3. At the STS conference, this main symposium was structured in two parts. The first part dealt with the retrospect of science and technology studies (in Europe and parts of North America this field of study is called science and technology studies); and the second part dealt with the future of STS as seen from the perspective of the symposium’s main participants. Given the limitations of time and space, it was not possible to accommodate all the presentations and discussions presented at this main symposium. Those interested in further details and information of this symposium and about the STS conference, may contact the author who was the Programme Chair of the STS conference.

STS and Public Policy: Getting Beyond Deconstruction

SHEILA JASANOFF

What are the prospects for science and technology studies (STS) in the coming century? This is neither an easy nor a straightforward question for a field that is only gradually finding—or, perhaps more accurately, making—a niche for itself in contemporary higher education. In the United States, the first college-and university-based programmes in STS were formed no more than a generation ago, and their institutional status still remains, for the most part, insecure or marginal. Not surprisingly, there are as yet no generally accepted opinions about the appropriate intellectual boundaries of STS, let alone about its theoretical coherence, relationship to established disciplines, or social utility. For senior scholars in STS, questions about the future of the field necessarily call forth a set of personal reflections, informed by their particular experiences in research, teaching and public engagement. I hope nonetheless that some of my observations will have resonance for STS scholars at other institutions, in other countries and in other specialties than my own.

For some twenty years now, I have been involved with science and technology studies at Cornell, one of America’s foremost research universities, as scholar, programme director, head of department, and, most recently, as interpreter and public advocate. My own research during this time has spanned a wide range of topics under the heading of science, law and democratic politics, including, most significantly, environmental regulation, technological risk management, the US and comparative science and technology policy, and

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science and the courts (Jasanoff 1986, 1990, 1995). Beginning around 1990, my personal research agenda has been closely linked to my department’s efforts to develop a graduate and undergraduate curriculum in STS. Increasingly as well, I have been called upon to translate some of the results of my research into policy advice.

On the basis of these experiences, I am confident that STS is going through a kind of renaissance in the United States. It is regaining some of the visibility that it enjoyed in the 1960s, when many of the programmes represented by the contributors to this special issue were founded, but it has also grown enormously in coherence and rigor. Interest in the field’s insights and offerings is arguably higher now than at any time since its inception. At Cornell, STS courses are rapidly gaining new audiences. Science and engineering students have discovered that a little STS exposure serves them well when they apply for positions in the government or industry. Humanists and social scientists are beginning to see that the social analysis of science and technology holds relevance for their own attempts to interpret and explain phenomena in culture and society. There is also a small but developing market in the policy world for the kinds of insights generated by work in our field. Among science advisers, risk analysts and environmental policy-makers, the professional communities that I interact with most frequently, there is a great deal of sympathy for perspectives offered by STS research. Can we productively sustain this momentum as we move into a new century? What are the primary obstacles before us and what are the opportunities?

In this paper, I will restrict myself to one aspect of these questions that I can address with some authority: how to strengthen the links between STS and public policy? I would first like to state a paradox and then suggest a strategy for resolving it. The paradox has to do with the growing gap between academic STS and popular expectations of it. Among scientists, journalists, foundations and government agencies, there is an almost unquestioned assumption that contemporary policy issues must be central to a field that claims to encompass the systematic study of science, technology and society. Yet, with relatively few exceptions (Cornell is a prominent case), STS departments and programmes in the United States have excluded not only science and technology policy, but more broadly the politics of science from their purview. While this neglect may be understandable in the light of circumstances surrounding the formation of STS, those historical reasons have long since ceased to be compelling. Given the centrality of science and technology in modern lives, and technology’s power to lock in unjust as well as just social arrangements (Bauman 1993; Sclove 1995; Winner 1986), democratic societies today have an obligation to fashion meaningful ways of talking about the interactions between science, technology and politics. In turn, the long-term viability of STS as an academic discipline depends on our rediscovering how we, as scholars and teachers in the field, can best serve that need.

The Inward Turning of STS

Nothing in the early history of STS in the United States would have led one to suspect that the field’s connections to contemporary policy and politics might one day begin to wear thin. Most programmes in ‘science, technology and society’, as the subject was initially known, were formed in the late 1960s to address issues that were then at the very forefront of political consciousness: the destructive involvement of science and technology in the Vietnam War and the Cold War; development policies in the Third World that exacerbated existing social inequities; emerging environmental problems such as nuclear power, air and water pollution, and species loss; and novel threats to human dignity through looming revolutions in genetic engineering and electronic communication. Unlike many traditionally humanistic subjects, such as philosophy or classics, STS at its inception effortlessly met the test of social relevance. What is more, it engaged without difficulty the interests of working scientists, who were often concerned about potentially harmful uses of their knowledge and ingenuity. But as the crisis atmosphere of the 1960s faded, so too did many STS programmes. A largely issue-driven intellectual enterprise struggled ineffectually to generate powerful theoretical ideas and debates that would catch the interest of other disciplines. Cost-conscious administrators were not persuaded that there was any space for a new field of STS, with unclear boundaries and an ill-defined mission, within the standard liberal arts curriculum. When I came to Cornell in 1978, there had already been talk of shutting down STS; such talk was to continue for years without any definitive resolution.

By the mid-1980s, few major American universities any longer retained a substantial investment in the social and political studies of
science and technology. Discipline-based programmes in the history, philosophy and, to a lesser extent, sociology of science fared somewhat better, in part because they had a tradition of controlling their own faculty appointments and contributions to the curriculum. For the rest, STS courses were seen as frills or luxuries that did not justify full faculty appointments, particularly at the expense of the traditional disciplines. At Cornell, for example, a once-popular undergraduate course on the impact and control of technological change steadily lost enrollment in the late 1970s. No one complained when the course was quietly eliminated in the early 1980s.

Clearly, STS was desperately in need of intellectual regeneration and help was fortunately at hand. Significant intellectual movements in Europe and elsewhere were adapting investigative methods from the interpretive social sciences to study the workings of science and technology. In Britain, the work of David Bloor (1976) and others of the Edinburgh school gave rise to a new sociology of scientific knowledge (SSK), which boldly claimed that epistemological questions once monopolised by the philosophy of science could be addressed as effectively, if not more so, through sociology. Scientific facts, according to SSK-trained scholars, were best understood as products of socially negotiated understandings about the natural world (see, for example, Collins 1985); they were, in this sense, socially constructed. Such views drew support from pioneering ethnographic research done by Bruno Latour in the mid-1970s at the Salk Institute in California (Latour and Woolgar 1979). The notion that facts were things whose status was to be explained rather than taken for granted—and that illumination could be had by looking away from idealised representations of science, at what scientists actually did—proved to be enormously liberating. New and highly productive frontiers of research opened up, cutting across older disciplinary boundaries within STS, such as that between the history and sociology of science. One indicator of change was the formation in 1991 of Cornell's new Department of Science and Technology Studies, which brought together two previously independent programmes in science, technology and society, and in the history and philosophy of science and technology.3

Intellectual respectability, however, carried costs that were not inconsequential. Chief among these was a loss of connection with the scientific, engineering and policy communities whose activities, both historical and contemporary, have constituted the central objects of inquiry in STS. As conversation deepened among historians, philosophers, sociologists and anthropologists of science, no obvious niche remained for distinguished scientists or experienced science policy experts, who could once have settled, almost for the asking, into second careers in STS. Gone, too, was the sense of easy communion between academic STS research and the messy practicalities of public policy-making. Focused increasingly on the specificities of scientific production, STS scholars seemed tacitly to accept scientists' own understandings of where science begins and ends, and thereby to lose touch with the wider social relations of science and technology. Micro-studies of laboratories and other scientific institutions either ignored the broader political and ideological contexts of scientific practice or else explored relatively narrow slices of scientific culture, such as scientific controversies, fringe science or the low representation of women in science. Even work that patently dealt with the intersection of science and the state, such as Donald MacKenzie's (1990) admirable study of missile accuracy or Chandra Mukerji's (1989) ethnography of the Scripps Institution of Oceanography, presented notably less full-blooomed portraits of political institutions and practices than of scientific ones.

As STS has matured, exchange between scholars and practitioners of science, engineering and science policy has grown, if anything, more contentious. Scientists and decision-makers, still largely wedded to preconstructivist understandings of science, tend to feel excluded or even patronised by a specialist disciplinary discourse that strikes them as unnecessarily opaque and distant from their lived experience. Few in the world of public policy intuitively understand a field whose very object seems to be to question the supremacy of scientific rationality. How could STS, so defined, possibly help resolve such critical human problems as hunger, poverty, violence, disease and environmental degradation—problems whose solution has traditionally been thought to depend on the production of more and better scientific knowledge? Some view the emergence of a newly empowered social study of science with even deeper misgivings—as part of a contemporary cultural revolt against reason, progress and modernity itself (Gross et al. 1996; Gross and Levitt 1994).

STS today, then, faces sharply different challenges from those that it confronted in the late 1970s. The field can no longer be faulted for lacking theoretical insights or intellectual energy. At the same time, the rebirth of faculty commitment and student interest in STS has occurred, at least within US academic settings, at the expense of
commitments seem to travel more swiftly today than they did a generation ago. Clearly, STS has much to provide, but it also has a major task of intellectual diplomacy ahead. Where should it begin?

The Perils of Deconstruction

From my strangely underpopulated corner of the field, it appears that restoring the neglected political dimension of science and technology to the centre of STS research and teaching is an indispensable prerequisite for the field’s continued success. Too much of the world’s economic and political order today depends on science and technology for STS scholars to retreat into esoteric epistemological debates about the nature of knowledge and reality. Some of the most exciting work in STS, in any case, concerns the ways in which human societies establish and maintain the boundaries between scientific and other forms of authority—legal, political, religious and social. To elucidate these processes in their full richness, STS research will necessarily have to look outward. The deep understanding that STS has gained of science in recent years will have to be integrated with comparably deep insights into the institutions, practices and cultures that form the other side of the science-society boundary. Much will depend on the coming decades on how skillfully STS scholars represent the interpenetration of science and society, and how compellingly they draw the connections between STS and the broader intellectual and social currents of our time.

If our field is to regain the significance that it was once thought to hold for public policy, it will need, first and foremost, to get beyond the label of ‘deconstruction’. Deconstruction—the analytic process by which scientific claims are disentangled into their material, social and rhetorical components—has proved to be an immensely useful and powerful methodological device within STS. But the concept has also acquired some negative connotations. People who casually come upon STS without any professional preparation are often troubled, or even turned off, by the anti-realist flavour of deconstruction; a common, but telling, error is to identify constructivism with a mindless relativism that places all factual claims on the same footing, treating none as more robust than any other. For many scientists, the word deconstruction carries the stamp of moral nihilism, a denial of the genuinely progressive achievements of science and technology over
of STS. One is the recognition that what we take to be matters of fact about the physical world are significant social achievements that may vary from one historical or cultural setting to another. Another is the understanding that supposedly inanimate technologies—such as genetic engineering, nuclear power plants, space telescopes or computerised databases—actually incorporate social beliefs and practices, such as legal rules or cultural judgements of fairness. Still another is that the capacity to produce particular forms of scientific knowledge and understanding is indissolubly linked with other kinds of social and political capacity (Ezrahi 1990).

Research on topics such as scientific and technological controversies, accidents, testing and safety, and the social acceptance of new technologies has illuminated how social and cultural assumptions get incorporated into images of the way the world works. By casting light on these complicated constructions, STS offers more creative ways for people to change those things that they find most constraining, hazardous or inequitable. Conventional policy analysis has been hampered, for example, by taking the boundaries between the scientific, the social and the technological worlds as given and unchangeable. This presupposition often leads to a premature narrowing in both the framing and solution of perceived problems. Thus, inappropriately rigid, technology-based solutions may be superimposed upon complex and dynamic sociotechnical problems: better contraceptive technologies to fight overpopulation; high dams to cope with water scarcity; genetically engineered crops for dealing with hunger; more computers in the classroom to compensate for poor teacher–student ratios; new, ‘safer’ chemicals to replace those shown to harm birds, fishes or stratospheric ozone. These ‘technological fixes’ often fail because they were targeted at incomplete understandings of the underlying problems, without due regard for the ways in which the human and the material elements of technological systems complement one another. Constructivist research can improve the analysis of policy alternatives by presenting more nuanced accounts of these interconnections.

Another way in which constructivist work in STS can advance policy-making is by illuminating aspects of controversy that decision-makers and their expert advisers often find baffling. The STS approach to controversy symmetrically examines the foundations for both true and false beliefs, asking how people arrived at judgements about the rightness or wrongness of particular facts. This method of

Several centuries. Still others confuse deconstruction in STS with a theory of textual interpretation that seems to have little to say about science’s most tangible and material contributions to the world we live in.

It is, of course, profoundly misleading to identify the idea of deconstruction that has developed in STS scholarship with relativism or a denial of reality. On the contrary, the constructivist strain in STS represents, quite possibly, the most dedicated attempt to grasp the nature of reality that is currently underway in any of the social sciences. By refusing to take reality claims for granted, STS helps to deepen our awareness of the processes by which human societies form their perceptions of reality. Skeptical questions about how something comes to be seen as ‘real’, open the door, in effect, to more complete accounts of what is felt to be material and immutable or universal and true, in particular, historical and cultural circumstances. Yet, to explain these ambitions to others, STS will have to find more effective ways of describing its methods and commitments. In particular, to avoid the misunderstandings surrounding deconstruction, STS should focus on the term’s positive counterpart: that is to say, on construction. Making sense of the way technological societies construct their varied forms of life is, after all, at the heart of the contemporary STS project.

Constructivism and Public Policy

As soon as constructivism is put in a positive light—as the study of how complex scientific claims and technological products are put together out of heterogeneous construction materials—we begin to see how STS scholarship can productively link up with the concerns of public policy. Some of the most compelling work in STS has centred on the ways in which scientific knowledge, technological artifacts and social order are not separate from each other, but are held together through complex interconnections (Bijker et al. 1987; MacKenzie 1990; Shapin and Schaffer 1985). There are several different ways of speaking of these connections, using terms like heterogeneous engineering, actor-network theory, cyborgs and hybrids (Haranay 1991), mutual shaping, and co-production. Fortunately for the health of STS, no single theory or school of thought dominates the field, but there are some strong commonalities among the different subfields
interrogation can be extremely informative because it illuminates the
nooks and crannies where beliefs are put together, revealing underly-
ing, possibly unarticulated, normative assumptions, as well as tacit
models of nature and society, whose validity may never have been
tested. The framework of constructivism also accommodates the
untidiness of science's day-to-day practice. It respects the indetermi-
nacy of individual observations, and hence the potential for legiti-
mate disagreement about complex phenomena. It stresses that sci-
entific 'facts' are the product of social triangulation—a question
of many, painstakingly cross-checked observations converging to the
same, collectively endorsed, but always provisional endpoint. Policy-
makers trained in constructivist modes of thought will learn not to
hold individual scientific judgements to absolute standards of logic
and evidence, but rather to devise processes that promote collective
deliberation and gradual cognitive convergence.

STS scholarship at its best offers not only new ways of grasping why
technologies malfunction or controversies occur, but also novel
insights into the mutually sustaining dynamics (or co-production) of
science and society. Comparative research over the past two decades
has shown, for instance, that human responses to both nature and
technology are culturally embedded and place-specific. Repeatedly,
when we might have expected uniformity in people's appreciation of
new scientific or technological developments, we have found signifi-
cant differences. So, for example, national regulatory systems have
come to different results when trying to estimate the risk of cancer
from dioxin, the contribution of greenhouse gases to global warming,
the risks of releasing genetically engineered organisms into the envi-
nroment, or the sustainability of particular whaling or fishing prac-
tices. People and their governments, it appears, perceive the 'same'
technological risks (and sometimes benefits) differently, reflecting
their disparate cultural and political traditions (Brickman et al. 1985;
Jasanoff 1986). Biotechnology, for example, has drawn divergent
public and policy responses in Germany, France, Denmark and the
United States. New medical technologies, such as prenatal testing,
are not equally accepted in every society into which they are intro-
duced; alternative medicine, similarly, enjoys more acceptance in
some technologically advanced societies than others. By exploring
such variations in public responses to technology, STS research has
opened up new ways of understanding how cultural commitments
enter into—and are reinforced by—the construction of science and
technology.

In a time of growing interaction among cultures of all kinds—eco-
nomic, social, and political—this aspect of STS research promises to
be especially valuable with respect to policy-making. When STS
scholars have looked at the cross-cultural reception of new technol-
ogies, they have uncovered substantial differences in the methods by
which people distinguish between acceptable and unacceptable tech-
nological developments. For example, some decision-making cul-
tures insist on a model of objectivity that rigidly separates science
from politics, whereas others believe that good decisions require a
constant blending of values and expertise (Jasanoff 1986; Porter
1995). Quantitative analysis is more favoured as a decision-making
technique in some countries than in others. In some policy systems,
decisions are required to be transparent and policy-makers must pro-
vide explicit explanations for their decisions; in others, decision-
makers have to meet tacit standards of virtue and reasonableness, but
need not publicly explain their reasons for arriving at particular deci-
sions. In some cultures, technological controversies are resolved, by
preference, through litigation, while in others lawsuits are seen as a
sign of social breakdown that should be avoided at all costs (Brick-
man et al. 1985). In identifying these broad and varied patterns,
constructivist STS work provides important insights into the diversity
and distribution of basic human preferences concerning technologi-
cal development.

Reconfiguring STS

To recapitulate, as we look toward the development of STS in the next
century, an important task will be to discard the negative labels that
others have tried to fix on our field's distinctive approaches to under-
standing how science, technology and society fit together. STS
research is not at all interested, as some have suggested, in the denial
of truth and reality. Quite the contrary, this emerging field is dedi-
cated to the construction of deeper, more socially grounded accounts
of scientific truth and material reality than are currently available in
most other academic disciplines, including more established bran-
ches of the natural and social sciences. This is the strong and positive
sense in which STS scholarship may quite accurately be called
constructivist. It is an approach that questions and is skeptical of prior assumptions, but its ultimate aim is to piece things together constructively, combining heterogeneous elements into richer pictures of complex systems and activities. Policy-makers who wish to make wise decisions about science and technology should learn to take the resulting pictures seriously, for they offer the possibility of reframing socially and culturally blinkered problem definitions—and so opening the way to solutions that respect human aspirations and capacity.

At the same time, we STS scholars must learn how to represent our work more effectively to audiences outside our immediate professional networks. Finding the right language is a start, but more will be needed in order to regain STS's once prominent place in policy debates. STS as a field will have to resist the ever-present temptation to fragment internally along older disciplinary lines, setting science policy against technology studies or history of science against the study of science as culture. Students of science and technology, whatever their particular methodological orientations, should acknowledge the shared theoretical commitments that unite them as members of an emerging intellectual community. Above all, academic STS programmes should overcome their distaste for the real worlds of policy and politics. Just as Molière's Monsieur Jourdain discovered that he had always been speaking prose, so STS scholars should acknowledge that the study of science and its myriad applications is inseparable from the study of power in modern societies (Jasanoff 1996). This recognition should guide both curricular developments and faculty appointments, as STS departments and programmes once again strive to integrate the politics of science and technology into their educational missions. If these efforts succeed, then STS will indeed have much to offer to policy-makers and democratic publics in the twenty-first century.

NOTES

1. An overview of major research sites and theoretical orientations in STS may be found in Jasanoff et al. 1995.

2. Correll was one of the three US universities (along with the University of California at San Diego and the University of Minnesota) that received substantial grant support from the US National Science Foundation in the early 1990s to establish interdisciplinary graduate programmes in STS. Of the three, Cornell was the only one that consolidated science and technology studies into a single department.
STS in Europe

ARIE RIP

STS is a commonly used acronym but it is an ambiguous term, interestingly so as far as the emergence of STS in Europe and elsewhere is concerned.

The acronym can be spelled out to read science and technology studies: an interdisciplinary approach to the study of science and technology, in which history, philosophy and social studies contribute, and more recently, also economics, political science and cultural studies. Work in science and technology studies is published in interdisciplinary scholarly journals like Social Studies of Science. It can also contribute to the disciplines it draws on, sometimes raising new issues, as in the so-called empirical turn in the philosophy of science and technology. My favourite example of a contribution to a mainstream discipline is the study of Don MacKenzie and Graham Spinardi on ‘Tacit Knowledge, Weapons Design and the Uninvention of Nuclear Weapons’, published in the American Journal of Sociology, one of the top disciplinary journals (MacKenzie and Spinardi 1995). Their article combines detailed sociological analysis with a fresh perspective on science and technology, and it is exactly the latter which characterizes the intellectual contribution that STS can make.

As a field of study, STS emerged in Europe and the United States in the late 1960s and early 1970s. It is indicative how a degree course in the History, Philosophy and Social Studies of Science was established at the University of Sussex, parallel to the Science Policy Research Unit. The Handbook edited by Ina Spiegel-Rössing and Derek de Solla Price captures the early achievements, and reflects the combination of disciplinary and policy orientations (Spiegel-

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