Introduction: The Visionary Challenges of STS

Understanding STS is a challenge—and in more than one way. First off, STS is not easily defined. Second, it challenges us to think about our scientific and technological society with greater depth than is often assumed to be necessary. Furthermore, STS is the outcome of more than one vision, and may be viewed from more than one perspective. To appreciate the rich and complementary character of these challenging visions, it helps to have some knowledge of the historical background out of which STS has emerged, and some preliminary profile of the spectrum of views collected in the present volume.

Historical Background and the Challenges of STS

The rise of modern science and technology has presented a series of special challenges to society. In the sixteenth and seventeenth centuries (with Galileo, Bacon, and Descartes) and again in the nineteenth century (with Darwin) conflicts arose between science and religion, none of which have ever abated. In the eighteenth and nineteenth centuries (with the industrial revolution) special problems arose for economics and politics, which neither socialism, capitalism, nor democracy have been able fully to resolve. The twentieth-century advent of nuclear weapons, electronic computers, and biotechnologies has only intensified these multiple challenges that range from issues of personal belief and social justice to nuclear risk, environmental pollution, cultural integrity, and self-identity.

The interdisciplinary field of STS is the most general attempt to map out and to assess such challenges, as well as the responses that have emerged. As such STS is itself a challenge to both routine acceptance of scientific and technological change and uninformed or narrow-minded reactions to such changes. STS takes up the challenge of the influence of science and technology on society. It becomes itself a challenge to uncritical acceptance of the world-historical transformation that began in the sixteenth century and has reached a dynamic crescendo as we enter the twenty-first.

The interdisciplinary STS challenge has roots in diverse disciplinary formations and cultural activities. The economic analyses of Adam Smith and Karl Marx, the novels of social consciousness by Dickens and Zola, and political reform movements that have gone under the names of liberalism, progressivism, and even neoconservatism have all played roles. But it is disciplinary specializations in the history and philosophy of science dating from the early part of the twentieth century, which were eventually followed by parallel disciplinary studies of technology and medicine, that have been the most salient influences in STS. During the mid-1960s various configurations of these scholarly pursuits—influenced as well by such activist initiatives as the consumer and environmental movements—became formally known as both the STS movement and STS studies (Cutcliffe 2000).

"STS" is actually a contested acronym. At first it stood for "Science, Technology, and Society"—and was characterized as a movement. Science, technology, and society programs emerged at various universities in the United States, Europe, and Australia, not always using this exact phrase. Examples include, for instance, the Science in a Social Context or SISCON program in the U.K. and the Values, Technology, Science, and Society or VTSS program at Stanford, both from the 1970s. When STS played a role in K-12 science education it was often time hyphenated as Science-Technology-Society and used as an adjective to qualify curriculum content. During the 1980s a number of university departments such as those at Cornell University and Rensselaer Polytechnic Institute reinterpreted the acronym to stand for science and technology studies, and took steps to transform the interdisciplinary field into a scholarly discipline with all the accoutrements thereof—from tenured faculty lines and degrees to journals and textbooks.

Early science, technology, and society programs often adopted as their representatives such figures as Jacques Ellul (1964) and Lewis Mumford (1967 and 1970). They presented global character-

izations of science and technology as independent or semiautonomous forces dominating society, with at least implicit calls for their active delimitation. Later science and technology studies scholars have come to focus on the analysis and explication of specific sciences and technologies as complex societal influences and social constructs entailing a host of political, ethical, and general theoretical questions. In this "contextual" view, STS presents science and technology as neither wholly autonomous juggernauts nor simply as neutral tools ready for any utilization whatsoever. Instead, sciences and technologies are seen as value-laden social processes taking place in specific contexts—interactively shaped by, and in turn shaping, the human values reflected in cultural, political, and economic institutions.

Against this background of tensions between macro and micro perspectives, STS challenges us to pursue interdisciplinary conceptualizations of the attendant complex interactions at both the individual and global levels. Medical science and technology—which, in social constructivist analyses such as those by Bruno Latour and Steve Woolgar (1979), merge into technoscience (Latour 1987)—obviously are influenced by and influence health care practices and policies. But they also may be linked with issues as seemingly remote as stratospheric ozone depletion, since the presence of effective technoscience treatments for skin cancer in Europe, North America, and Australia make the developed world, which is the primary cause of ozone depletion, more able to meliorate the consequences than underdeveloped countries in South America, Africa, and Asia.

A second challenge of STS is, in both micro and macro analyses, to pursue interdisciplinarity by walking a fine line of judicious analysis between promotional enthusiasm and oppositional rejection. In all its incarnations, despite repeated charges to the contrary, it is crucial to note that STS is neither pro-science and technology—what Langdon Winner has called HSTS, "Hooray for Science, Technology, and Society"—nor is it anti-science and technology. To call even the STS movement anti-technology simply because it often subjects science and technology to wholesale criticism is like calling an art critic "anti-art" (Winner, 1986, p. xi; and 1989, p. 436).

A Spectrum of STS Visions

Given the contextual relationship between science, technology, and society, and the generalized description of STS as a field of

study more than a discipline, it is natural that it exhibits many different approaches to issues and emphases. There is not just the challenges of STS; there are also many challenges in STS. Making sense out of the interdisciplinary complexities and the debates among different approaches to STS can be a daunting task. One aim of this book is thus to assist in such a sorting out process by providing a selection of brief statements representative of influential persons and perspectives in the broad STS field.

To this end we have invited ten STS scholars each to contribute short essays outlining their views on either the current state of STS or where the field may or should be headed. It is our hope, moreover, to enhance not just the understanding of science, technology, and society relationship but to advance intelligence in public decision-making with regard to science and technology.

To facilitate comparisons of the ten visions of STS we have divided them into three groups: general perspectives, applications, and critiques. This should be taken as more a heuristic classification than a rigid categorization, because in fact each essay makes some claim to advancing a general perspective, applying STS to particular problems, and criticizing inadequacies of the field. There are nevertheless differences in emphasis, and these are reflected in the provisional categorization that has been adopted.

Part I, "General Perspectives," includes four basic programmatic statements. Given the important role played by the question of technological determinism in STS discussions, it is appropriate to open with a chapter by Langdon Winner revisiting this issue. The truth is that although any comprehensive strong determinism has been widely rejected, it remains reasonable to argue a modified determinist thesis with regard to many aspects of technology. Indeed, as Winner effectively points out, there remains a recurring tendency in society at large to grant or adopt some kind of technological determinism.

Wiebe Bijker, the second essayist in this collection, makes a strong brief for what is called the social constructivist view of science, technology, and society. Social constructivism is the most systematically pursued program in the STS field; to some extent this view developed in opposition to and has largely replaced the research in technological determinism. Social constructivism has nevertheless been criticized as sometimes coming close to adopting a promotional or apologetic stance toward science and technology. Bijker restates the social constructivist stance as an attempt precisely to steer the challenging course between the barking Scylla of

determinism and the swallowing Charybdis of endorsement.

In the third chapter, Lars Fuglsang, with a sketch of three general approaches to STS in relation to public policy formation, considers two versions of determinism: one in which science and technology shape society, another in which society shapes science and technology. As a more sound basis for policy formation and public action, Fuglsang argues for the interactionist approach that has become somewhat characteristic of the STS field.

Susan Cozzens, in a fourth essay, considers the problem of interdisciplinarity, especially from an academic standpoint. For her, there is also a problem of determinism, but by the inherited disciplines that contribute to any general STS understanding. The general challenge in STS is to work at transcending these multiple disciplinary divides.

The next three chapters, which constitute Part II, "Applications," all choose to stress more specialized perspectives in and on STS. Rudi Volti offers an STS perspective on technology and work, challenging some traditional views. Robert E. Yager, in a further challenge to college-based STS discussions, describes the role STS plays in educational theory, especially as influential in primary and secondary schools. Albert H. Teich examines STS from the perspective of a policy analyst. Each of these three applied visions uses STS not only to raise questions about popular assumptions regarding science and technology in contemporary society, but also to envision new ways of doing STS itself.

The need to envision new ways of doing STS, and thereby to renew the field, becomes the major theme of Part III, "Critiques." Richard Sclove takes an ironic approach, pointing out that on "other planets," such as some European countries, STS involves much more than just studying science and technology issues; it involves as well doing something about them. A robust STS attitude requires bridging the theory-practice divide.

Eulalia Pérez Sedeño subjects STS to a feminist criticism. For her the greatest weakness in STS has been the failure to appreciate the masculine biases of much science and technology, and the ways in which science and technology have differentially impacted women and men. Her argument may well have related implications for ways STS has failed to appreciate the differential impacts on various ethnic groups.

The collection concludes with Wilhelm E. Fudpucker's challenge to STS to rethink itself in light of fundamental transformations taking place in technology. Too often, he implies, and too eas-

ily, STS has assumed that it knew what the science or the technology is with which society interacts. It is not just conceptions of the theory-practice divide or disciplinarity or feminism that constitutes a challenge to STS; it may even be our conception of technology.

As indicated, these essays include several general assessments of the field as a whole (Winner, Bijker, Fuglsang, and Cozzens). There are also specific calls for more effective democratic participation in science and technology decision-making (Sclove) in the face of a concern regarding the deterministic nature of technology (Winner). Three pieces focus on applied themes in STS (Volti on work, Yager on education, Teich on science and technology policy). Others critique the effectiveness of STS as currently constituted (Pérez Sedeño and Fudpucker).

These diverse visions—appropriate for a truly interdisciplinary field—are representative of a diversity of authors from a diversity of contexts. The authors come from universities and independent institutes or professional organizations, as well as from as many as five different countries. Both younger and more well established practitioners of STS are granted an opportunity to present their visions and challenges. Taken together, these essays thus offer an exciting overview of the STS field, one that provides readers a kaleidoscopic perspective on many science and technology issues.

Collective and Independent Uses

The order of presentation may not always be the order that a reader may want to make use of these essays. In fact, each essay stands alone, and may be fruitful in any number of combinations.

Each of the essays is preceded by a brief headnote that summarizes its main theme, indicates the author's background, and raises one or more questions to consider while reading the essay. The aim here is to emphasize our effort to provide, not a single authoritative interpretation, but rather a series of ideas on STS approaches that will allow students and general readers to better grasp science and technology issues and as a result to exercise more informed citizenship with regard to science and technology in their lives. It is our hope thereby to enhance not just understanding of the relationships between science, technology, and society, but public decision-making with regard to science and technology as well.

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