Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program

Director: Steven L. Goldman
Editor: Stephen H. Cutcliffe

Number 32, November 1982
ISSN: 0275-8075

ENGINEERING AND THE PHILOSOPHY OF TECHNOLOGY

The philosophy of technology is sometimes identified too closely with critics of technology --thinkers such as Lewis Mumford or Martin Heidegger. The fact is, however, that the very phrase "philosophy of technology" originated with engineers or those associated with engineers, and this is also a good thing for philosophers to keep in mind. What follows is a brief sketch of the development of the phrase "philosophy of technology" and of the corresponding philosophies of technology.

Two early manifestations of philosophy of technology were termed "mechanical philosophy" and "philosophy of manufacturers." In 1832 an American mathematics teacher (later lawyer) named Timothy Walker (1802-1856) took it upon himself to respond to Thomas Carlyle's criticism of mechanics in his "Signs of the Times" (1829). Actually Walker did not fully appreciate the contrast Carlyle drew between mechanics and dynamics as poles of human action and feeling, nor did he appreciate Carlyle's subsequent call for a reintegration of dynamics with mechanics --a reintegration which he later argued should be effected by "captains of industry" (*Past and Present*, 1843). Nevertheless, Walker's "Defense of Mechanical Philosophy" has become a classic, claiming that mechanical philosophy was a means for making democratically available the kind of freedom enjoyed only by the few in a society based on slavery.

In 1835 the Scottish chemical engineer Andrew Ure (1778-1857) coined the second related phrase "philosophy of manufacturers," to designate his "exposition of the general principles on which productive industry should be conducted with self-acting machines." Ure's book included a number of conceptual issues which have continued to concern philosophers of technology: distinctions between craft and industrial production, the classification of machines, and the possibility of rules for invention. Yet, because this discussion was coupled with an enthusiastic apology for the factory system, its more analytic side has often been overlooked. Contemporary cybernetics, systems theory, and operations research can, however, be seen as natural extensions of Ure's analysis.

Forty years later it was the German philosopher Ernst Kapp (1808-1896) who originated the phrase *Philosophie der Technik*. But Kapp was an unusual kind of philosopher; especially was he an unusual kind of German philosopher. Like his contemporary Karl Marx (1818-1883), Kapp was a left-wing Hegelian who got into trouble with the German

authorities in the 1840s because of political attempts to translate Hegel's dynamic idealism into firm materialist terms. But unlike Marx, whose materialism remained limited to an abstract and scholarly analysis of economics, Kapp developed what we would now call an environmentalist philosophy, and when forced to leave Germany, chose, not London (and the British Museum), but the American frontier.

Kapp emigrated to the German pioneer settlements of central Texas, and for the next fifteen years led the practical life of farmer, inventor, and associate of the newly formed Smithsonian Institution. As such, he lieved at close quarters with tools and machinery. After his return to Germany in 1865, he reflected on this experience and formulated a philosophy of technology in which tools and weapons are understood as different kinds of "organ projections." Although this is an idea which can be found hinted at by Aristotle, it was in Kapp's hands that it first received detailed elaboration and through him that it came to influence the thought of such contemporary figures as Arnold Gehlin and Marshall McLuhan.

In the decade of Kapp's death, the Russian engineer P. K. Engelmeier began to publish papers in German periodicals employing the term "philoosphy of technology" and calling for the philosophical elaboration and social application of the engineering attitude toward the world. In 1911 Engelmeier restated this thesis before the 4th World Congress of Philosophy held at Bologna, Italy. And with the founding of the Russian Engineering Society in 1917, Engelmeier undertook to proselytize for what in America became known as the technocracy movement --that is, the idea that society should be interpreted, re-structured, and managed according to technological principles. Indeed, because of this Engelmeier fell out of favor with Marxist authorities in the Soviet Union and was almost certainly executed for counter-revolutionary tendencies during the Industrial Party Affair of the early 1930s.

A few other nodal points in the development of this technological philosophy: two engineers, Max Eyth (1836-1906) and Alard DuBois-Reymond (1860 - ?), independently undertook to analyze the technical invention process. Eyth distinguished between the creative germination of an idea, its development, and its final utilization. DuBois-Reymond likewise stressed the difference between invention as psychological event and as material object. Both authors sought to identify the initial creative inspiration in the mind of the engineer with what goes on in the mind of the fine artists. An effort was thus being made to build bridges between engineering and the humanities. It is no doubt significant that whenever subsequent similar efforts have been made, almost invariably an argument has arisen concerning the unity of creativity in both the technological and aesthetic realms. Samuel Florman's *The Existential Pleasures of Engineering* (1976) is a good recent case in point.

In 1913 another German engineer Eberhard Zschimmer (1873-1940) became the third person to use the term "philosophy of technology" as the title of a small volume in which he defended technology against its cultural critics and proposed a neo-Hegelian interpretation of technology as "material freedom." Zschimmer's slim book went through many editions, and in the early 1930s was revised so as to reflect the ideas of National Socialism. Perhaps partly as a result, Zschimmer's thought has been stigmatized and ignored, although it presents a cogent technical interpretation of the meaning of freedom, one that unconsciously echoed Walker and has been implicitly reiterated in many contemporary engineering apologies for technological activity. That the goal of technology is human freedom achieved through, and understood in terms of, the material mastery of and escape from the limitations of nature has been, for instance, a common theme in the celebration of space exploration from *Sputnik I* in 1957 to the moon landing of 1969 and the Space Shuttle of today.

Following World War II, engineering-related philosophy of technology went through a period of sustained, systematic growth. In Germany, the first formal organizational developments took place within the Verein Deutscher

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Lehigh University, Bethlehem, PA 18015

Ingenieure (VDI, or Society of German Engineers) which conducted a series of conferences on themes related to the philosophy of technology. In 1956 the VDI established a special "Mensch und Technik" study group, which was broken down into working committees on education, religion, language, sociology, and philosophy. Since its inception, such members of this study group as Simon Moser, Hans Lenk, Gunther Ropohl, Alois Huning, and Friedrich Rapp -- most of whom teach in technical institutes and/or have degrees in both engineering and philosophy--have become the most prominent philosophers of technology in Germany. The 1970s witnessed the publication of a number of books by these men, with Rapp's *Analytical Philosophy of Technology* having recently been translated into English (1981).

Outside Germany, the term "philosophy of technology" has not been so common. There have, however, been related developments. The French engineer Jacques Lafitte undertook in *Reflexions sur la science des machines* (1932) to sketch a comprehensive analysis of technical evolution and the structure of industrial production. This analysis has been deepened by that of another engineer, Gilbert Simondon, in *Du Mode d'existence des objects techniques* (1958). Both works take considerable pains to be true to engineering experience, at the same time that they formulate an abstract interpretation of technological phenomena. Simondon, for instance, who has been an influence on Jacques Ellul, distinguishes between parts, devices, and systems as kinds of technological objects and proposes a theory of technological evolution on the basis of detailed references to examples like that of the internal combustion engine. In the Netherlands, to cite another example, the engineer Hendrik van Riessen began a second career in philosophy with *Filosofie en Techniek* (1949), a work which still provides one of the most comprehensive historico-philosophical surveys of the field to that date.

The English phrase "philosophy of technology" makes its first significant occurence as the title of a symposium in the Summer 1966 issue of *Technology and Culture* --the journal of the Society for the History of Technology, an association (and discipline) which, from its inception, has had strong alliances with the engineering community. The title "Toward a Philosophy of Technology" had originally been that of a paper by Mario Bunge, an Argentinian philosopher with intimate knowledge of West European discussions and strongly attracted to the positivist attempt to create what he calls a scientific philosophy. For him "technophilosophy," as he now calls it, is just one aspect of this larger project, which involves the interpreting of reality in scientific-technological terms and reformulating humanistic disciplines such as philosophy and ethics along scientific and technological lines.

The most outstanding figure in engineering-philosophy discussions, however, both before and immediately after World War II, was Friedrich Dessauer (1881-1963). Dessauer was also the fourth person to employ the term "philosophy of technology: in the titles of his works. As a research engineer who pioneered in the development of X-ray therapy, and as a Christian social democrat who openly opposed Nazism, Dessauer not only deepened the engineering analysis of technology but also sought to open up a dialogue with existentialists, social theorists, and theologians. His major works run from *Technische Kultur?* (1908) and *Philosophie der Technik* (1927) to *Seele im Bannkreis der Technik* (1945) and *Streit um die Technik* (1956). It is the work of Dessauer that is most often cited in those instances where philosophers of science mention philosophy of technology.

Indeed, one way to summarize Dessauer's philosophy of technology is to contrast it with the standard philosophies of science. The latter either analyze the structure and validity of scientific knowledge or discuss the implications of specific scientific theories for cosmology and anthropology. For Dessauer, both approaches fail to recognize the power of scientific-technical knowledge, which has become, through modern engineering, a new way for man to relate to the world. Dessauer attempts to provide a Kantian explanation of the transcendental preconditions of this power, as well as to reflect on the ethical implications of its application.

To the three Kantian critiques of scientific knowing, moral doing, and aesthetic feeling Dessauer proposes to add a fourth --a critique of technological making. In the *Critique of Pure Reason* (1781), Immanuel Kant (1724-1804) argued that scientific knowledge is necessarily limited to the world of appearances (the "phenomenal" world); it can never make unmediated contact with "things-in-themselves" ("noumena"). Critical metaphysics is, however, able to delineate the *a priori* forms of appearances, and to postulate behind phenomena the possible existence of some noumenal reality. The *Critique of Practical Reason* (on moral doing), and the *Critique of Judgment* (1790) (concerned with aesthetic evaluation), go further; they affirm the necessary existence of a "transcendent" reality beyond appearances as a precondition of the exercise of moral duty and the sense of beauty. Practical and aesthetic experience, nevertheless, are unable to make positive contact with this transcendent reality, nor can analyses of these realms of experience articulate the noumenal structures behind them.

Dessauer argues that making, particularly in the form of invention, does establish positive contact with things-in-themselves. This contact, for Dessauer, is confirmed by two facts: that the invention, a created object, is not something previously found in the world of appearances; and that, when it makes its phenomenal appearance, it works. An invention is not just something dreamed up, imagination without power; it is the result of a cognitive encounter with a realm of pre-established solutions to technical problems. Technological invention involves "real being from ideas" --that is, the engendering of "existence out of essence," the material embodiment of a transcendent reality.

Although philosophers have generally found something naive and crude about Dessauer's adaptation of Kant, we should not overlook his authentic extension of the Kantian point of view. For Kant, all reasoning is oriented toward the practical; the more practical it is, the closer experience comes to a decisive transcending of its own phenomenal limitations. For Kant such transcendence takes place in the realm of moral and aesthetic experience. Dessauer, however, locates the decisive penetration of appearances precisely in a kind of practical experience that Kant failed to recognize as worthy of serious consideration --that is, in modern technology.

In harmony with this metaphysical analysis, Dessauer also proposes a theory of the moral, not to say the mystical, significance of technology. Most such theories limit themselves to a consideration of practical benefits. For Dessauer, however, the autonomous, world-transforming consequences of modern technology are witness to its transcendent moral value. Man creates technology, but its power --which resembles, he says, that of "a mountain range, a river, an ice age, or a planet" --goes beyond anything man expected: it brings into play more than this-worldly forces. Modern technology should not be conceived simply as "the relief of man's estate" (Francis Bacon); it is, instead, a "participating in creation, ...the greatest earthly experience of mortals." With Dessauer engineering technology thus takes on the distinctive character of a religious mystical experience.

Engineers are often thought to be unaware of the need for philosophy --especially of any need for a philosophical analysis of technology. In fact, it can be shown that engineers have themselves not only on occasion been aware of such a need, but that they have even proceeded to discuss on the basis of their experience certain general philosophical issues. The adequacy of this technological philosophy is, of course, subject to debate. But in many instances it might be that a good entree into the philosophy of technology for engineers would be through this kind of literature and the issues it raises for itself.

Carl Mitcham
Department of Philosophy
Polytechnic Institute of New York
Brooklyn, New York 11201

[Some paragraphs of this article have been adapted with permission from the author's chapter on "Philosophy of Technology" in Paul T. Durbin, ed., *A Guide to the Culture of Science, Technology, and Medicine* (New York: Free Press, 1980).]

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COURSE SYLLABUS

COMMUNICATIONS TECHNOLOGY AND CITIES

H79.2006
Spring 1982

Prof. M. Moss
New York University
Interactive Telecommunications Program

This course is designed to provide an understanding of the relationship of new communications technologies to urban development and the role of new telecommunications technologies in the provision of public and private services.

Course Outline and Reading Assignments

Week 1 - Feb. 9 *Introduction: The Future Now.*

Week 2 - Feb. 16 *Communications Technology and Urban Development.*

2.1 Melvin Webber, "Urbanization and Communications", G. Gerbner, *et al*, eds., *Communications Technology and Social Policy*, John Wiley, 1973.

2.2 Daniel Bell, "Communications Technology For Better or Worse", *Harvard Business Review*, May-June 1979.

2.3 Ronald Abler, "The Telephone and the Evolution of the American Metropolitan System", I. Pool, ed., *The Impact of the Telephone*, MIT Press, 1976.

2.4 Forrest W. Warthman, "Telecommunication and the City", *Annals of the American Academy of Social and Political Science*, March 1974.

2.5 Jean Gottman, "Megalopolis and Antipolis: The Telephone and the Structure of the City", I. Pool, ed., *The Social Impact of the Telephone*, MIT Press, 1977.

2.6 Peter Cowan, "Moving Information Instead of Mass: Transportation Versus Communication", G. Gerbner, *et al*, eds., *Communications Technology and Social Policy*, John Wiley, 1973.

Week 3 - Feb. 23 *Communications Within Cities.*

3.1 Richard Meier, "The Metropolis As a Transaction-Maximizing System", *Daedalus*, Fall 1968.

3.2 William T. Knox, "Problems of Communication in Large Cities", I. Pool, ed., *Talking Back: Citizen Feedback and Cable Technology*, MIT Press, 1973.

3.3 Richard Meier, *A Communications Theory of Urban Growth*, MIT Press, 1963, Chapter 3, "Uses of Time and Space".

3.4 Karl Deutsch, "On Social Communication and The Metropolis", *Daedalus*, 1963.

3.5 Paul Craven and Barry Wellman, "The Network City", *Sociological Inquiry*, Vol. 43, no. 3-4.

Week 4 - Mar. 2 *Urban Information Flows.*

4.1 Brenda Dervin, "The Everyday Information Needs of the Average Citizen", M. Kochen and J. Donohue, eds., *Information for the Community*, Chicago: American Library Association, 1976.

4.2 Marshal Ernst, "The Mechanization of Commerce", *Scientific American*, September 1982.

4.3 Richard Meier, "Urban Ecostructures in a Cybernetic Age: Responses to Communications Stress", G. Gerbner, *et al*, eds., *Communications Technology and Social Policy*, John Wiley, 1973.

4.4 H. Cox and D. Morgan, *City Politics and The Press*, Cambridge University Press, 1973, Chapter 3.

4.5 Jack Deacy, "What The Big Dailies Don't Tell You About What's Going On In The City", *New Yorker*, May 24, 1971.

4.6 Brenda Dervin, "Communication Gaps and Inequities: Moving Toward a Reconceptualization", Dervin and Voigt, eds., *Progress in Communication Sciences*, Ablex Publishers, 1980.

Week 5 - Mar. 9 *Media Images of the City.*

5.1 Paul Hirsch, "Television As A National Medium". D. Street, *et al*, eds., *Handbook of Contemporary Urban Life*, Jossey-Bass, 1978.

5.2 David Street and W. Paul Street, "Print Media in Urban Society", D. Street, *et al*, eds., *Handbook of Contemporary Urban Life*, Jossey-Bass, 1978.

5.3 Ben H. Bagdikian, "Conglomeration, Concentration and The Media", *Journal of Communication*, Spring 1980.

5.4 Clinton Cox, "Meanwhile in Bedford-Stuyvesant", *More*, April 1976.

5.5 David L. Altheide, *Creating Reality*, Sage Publications, 1976, pp. 1-28.

5.6 Stephen White, "Toward A Modest Experiment in Cable Television", *The Public Interest*, Summer 1968.

Week 6 - Mar. 16 *The Effects of New Telecommunications Technologies on Urban Communities.*

6.1 Nathan Katzman, "The Impact of Communication Technologies: Promises and Prospects", *Journal of Communication* Vol. 24, No. 4, 1979, p. 47.

6.2 Harold Mendelsohn, "Delusions of Technology", *Journal of Communication*, Summer 1979.

6.3 Kenneth L. Kraemer, "Telecommunications/Transportation Substitution and Energy Conservation, Part I", *Telecommunication Policy*, March 1982.

6.4A *Telecommunications for Metropolitan Areas: Opportunities for the 1980's*, National Research Council, 1978, pp. 1-38, 81-87.

6.4B Kenneth L. Kraemer and John Leslie King, "Telecommunications/Manipulation Substitution and Energy Conservation", *Telecommunications Policy*, June 1983.

6.5 Jean Crattman, "Office Work and the Evolution of Cities", *Ekistics*, Jan/Feb 1979.

6.6 J. B. Goddard and R. Pye, "Telecommunications and Office Location", *Regional Studies*, Vol. II, 1977.

Week 7 - Mar. 23 *Communications Technology and Local Politics.*

7.1 Kenneth C. Laudon, *Communications Technology and Democratic Participation*, Praeger, 1977, pp. 1-49.
7.2 Ithiel de Sola Pool and H. Alexander, "Politics in a Wired Nation," de Sola Pool, ed., *Talking Back: Citizen Feedback and Cable Technology*, MIT Press, 1973.
7.3 Mitchell L. Moss, "Cable Television: A Technology for Citizens", *Journal of Urban Law*, Spring 1978.
7.4 Donald Michael, "On Coping with Complexity: Planning and Politics", *Daedalus*, Fall 1968.
7.5 T. Haight, *et al*, "Uses of Computers and Communications Technologies by Grass Roots Community Organizations", Paper delivered at the 10th Telecommunications Policy Research Conference, 1982.
7.6 Laurence Zuckerman, "Cable News Hits the Small Time", *Columbia Journalism Review*, September/October 1982.

Week 8 - Mar. 30 *Public Applications of Information Technology.*

8.1 John Leslie King, " Local Government Use of Information Technology: The Next Decade", *Public Administration Review*, January/February 1982.
8.2 Kenneth L. Kraemer, William Dutton and Alana Northrop, *The Management of Information Systems*, Chtrs. 1, 9.
8.3 Frank Dimeglio, "Municipal Communications Management Comes of Age", *Telecommunications*, October 1981.
8.4 John Leslie King and Kenneth L. Kraemer, "Cost As A Social Impact of Information Technology", M. Moss, ed., *Telecommunications and Productivity*, Addison-Wesley, 1981.
8.5 M. Moss, ed., *Telecommunications and Productivity*, Part V: pp. 277-314.
8.6 Timothy Haight, "Community Uses of New Media: Organizing for Social Change", delivered at International Communication Association 31st Annual Conference, May 1981.

Week 9 - Apr. 13 *Sound in Education.*

Telelecture by Tony Schwartz

Week 10 - Apr. 20 *Narrowcasting.*

Lecture by Tony Schwartz

Week 11 - Apr. 27 *The Future of Urban Telecommunications.*

11.1 Ralph Lee Smith, "The Birth of a Wired Nation", *Channels*, April/May 1981.
11.2 Lawrence Grossman, "Arguing Against History", *Channels*, October/November 1981.
11.3 S. Lehman-Wilzig, "Will Cities Become Obsolete?", *Telecommunications Policy*, December 1981.
11.4 Larry J. Rosenberg and Elizabeth C. Hirschman, "Retailing Without Stores", *Harvard Business Review*, July-August 1980.
11.5 John A. Quelch and Hirotaka Takeuchi, "Nonstore Marketing: Fast Track or Slow", *Harvard Business Review*, July-Aug. 1981.

Week 12 - May 4 Student Projects.
Week 13 - May 11 Student Projects.
Week 14 - May 18 Student Projects.

ENERGY IN AMERICAN HISTORY CONFERENCE

Mountain Lake Hotel, a lovely resort in the mountains of southwestern Virginia near Blacksburg, was the setting for a three-day conference on Energy in American History in early October. The conference was sponsored by the Center for the Study of Science in Society at Virginia Polytechnic Institute and State University and coordinated by Arthur Donovan, the Center's Director. Additional support for the conference came from the Virginia Center for Coal and Energy Research and the National Endowment for the Humanities.

The goal of the conference was to provide a comprehensive account of the role of energy in American history by examining the concept of energy as it has been used in a variety of disciplinary traditions. Fifteen scholars interested in various aspects of energy and five commentators made prepared presentations at the meeting. In addition, about 40 other individuals attended the conference and participated in the discussions. The commissioned papers provided exemplary studies of specific episodes in the history of energy, and the commentaries then located these special studies in the more general context of American history. The papers were circulated before the conference, so that at Mountain Lake only brief summaries were given, most of the time being devoted to commentaries and discussion.

Five sessions were held. The opening session on "Concepts, Resources, and Theories" began with a paper by Dan Siegel (Wisconsin) on the history of the concept of energy. Tom Wilbanks (Oak Ridge National Laboratory) then summarized his paper on geographical perspectives on the way energy is produced and used in America. In the third paper in the session Sanford Lakoff (California, San Diego) contended that our major energy policies fall squarely within the liberal political tradition and can best be understood by an analysis of that tradition. In her commentary Susan Flader (Missouri) pointed out that the republican tradition, which is older than the liberal tradition, has been at least as important as the latter in shaping American values on energy issues. In the lively discussion which ensued Don Kash (Oklahoma) questioned the importance of ideology in the energy debate. Kash's challenge illustrated what turned out to be one of the underlying themes of the conference --a disagreement as to whether ideas and values or economic and administrative/political considerations were and are dominant factors in energy debates and decision making.

Thomas McCraw (Harvard) argued that Flader and other historians ought to be willing to generalize, and his charge sparked considerable debate throughout the meeting. What indeed is the task of the historian? How can the historical understanding of energy be moved beyond the narrow case study of this fuel or that policy to more comprehensive generalizations about energy's role in American history?

A fresh approach was taken in the papers by Edwin Layton (Minnesota), Arthur Donovan (Virginia Tech), August Giebelhaus (Georgia Tech), Richard Hirsh (Virginia Tech), George Mazuzan and J. Samuel Walker (Nuclear Regulatory Commission). Their papers dealt with water and wood, coal, petroleum, electricity, and nuclear power and were presented in the second and third sessions. Merritt Roe Smith (M.I.T.) and Thomas Park Hughes (Pennsylvania), the commentators on these sessions, suggested several ways in which these case studies might be integrated and generalized into a larger history of energy. Roe Smith pointed out the divergence between those who treated energy as a resource and those who treated it as a technology. Smith suggested that Donovan saw coal mining as primarily a problem in management. The social and cultural aspects of coal mining and its uses were, Smith suggested, at least as important as the business concerns that Donovan emphasized.

Thomas Hughes urged energy historians to look at the broader picture, to move beyond the American case study and take a comparative approach to the study of energy history. By using the comparative approach, Hughes contended, historians of energy would be able to formulate some interesting hypotheses about energy history. In the discussion which followed, many participants seemed unwilling or unable to accept the injunctions to address broader questions, to formulate more general hypotheses, and to attempt historical syntheses. Many of those at the conference clearly preferred to

concentrate on the further elaboration of specific studies within the broad range of energy topics.

The last two sessions addressed "Energy and Society: Institutional Conflicts and Policy Problems." Linda Lear (George Washington) dealt with hydroelectric power by using the Boulder Dam as a study in resource management. Papers by Rodney Carlisle (Rutgers), Richard H.K. Vietor (Harvard) and Jack Holl (Department of Energy) dealt respectively with federal research and petroleum conservation, oil policy and market forces, and Eisenhower's "Atoms for Peace" program. Taking a more comprehensive approach, John Clark (Kansas) sought to articulate a notion of the common good that federal policies are designed to serve.

In his commentary Richard Hewlett (History Associates) suggested a variety of ways in which the federal involvement with energy research, regulation, and policy direction can be seen as part of the larger story of science and government in America. Jan Laitos (Denver) developed a related theme in his commentary by sketching out the ways in which various energy problems and public concerns are coordinated in the American legal context.

Tom McCraw began his commentary with some general historiographical remarks. Addressing himself to the task of the historian as synthesizer, he noted it was here that many of the papers presented in the conference had not fulfilled their promise. Challenging those historians who see it as their task to discover and discuss economic and political models, McCraw contended that the principal goal of the historian should be to synthesize such models and make them intelligible by embedding them in an analytical narrative. McCraw called for historical studies of energy that integrate analysis, assessment, interpretation, comparison, and organization by making them all part of a conceptually informed historical narrative.

In the final discussion the participants assessed what had been accomplished at the conference and considered how they should proceed to develop further the field of the history of energy. It was pointed out that several important areas of energy history had received no more than passing notice: solar energy had not been discussed, nor had alternative energy sources such as synfuels been dealt with. The environmental dimension of energy history was also missing. Reemphasizing what he had said earlier in his commentary, Tom Hughes called for what amounted to a "social history of energy," suggesting that more attention needed to be paid to the production of energy and not just the consumption. The producers of energy, Hughes maintained, and the ramifications of various energy production systems need more attention. Roe Smith concurred, pointing out the need to devote attention to the "human dimension" in energy history.

After-dinner talks Friday and Saturday evenings added two more dimensions to the conference's consideration of energy questions Nicholas Georgescu-Roegen (Vanderbilt) spoke Friday evening on "The Promethean Condition of Viable Technologies." This talk set the consideration of energy history into the very large context defined by his well-known concern with the implications of thermodynamics for economic analysis. Don Kash, drawing on his experience in the federal government and his training as a political scientist, spoke on "Energy Policy Systems, Past and Present." This lively talk presented a compelling case for the development of a national energy policy that takes account of the nation's long and complex engagement with energy issues in the past.

By the end of the conference, there was general agreement that progress had been made in defining and delimiting the field of energy history within the American perspective. Participants agreed, however, that the history of energy needed to be made broader and more analytic. The field needs to be made more encompassing so as to include: comparative studies of energy, environmental dimensions of energy issues, and the "social history of energy."

The papers presented at this conference are being edited by Arthur Donovan and will be published as a special issue of the journal *Materials and Society*. They will subsequently be bound and sold as a trade book by Pergamon Press, publisher of the journal.

Ann F. La Berge, Assistant Director
Center for the Study of Science
in Society
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia

OPEN FORUM

FACING UP TO TECHNOLOGY

is the title of the Fall 1982 issue of *The Antaeus Report* from the Center for the Study of Education and Society. The issue's focus as implied in the title is on the need to come to grips with a value-laden technology that has become both a source of freedom and opportunity and a source of problems, limitations,and unwanted complexity. The bulk of the issue is given over to a lengthy interview with sociologist Manfred Stanley, author of *The Technological Conscience: Survival and Dignity in An Age of Expertise* (see *STS Newsletter, Issue 12*, June 1979, p. 19), in which he discusses the role of and need for "education" in today's modern technological society. Also included is a selection of excerpts from a presentation made by Joseph Bordogna, Dean of Engineering at the University of Pennsylvania. Bordogna argues for and outlines a course of liberal studies which would "combine the essence of an engineering education --the engineer's approach to defining and solving problems and making things work --with the advantages of a liberal education--the breadth of understanding of society, its history and its people." The issue concludes with a review of Darrell Fasching's *The Thought of Jacques Ellul: A Systematic Exposition* (Toronto: Edwin Mellen Press, 1981). For information on obtaining a copy of *The Antaeus Report*, write to the Antaeus Center for the Study of Education and Society, Ohio Wesleyan University, Delaware, Ohio 43015.

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I N T E R F A C E ' 8 3

The Department of English and History of Southern Technical Institute, a four-year college of engineering technology, is sponsoring, in conjunction with the Humanities and Technology Association, the seventh annual conference on the interface of the humanities and technology, in Marietta, Georgia (metro Atlanta), October 20-21, 1983.

We invite papers and presentations in the growing discipline that examines the integration of humanistic concerns and technological growth. To focus fully on this interaction, submissions should contemplate the following areas:

--Relationship between the humanities and technology as perceived by business and industry.
--Ramifications of technology in ethics.
--History and philosophy of science, technology, and architecture.
--Public policy toward science and technology.
--Curriculum design for the humanities and technology.
--Roles and effects of technology in science fiction, American studies, and popular culture.
--Responses of literature, aesthetics, and the arts to technology.

One-page, single-spaced abstracts, to be reproduced for conference participants, should include the author's name, affiliation, and the title of the paper. Send abstracts to:

Becky Kelly or Sandy Pfeiffer, Department of English and History
Southern Technical Institute, Marietta, GA 30060 [404-424-7202 or 7203]
Deadline for submissions is May 2, 1983.

SCIENCE IN SOCIAL ISSUES:

Implications for Teaching

is the title of a discussion paper by Glen S. Aikenhead prepared as part of a study of Canadian science education conducted by the Science Council of Canada. In his essay Aikenhead argues for a new science education, one that will provide Canadian students with an understanding of science as it is related to political and social decision making. It is the social contexts and processes of science, not merely an accumulation of scientific "facts" and procedures relevant primarily to the professional scientist, that students must learn in order to function readily in contemporary society. Aikenhead suggests approaches that might be utilized in the high school classroom drawing in part upon his own *Science: A Way of Knowing* (Univ. of Saskatchewan, 1975) a year-long science course for tenth-graders. Soft-bound copies of Aikenhead's essay may be obtained free of charge from: The Publications Office, Science Council of Canada, 100 Metcalfe Street, Ottawa, Ontario K1P 5M1.

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The First Issue

of the IEEE Center for the History of Electrical Engineering *Newsletter* appeared in October. The *Newsletter* is issued periodically "as a means for reporting on Center efforts and for disseminating information about resources and activities in electrical history." The first number contains brief pieces on the IEEE History Center's exhibits program and on its archival activities. Also included is a list of research projects currently in progress and a short annotated bibliography on new publications. A variety of other newsworthy items and announcements flesh out the issue's eight pages. If you are interested in receiving this useful newsletter, it is distributed free of charge and can be obtained by writing to: Center for the History of Electrical Engineering, IEEE, United Engineering Center, 345 East 47th Street, New York, New York 10017.

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THE NEH SUMMER SEMINARS FOR COLLEGE TEACHERS PROGRAM

will offer 84 eight-week seminars during the summer of 1983. Those teachers selected to attend will receive a stipend of $2,700 to cover travel expenses to and from the seminar location, books and other research expenses, and living expenses. The purpose of the program is to provide opportunities for faculty at undergraduate and two-year colleges to work with distinguished scholars in their fields at institutions with library collections suitable for advanced research. The 1983 Summer Seminars for College Teachers brochure, which lists seminar topics, directors, dates, and locations will be available locally from department chairpersons or from the Division of Fellowships and Seminars, MS 101, NEH, 806 15th Street, N.W., Washington, D.C. 20506 in January 1983. College teachers interested in applying to a seminar should write directly to the seminar director (addresses are listed in the brochure) for detailed information and for application materials. The deadline for submitting applications to directors will be April 1, 1983. Of particular interest to teachers in the science, technology and society field are the following seminars:

Stephen G. Brush
Institute for Physical Science and Technology
University of Maryland
College Park, Maryland 20742

History of Modern Physical Science

June 27 - August 19, 1983

D. Paul Thomas and Gene I. Rochlin
Department of Political Science
University of California
Berkeley, California 94720

Political Images: Science and Ideology During the Cold War, 1945-1960.

June 13 - August 5, 1983

James F. Childress
Department of Religious Studies
Cooke Hall
University of Virginia
Charlottesville, Virginia 22903

Principles and Metaphors in Biomedical Ethics

June 13 - August 5, 1983

Robert S. Westman
Department of History
University of California
Los Angeles, California 90024

Reappraisals of the Scientific Revolution

June 20 - August 12, 1983

BOOK REVIEW

Carroll W. Pursell, Jr. *Technology in America: A History of Individuals and Ideas.* Cambridge, Mass: MIT Press, 1981. xi, 264 pp. Illus., bibliog. Paper, $9.95.

Technology in America is an anthology which uses the careers of leading inventors as a springboard to examine the context and consequences of technological change. With only two exceptions, the essays were originally written for this volume, and are therefore fairly uniform in length, scope, and purpose. The essays are intended for the undergraduate student taking an introductory course in the history of technology. Unlike existing anthologies in the field, which primarily reprint scholarly articles from professional journals, these essays are reasonably broad while not presuming much background knowledge of the field.

Although the chapters, with one exception, are built around the achievements of a single individual, neither Pursell nor the other authors imply a "great man" theory of invention or change. The social, economic, and technological context of each individual and each innovation is clearly deliniated. In the course of the book, the major themes in the history of technology are all developed: the transfer of technology, America's practical and democratic approach, the American system, institutionalization of knowledge and scientific research, technology as a system, energy and conservation. A complete list of the authors and the topics is included below.

The essays are well-written and some are quite sophisticated, most notably Hugo Meier on Jefferson. Several important topics are omitted; there are no essays on steam engines, railroads, the telegraph, textiles, or television. But, the volume is not intended as a comprehensive text in the history of American technology, although it comes closer than any previous offering.

I have assigned the volume in my one semester course in the history of American technology, and I have found it to be very useful. It enables me to fill some gaps and provides greater thematic continuity to the readings. Each instructor, of course, has his own emphasis, but I particularly found the essays on Eads, Francis, Pinchot, Lindbergh, Chaplin, and Cooke, enlarged the coverage of my course. Student response to the volume has generally been favorable, although sometimes they have learned the hard way that the essays, although relatively short, repay a very close reading. Each chapter can provide the basis for a good short essay question.

There are a few well-chosen illustrations in each chapter which provide a valuable addition to the text, and a brief bibliography is appended at the end. The book is overpriced, but such are the times in which we live.

--Roger D. Simon
Department of History
Lehigh University

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M*E*T*A*

MANKIND, ETHICS, TECHNOLOGY, AND THE ARTS

RECENT PUBLICATIONS

BROMBERG, JOAN LISA. FUSION: SCIENCE, POLITICS, AND THE INVENTION OF A NEW ENERGY SOURCE. CAMBRIDGE, MA: MIT PRESS, 1982. XXVI + 344 P. ILLUS. $30.00.

Bromberg traces the history of magnetic fusion from 1951 to 1978 primarily through the four programs on which the majority of government funding has been spent to date --Lawrence Livermore National Laboratory, Los Alamos Scientific Laboratory, Oak Ridge National Laboratory, and the Princeton Plasma Physics Laboratory. The strategy of fusion research readily falls into three periods: 1) the 1950s, in which fusion was characterized by trial and error due to the lack of complete scientific understanding of the attendant problems, 2) the 1960s, a period of basic research necessitated by the need to understand plasma, and 3) the 1970s, during which period research focused on a result-oriented reactor product, in part due to the social demands engendered by environmental and energy issues. The author clearly shows the interrelationship between science and politics, noting that "the major decisions in fusion research have always emerged from a medley of technical, institutional, and political considerations" (p. 2). The study is based upon extensive research in official government and laboratory archives, the personal files of numerous participants, and 175 oral interviews with fusion scientists, engineers, and administrators. S.H.C.

FLORES, ALBERT, ed. DESIGNING FOR SAFETY: ENGINEERING ETHICS IN ORGANIZATIONAL CONTEXTS. Troy, NY: Center for the Study of Human Dimensions of Science and Technology, Rensselaer Polytechnic Institute, 1982. 227p. $5.00.

Case studies and papers examine how organizations can positively influence their design engineering staff to develop products that demonstrate concern for public safety. Flores details the formal mechanisms used by two organizations with excellent product safety records, Monsanto and NASA, to insure the safety-consciousness of their engineers. The editor also surveyed five hundred engineers regarding the effect of these mechanisms on their work. A second part of the volume is devoted to analysis of and response to this data by eleven scholars and practicing engineers. George Sinclair contends that much research on the ethics of engineers is misguided because unethical behavior is confused with professional incompetence. The effective brief piece by Robert Perrucci outlines the basis for his belief that the engineering profession, in its current state, is so oriented toward serving economic and political interests that it is unable to address large-scale societal problems. Michael Bayles points out the factors involved in the determination of acceptable risk, methods of analysis, and the types of expert input that are necessary from engineers, economists, the public affected. An overview of the product design process is provided by Robert M. Anderson of General Electric. He details a methodology for assessing product hazards and a process to integrate concern for hazards into the design program. Robert Baum discusses institutional impediments to safety that are independent of the engineer's ethical principles. The questionnaire used in the survey of engineers is appended.

FOLSOM, MICHAEL BREWSTER AND STEVEN D. LUBAR, EDS. THE PHILOSOPHY OF MANUFACTURES: EARLY DEBATES OVER INDUSTRIALIZATION IN THE UNITED STATES. VOL. I, DOCUMENTS IN AMERICAN INDUSTRIAL HISTORY. CAMBRIDGE, MASS: MIT PRESS AND MERRIMACK VALLEY TEXTILE MUSEUM, 1982. XXXIX + 462 P. ILLUS. $45.00.

The first volume in a new series entitled Documents in American Industrial History brings together forty-four major documents from the debates over the rise of industrialization in the United States from the period 1775-1860. Not unexpectedly, much of the debate focuses on differences between those who favored the "encouragement of manufactures" and those who sought to preserve America's agrarian heritage. Included are selections from Thomas Jefferson, Alexander Hamilton, Tench Coxe, George Logan, Henry Clay, Daniel Webster, Thomas Carlyle, Timothy Walker, Edward Everett, Andrew Ure, Henry David Thoreau, and Ralph Waldo Emerson. A useful essay by the editors outlines the general parameters of the debate, and brief introductions at the head of each selection establish their place within the broader framework. On balance this is an excellent primary source collection for those who seek a fuller understanding of our early industrial history but do not have access to major research collections. S.H.C.

GEORGE, PETER. THE EMERGENCE OF INDUSTRIAL AMERICA: STRATEGIC FACTORS IN AMERICAN ECONOMIC GROWTH SINCE 1870. ALBANY: STATE UNIVERSITY OF NEW YORK PRESS, 1982. XII + 242 P. TABLES, BIBLIOG. $10.95.

A series of interpretive essays traces the emergence of a modern American mixed economy as it developed after the Civil War. George focuses on technological and organizational changes in agriculture and manufacturing during the period 1870-1930. Among other topics, he discusses sources of economic growth; components of technological change --invention, innovation, and diffusion; organizational and administrative changes in manufacturing; technological and organizational change in agriculture; agrarian and industrial unrest and the response of governmental regulation; and the collapse of the classic market economy with the coming of the Great Depression. Brief case studies are utilized to illustrate some of these general developments: i.e. machine tools and the Draper Loom to explicate the process of technological diffusion; biographical sketches of Edison, Ford, Carnegie, and Morgan to portray the essence of entrepreneurship; the DuPont firm as illustrative of organizational change in manufacturing; grain and dairy farming as indicative of agricultural productivity growth; and railroad regulation as an example of a response to industrial unrest. Based primarily on secondary sources, this book would make a good auxiliary text in an upper-level undergraduate course in the history of technology. S.H.C.

HOFFMAN, MICHAEL W. and JENNIFER MILLS MOORE, eds. ETHICS AND THE MANAGEMENT OF COMPUTER TECHNOLOGY: PROCEEDINGS OF THE FOURTH NATIONAL CONFERENCE ON BUSINESS ETHICS. Cambridge, MA: Oelgeschlager, Gunn and Hain, 1982. 175p. $25.

Sponsored by the Center for Business Ethics at Bentley College, the dozen papers presented at this conference cover the vastness of changes generated by computer technology, responsible computer and information products management, the issue of privacy, strategic planning, and the increasing powerlessness of individuals. Joseph Coates sees computer technology as a promoter of human autonomy which threatens the traditional business structure. He considers the personal orientation of the Judeo-Christian tradition to be inadequate in a society dominated by organizations. James Emery and Abbe Mowshowitz argue for and against the computer as a neutral tool. Emery lays the blame on failures in design and implementation while Mowshowitz finds built-in biases in the technology, particularly a fostering of remote social control. Examples of unethical behavior and white-collar crime by computer technologists are detailed by Donn B. Parker. Two educators from Rensselaer and MIT describe their efforts toward teaching ethical responsibility in computer use. Strategies for the management of computer technology and information are outlined by a consultant and a former director of the Federal Paperwork Commission. Both stress the lack of control and inefficient use of information assets at the present. Arthur Miller of Harvard Law School points out four areas of public fear regarding potential violations of privacy. James Brian Quinn contends that computers will create more jobs, augment democracy, foster progress in developing countries. Sidney Schoeffler holds that an extensive information database is essential to a rational, informed society.

HORWITCH, MEL. CLIPPED WINGS; THE AMERICAN SST CONFLICT. CAMBRIDGE, MA: MIT PRESS, 1982. XVIII + 473 P. ILLUS. $25.00.

The political conflict over whether the United States would build a supersonic commercial aircraft began in the late 1950s and continued to the early 1970s. The author depicts the many elements of the controversy: bureaucratic intrigue, managerial incompetence, economic considerations, technical problems, and the unexpected and powerful, organized public protest. Predominently emerging from the saga is the realization that the power and prestige battle among public bureaucracies, ambitious officials, and corporations actually steered the events until citizen opposition entered the scene. Claims of economic necessity and national pride appear to have served only as rhetoric for those who vied to control massive funds. Cooperation with Britain and France was consistently vetoed by bureaucrats who did not want to share the responsibility and assumed glory. Horwitch successfully chronicles how a technical R and D project changed from an engineering problem and a debate about government funding of commercial interests into a societal war based on environmental quality. Four phases of the conflict are identified: a "prelude" in which the possibility of the commercial transport was discussed and studied; a "containment" period beginning with the election of Kennedy during which the FAA head developed a firm administrative foundation; "fragmentation" from 1963 to 1968 when bureaucratic fighting, economic doubt, presidential support, poor management, the beginnings of media criticism and public protest splintered the program; and "explosion" from 1968 to 1971 when the national protest campaign succeeded in convincing Congress to terminate the program. Horwitch finds the relevance of the SST matter in the pattern of the conflict from limited issue to societal concern. The four stages define a model for high technology projects that has become more common in the last decade wherein new values, new participants, and new rules for decision/making gain acceptance.

HOY, SUELLEN M. AND MICHAEL C. ROBINSON, EDS. PUBLIC WORKS HISTORY IN THE UNITED STATES: A GUIDE TO THE LITERATURE. NAHSVILLE, TENN: PUBLIC WORKS HISTORICAL SOCIETY AND THE AMERICAN ASSOCIATION FOR STATE AND LOCAL HISTORY, 1982. X, 477 PP. BIBLIOG. $49.00.

This extensive annotated bibliography includes over 5,000 annotations and is arranged topically by type of public works activity --planning, engineering, and administration; irrigation; waterways; flood control and drainage; sewers and wastewater treatment; community water supply; solid wastes; roads, streets, and highways; urban mass transportation; airways and airports; public buildings; parks and recreation; energy; and military installations. Each major section is preceded by a short essay outlining the range of materials included. With few exceptions, the works are historical in approach and include books, articles, and dissertations, with some titles that overlap more than one section being cross-listed. Annotations are relatively brief and to the point. While specialists may find that certain items in their particular field have been excluded, this collection is probably as close to being "comprehensive" as any single-volume could reasonably be expected to be. A single, combined author and title index is included. S.H.C.

KULIK, GARY; ROGER PARKS; AND THEORDORE Z. PENN, EDS. THE NEW ENGLAND MILL VILLAGE, 1790-1860. VOL. 2, DOCUMENTS IN AMERICAN INDUSTRIAL HISTORY. CAMBRIDGE, MASS: MIT PRESS AND MERRIMACK VALLEY TEXTILE MUSEUM, 1982. XXIV + 520 P. ILLUS. $40.00.

This second volume in the series of Documents in American Industrial History nicely complements the first on the early debates over industrialization. Its focus is on the "Rhode Island System" of textile manufacturing involving rural villages clustered around small mills, rather than the larger Lowell-type factory cities (which will be the subject of two subsequent volumes in the series). These small-scale developments were "the first characteristic form of American industrial community." The documents reveal much about the companies and their owners, as well as the employees, the conditions under which they labored, and their attitudes toward work. Included are memoirs and letters, company records and regulations, plus contemporary accounts of village life. Because of their range and scope the documents appear to tell a less easily followed story than those of the first volume, but the editors' introduction and headnotes, as well as their organization, provide the necessary framework for understanding and analysis. A most valuable primary source collection. S.H.C.

MARK, ROBERT. EXPERIMENTS IN GOTHIC STRUCTURE. CAMBRIDGE, MA: MIT PRESS, 1982. X + 135 P. ILLUS. $15.00.

Experiments in Gothic Structure is the intriguing result of fifteen years of Robert Mark's research in applying the analytical techniques of modern structural mechanics to the architecture of Gothic cathedrals. By subjecting models of the great cathedrals to scaled loads simulating the effects of gravity and wind, Mark is able, through computer modeling and photographic analysis, to answer questions surrounding the necessity of architectural elements such as flying buttresses, pinnacles, and vault ribs. Among the many structures examined are the cathedrals of Chartres, Bourges, Amiens, Palma, Beauvais, and Cologne. Mark's findings lead him to conclude that in general a theory of structural rationalism should be used to interpret Gothic architecture; that is, decorative elements are largely a result of structural considerations. This study could well be utilized in a course designed to teach liberal arts students about certain basic elements in technology and engineering. S.H.C.

MARVIN, CAROLYN. "FABLES FOR THE INFORMATION AGE: THE FISHERMAN'S WISHES.: THE ILLINOIS ISSUES HUMANITIES ESSAYS (SEPT. 1982): 17-24. (AVAILABLE AT NO COST FROM THE ILLINOIS HUMANITIES COUNCIL, 201 WEST SPRINGFIELD, CHAMPAIGN, ILLINOIS 61820.)

Drawing upon the analogy of the fable of the fisherman who receives three wishes, Marvin argues that our most widely held expectations for the computer and the information age are misguided and lack imagination. Noting the inherent value-laden nature of all technology --it must be if it is human-made-- she counters the belief that computers are somehow neutral and simplistically provide us opportunities for choice and self-determination by suggesting a rather more complex reality. Likewise, the author suggests that computers will not automatically and democratically diffuse throughout society offering safety and security. "The diffusion of computers and computing skills depends on something besides desire, something that is neither democratically or automatically distributed --and that is money." Finally, Marvin suggests that computers will not provide us "novel possibilities for self-expression and development," will not "offer inexhaustible resources for liberating the human spirit," at least they will not without a very conscious effort to utilize them in non-power aggrandizing ways. "Technologies like computing do not, no matter how much we wish them to, release us from the eternal human obligation to make responsible value choices." S.H.C.

MC DOUGALL, WALTER A. "TECHNOLOGY AND STATECRAFT IN THE SPACE AGE -- TOWARD THE HISTORY OF A SALTATION." AMERICAN HISTORICAL REVIEW 87 (OCTOBER 1982): 1010-1040.

The literature on the impact of space technology in four realms is examined: 1) international politics, 2) political role of science and scientists, 3) the relationship of the state to technological change and, 4) political culture and values in nations of high technologies. McDougall suggests that while Sputnik created an international stir, the space race did not alter the nature of the international system. The Space Age brought science and technology into politics, but it did not radically change politics or make scientists powerful. The real change wrought by Sputnik, McDougall concludes, was in the role of government in furthering scientific and technical advances. Sputnik's appearance was a "saltation that transformed governments into self-conscious promoters, not just of technological change but of perpetual technological revolution."

NEWLAND, KATHLEEN. PRODUCTIVITY: THE NEW ECONOMIC CONTEXT. WORLDWATCH PAPER NO. 49. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, JUNE 1982. 47 P. $2.00.

In a general essay, Newland examines the limitations of the concept of productivity as an indicator of progress. Designed to gauge changes in material standards of living, productivity measures are inappropriate expressions of the social and political ramifications of these changes. Newland cites numerous factors that have contributed to an apparent decline in productivity including the growth of service industries, demographic changes, resources use and supply, and worker wage structures. The impact of new electronic technologies on productivity is also assessed. Newland wonders who would gain from productivity growth. Though such growth might serve as a check against inflation and strengthen a country's trading position, it is doubtful, Newland concludes, that the benefits of productivity gains would be distributed widely.

O'NEILL, GERARD K. 2081: A HOPEFUL VIEW OF THE HUMAN FUTURE. NEW YORK: SIMON AND SCHUSTER, 1981. 284 P. $13.95.

The impression arises from reading this futuristic vision that O'Neill is lobbying for a self-fulfilling prophecy, that is, to solidify in the collective mind's eye the conception of space colonies --a scenario for which he has provided substance for several years. Along with space colonies, four additional technologies are considered to be the shapers of the coming century: computers, automation, energy, communications. A previously published journal article which discussed the roles of these technologies has been covered in this column (No. 26, Nov.,1981); therefore, we will turn to the remainder of the book in which O'Neill presents observations on the planet in 2081 from the viewpoint of an imaginary reporter, followed by the reasoning behind the forecasts. Futureworld is brimming with resolutions for rather bothersome problems of today, such as automatic collection of baggage at airports, foolproof identification, comfortable and swift public transportation, housemaid robots, and grocery delivery computers. The treatment throughout is limited to the surface effects of technology. Political and social implications rarely intrude in this fantasy. Erie, PA is transformed into a tropical paradise, and the vacationer to Disney World in 2081 encounters preserved relics of the past. Technical innovations are predictable to anyone who has read Bradbury, Asimov, Clarke, and Wells. O'Neill is either talking down to us, or he has sprouted mouseketeer ears.

SCHALLENBERG, RICHARD H. BOTTLED ENERGY: ELECTRICAL ENGINEERING AND THE EVOLUTION OF CHEMICAL ENERGY STORAGE. PHILADELPHIA: AMERICAN PHILOSOPHICAL SOCIETY, 1982. XVI, 420 P. ILLUS, BIBLIOG. $20.00.

A case study of the evolution of the storage battery, which reveals the interaction between changing needs and the response of battery designers to meet those needs. After a brief introductory chapter, Schallenberg traces the history of the lead-acid storage battery from its commercial beginnings in the 1880s and 1900s, through its adaptation to electric cars in the early 20th century, and since the 1920s to its more common application within gasoline powered automobiles. The final chapter covers the alkaline battery. A valuable contribution to our understanding of technological innovation. S.H.C.

SEGAL, HOWARD P. "THE AUTOMOBILE AND THE PROSPECT OF AN AMERICAN TECHNOLOGICAL PLATEAU." SOUNDINGS 65 (SPRING 1982): 78-87.

American culture has traditionally sought ways of merging the natural and the technological. For the American mainstream, Segal suggests, the automobile has been perceived as a means of "reconciling phenomena deemed irreconcilable." The automobile could create a "middle landscape" --an urban escape for farmers, suburban homes for urbanites. Waning enthusiasm for automobiles accompanied the fading of the suburban landscape ideal. Segal suggests that the automobile is assuming a rightful, more modest place in a "technological plateau," a leveled-off state of technology which permits economic, social, and cultural concerns to garner society's attention.

SLADE, JOSEPH W. "THOMAS PYNCHON, POSTINDUSTRIAL HUMANIST." TECHNOLOGY AND CULTURE 23 (JANUARY 1982): 53-72.

Alienation or discontinuity between man and machine torments Pynchon's men and women. In The Crying of Lot 49 and Gravity's Rainbow, characters long for an organic wholeness, a "connectedness" with their world including its technologies. They encounter barriers to a continuum at every turn and assault the obstacles with anything available, including science, religion, sexual perversion, drugs, and paranoia. That human beings do resemble cybernetic systems is asserted in Gravity's Rainbow. Blicero's rocket, with its cargo, demonstrates that man has made a machine of his world. However, nature's destruction of the machine by gravity claims a discontinuity between machine and nature. Man's artifical technological world is much more akin to him than is the real world of nature. Pynchon borrows from sociological, managerial, economic, psychological, and communication theories of Mazlish, Weber, Drucker, McLuhan, Wiener, Mumford, Ellul and others to establish a thermodynamic system within which Western man, "impelled by a Calvinism that recoiled at the randomness of nature's transformations, developed science and mathematics to establish order." Man displaces nature with artificial institutions, bureaucracies, systems. The Protestant God is order, chaos is an Other. The Western world is a self-sustaining system with its own dynamics of order and disorder --man the machine has created a world in his own image. Freedom and spiritual well-being can be achieved, aided, Pynchon demonstrates, by science and technology. Extrapolating from scientific principles of uncertainty and complementarity, Pynchon finds that man can possess several qualities simultaneously and paradoxically in a situation that enhances free will. Technology holds charisma for Pynchon because it is the agent by which man can modify all the structures surrounding him. While for humanists technology debases, for Pynchon it "remystifies" the universe.

STILGOE, JOHN R. "MOULDING THE INDUSTRIAL ZONE AESTHETIC: 1880-1929." JOURNAL OF AMERICAN STUDIES 16 (APRIL 1982): 6-24.

In the novels of such writers as Sinclair Lewis and William Dean Howells, and in the more intellectual magazines, the industrial landscape was a subject of scorn and dismay. However, during the same period, trade journals and some popular magazines promoted an "industrial aesthetic" which admired the sprawling, mammoth, bewilderingly complex industrial zone. Particular praise was reserved for industrial works designed according to the strictest functional rules, stripped of ornament, unnecessary walls, ceilings, or paint. Guidebooks were published which unravelled the maze of structures, lights and line; engravings of factories and even picture albums appeared. Stilgoe astutely notes that in these pre-Depression depictions of industrial grandeur, workmen appeared as mere silhouettes or not at all. When cheerful popular depictions vanished after 1929, the appeal of the zones remained for a small group of artists.

STROMBERG, PETER L.; MALHAM M. WAKIN; AND DANIEL CALLAHAN. THE TEACHING OF ETHICS IN THE MILITARY. HASTINGS-ON-HUDSON, NY: HASTINGS CENTER, 1981. 85 P. BIBLIOG. $5.00.

Callahan, director of the Hastings Center, collaborates with two military professionals who teach at the Air Force Academy and West Point. The authors review the tradition of ethics in the military, beginning with just war theory, and chronicle the teaching efforts to date. Major moral problems peculiar to the military are singled out, namely, those surrounding obedience, false reporting, careerism, efficiency reports, protecting the innocent in war, as well as nuclear, chemical and biological warfare. The text then turns to suggestions for appropriate materials and teaching techniques for specific types of military audiences and ranks, such as ROTC, service academies, war colleges, and basic training. Recommendations include the earnest support of commanders, the thorough education of potential ethics teachers, centralized development of teaching materials and uniform training of teachers of subcourses, and support of conferences and workshops. An annotated bibliography is provided.

WACHHORST, WYN. THOMAS ALVA EDISON: AN AMERICAN MYTH. CAMBRIDGE, MA: MIT PRESS, 1981. IX + 328 P. ILLUS., BIBLIOG. $15.00.

Edison was a man of myth --some of it self-perpetuated-- as well as of substance. Wachhorst analyzes the development of those myths, of the public's perception of Edison, through the changing cultural milieu which gave rise to them. Edison, whose career both spanned and was implicated in major societal and technological transformations during the late 19th and the early 20th centuries, represented both the bright and dark sides of science and technology. He became representative of the "machine in the garden" symbolism which tried to reconcile pastoralism and technology. In tracing Edison's career and the resultant public image, Wachhorst depicts three roughly discernable periods. The first lasted from the invention of the phonograph in 1877 to its perfection in 1888 in which period Edison did some of his best work and was accorded the appelation of "The Wizard of Menlo Park." A second stage covered the two decades surrounding the turn of the century in which the image of Edison as "great inventor" took on a life greater than that of the man himself. In the third period which lasted until Edison's death, the image shifted once again, to Edison as "Great American," benefactor of mankind. In the period after his death, Edison's image became increasingly humanized. In the late 20th century, emphasis has shifted from the myth to the man, and in the end "the man who remains is finally greater than the myth," (p. 15). Based on extensive research into the numerous biographies, articles, newspaper clippings and other Edison sources, Wachhorst has provided a fascinating look at a man and his culture. S.H.C.

WEINSTEIN, JAY. SOCIOLOGY/TECHNOLOGY: FOUNDATIONS OF POSTACADEMIC SOCIAL SCIENCE. NEW BRUNSWICK, N.J.: TRANSACTION BOOKS, 1982. 367 P. $29.95.

The current endeavor to incorporate the knowledge and study of social factors into technical education, research, and innovation activities is explored. "Postacademic" is used since the integration of social scientists into the private and government sectors for such educational endeavors is seen as the dominant orientation. Part I reviews the commentary of social theorists about technology, focusing on Weber, Veblen, Ogburn, Mannheim, C. Wright Mills, and the Frankfurt School including Pollack and Marcuse. The following two parts explore the transition of social science research to settings other than the academic doctorate-granting program. Trends discussed are the birth of Science, Technology and Society and other interdisciplinary programs; the increased application of social science in engineering, planning, and policy-making; and the political commitment to Third World development. Two theories of technological impact are examined, the "positivist-technocratic" view which equates progress and the good life with technological innovation; and the belief in "autonomous" technology which links innovation to individual loss of control over personal lives. The final part looks skeptically at the prospects for the redistribution of resources necessary for social science to contribute to the humanization of technology. A discussion is provided of the bearing of schools or styles within sociology, from subjectivist to natural scientist, on the conduct of such research. The author calls for an activist commitment toward the new orientation.

Judith Mistichelli
Center for Bioethics Library
Kennedy Institute, Washington, D.C.

Christine Roysdon
Lehigh University Libraries
Bethlehem, PA

EBCN/cpf

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