citizens. If it restores important value conflicts to the public sphere—and if it permits genuine contestation among science, state, and society—then public engagement may prove to be the right participatory formula in this historical moment, at least for democracy in America.

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