Chapter 18

Albert Borgmann and a Philosophy of Technology?

I begin this chapter with Higgs, Light, and Strong and their argument in *Technology and the Good Life?* (2000) in favor of the need for a new discipline:

Broadening the scope of Philosophy of Technology

"The set of questions a philosophy of technology should address in order to fulfill its promise are often at the intersection of it and other fields. In our opinion, philosophy of technology at its best should appeal to a very wide audience partly because it illuminates our shared, ordinary everyday life, such as with things and devices, and partly because the issues it probes cut across the full range of disciplines. Many of these issues are already vital matters of concern for these disciplines, such as ethics, social and political philosophy, aesthetics, art history, architecture, music, anthropology, religion, history, history of science and technology, cultural studies, sociology, political science, economics, linguistics, literary criticism, visual culture, and the hard sciences. For example, one of the interdisciplinary successes that philosophy of technology has had is with environmental ethics. Issues that join both fields are addressed in journals regularly, and numerous books have appeared. However, this kind of success should be occurring with other fields as well. What does philosophy of technology have to offer other disciplines? In the view of some of our contributors, traditional philosophical approaches may not be capable of questioning and challenging technology in a sufficiently radical manner. Nevertheless, we can show the kinds of questions a robust philosophy of technology can raise and address. . . ."

And on Borgmann as a focus:

Why Borgmann's Philosiphy Of Technology?

"Albert Borgmann's work is a good candidate to begin such a rethinking of philosophy of technology so that it is better prepared to answer the challenges laid before it. . . . His work falls in the tradition of the kind of substantive philosophy of technology initiated by Heidegger, Ellul, and Mumford. As a philosophy of technology it is far more comprehensive and ambitious than earlier philosophy of technology, setting its sights on larger issues of social criticism

while simultaneously meeting scholarly demands already established in the field by previous works. Specifically, there are four chief reasons why Borgmann's work deserves a central place in advancing the philosophical study of technology.

"The first reason is that Borgmann builds his theory from a descriptive phenomenological account. He takes up his field of inquiry with a description of the shift from 'things' to 'devices,' from fireplaces to central heating, from candles to sophisticated lighting systems, from wooden tables to Formica, from traditional foods and drinks to Lite versions, from shoelaces to Velcro, from craftwork to automation, from traditional performances and physical activities to home entertainment centers. For Borgmann these substitutions constitute a repeated pattern that can be described, a pattern that Borgmann claims also has repeated consequences (which can be similarly described) for our relationships to our physical surroundings, our relationships to ourselves and others. Discussing whether Borgmann's characterizations are accurate is a fruitful beginning for a discussion of how technology effects our assessment of the good life. . .

"Second are the diagnostic aspects of Borgmann's philosophy. Borgmann locates the problem of technology in relationships. His critique considers the adverse effects technology has on our relationships to our physical surroundings, and our human relationships in their political, social, and aesthetic dimensions. In this sense, the focus of Borgmann's work is not simply technology itself as an object of study, but more thoroughly human relationships and our relationships to our surroundings as they are inevitably affected by technology.

"Third, considered prescriptively and on the basis of his diagnosis, Borgmann argues that these relationships can be reconfigured into a socially reconstructive program. In fact, Borgmann's theory, along with others such as those of Andrew Feenberg and Langdon Winner, is one of the few attempts at developing a comprehensive series of reform proposals for technology. It also addresses questions of nature and environment, rather than restricting reform of technology to built space and artifacts, thus exceeding the traditional purview of the field. Focusing on Borgmann's work in conversation with and divergence from these other reform proposals will help to move the field forward.

"From another standpoint, Borgmann calls for a philosophical reassessment of social life that challenges received notions of what constitutes the good life. While many moral theorists of late have followed the charge of the communitarians to expand moral discourse beyond a thin assessment of the good,

Borgmann adds a call for attention to the material and artifactual foundations of a thicker reconception of the good.

"Borgmann's is not an abstract theoretical contribution to an assessment of the good life but a grounding and practical means to create a context and a language whereby our material world can be normatively assessed as part of a more robust moral ontology. Borgmann puts it this way after briefly acknowledging a debt to Heidegger in formulating the wider contours of these views: 'Heidegger says, broadly paraphrased, that the orienting power of simple things will come to the fore only after the rule of technology is raised from its anonymity, is disclosed as the orthodoxy that heretofore has been taken for granted and allowed to remain invisible. As long as we overlook the tightly patterned character of technology and believe that we live in a world of endlessly open and rich opportunities, as long as we ignore the definite ways in which we, acting technologically, have worked out the promise of technology and remain vaguely enthralled by that promise, so long simple things and practices will seem burdensome, confining, and drab. But if we recognize the central vacuity of advanced technology, that emptiness can become the opening for focal things. It works both ways, of course. When we see a focal concern of ours threatened by technology, our sight for the liabilities of mature technology is sharpened' (Borgmann 1984, 199).

"And finally, fourth, Borgmann's work is important because of the depth and breadth of his diagnosis and his prescriptions. Borgmann's reform program advocates a set of issues that any political system must address if it is to be effective in a social sphere dominated by technology. The work is therefore potentially of interest to a great variety of political positions and not simply an appeal to the most effective program for the reform of technology by a particular ideological persuasion."

It should be noted that, in his reply to his critics at the end of the volume, Borgmann is skeptical about the editors' claims about using his work as a focus of a new discipline: "As regards our position within academic philosophy, there is not much reason to lament insignificance within an enterprise that is itself insignificant."

But given the optimistic assessment of the disciplinary potential in Borgmann's thought, especially in *Technology and the Character of Contemporary Life* (1984), I think we need here a review of his thinking as a whole. I attempted that in a review that formed the basis for a chapter in my *Social Responsibility in*

Science, Technology, and Medicine (1992). Here is that assessment, which I put under the heading of Borgmann as a "modest neo-Heideggerian."

In *Technology and the Character of Contemporary Life*, Borgmann is poetic, as I noted in my review and book. I began both with these quotes from Borgmann's book:

"The great meal . . . where the guests are thoughtfully invited. the table has been carefully set, where the food is the culmination of tradition, patience and skill and the presence of the earth's most delectable textures and tastes, where there is an invocation of divinity at the beginning and memorable conversation throughout . . .

"The great run, where one exults in the strength of one's body, in the ease and the length of the stride, where nature speaks powerfully in the hills, the wind, the heat, where one takes endurance to the breaking point, and where one is finally engulfed by the good will of the spectators and the fellow runners . . .

"Like a temple or a holy precinct, the wilderness is encircled and marked off from the ordinary realm of technology. To enter it, we must cross the threshold at the trailhead where we leave the motorized conveniences of our normal lives behind. Once we have entered the wilderness, we take in and measure its space step-by-step. A mountain is not just a pretty backdrop for our eyes or an obstacle to be skirted or overwhelmed by the highway; it is the majestic rise and elevation of the land to which we pay tribute in the exertion of our legs and lungs and in which we share when our gaze can take in the expanse of the land and when we fee1 the cooler winds blow about the peaks."

Much of Borgmann's focus is on these "focal things and practices," which partly explains the poetry of his approach. But he is also intent on pointing out that amidst the clamor of our technological world, there are poetic authors who have highlighted focal things. The quotes above, about the culture of the table and running, are largely borrowed.

To discover more clearly the currents and features of this, the other and more concealed, American mainstream, I take as witnesses two books where enthusiasm suffuses instruction vigorously, Robert Farrar Capon's *The Supper of the Lamb* and George Sheehan's *Running and Being*. Both are centered on focal events, the great run and the great meal.

Borgmann even claims that he could not have undertaken his project—his phenomenological or "deictic" characterization of the truly important features that can redeem our troubled technological world—if there were not other souls with similar thoughts (and writings) to spur him on and give hope to the project.

But Borgmann is also a philosopher, and his book deserves to be analyzed—even argued with—as well as savored. One of the beauties of the book is that the philosophical argument is presented with as much simplicity and grace as the descriptions of focal things, events, and concerns.

Technology and the Character of Contemporary Life is a tightly structured philosophical treatise. Borgmann begins the book with a summary of the theories he opposes: "These summaries distinguish a multitude of approaches, but all distinctions fit well one of three essential types: the substantive, the instrumentalist, and the pluralist views of technology." However, Borgmann is modest about the originality of his own theory: "Clearly, the theory of technology that we seek should avoid the liabilities and embody the virtues of the dominant views. It should emulate the boldness and incisiveness of the substantive version without leaving the character of technology obscure. It should reflect our common intuitions and exhibit the lucidity of the instrumentalist theory while overcoming the latter's superficiality. And it should take account of the manifold empirical evidence that impresses the pluralist investigations and yet be able to uncover an underlying and orienting order in all that diversity."

The theory that Borgmann proposes to meet these exacting demands is his own version of neo-Heideggerianism. He claims to discern a pattern of taking up with reality—the "device paradigm"—that characterizes life in the modern world. (I would paraphrase what Borgmann means by "device paradigm" roughly as the claim that humans, in the modern world, have tended more and more to look for gadgets or devices or systems that will make life easier—at the risk of emptying all "focal" things of their traditional significance.)

Before summarizing the various theories, Borgmann had characterized his mode of philosophizing as derivative from Aristotle as well as Heidegger (for both of whom, despite their differences, he says "there is no sharp dividing line between social science, or perhaps social studies, and philosophy"), yet it is also an approach that takes seriously "the metatheoretical turn" of analytical philosophy.

In the end, Borgmann says, he will show, by using it at the beginning, that an analytical approach to philosophy of technology must be an "inconclusive enterprise." Even so, "the present study has to draw on many of the concepts, methods, and insights of mainstream philosophy to obtain a reflective and radical view."

By the end of the book, all this is clarified—perhaps most succinctly in a chapter devoted to "political affirmation" of the possibility of reforming our technological way of dealing with reality: "These suggestions, drawn from the analysis of technology and the experience of engagement [with focal things], are mere hints, of course. But they shed new light, I believe, on a problem that has become puzzling and untractable within the liberal democratic tradition. They are essentially consonant, however, with the proposals to achieve greater social justice as they have been formulated by the best proponents of that tradition, for example, [John] Rawls, [Lester] Thurow, [and John Kenneth] Galbraith."

That is, Borgmann is "radicalizing" the analytical theory of justice of Rawls and the post-Keynesian economics of Galbraith and Thurow by bringing out the "focal" concerns of a minority within technological culture—including himself, but also such authors as Capon and Sheehan, mentioned earlier. Borgmann is opposed to Marxist radicalism (a version, in his opinion, of instrumentalism, no matter that Marxists claim to oppose it), as well as the radicalism of the right (where, presumably, he would place Ellul—or, at least, Ellulians who would wish to return to a pretechnological golden age).

It is in part three that Borgmann discusses the possibilities of reform. Its main vehicle, Borgmann claims, is public "deictic discourse"—the reopening of "the question of the good life," as opposed to continued preoccupation with the consumption of device-procured commodities. Borgmann ends the book, in a chapter on "recovery of the promise of technology," with a nuanced summary of the basis of his hope: "The focal things and practices that we have considered . . . are not pretechnological, i.e., mere remnants of an earlier culture. Nor are they antitechnological, i.e., practices that defy or reject technology. Rather they unfold their significance in an affirmative and intelligent acceptance of technology. We may call them metatechnological things and practices. As such they provide an enduring counterposition to technology."

How hopeful is Borgmann? I believe it is safe to say that, though he ends the book with an expression of hope that focal concerns will prevail, his worries

were serious enough to motivate him to write the book—perhaps as a warning, and at least as a rallying cry for the "concealed" minority who already care more about focal things than about the promise of technology to provide ever more commodities.

I returned to some of the same issues in my contribution to *Technology and the Good Life?* Here is the way I ended my essay: "What should we conclude from [my] retrospective and prospective? Abstractly, it would seem there are four possibilities. Some people will scoff. I had unrealistic hopes in the first place, they will say. Philosophy's aims should be much more limited—limited, for instance, to analyzing issues, leaving policy changes to others (to the real wielders of power whose efforts might be enlightened by the right kind of philosophical speculations); or limited to critiquing our culture (following Hegel) after its outlines clearly appear and it fades into history, imperfect like all other mere human adventures.

"Others will go to the opposite extreme. I set my sights too low, they will say. We must still hold out for a total revolution. The injustices of our age, as well as its ever-increasing depredations of planet Earth, demand this. Still others are likely merely to lament the fate to which technological anticulture has doomed us; we must resign ourselves to the not-dishonorable role of being lonely prophetic voices crying out against our fate.

"Then there is my own conclusion, a hope—following John Dewey . . . —that we will actually do something about the technosocial evils that motivated us in the first place. That we will abandon any privileged place for philosophy, joining instead with those activists who are doing something about today's problems. . . .

"Albert Borgmann might be read as endorsing any one of these options. . . But I hope he would, with me, endorse the fourth option. We might, no matter how weak our academic base, still manage to succeed in conquering particular technosocial evils one at a time" (pp. 47–48).

And here is Borgmann's reply at the end of *Technology and the Good Life?* Up to a point, he seems to agree with me and Larry Hickman and Andrew Light: "What is the prospect of coming closer to a commonwealth of the good life? . . . As for concrete steps that philosophers should take, I join the pragmatism of Durbin, Hickman, and Light. I take from Durbin the commitment to social justice and social activism, from Hickman the diversity of approaches, and from

Light the call for a measure of cooperation" (p. 367).

But Borgmann agrees only up to a point: "Whatever else the philosophy of technology may be, it *is* philosophy and should recognize the standards of its guild and tradition. . . . Philosophies that we as professional thinkers admire and emulate have never been specialized. The great moral doctrines, e.g., have invariably been of a piece with an ontology or metaphysics, a psychology or epistemology, and a cosmology or theology . . . [and] not much light can be shed on any one part to the exclusion or in ignorance of all others.

"One honorable and helpful way of meeting this requirement is to draw on a great thinker or tradition, on pragmatism, phenomenology, the Frankfurt School, analytic philosophy, on Kant or Heidegger."

At this point, however, Borgmann praises the work of a philosopher, David Strong, who has drawn on Borgmann's own work: "The immersion in technology may give a philosopher access to a strand of reality that, when fully traced, reveals a new vision of the fabric of reality" (p. 368). And the subtitle of Strong's book is enlightening: *Crazy Mountains: Learning from Wilderness to Weigh Technology* (1995). So in the end we are back to Mitcham's call (Chapter 1) for philosophy to "take the measure of technological society as a whole."

Controversies? Right out of the box (if we remember other metaphysicians in Chapter 16 above), it is clear that Borgmann is more optimistic than Verene—speaking for Ellul (and Hegel and Vico). Borgmann's "substantive" predecessors, Heidegger as well as Ellul and Mumford, were all more pessimistic than Borgmann himself is. Since Mitcham (see Chapter 1) often seems to ally himself with Borgmann without reservation, there is no controversy there. All the metaphysicians agree that mere technical thinking is inadequate for the social criticism our culture needs—and they are equally strongly opposed to Marxist thought as the source of a valid critique, though Borgmann blesses the founding of one's thought on the Frankfurt School, as Feenberg does. The editors of *Good Life?* suggest that Borgmann's thought has much in common with Winner, but that seems unlikely unless Borgmann becomes more explicitly political. In my contribution to *Good Life?* I suggest that he could be more pragmatic, but as I read his reply he accepts that suggestion only up to a point. And Hickman has repeatedly attacked Borgmann as *idealistic*. Science opponents would include Pitt (Chapter 9), though his ire is directed at Winner and Heidegger rather than Borgmann.

A note: at the beginning of this chapter, Higgs et al not only said their hoped-for new academic discipline should build on Borgmann; it should also branch out to make connections to different areas of contemporary life, to deal with real-world and not merely academic issues. In the next chapter, I turn to the work of colleagues in the Netherlands, who are as resolutely academic as Higgs et al would hope but who also defend a wide diversity of approaches and cover a broad assortment of issues.

Chapter 19

Dutch Schools

Pieter Tijmes of Twente University, in a survey for *Techné* 3:1 (Fall 1997), provides the following summary of Dutch philosophy of technology: "In the past, Holland brought forth one great philosopher, Benedictus de Spinoza (1632–1677). At this moment there are many philosophers of technology, judging from the significant (quantitative) contribution to the Duesseldorf conference of the Society for Philosophy and Technology in the Fall of 1997. To be honest, today's Dutch philosophers do not have the stature of Spinoza. He had philosophy as an avocation; he earned his living as a technician by grinding and polishing lenses. His Dutch descendants make philosophy their business today even a concern of the Dutch government. It is the difference between avocation and occupation. The Duesseldorf attendance was predominantly connected to the philosophy departments at the Dutch *technological* universities. A common characteristic of these departments is their claim of a mission to do research in philosophy of technology. In my endeavor to characterize their research for American ears I became aware of the particularities of the general educational system in Holland, and in addition to this of the specific local situation of the respective faculties: how big is the staff, who contributes to the philosophical research program, does the faculty offer a major in philosophy, and other issues of that kind. I shall pass over these relevant details and differences, but I shall mention the e-mail address of the program leaders who would be willing to inform readers who want more detail.

"At the University of Delft, philosophy of technology is close to what Carl Mitcham would call engineering philosophy. With the flourish of trumpets they insist on designing as the quintessence of engineering activity. Design and the development of technological products are considered their *pièce de rèsistance*. They like to follow Friedrich Rapp (1974) saying that "a methodological and even an epistemological analysis of the theoretical structure and the specific methods of procedure characteristic of modern technology" is to be emphasized. Philosophical reflection on designing activities is, in their view, also of utmost importance for discussions of the consequences of technology. Ethics appears within the context of the design and development of products. In other words, engineering praxis is central to their research. This philosophy of design means a critical evaluation of conditions and assumptions with regard to determinism or to social constructivist interpretations of technology. The prominence attached to

the phase of design is a specialty at Delft. Design is cherished as the key to contributing to the real-world problems of controlling and steering technology. Staff: 4 members; e-mail address: p.a.kroes@wtm.tudelft.nl.

“Let us next look at Eindhoven, where the engineering activity of design is also written in capitals. Their philosophical interest, however, is not to be confused with that of their colleagues at Delft. In Eindhoven, "philosophy and methodology of the technological sciences" are centered on the methodological analysis of the processes that create products. In this methodological analysis, they deal with the interplay of scientific, technical, economic, political, legal, and aesthetic factors in the engineering process of decision-making (S, T, E, P, L, and A factors). This design methodology—interdisciplinary in character—is in a developing stage; concrete projects with respect to specific products are their inspiring examples of the way ahead: e.g., refrigeration apparatus as based on the Stirling cycle, packaging machines, etc. Quality Function Deployment is a specific topic of interest. Research on this topic should be a means for finding concordances between technical realizations and social desirabilities. Again, concrete case studies are done as precursors of a successful and helpful theory on choices within the production process. Staff: 3 members; e-mail address: m.j.d.vries@tm.tue.nl.

“An agricultural university is the stage for philosophical reflection in Wageningen. There, agricultural and environmental sciences are the point of departure. Four themes are on the agenda. At Wageningen, the sciences contribute to practices as agricultural ways of living, with references to types of farmers, specific landscapes, and consumer behavior. Given the fact that technologists are in a sense undercover revolutionaries, the Wageningen people want to open the black box of science and technology. Philosophical analysis of the concept of sustainability is their second theme of attention. In their view, sustainability is a matter of the remoralizing of agricultural technology with all its ambivalent problems. A third philosophical topic concerns technological knowledge. In modern society knowledge is not limited to the traditional labs of universities and big corporations like Philips and Shell, but is also generated outside. And, fourth, the dimension of *political participation* in the complex networks controlling and steering technology is the crown of this program. It is a characteristic feature of the Wageningen philosophy that, starting their reflection from a broader analysis of society, they use it as a departure point for the analysis of the interrelation of technological and ethical aspects in practices and institutions. Staff: 11 members; e-mail address: michiel.korthals@alg. tf.wau.nl.

"The University of Twente is the youngest university. All sorts of philosophical disciplines are collected in a department of systematic philosophy that is doing research under the heading, Philosophy of Technological Culture. The program focuses on a 'current affairs' analysis aimed at clarifying our technological culture, and deals with problems and dilemmas—on both individual and collective levels—that result from recently introduced technologies. These questions range from social relations and ways of life, human possibilities and desires, to experiences of body and nature. In a permanent discussion with and a cautious opposition to the classical philosophy of technology, they want to give more context to their findings. Concepts such as the 'megamachine' (Mumford), *technotope* (Ellul), *Gestell* (Heidegger) are only used heuristically and not as *a priori* concepts. In this sense the Twente philosophers like to speak about an empirical turn within the philosophy of technology. From a philosophical point of view one can distinguish two main lines: hermeneutics of the technical experience, and social philosophy of technology. Under the hermeneutical heading, attention is paid to the mediating role of artifacts and to metaphors and representations generated by technology. Under the social philosophy heading the relationships between technology and politics are investigated. Scarcity as a constitutive feature of technological culture plays a privileged role. Recently there has been a convergence of interest on medical technology, sustainable technology, and information technology. Staff: 9 members; e-mail address: h.j.achterhuis@wmw.utwente.nl."

Up to this point, Tijmes had not related his survey to North American philosophy of technology. So I will intersperse here another contribution from Tijmes's University of Twente. Hans Achterhuis's *American Philosophy of Technology: The Empirical Turn* details the work of his and Tijmes's colleagues at Twente (including the two themselves). The material here is taken from a review (for *Metaphilosophy*, July 2004) that I did of that book.

Achterhuis begins his book—a collection of profiles of American philosophers by Dutch colleagues in the philosophy department of Twente University in the Netherlands—with an introduction in which he attempts to justify his subtitle, "The Empirical Turn." About that introduction, series editor Don Ihde (one of the philosophers profiled in the book) says this:

"The reader should take careful note of the introduction, which lays out the differences . . . between the high-altitude and 'transcendental' perspectives of our

acknowledged ‘god-fathers’ [for example, Martin Heidegger, Hans Jonas, and Jacques Ellul] and the lower-altitude, more particular and pragmatic looks at technologies of the Americans included here” (p. viii).

The Americans, discussed in alphabetical order, are Albert Borgmann of the University of Montana, Hubert Dreyfus of the University of California at Berkeley, Andrew Feenberg of San Diego State University, Donna Haraway of the History of Consciousness Program at the University of California at Santa Cruz, Don Ihde of the State University of New York at Stony Brook (where the book’s translator, Robert P. Crease, also teaches), and Langdon Winner of the Department of Science and Technology Studies at Rennselaer Polytechnic Institute. (The Dutch authors make much of the personal careers and affiliations of the American philosophers.)

Only a snippet from each Dutch author’s presentation and critique of one of the six Americans can be presented here, but I will try to give the flavor of each review.

Pieter Tijmes provides the discussion of the thought of Albert Borgmann, and here is his introduction: “I shall discuss how Borgmann diagnoses the ills of contemporary life, what his concept of the device paradigm of technology is, and what its implications are . . . in showing that technology is indeed a revolutionary factor in society” [today] (p. 11).

Tijmes thinks that Borgmann’s device paradigm, as a tool for diagnosing the ills (and potential promise) of our contemporary technologized society, “has a great advantage over Heidegger’s own method” (p. 14), which Tijmes views as too deterministic. Borgmann’s characterization, on the other hand (Tijmes says) “can help us understand how attractive technology has become in our society, and why” (p. 14). However, in the end, Tijmes is also critical: “Borgmann, I think, . . . speaks far too uncritically about natural [as opposed to cultural and technological] information, and is far too accepting of religious declarations about reality. . . [even when] borrowed from different religions” (p. 35).

In general, Tijmes seems fair to Borgmann, even when (in the end) he is critical; and he is extremely generous in showing how Borgmann’s analytical/phenomenological approach is an advance over Heidegger’s “ontological” characterization of Technology (capital T).

Even though he participated in the conference that gave rise to a Borgmann festschrift—Higgs, Light, and Strong, eds., *Technology and the Good Life?* (2000)—Tijmes makes no reference to that book or the editors' idea of making it the basis of a new academic specialty.

Philip Brey (who works in many fields associated with computers and information systems) provides the chapter on Hubert Dreyfus as the American critic of the set of computer-related technologies that have come collectively to be called Artificial Intelligence (AI). The basic issue here with respect to Dreyfus has to do with his relationship to philosophy of technology. There is no question that his work touches on technology—of all the technologies that have led people to call ours a "technological culture," computer technologies in the broadest sense certainly are in the forefront—and Dreyfus is extremely well known, not only in American philosophical circles but worldwide. But many critics of philosophy of technology over the past twenty-five years have complained that it is overly abstract, concerned only with the vague notion of Technology with a capital T; which means that these critics often do not consider the philosophy of computers and AI to be part of the field. The criticism seems to me unfair, at least for the Society for Philosophy and Technology; every one of our conferences beginning with the second (1983) has had programs and papers on computers, and frequently on AI in particular. So since the society has always defined its scope as including any philosophical approach to any technological issue, we have always thought of Dreyfus, along with all others concerned with philosophy and computers, as part of the field.

That said, Dreyfus does not need as much of an introduction, for an American audience, as other philosophers of technology. Brey sums up Dreyfus's well-known themes this way: "Ever since his earliest work on the subject, Dreyfus has progressively honed and extended his philosophical critique of AI by broadening his use of the work of phenomenologists such as Heidegger, Merleau-Ponty, and Husserl, and by making use of the insights of other philosophers, including Michel Foucault and Soren Kierkegaard. One of Dreyfus's principal concerns, which appears with regularity throughout his writings, is to articulate the various ways in which human beings experience the world" (p. 39).

Brey's next point (equally well known) makes the link to AI: "Another regularly recurring concern is his critique of Cartesian rationalism. . . . Rationalism, as it crops up in AI and elsewhere, knows nothing of these original structures of reality and fails to do justice to the role of intuitive knowledge and skills" (pp.

39–40).

Brey later on turns this into an account of Dreyfus's "most important criticism" of AI: "Dreyfus's most important criticism . . . is directed against the epistemological assumption, underlying all forms of classical AI, that intelligent behavior can be reproduced by formalizing human knowledge (i.e., codifying it in rules). The application of formalized, rule-given knowledge, however, appears to run up against an important problem. . . . If one sought to make rules sensitive to context, all possible contexts would have to be formulated, or separate rules of application would have to be formulated. Both solutions appear to be without an end" (pp. 45–46).

And here is Brey's summary of Dreyfus's conclusion: "Human beings, Dreyfus observes, are able to interpret elements effortlessly from the context. Thus if they encounter a misspelled word in a text, they automatically fill in the right meaning, while computers grind to a halt. Human beings, Dreyfus concludes, have 'common sense' . . . [which] computers lack" (p. 46).

Probably the most interesting aspect of Brey's summary of Dreyfus's contributions to philosophy of technology is his conclusion: "Much of the inspiration for the development of [recent] work [in AI] can be traced back to the work of Dreyfus himself. Dreyfus was the one who introduced the ideas of thinkers like Heidegger and Merleau-Ponty into the AI world. The work of such AI researchers as [Terry] Winograd and [Fernando] Flores, and [Philip] Agre and [David] Chapman, was explicitly inspired by his ideas. Many other AI researchers, even including . . . [opponents Marvin] Minsky and John McCarthy, admit that Dreyfus's critiques have influenced their own research" (p. 61).

And here is Brey's last sentence: "Dreyfus is living proof that philosophers can indeed play a major role as critics of, and commentators on, science and technology in practice" (p. 61). They can, Brey is saying, even have a positive impact on the way science and technology—in this case, computer science and technology—are practiced.

The editor of this volume, Hans Achterhuis, also provides a chapter on the philosophy of technology of Andrew Feenberg. In this case, all the critiques come upfront, where Achterhuis dismisses Feenberg's early books: "Many passages [in Feenberg's first book, on Lukacs and critical theory] practice the kind of fastidious exegesis of sacred texts and indulgence in polemics with other

interpreters [of Marxism] who are deemed to be insufficiently orthodox that was popular some decades ago but has not worn well" (p. 66). And even when Feenberg turned to technology in his second book—Achterhuis says—"The persistence of a rigid (neo)marxist framework . . . makes it difficult to fully appreciate the very interesting ideas of Feenberg himself" (p. 66). These criticisms out of the way, Achterhuis almost uncritically accepts the theses of Feenberg's later books, *Alternative Modernity* (1995) and *Questioning Technology* (1999). For Achterhuis, the key to understanding Feenberg's innovative approach to philosophy of technology is a distinction between "primary and secondary instrumentalization."

Here is Achterhuis on the first: "The first level of instrumentalization corresponds to the perspective of the classical philosophy of technology on modern technology, but also to the common sense conception of technology and the conception of technical experts themselves. This level concerns what Feenberg calls the "functional constitution of technical objects and subjects," and addresses the meaning of modern technology apart from all the social meanings that it might receive" (p. 88).

But both Achterhuis and Feenberg are interested in a different picture: "More recent and empirically directed studies of technology, Feenberg points out, have allowed us to see that primary instrumentalization is only part of the story of modern technology. . . . In order for there to be an actual technological system or device, a second level of instrumentalization is necessary. 'Technique must be integrated with the natural, technical, and social environments that support its functioning'" (p. 90).

After noting in passing, with inadequate justification, that "Feenberg regards the environmental movement as 'the single most important domain of democratic intervention into technology'" (p. 91; Achterhuis should have spelled this out at greater length if he felt it is so central to understanding the recent Feenberg)—Achterhuis draws this conclusion: "The practical relevance of Feenberg's theoretical distinction between the two levels of instrumentalization is that it suggests the possibility of a future in which, according to the apt last line of his book [*Questioning Technology*, 1999], "technology is not a fate one must choose for or against, but a challenge to political and social creativity" (p. 92).

Unfortunately, neither Feenberg nor Achterhuis says much about what kinds of social and political activity are called for. At one point in their younger days,

probably both would have endorsed some sort of Marxist (most likely neo-Marxist) rebellion, but since the demise of Soviet Communism it is important at least to hint at one's political program. Beyond theorizing "new possibilities," neither Feenberg nor Achterhuis does so.

In the Achterhuis collection, Donna Haraway's "socialist, feminist, and anti-racist" (p. 107) political philosophy is presented by Rene Munnik. Or, "Rather, her cyborg thesis is a description of an anthropological condition in which political issues are at stake" (p. 107).

Exactly what this means, even for Munnik, is a little unclear. But Munnik makes this attempt to clarify: "The cyborg is our ontology. . . . [Or, rather it] marks a fundamental turning point in philosophical anthropology . . .[which] is generally conceived as anthropo-ontology. . . . But at the end of the twentieth century these ways of being [of humans] are inextricably involved with technology: anthropoontology is cyborgontology" (p. 102).

Munnik had earlier noted that, at one stage in her career, Haraway had been a primatologist, but she later joined an interdisciplinary—Munnik says even "antidisciplinary" (p. 100)—program at the University of California at Santa Cruz, where she developed her interest in the concept of a cyborg.

"Philosophical anthropology" is a strange sort of creature in American philosophy—generally popular only among philosophers with an interest in European ontology. And "cyborg" must be taken, at least minimally, as a metaphor. But Munnik ends his account in a curious way: he concretizes cyborgs in terms of "the half-alive, half-dead occupants" of intensive-care units in hospitals and says it would not be "surprising if it turned out that cyborgs make very poor coalition partners" (p. 116) in the kind of radical politics Haraway wants her philosophical anthropology to prepare for. This seems unfair to Haraway, no matter how fuzzy the cyborg concept may seem to be in its various "antidisciplinary" formulations.

The Achterhuis collection next turns to a philosopher who has unquestioned credentials in academia—Don Ihde, long-time professor and chair of the philosophy department of the State University of New York at Stony Brook. [I used this material in Chapter 10 above, so will skip most of it here.]

Here is how Verbeek begins his account: "Ihde . . . is a pioneer in two respects.

First, he was one of the earliest philosophers in the United States to make technology the subject of philosophical reflection. . . . He published his first book on the philosophy of technology, *Technics and Praxis*, in 1979, [and this was just] the first of over half a dozen books he has written in the field". . . . (p. 119). (The rest is already in Chapter 10 on Ihde above.)

But there is one last philosopher discussed in the book, Langdon Winner, whose views are summarized and, to a limited extent, critiqued by Martijntje Smits. Smits focuses mainly on Winner's key idea, that all "artifacts have politics," that there are, ultimately, no politically neutral technologies. Along the way, she notes Winner's "love-hate relationship with Ellul" (p. 154); "the empty box of social constructivism" (p. 163); and Winner's (she thinks mostly implicit) commitment to a kind of democracy inconsistent with the politics embodied in most large-scale technological systems (p.165).

Smits's main critique of Winner is that this last commitment, to a kind of democracy at odds with large technological systems, is left vague and abstract (p. 166). Here is her main conclusion: "Winner's work searches to work out a middle path between the philosophy of technology . . . and social constructivism. . . . One might remark . . . that Winner has performed an important service in pointing out clearly how imperative it is to find a middle path. But the weaknesses of his 'Artifacts/Ideas' [1991] article also indicate how tricky it is to actually walk this middle path" (p. 166).

And later: "In assuming that direct democracy is an unproblematic norm, Winner implies that political power exercised in this way is ipso facto beneficent, and ignores the question of how power is actually exercised in those practices" (p. 167).

This may be unfair to Winner (see Chapter 12). In "Techné and Politeia" (1986), Winner calls for a kind of constitutional convention each time a new large-scale technological enterprise is considered. This does not say that direct democracy is "ipso facto beneficent"; only that ordinary citizens are to be trusted more than undemocratic technological elites. And this brings us back to John Dewey (rarely mentioned by Winner, and then mostly negatively), whose similar appeal to a sort of direct democracy does not assure a beneficial outcome in every exercise of democracy—though every social problem (here, sociotechnical problem) is still better entrusted to the people than to technical elites.

To sum up with respect to the Achterhuis volume: it clearly represents, in an only

mildly critical way, some of the most interesting philosophical work related to technolog*ies* that has been done in the USA in recent decades. It thus shows Dutch philosophy of technology (at least at Twente) to be heavily involved with American work, but also admirably diverse. As Tijmes notes, however, the other Dutch schools may in some sense be more original; and many observers think Tijmes's last example—science, technology, and society as perhaps best represented by Wiebe Bijker—is the most significant. (See Chapter 25 below.)

I now return to Tijmes's survey: "In this survey I have so far confined myself to the technological universities, where philosophers explicitly claim to do philosophy of technology. This is a limitation because there is also philosophy of technology outside these departments although more on an individual basis. On the other hand, I have also passed over those who are doing research in the field of Science, Technology, and Society. They do not claim to do philosophy, but their work could be of utmost importance to the programs mentioned.

"I certainly agree that members of the Society for Philosophy and Technology ought to be less narrow and more ecumenical. What is on parade as philosophy of technology might turn out really to be STS; or vice versa. Among the non-technical universities philosophy of technology is most heavily represented at the University of Maastricht, where it is part of an interdiciplinary STS program.

"The Netherlands Graduate School of Science, Technology, and Modern Culture (WTMC) is a formal collaboration of Dutch researchers, who study the development of science, technology, and modern culture. The school has a total of 48 affiliated researchers, who represent a variety of disciplines: philosophy, literature, history, psychology, and sociology. A considerable number of these researchers have been educated in the natural and technical sciences. The principal researchers in the WTMC program are affiliated with the University of Maastricht, the University of Amsterdam, and the University of Twente. However, agreements have also been reached with the University of Groningen, the University of Leiden, and the Agricultural University of Wageningen, which enable researchers from those institutions to participate in the graduate school. The institutes involved in the graduate school conduct the vast majority of the research in this area in the Netherlands.

"The increasing interpenetration of science, technology, and modern culture and society implicates five core questions, the answer to which can contribute to a diagnosis of the ills of modern society and culture: (1) What roles do science and

technology play in the transformation process in which societies are entangled, and how are these roles to be empirically researched and theoretically clarified? (2) How are science and technology influenced, substantively and organizationally, by the societal and cultural processes in which they are interwoven? (3) How are the boundaries to be drawn between science, technology, and the culture in which they are produced and reproduced, and how are these boundaries made visible or invisible? (4) How are normative questions concerning science and technology taking shape, and what does this imply about the way in which these questions are treated? And finally, the reflexive question, (5) how are analyses of the development of modern culture, and especially the position of science and technology, to be legitimated, without appealing to the prevailing epistemological paradigm which itself is a characteristic result of the rationalistic process?

STS or philosophy? Never mind. Ask the scientific director of the school: w.bijker@TSS.Unimaas.nl."

The papers presented after this introduction in Tijmes's *Techné* survey—Tijmes continues—do not represent all of these perspectives. They are, simply, about half of almost a dozen Dutch contributions to SPT's tenth international conference, held at the University of Dusseldorf in September 1997. For another collection of Dutch contributions to the philosophy of technology, Tijmes adds that the interested reader can consult a volume he guest-edited in the *Research in Philosophy and Technology* series, published in 1998.

I might also mention in passing Egbert Schuurman, a Dutch engineer/philosopher and Senator, who attended a few SPT conferences; his perspective is religious, Dutch Reformed, and he is strongly influenced by Ellul, who has also influenced others in that denomination. I mention him just to complete the picture of Dutch philosophy of technology as I know it.

A second aside: in July 2005, the Technical University of Delft hosted the 14th international conference of SPT. Much in evidence, alongside a truly international gathering of philosophers from all over the world, was the Delft school's particular approach, as sketched above by Tijmes. But a philosopher from Twente, Peter-Paul Verbeek, had published a booklength version of his own take on philosophy of technology: *What Things Do: Philosophical Reflections on Technology, Agency, and Design* (2005). Verbeek has many views in common with the Delft group. Conveniently for my purposes here, Albert Borgmann did

a review almost as soon as the book was published.

Borgmann first provides a faithful summary of the book: “The three parts of *What Things Do* reflect the three phases of philosophy of technology. The first is defined by the founding fathers of the discipline, Martin Heidegger and Jacques Ellul, and extends roughly from 1925 to 1955. It was followed by a fallow period of some twenty years. In the United States, philosophy of technology began as a self-conscious discipline in the early seventies, largely through the organizing efforts of Paul Durbin and Carl Mitcham. The most influential philosophers of this group have been Langdon Winner, Don Ihde, Kristin Shrader-Frechette, and Andrew Feenberg.

‘The second phase took philosophy of technology beyond its preparadigmatic jumble and established something like schools of thought and canonical texts. More broadly, it established 'technology' as the, or at least as one, defining term of contemporary culture. This phase is now reaching its end and has been overlapping with the third generation that includes Verbeek.

“His book is a careful and critical discussion of his predecessors, and it develops an original program on the basis of those discussions. . . .

“In the concluding part, Verbeek employs the positions and concepts he has elaborated in the first two parts to sketch an original relation of humans and technological artifacts. He does so by examining rival proposals, and he finds that they lose the material and sensible presence of technological devices by concentrating on their functions or their significations. In either case there are functional equivalents (and in fact improved versions) that can serve as signs or perform functions so that the particular technological realization is incidental and temporary. The criteria a properly designed device has to meet are transparency (so the device can be understood) and engaging capacity (so its presence in our lives will be vigorous).”

Borgmann then provides his neo-Heideggerian critique: “As for shortcomings, there are two I want to mention briefly. Neither is damaging to the central concern of *What Things Do.*

“The first concerns Verbeek's postphenomenological ontology. That humanity and reality interact and shape one another is a truism. Verbeek wants to get beyond that commonplace to a 'more radical phenomenological perspective in

which subject and object are not merely intertwined with each other but constitute each other' (p. 112). That position either comes to a fairly straightforward realism or it is incoherent. For assume the constitution of a person is resolvable into its constituents, i.e., into its subjective and objective elements. Then we are back in some sort of realism. Or assume the constitution is not analyzable into its elements. Then it is invisible as a constitution and no longer properly so-called.

"Verbeek tends toward the former interpretation, and to avoid a more or less naive perspective he resorts to Kantian things-in-themselves as the anchors to objects and subjects (pp. 112 and 164). But there is nothing new or radical in this. Verbeek could simply drop what he himself calls 'a transcendental construction' (p. 164) without any loss to his critiques or proposals."

In this chapter on Dutch schools of thought in philosophy of technology, it would not be appropriate to get into the details of this disagreement. Enough to say that Verbeek is what I would call "Delftian," whereas Borgmann thinks he ought to move toward neo-Heideggerianism. Nonetheless, this disagreement allows me to bring this somewhat different chapter to a close.

Partly because the Dutch tend to set out their differences in close parallel to American differences, but partly also on their own terms, the Dutch schools seem to me to offer a fair parallel of the variety of *controversial viewpoints* that we have seen show up repeatedly in earlier chapters:

Wageningen school and Brey (not on Dreyfus, but his social democracy)

Tijmes (Heidegger)

Achterhuis (on Feenberg)

Delft and Eindhoven ("technical")

This leaves out Bijker and STS, but Chapter 25 below will include that as an anti-academic view.

Perhaps my inclusion of the Twente reflections on American philosophy of technology makes it too easy to say that the Dutch schools fairly closely mirror USA quadrants, but as we have seen in Chapter 13, the pattern also seems to hold

in Germany and Spain, so it does not seem out of step for the same to occur in the Netherlands. And by now the astute reader can see where this is heading. Contrary to many misrepresentations—including misrepresentations by some SPT authors—the philosophers affiliated with SPT, as well as those who have collaborated with them in Germany, Spain, and the Netherlands, are dealing and have from the beginning dealt with important traditional philosophical issues. These issues would often be said to cover the entire philosophical spectrum. I prefer to say—in order to underscore completeness—that they come from all the quadrants in the world of philosophy. See the essay at the end of this book.

Still, we need to stop and think here for a moment about the next several chapters: Chapter 20, on engineering and computer ethics; Chapter 21, on technology and the problems dealt with in environmental ethics and politics; Chapter 22, on biotechnology; and Chapter 23, on agricultural technologies. In some sense, these are all issues that have been around since the beginning, both within SPT and in developments alongside it. But it could be said—indeed, defenders of the "new discipline" in fact do say—that these can now be considered subdisciplines within the *new* philosophy of technology. In that respect, the core claim is that these areas require a level of professionalism that one should expect from an academic field; but, what is more, they require—for instance on the part of a young scholar entering any of the subfields—a high degree of specialized knowledge in some chosen area within the academic disciplines broadly speaking. You can't do engineering ethics without some knowledge of engineering, or environmental ethics without a grounding in ecology, and so on.

Chapter 24 will extend this broadening to still more features of the contemporary technological world, but I will save comments about that until we get there**.**

Chapter 20

Ethics in Engineering and Computer Technology: Deborah Johnson

Deborah Johnson has a body of work that represents two subfields partly neglected by philosophers in SPT: engineering ethics and computer ethics. And she has taken controversial stances relative to authors (not only philosophers) in both fields. This chapter gets us into some of the concrete issues that deserve to be mentioned alongside broader conceptual controversies. Johnson has also written on business ethics, and from this variety of contributions on concrete issues it should be possible to see where she is coming from in terms of her contributions to controversies in these areas. But Johnson's main claim to fame is that she has worked, almost as an insider, with and within professional technical societies attempting to regulate themselves.

Here is Johnson's own "Biographical Sketch for the Online Ethics Center": "She is currently the Anne Shirley Carter Olsson Professor of Applied Ethics in the Department of Technology, Culture, and Communication in the School of Engineering and Applied Sciences of the University of Virginia. Johnson was given the ACM SIGCAS Making a Difference Award in 2000. In 2001 she received the Sterling Olmsted Award for 'innovative contributions to liberal education within engineering education' by the Liberal Education Division of the American Society for Engineering Education.

"Johnson is the author/editor of four books: *Computer Ethics* (third edition, 2001); *Computers, Ethics, and Social Values* (co-edited with Helen Nissenbaum, 1995); *Ethical Issues in Engineering* (1991); and *Ethical Issues in the Use of Computers* (co-edited with John Snapper, 1985). She says she is currently at work on a new anthology, a reader in Science and Technology Studies, to be co-edited with Joseph Pitt.

"Johnson has also published over 40 papers in a variety of journals and edited volumes. Her papers have appeared in *Communications of the ACM, Ethics, Annals of the New York Academy of Sciences, IEEE Technology and Society Magazine, The Monist,* and *The Encyclopedia of Ethics.* She co-edits the journal *Ethics and Information Technology* published by Kluwer and is co-editing a book series on Women, Gender, and Technology with S. Rosser and M.F. Fox for the University of Illinois Press.

"Johnson has taught courses on ethical theory; information technology, ethics, and policy; engineering ethics; and, values and policy. During 1992–1993 she was a Visiting Professor in the Department of Civil Engineering and Operations Research of Princeton University where she worked on a National Science Foundation project on ethics and computer decision models. In 1994 and 1995 she received National Science Foundation funding to conduct workshops to prepare undergraduate faculty to teach courses and course modules on ethical and professional issues in computing. Currently she is co-principal investigator for another NSF grant to offer workshops on teaching computer ethics using the Internet.

"In her activities with professional organizations, Johnson was president of the Society for Philosophy and Technology and has taken on the presidency of a new professional society, the International Society for Ethics and Information Technology (INSEIT). In the past she has served as treasurer of the ACM Special Interest Group on Computers and Society and chair of the American Philosophical Association Committee on Computer Use in Philosophy."

This last-mentioned kind of work on Johnson's part suggested to me that I might well include here an essay I once did about how effective (or not) such work with professional societies can be. I was accused of being excessively negative there, but for present purposes what the essay (the parts of it I include here) amounts to could stand as one objection to Johnson's kind of work, no matter how valuable for SPT on other grounds. So I start this chapter with an objection to one part of Johnson's work. I will follow that with her answers, as I understand them, including a very recent theoretical addition to her earlier work. (She presented the new outlook at the SPT international meeting in the Netherlands in 2005.)

Here is my set of objections, which can be found in my "Activist Philosophy of Technology: Essays, 1989–1999" (www.udel.edu/Philosophy/pdurbin/Pub.html, where the source is "Engineering Ethics and Social Responsibility: Reflections on Recent Developments in the USA," *Bulletin of Science, Technology and Society* 17: 2–3,1997: pp. 77–83):

Engineering Ethics and Social Responsibility

I offer here philosophical reflections on roughly twenty-five years of work on engineering ethics in the USA. (For other countries, see Lenk and Ropohl, 1987, and Mitcham, 1992.) My comments fall into three parts. In the first I discuss

efforts of philosophers to contribute to the field, and that is all I will include here—except for some final comments.

Philosophers and Engineering Ethics

In the early 1970s, engineering ethics seemed to be a promising field for philosophers to enter—along with the new field of bioethics, that had recently supplanted the old field of medical ethics, as well as business ethics and several other branches of what was coming to be called applied or professional ethics. Technology was being widely criticized. There were a number of scandalous cases or emerging issues associated with engineering and related areas of applied science. Old codes of ethics were seen as in need of updating and better enforcement. And some philosophers, perhaps especially those associated with technology and society programs in academia, thought they saw interesting issues ripe for conceptual analysis. Besides, it was a time of retrenchment in the graduate education of philosophers, so there seemed to be opportunities for employment in engineering-related settings.

There are several possible roles for philosophers to play when it comes to examining ethics and engineering.

One can, for instance, play the role of external gadfly, where 'external' refers to a position entirely outside the engineering community (see Churchill, 1978). This community, as I am defining it here, ought to include not only engineers in the strict sense but engineering managers and technicians as well as many other related technical workers—from chemists and applied physicists to econometricians engaged in technological planning or forecasting.

It is also possible to play the role of internal gadfly, within engineering (or research-and-development) institutions; some people consider this to be the proper role of the philosopher (or humanist critic) with respect to the engineering or any other professional community (see Baum, 1980). According to this view, one can be part of an ethics case review panel, or of a technology assessment team, or a philosopher/professor of engineering ethics in an engineering school and play the role of gadfly every bit as effectively as—perhaps even more effectively than—someone from the outside.

It is also possible, finally, to serve on one of these committees without thinking of oneself as a stranger or gadfly. Philosophers, for example, have been asked to

help revise codes of ethics. So we also serve as laypersons on ethics review panels for engineering (and other) professional societies.

What can we conclude about these efforts of North American philosophers over the past quarter century? I will try to summarize the results by looking at what happened at gatherings associated with the most ambitious project to be undertaken in the United States—the National Project on Philosophy and Engineering Ethics, directed by Robert J. Baum.

The first stages of the development of this project have been well described by one of Baum's colleagues, Albert Flores (1977). He starts by pointing out conflicts that persist for individual engineers even if they conscientiously follow their society's code of ethics; legal challenges to professional societies' activities; and thorny ethical issues associated with doing engineering in foreign cultures—in short, he recognizes that there are 'serious issues that challenge the professional engineer's commitment to acting as a true professional.' Then Flores asks himself whether anything might be done to help solve these problems and says this: "One plausible suggestion is that since these questions clearly raise moral and ethical issues, it seems reasonable to expect some helpful guidance from scholars and academics with competence in ethical theory." The National Endowment for the Humanities agreed and provided funding for a multi-year project in which engineers would learn something about academic ethical theory, philosophers would learn more about engineering, and philosopher-engineer teams would develop ethics projects of various sorts. An outstanding example of one of these projects is the textbook, *Ethics in Engineering* (1990), by philosopher Mike Martin and engineer Roland Schinzinger.

Another feature of the National Project on Philosophy and Engineering Ethics was a series of national conferences, beginning with one at Rensselaer Polytechnic Institute in 1979. Rachelle Hollander, a philosopher who is also the program manager for the agency of the National Science Foundation that funded the second and third national conferences, has described the second conference, held at the Illinois Institute of Technology in 1982. Hollander (1983) focuses on philosophical contributions: 'Philosophers . . . develop[ed] abstract principles on which engineering obligations could rest. One presentation attempted to ground engineers' whistleblowing rights in more general moral rights to behave responsibly, while yet another developed an argument that engineers are morally required to act on the basis of a principle of due care, requiring those who are in a position to produce harm to exercise greater care to avoid doing so.

But Hollander also points out how these abstract principles were challenged at the conference, not only by engineers but by other philosophers. And she ends her report with a summary of some other disagreements—'There was, for example, considerable discussion about whether whistleblowing is ever justified, about the [conflicting] loyalty that engineers owe the public, their clients, [and] their employers,' and so on—along with recommendations for the future. Among these, Hollander points out how important social (as opposed to but encompassing individual) responsibility is; that risk assessment is a social problem; and that engineers, engineering educators, other educators, and a whole host of other actors must cooperate in solving such social problems.

The third national conference was held in Los Angeles in 1985, and it picked up on Hollander's (and others') focus on the concrete problem of risk assessment. The proceedings of the conference were edited by Albert Flores and published under the title, *Ethics and Risk Management in Engineering* (1989). Almost half of the contributions, following the earlier pattern, are by engineers. But philosophers and other critics outside the engineering community have interesting things to say in the volume. Deborah Johnson argues on moral grounds that government needs to have a role in dealing with the risks associated with toxic wastes; Thomas Donaldson appeals to well known ethical theories to raise doubts about whether international standards can be established to regulate such risks; and Kristin Shrader-Frechette argues that all risk assessments necessarily involve value judgments. In addition, Sheila Jasanoff discusses the differences between ethical and legal analyses of risk issues, while Carl Cranor focuses on the legal mechanisms—the law of torts and regulatory law—that currently control social responses to exposures to toxic substances and similar technological risks.

These are worthy contributions to the literature, both of engineering ethics and of applied philosophy, and these same authors have produced several books extending their contributions (see Cranor, 1992; Jasonoff, 1986; and Shrader-Frechette, 1991). But if we look beyond the three national conferences to the general body of philosophical literature in this period, one thing is overwhelmingly clear. Nothing approximating the pronounced movement of philosophers into the field of bioethics ever occurred; there simply was no groundswell of philosophers moving into engineering ethics. A diligent perusal of *The Philosopher's Index* from 1975 right up to the present reveals only a handful of articles and even fewer books on any aspect of ethics in relation to

engineers. In spite of early promise, (philosophical) engineering ethics remained stagnant while bioethics boomed—indeed, engineering ethics very nearly disappeared from the philosophical literature.

No key concepts paralleling the so-called mantra of bioethics—autonomy, beneficence, non-maleficence, and justice—have ever been put forward. Philosophers have written introductory textbooks, and contributed articles or chapters to anthologies (see, for example, the contributions to Johnson, 1991), but nothing even remotely approximating the attempts of bioethicists to provide philosophical foundations for their field (see Engelhardt, 1986 and 1991) has emerged. I know most of the philosophers involved in engineering ethics, and, by these remarks, I mean no disparagement of their efforts. But I believe all of us who had high hopes in the 1970s for the development of philosophical engineering ethics have been deeply disappointed.

My two other sections, Engineers and Engineering Ethics, and Possibilities for Engineer-Philosopher Cooperation, turned up equally disappointing results. Engineering societies rarely actually police their members' unethical behavior, and widespread cooperation would require major changes in attitude and behavior on the part of both engineers and their would-be philosopher-collaborators.

Conclusion

To sum up, I believe that the recent history of engineering ethics in the USA is not a happy one. Philosophical engineering ethics has turned out to have an extremely limited impact in academia. And the efforts of engineers and their professional societies are too limited in both scope and impact.

This is a very different way for me to start a chapter, but Johnson's many contributions—both to engineering ethics and to computer ethics—constitute her reply to such objections. Mainly she replies with hope. In her *Ethical Issues in Engineering*, Johnson (echoing Noble and Goldman in Chapter 15 above) first notes the complexity of the issues: “We will focus on individuals and look at what individuals can and should do when confronted with tough ethical choices; and we will focus on engineering as a system (a set of practices created by laws, rules, and conventions) that encourages and constrains various kinds of behavior. The system includes engineering education, professional societies, the culture of corporations, laws regulating the work of engineers, and so forth.”

But this is followed immediately with this expression of hope against these odds: "The subject of engineering ethics is rarely discussed during the education of engineers. Yet many engineers experience ethical dilemmas while practicing engineering. This anthology of readings was assembled with the idea that engineers will be better able to deal with ethical questions that arise in their practice if they have an opportunity to reflect on these issues long before they face them."

Johnson's parallel assessment of the situation among computer professionals, in her *Computer Ethics* (with Helen Nissenbaum)—where she remains confident that courses in ethics will help—is somewhat more hesitant: "In the case of computer professionals, because the profession is relatively new and not well organized, the commitment to public safety and welfare is neither well entrenched in everyday practice nor well articulated in professional codes or literature. . . .

"[But] the bottom line is that all of us will benefit from a world in which computer professionals take responsibility. . . . Ideally we would have all computer professionals working to shape computer systems for the good of humanity."

In something of a departure from her earlier stance, Johnson has recently broadened her theoretical outlook on engineering ethics, using insights from the Science, Technology, and Society (or Science and Technology Studies) community (or communities).

Here is her first modification of her earlier approach: "STS accounts of technological development suggest that engineering decision making involves a variety of social and value decisions. Engineers work in a context that is far from isolated. Their work and their decisions take into account cultural notions, legal requirements, market conditions, limited knowledge, time constraints, and more. From the perspective of engineering ethics, this view suggests that engineers have more latitude than is typically ascribed to them by engineering ethicists."

Johnson then adds: "STS accounts [further] suggest that many other actors, in addition to engineers, are also involved in making technology what it is. . . . Thus, STS accounts provide a much more complicated view of what it is that engineers are doing. It is a view that suggests that engineers have, on the one

hand, more latitude in design in that their decisions aren't dictated by an objective body of knowledge and, on the other hand, less latitude in the sense that many other actors are involved in technological development. . . . This calls for a very different view of the responsibilities of engineers."

Johnson's second major modification of her earlier view (which, recall, reflects the view of other engineering ethicists as well) comes under the heading of "socio-technical systems": "Were engineering ethicists to embrace the [STS] idea that engineers are not just making 'things' but making socio-technical systems, the view of what engineers do is broadened, and the range of factors for which engineers are responsible is significantly expanded. . . . The reframing provided by STS suggests that engineers already take into account and sometimes redesign not just the thing being produced but the social practices, social relationships, and meanings associated with the thing."

Her third modification comes under the heading of "expertise": "STS scholars have devoted a significant effort to better understanding the source, nature, and authority of expertise. Of particular importance for engineering ethicists is the STS argument that the authority of expertise is not derived from an (objective) value-neutral body of knowledge. The authority of expertise is dependent on a variety of social practices and this expertise is socially situated."

At this point, Johnson introduces a reflective note of caution: "Because of the complexities it introduces, many engineering ethicists may be tempted to simply dismiss the entire STS discussion about expertise. But in the long run this would be detrimental to their endeavors. STS scholars are not the only ones questioning the notion of expertise—lawyers, legislators, and members of the public question engineering judgments on a daily basis and reject their claims to objectivity. . . . Thus engineering ethicists can view the STS conversation on expertise as a resource rather than a threat."

I would add one caveat here: Johnson's reflective caution may not go far enough. As the so-called "science wars" show (see Chapter 25, below)—and as Steve Goldman has argued (in Chapter 15, above) in the name of the "social captivity of engineering"—not only engineering ethicists but engineers themselves, willingly echoing their managers and corporate leaders, may be more than "tempted" to resist the alleged insights of STS scholars; they may outright resist them as distortions of the objectivity claims that scientists have a right to make—and that engineers, in applying scientific knowledge, can claim objectivity and

expert knowledge for their work as well. In opening up her earlier view, Johnson may additionally have opened a hornet's nest.

Johnson's one-time colleague at Rensselaer Polytechnic Institute, Langdon Winner (see Chapter 11 above), is emphatic not only that STS scholars ignore such values challenges, but also that Johnson's calls for engineering ethics training are woefully inadequate. Winner emphasizes that in a democracy the public has a right to expect more than education in engineering ethics, even when coupled with engineering professional self-regulation. (As I argued above, there is all too little of that.)

Winner says: "On the one hand it is clear that, properly speaking, a person can be responsible only for his or her own decisions, actions, and their consequences. At the same time there is an important sense in which each person is now responsible for nothing less than the future of humanity itself. . . . Any effort to define and teach engineering ethics which does not produce a vital, practical, and continuing involvement in public life must be counted not just as a failure, but a betrayal as well" [Philosophy and Technology (Kluwer) series, volume 7, pp. 63–64].

Even some computer professionals, ignoring the caution of Johnson's outlook, have gotten involved in public life beyond that of their professional associations. As I noted in *Social Responsibility in Science, Technology, and Medicine,* Computer Professionals for Social Responsibility has been active in testifying before the U.S. Congress, in contacting the media and alerting the public about electronic invasions of privacy and other infringements of civil liberties, in promoting forums for the public discussion of issues such as the software requirements of the Strategic Defense Initiative (Star Wars) as well as privacy issues, in watchdogging the FBI's efforts to expand crime information records, and in publishing civil-liberties-related issues—along with the American Civil Liberties Union. CPSR also spearheaded the battle to get technical people to refuse to work on the Star Wars project.

Terry Winograd of CPSR describes his experiences in a selection in the Johnson/Nissenbaum anthology on computer ethics (pp. 25–26): "In talking about these issues I will not try to draw a careful link between terms such as 'ethics,' 'morals,' 'values,' and 'social responsibility.' These distinctions can be important for some purposes, but I will interchange them freely here with more of a concern for the ring of the sentence than for the precise differentiation of the

concepts.

"When I speak of my own work, I include more than the narrow pursuit of research and development in computer science. For almost ten years I have been a participant in the work of Computer Professionals for Social Responsibility (CPSR), an organization that has brought together people from around the country (in fact, around the world) to share understandings and to act collectively in many of the areas that are being discussed in this text. That activity is not a diversion but a critical part of the work of a computer professional. One of the things I want to highlight is the way in which organizations like CPSR and the National Conference for Computing and Values (NCCV) play a central role in ethical conduct for computer professionals.

"In addition, during the past three years, Helen Nissenbaum (now at Princeton) and I have developed and taught a course on 'Computers, Ethics and Social Responsibility' for undergraduate computer science majors at Stanford University. As all of us in academia know well, there is no better way to expand your own understanding than to throw yourself into a room full of bright undergraduates who want to master a difficult topic and expect you to help. Much of my understanding has grown from the generative interaction that comes in teaching, and that too is a central part of my work as a computer scientist. It has forced me into some hard and productive thinking about the questions being raised at a conference on Computing and Values. . . .

"In this paper I will present and contrast some common views of how ethics and values are related to computing and see what these views imply for the activities we can undertake to promote ethical behavior and social responsibility. My emphasis is on the fundamentally social nature of ethical concerns: with looking beyond the role of the individual to the larger context of discourse and action that generates the world in which individuals make choices and act. Rather than focusing on the isolated individual faced with an ethical dilemma, I want to direct our gaze to the larger swirl of human discourse, which is the source of the interpretations, values, and possibilities that make ethical choice meaningful.

"The announcement for the NCCV conference declared a vision: to integrate computer technology and human values in such a way that the technology advances and protects those values rather than doing damage to them.

"This will require acts of individual moral courage, and it will be based on a lot

more. We need to create an environment in which the consideration of human values in our technological work is not a brave act, but a professional norm. We need to produce a background of understanding in which it is simply taken for granted by all computer professionals that value considerations are foremost. We need to forge everyday practices and ways of teaching that reinforce that understanding.

"In that spirit, I will argue that the kind of inquiry and discussion that motivate the conference, and that have been at the heart of CPSR's ten years of work, are a primary form of ethical behavior."

Finally, neo-Marxist radicals such as Andrew Feenberg (see Chapter 13, above) go even farther than Winner and Winograd, saying that political activity of just any kind is not enough; we need revolutionary thinking that will bring about a wholesale change in technological society before any meaningful change can take place. As it stands now, engineering ethics is at best dealing with symptomatic, not substantive issues.

So, *controversies?* If we recall the idealistic view of Friedrich Dessauer (Chapter 15) about engineers having a kind of post-Kantian categorical imperative to save the world, we have a fairly clear four-quadrant set of options:

Dessauer's idealism and engineering ethics reflecting it;

public activism on the part of engineers and computer professionals (CPSR);

professional self-regulation (Johnson, Lenk and colleagues in Germany in Chapter 13);

and finally radical criticism (Winner or Feenberg).

Chapter 21

Philosophy of Technology and Environmental Ethics: Andrew Light

Though this chapter focuses on the next SPT president after Johnson, Andrew Light, interest in the environment on the part of members of the society had been there from the very beginning. Kristin Shrader-Frechette (Chapter 3 above), along with Stanley Carpenter, had championed environmental concerns among philosophers of technology from the earliest days of SPT. Then, over the next decade or so, increasing numbers of philosophers noticed the connection between technological developments and the environment—most often to the detriment of the environment. (For one example, see the later work of Don Ihde in Chapter 10. For another, the *Research in Philosophy and Technology* series, after it was no longer the official publication of SPT, published bibliographies and more than one volume on technology and the environment.) Nonetheless, it was Light, beginning in the mid–1990s, who led the group of philosophers within SPT who focused more and more on philosophy of technology and environmental philosophy.

Light has now moved to the University of Washington, but his old NYU online bio is still a useful introduction: "Andrew Light, Ph.D. (University of California, Riverside, 1996), is Assistant Professor of Environmental Philosophy, Director of the Environmental Conservation Education Program and Co-Director of the Applied Philosophy Group at New York University. He is also a Research Fellow at the Institute for Environment, Philosophy & Public Policy at Lancaster University (U.K.), and a Faculty Fellow at the Center for Sustainable Development in the School of Architecture at the University of Texas at Austin. His primary areas of interest are environmental ethics and policy, philosophy of technology, and political and social philosophy.

"Light is the author of over sixty articles and book chapters on these topics, and is editor or co-editor of fourteen books. The ones I find relevant are included in the bibliography at the end.

"Most of Light's work in environmental philosophy (he says) has focused on the failure of the discipline to fulfill its promise as a guide to formulating better, more morally responsible environmental policies. Identifying several theoretical debates in the field which have prevented it from aiding in the development of better policies, Light argues that a pragmatist methodology is needed to

transform environmental ethics into a more practical ethics, able to participate in the actual resolution of environmental problems. Consistent with this work, he has co-authored a book, *Environment and Values*, with John O'Neill and Alan Holland (2004), which offers a historical and community based approach to environmental valuation.

"In addition to these activities, Light works with many journals and professional societies. He serves on the editorial boards of *Environmental Ethics*, *Environmental Values*, *Ecological Restoration*, *The Journal of Architectural Education*, and *CNS*. In 1994 he co-founded the Society for Philosophy and Geography with Jonathan Smith (Texas A&M University) and co-edits the Society's journal, Philosophy and Geography (Carfax Publishers), which publishes interdisciplinary work on questions of space, place, and both urban and natural environments. He has also helped to organize eleven international conferences on environmental issues in North America and Europe, and is a past president of the Society for Philosophy and Technology."

To give something of the flavor of Light's attitude toward deficiencies in the field of environmental ethics—which grew up almost exactly in step with SPT—I include here selections from the introduction to *Environmental Pragmatism* (edited by Light with Eric Katz):

Introduction: Environmental pragmatism and environmental ethics as contested terrain

"As environmental ethics approaches its third decade it is faced with a curious problem. On the one hand, the discipline has made significant progress in the analysis of the moral relationship between humanity and the non-human natural world. The field has produced a wide variety of positions and theories in an attempt to derive morally justifiable and adequate environmental policies. On the other hand, it is difficult to see what practical effect the field of environmental ethics has had on the formation of environmental policy. The intramural debates of environmental philosophers, although interesting, provocative and complex, seem to have no real impact on the deliberations of environmental scientists, activists and policy-makers. The ideas within environmental ethics are, apparently, inert—like Hume's *Treatise*, they fall deadborn from the press.

"The problematic situation of environmental ethics greatly troubles us, both as philosophers and as citizens. We are deeply concerned about the precarious state

of the natural world, the environmental hazards that threaten humans, and the maintenance of long-term sustainable life on this planet. The environmental crisis that surrounds us is a fact of experience. It is thus imperative that environmental philosophy, as a discipline, address this crisis—its meaning, its causes and its possible resolution.

"Can philosophers contribute *anything* to an investigation of environmental problems? Do the traditions, history and skills of philosophical thought have any relevance to the development of environmental policy? We believe that the answer is yes. Despite the problematic (and, heretofore, ineffectual) status of environmental ethics as a practical discipline, the field has much to offer. But the fruits of this philosophical enterprise must be directed towards the practical resolution of environmental problems—environmental ethics cannot remain mired in long-running theoretic debates in an attempt to achieve philosophical certainty. As Mark Sagoff has written: '[W]e have to get along without certainty; we have to solve practical, not theoretical, problems; and we must adjust the ends we pursue to the means available to accomplish them. Otherwise, method becomes an obstacle to morality, dogma the foe of deliberation, and the ideal society we aspire to in theory will become a formidable enemy of the good society we can achieve in fact.'

"In short, environmental ethics must develop for itself a methodology of *environmental pragmatism*—fueled by a recognition that theoretical debates are problematic for the development of environmental policy.

"This collection is an attempt to bring together in one place the broad range of positions encompassed by calls for an environmental pragmatism. For us, environmental pragmatism is the open-ended inquiry into the specific real-life problems of humanity's relationship with the environment. The new position ranges from arguments for an environmental philosophy informed by the legacy of classical American pragmatist philosophy, to the formulation of a new basis for the reassessment of our practice through a more general pragmatist methodology.

"From the perspective of environmental pragmatism, we can return to our question: why has environmental ethics failed to develop its practical task? Perhaps one reason is methodological and theoretical dogmatism. Mainstream environmental ethics has developed under a narrow predisposition that only a small set of approaches in the field is worthwhile—that only some ways of

developing an environmental philosophy will yield a morally justifiable environmental policy. Although a wide variety of positions is discussed in the literature, the consensus it seems, is that an adequate and workable environmental ethics must embrace non-anthropocentrism, holism, moral monism, and, perhaps, a commitment to some form of intrinsic value. Those who wish to defend or develop different positions are rarely heard or taken seriously, and are always assumed to have the burden of proving just cause for deviating from the norms of current theory. It seems that anyone who is still questioning which is the correct side in the debates over individualism/holism, anthropocentrism/nonanthropocentrism, instrumental/intrinsic value and pluralism monism is seen as being unnecessarily obfuscatory."

There is a now-famous "hotspots" claim (Mittermeier, 2000) that stopping the loss of biodiversity is "simply the right thing to do." Moral philosophers, and more particularly environmental philosophers, rarely accept a claim that any activity is simply the right thing to do—without argumentation. And there is a lively debate among environmental ethicists about the priority, let alone unchallenged duty, of preserving biodiversity or saving species from extinction. (See Bryan Norton, *The Preservation of Species,* 1986.)

So I now turn to a *spectrum* of environmental ethics claims and the philosophers (and others) who make them.

Some people say that contemporary environmental ethics begins with the work of a scientist, Rachel Carson in *Silent Spring* (1962; see also Frank Graham, 1970). Others say the movement began earlier, with a famous debate between Gifford Pinchot, of the U.S. Forest Service, and John Muir, founder of the Sierra Club, over the Hetch Hetchy dam project in California in the early decades of the twentieth century.

But what I am talking about is not such disagreements among scientists; it is about philosophers' disagreements over the principles on which they think answers to questions such as water pollution or dam building must be based—specifically, the spectrum of positions in environmental ethics.

Many of the disagreements can be followed in two books: Michael Zimmerman, ed., *Environmental Philosophy* (4th edition, 2004 [copyright says 2005]), and Joseph DesJardins, ed., *Environmental Ethics* (1999).

Among the disputants, I will begin with Light and *Environmental Pragmatism*. Most of Light's work in environmental philosophy (judging from his own web site, above) has focused on the failure of the discipline to fulfill its promise as a guide to formulating better, more morally responsible environmental policies. Light argues that a pragmatist methodology is needed to transform environmental ethics into a more practical ethics, able to participate in the actual resolution of environmental problems. Concretely, he works on ethical issues in *restoration ecology* and has been actively involved in that movement.

Light's (and others') environmental pragmatism and work on such issues as ecological restoration (typically around urban centers such as Chicago) brings criticisms from opponents all along the environmental ethics (and politics) spectrum.

The most extreme among critics of environmental activism are those who say there is no problem and restoration is wasted effort; some of these critics are people associated with the so-called Wise Use or Anti-Takings movements. (See, among others, Ron Arnold, 1999; and Gregg Easterbrook, 1995.)

Less extreme, but still somewhat politically conservative in my opinion, are defenders of ecological economics, such as Herman Daly. He critiques the standard environmental economics that underlies some anti-environmentalism (definitely conservative if not reactionary). Daly offers his criticisms in the name of measures of sustainability that include calculations of the values contributed to society by natural phenomena; these can be seen, among other places, in books such as Daly's *Valuing the Earth* (1993).

From the other end of the environmental (and/or political) spectrum come critics, like J. Baird Callicott (for example, in the Zimmerman anthology), who worry that environmental pragmatists (he explicitly mentions Light) are simply avoiding the basic issue of environmental ethics—whether or not, and to what extent, non-human beings such as animals and plants and ecosystems have either interests or rights that conflict with human beings' rights. Callicott himself is a long-time defender of Aldo Leopold's "land ethic," which he has updated, turning it (he thinks) into a defensible holistic ecocentrism.

There are also Marxist and ecofeminist environmental philosophers for whom environmental problems are the result of various divisions both within society *and pitting humans against nature*—class divisions, male domination ideologies,

false nature/humans dichotomies, and so on. In my opinion, Karen Warren is the best defender of such views, and her latest version (possibly her best?) is also to be found in the Zimmerman volume.

I should add here radical defenders of wilderness for its own sake, such as David Strong in *Crazy Mountains* (1995).

In line with Hickman (Chapter 14 above) and American Pragmatism, I side with Light, and other environmentalists calling themselves pragmatists, against their critics. Callicott challenges them—us—saying that we have set up "a false dichotomy between the classical activity of theory building . . . and the activities that they call for philosophers to take up instead" (in Zimmerman, p. 15). This seems to me to have things backward; I think its Callicott who has set up a false dichotomy. John Dewey, for the most famous example in American Pragmatism, was a lifelong opponent of dichotomized thinking. (See *The Quest for Certainty*, 1929; but for that matter any of Dewey's works.)

Callicott, along with his criticism, offers an irenic add-on: "In the very spirit of pluralism that the environmental pragmatists laud, it would be better to represent activities—such as popular value description and clarification and policy formation—as complementary to the more theoretical concerns of 'traditional' environmental philosophers than as an alternative to them." And Callicott applauds Bryan Norton's *Towards Unity among Environmentalists* (1994).

However, it seems to me that Callicott betrays his own irenic hopes when he accuses pragmatists of implicitly "trying to discourage exploring the theoretical question . . . so that the old conventional answer to that question—only human beings [are morally considerable]—will prevail by default" (p. 15). His failure, it seems to me (I should say this modestly if I want to join him in irenicism), lies in limiting pragmatists to "popular value description and clarification and policy formation." Those are not by any means the only things pragmatists advocate; indeed, in Callicott's formulation, these activities sound suspiciously like philosophical activists "advising" their fellow activists from some high ground of theory. Hickman for one (see Chapter 14 above), following Dewey, is not just calling for philosophers to describe or clarify values—even to help environmental policy makers formulate policies from some "higher" ground. The Deweyan or American Pragmatist plea is to jump in together with other activists, experts and non-experts alike, to work out "on the ground" some practicable (hopefully defensible) solution to the problem at hand. Dewey says

we should give up forever the idea that we are some sort of Platonic philosopher-kings with advice for the less enlightened to follow.

Complementarity and working together and respecting other people's values (even other philosophers' value systems) are important. But for pragmatists it's the urgency of the problems that counts. When philosophers say, "Yes, but we won't solve those problems unless we can first be clear about what count as good or acceptable solutions," that creates a problem. Usually we don't have the time—centuries?—to wait for philosophers to come to agreement on theoretical issues. On issues such as the loss of biodiversity at alarming rates worldwide, if we wait we are likely to be too late. That's what gives force to Mittermaier's moral imperative. And the same is true for global climate change and a number of other urgent global environmental issues.

Pragmatists, morover, are not the only kind of activist environmental philosophers. I mentioned Karen Warren and ecofeminism earlier. In her introduction to the section she edited in Zimmerman (4th ed., p. 147), Warren says: "Ecofeminism has always been a grassroots political movement by pressing pragmatic concerns. These include issues of women's and environmental health, to science, development, and technology, the treatment of animals, and peace, anti-nuclear, anti-militarism activism. The varieties of ecofeminist perspectives on the environment are properly seen as an attempt to take seriously such grassroots activism and political concerns by developing analyses of domination that explain, clarify, and guide that praxis."

And Warren (p. 148) quotes approvingly Noel Sturgeon's characterization of ecofeminism, as a social movement through which change is produced by numerous kinds of "action," including that of the deployment of symbolic resources, shifts in identity construction, and the production of both popular and scholarly knowledge—as well as direct action, civil disobedience, strikes, boycotts, demonstrations, lobbying, and other more traditionally recognized forms of political action.

Warren's own contribution to the Part 2 she edited—"Ecofeminism and Social Justice"—is, I think, a brilliant summary of the range of ecofeminist writings, as well as one of the best summaries she has written of her own anti-dichotomies approach (pp. 252–279).

But there may be limits to Warren's—and Sturgeon's and other ecofeminists'—

commitment to activism, if they want activists to wait until anti-dichotomous thinking has replaced dichotomous thinking in contemporary society. It may well be the case, environmental pragmatists would say, that we can't ultimately address important environmental issues in an effective manner until people generally—and especially political and ideological leaders—come to see that misguided dichotomies are destroying and will continue to destroy both society and the environment so often falsely separated from it. But, they say, we often can't wait for "ultimately": for example, faced as we are with rapid species destruction, to wait is too late. Recognizing this, some ecofeminists say we should work simultaneously on both symbolic and real-world challenges.

Controversies in environmental ethics and philosophy of technology? Light is clear that he is a *pragmatist* (restoration ecologist). His website says he is opposed to the whole now-standard environmental ethics spectrum (whether we view this as a range extending from environmental economics to "deep ecology," or as a left/right political spectrum), because it has "not achieved what it set out to accomplish." But critics doubt that Light's favored restoration ecology will work—or that it is even necessary. Ecofeminists want to deal with the strongly "symbolic" issues of false dichotomies.

And, in the most fundamental challenge (in these terms) to environmental pragmatism, Callicott says it abandons the field, giving up on the effort to devise a defensible holistic or biocentric rather than human-centered philosophy—thus, by default, ending up with a human-centered view which will not lead to "pragmatic" solutions that match the environmental challenge.

There is a certain irony here. Light had been a leader among the trio calling for a new academic philosophy of technology subspecialty (Chapter 18 above). But as I have presented him here, he sounds like an activist (like myself, see Chapter 17) opposing academic arguments over the foundations of environmental philosophy. What this suggests is that there is more than a little tension in the call for an academic specialty. We next turn to a philosopher with radical, even Marxist roots, who ended up spending a good part of his career as a regulatory bureaucrat—on biotechnology issues—in Washington, D.C.

Chapter 22

Philosophy of Biotechnology: Sheldon Krimsky

Before I get to Krimsky (whose biographical materials I will give later), some general comments are in order about the current state of philosophical thinking on biotechnology. Though I have presented the following material elsewhere, most recently at the 2005 SPT conference in Delft, it has not previously been published. So I present it here as new.

Philosophical work to date has followed traditional lines, beginning with ethics.

One of the earliest attempts by a philosopher—an analytical philosopher in this case—to be balanced in his approach was that of Jonathan Glover, in his *What Sort of People Should There Be?* (1984); there Glover gives a cautious green light to some sorts of genetic engineering. At about the same time, a Heideggerian, Wolfgang Schirmacher (1987) offered his reflections on the early debate in Germany; Schirmacher's endorsement was even more positive, arguing that we have a responsibility to use genetic manipulations to improve human behavior, so often less than moral up to now.

I have found at least four books with "genethics" or a variant in their titles: David Heyd, *Genethics: Moral Issues in the Creation of People* (1992); Kurt Bayertz, *GenEthics: Technological Intervention in Human Reproduction as a Philosophical Problem* (1994); reflects the same German debates as Schirmacher; David T. Suzuki, *Genethics: The Clash between the New Genetics and Human Values* (1989); more critical; and David T. Suzuki, *Genethics: The Ethics of Creating Life* (1988).

Nor does this exhaust the list. There are at least two collections with similar titles: Justine Burley and John Harris, *A Companion to Genethics* (2002); contributions mostly by philosophers; and M. Khoury, W. Burke, and E. Thomson, eds., *Genetics and Public Health in the 21st Century: Using Genetic Information to Improve Health and Prevent Disease* (2000); mostly non-philosophers and mostly optimistic.

In addition (and finally, because my intent is not to be exhaustive), there are two textbooks on related subjects: Michael Boylan and Kevin E. Brown, *Genetic Engineering: Science and Ethics on the New Frontier* (2001); and Michael C.

Brannigan, *Ethical Issues in Human Cloning: Cross-Disciplinary Perspectives* (2001), which includes an interesting range of perspectives from religious ethicists.

Politics would be the next heading, and many things have been written about the politics of various aspects of genetics, including the exporting of genetically modified foods and seeds to various countries. But one philosopher has had the field almost to himself in providing balanced, judicious assessments of all aspects of biotechnology. That philosopher is Sheldon Krimsky, and I will take up his work at length later in this chapter.

Next would come philosophy of science approaches to biology, though for the most part philosophers of biology—though that subfield is flourishing—have had little to say about biotechnology. On the other hand, they have had much to say about genetics, where one big issue has been whether genetic explanations are (rightly or wrongly) reductionist.

The basic science (accessible to an intelligent lay reader) can be found in Michel Morange, *The Misunderstood Gene* (2001). Morange is not a philosopher but a biologist and historian of science; however, his treatment of genetics is judicious and balanced enough to satisfy any philosopher. He also, conveniently, has authored a *History of Molecular Biology* (1998).

The basic reductionist text is Richard Dawkins's *The Selfish Gene* (1989). Kim Sterelny, *Dawkins vs. Gould* (2001), summarizes one controversy. And Richard Lewontin, in *It Ain't Necessarily So: The Dream of the Human Genome and Other Illusions* (2000a), and *The Triple Helix: Gene, Organism, and Environment* (2000b), provides the best-known anti-reductionist counterpoint.

Many traditional philosophers of science, including philosophers of biology, are critical of social-constructionist interpretations of the sciences, including the biomedical sciences. (See Chapter 25 below.) The major social constructionist who has worked closely with biological research communities and provided detailed quasi-anthropological accounts of what goes on there is Karin Knorr-Cetina, beginning with her *The Manufacture of Knowledge* (1981), but continuing in such studies as "Image Dissection in Natural Scientific Inquiry" (1990, with Klaus Amann). Knorr-Cetina's work neither takes sides in the reductionism controversy nor deals directly with biotechnology, but it could support the claim that much of what passes for pure science in biology is closely

akin to goal-directed biotechnology as found in the industrial genetics labs studied by Krimsky (below).

Finally I'd like to raise the issue as to whether there ought to be a philosophy of biotechnology proper in any kind of general sense. Here I will pick up several threads from Chapter 15 above on philosophy of engineering. One of the reasons why traditional philosophers of biology have little to say about biotechnology beyond the issue of genetic reductionism is that they often (at least implicitly) buy into the notion of biotechnology as simply applied biology. So that is a good begining here.

The philosopher who has identified technology (in general) with applied science is Mario Bunge, and he has spelled out his approach to biotechnology explicitly in his *magnum opus*, *Treatise on Basic Philosophy* (multivolume, each volume with a different date, beginning in 1983; the material on biotechnology is in volume 7, 1985, pp. 246ff.).

Bunge begins: "This section deals with biotechnology" (p. 246); and it becomes obvious very quickly what Bunge's approach is: "Iatrophilosophy, or the philosophy of medicine . . ."—where he identifies philosophy of biotechnology with philosophy of medicine. Unfortunately, according to Bunge, not much "serious iatrophilosophy" has been published yet, so there is "much that analytically oriented philosophers could do to prepare the terrain" (p. 246).

Bunge continues: "Medicine [recently tapping biology in general and molecular biology in particular] . . . is now on the right track, though it has a long way to go before attaining the rigor and effectiveness of engineering" (p. 246).

For Bunge, "Therapeutics [is] a branch of biotechnology" (p.2 48). And he provides what for him is a telling example: "Once . . . a [biochemical] mechanism [of a pathogen] has been unveiled, the technical problem of designing drugs inhibiting the pathogen can be posed in precise terms" (p. 249). So medicine can become a science, and medical cures are straightforward "engineering" applications of that science.

If this seems too narrow and deterministic, Bunge admits that, "Over the past decades, medicine has gradually . . . adopted the *systemic* model of man as a biopsychosocial entity" (p. 249)—so the range of medical sciences to be applied in bioengineering and biotechnology has been broadened considerably. But

whatever the branch of medical science and therapeutics as straightforward bioengineering, the model is the same: science applied equals engineering or technology. For more detail, see Martin Mahner (with Bunge), in *Foundations of Biophilosophy* (1997).

As we saw in Chapter 15 (as well as in Chapter 5 on Bunge), there are many critics of the application model. Historians of science and technology, for more than 25 years, have attacked the notion that technology (or engineering) is simply applied science (see, for example, Edwin Layton, "A Historical Definition of Engineering," 1991, where Layton summarizes his own previous work and that of other historians). But I am not aware that any of them have challenged Bunge on biotechnology. Philosophers similarly have challenged the applied science model. For example, in the same volume in which Layton's historical critique appears, philosopher Steven Goldman (1991) argues that the nature of engineering has been obscured by both scientists and engineers (along with managers and the public), who think along the lines laid out by Bunge. By cloaking their work in the mantle of praise for science—nearly always adding "for the public good"—engineers and their defenders, according to Goldman, are able effectively to mask the "social determinants of technological action" that actually drive modern engineering at every level, including the level of what counts as engineering knowledge. Using example after example of how engineering decision makers almost never pursue the "technical best," deferring instead to managerial decisions about what to pursue and how far, Goldman concludes: "Engineering thus poses a new set of epistemological problems deriving from a rationality that is different from that of science. The rationality of engineering involves volition, is necessarily uncertain, transient and nonunique, and is explicitly valuational and arbitrary. Engineering also poses a distinctive set of metaphysical problems. The judgment that engineering solutions "work" is a social judgment, so that sociological factors must be brought directly into engineering epistemology and ontology" (Goldman, 1991, p. 140).

These "captive" experts tend to see nothing wrong with the "applied science" model. Goldman attributes this to a kind of cultural blindness: "The purported value neutrality of the technical is an ideologically motivated strategem." (Goldman says engineers voluntarily go along with their managers, with whom, on this point at least, they share the ideology.) "It serves," Goldman goes on, "to insulate from criticism the social factors determining technological action" (p. 141).

Goldman's conclusion is controversial, but it seems to me that both critics and defenders of engineering agree on the "captivity" of engineering practice. Defenders seem to claim that engineering, freed of its constraints, could be more objective—this is clearly Bunge's hope. Critics like Goldman say, instead, that we have to judge engineering—even engineering's epistemology or knowledge claims—not by what it might be, but as it is in the real world.

None of Goldman's examples has anything to do with biotechnology, but so many of the large biochemical and pharmaceutical corporations have their research and development departments involved in biotechnical development that it is easy to see how Goldman's view would be instantiated there as "captive biotechnology."

As I said in Chapter 15, because I think engineering is a key component of any adequate philosophy of technology (see also Durbin, 1991, introduction), I pause for a moment to consider the philosophizing of an engineer, Billy Vaughn Koen (1985, 1991, 2003), who believes both that engineering has been almost totally ignored by philosophers and that he has captured the essentials of *the* engineering method. It also happens that, in his latest book (2003)—which ambitiously turns his engineering method into *the* universal method of human problem solving—Koen also includes a brief comment on the current state of bioengineering, as we will see in a moment.

The essence of the engineering method that Koen thinks he has discovered can be summarized briefly (too briefly?) under two headings: heuristics, and "sota" or state of the art. Koen concludes: "My Rule of Engineering is in every instance to choose the [always fallible] heuristic from what my personal sota takes to be the engineering sota at the time I am required to choose" (Koen, 1991, p. 57).

And: "If . . . all engineers in all cultures and all ages are considered, the overlap [among their sotas] would contain those heuristics absolutely essential to define a person as an engineer" (p. 58).

Again as noted in Chapter 15, Koen has little use for definitions like that of Bunge, that engineering is applied science—though he readily admits that engineers' sotas do include scientific knowledge. Nor does Koen agree wholeheartedly with Goldman's anti-Bunge "captive engineering" view, though he does emphasize that the state of the art in any engineering project clearly must

include managerial and other non-engineering constraints (including public and political input). What Koen wants us to see is that good (he would even say the best) engineering practice always contains the fallibility of heuristics (he thinks unlike science), *but* it is also always bound by best practices of the time, the sota or state of the art.

I mentioned that Koen is willing to go far out on a weak branch to generalize: "The responsibility of each *human as engineer* [is] clear. Everyone in society should develop, learn, discover, create, and invent the most effective and beneficial heuristics. In the end, the engineering method is related in fundamental ways to human problem solving at its best" (Koen, 1991, p. 59).

And Koen's latest book, *Discussion of the Method* (2003), attempts to turn this generalization into *the* universal method of human problemsolving, following in a long line of philosophers (and others) who have attempted to discover such a universal method. And what is relevant here is Koen's few comments (2003, p. 249) that apply his universal method to an assessment of the state of the art today in bio-engineering: "Both behavioral and genetic engineers recognize that they want change in a highly complex, unknown system and, not surprisingly, instinctively appropriate the title engineer. Saying you are an engineer, however, doesn't necessarily mean that you are a very good one.

"The present state of the art of both the behavioral and genetic engineer contains the appropriate heuristics for behavioral modification, but few of the heuristics of engineering. . . . Neither has the slightest notion of the importance of making *small changes in the sota, attacking the weak link*, or *allowing a chance to retreat*."

This is a serious indictment of genetic (and behavioral) engineering, as currently practiced, and here it comes from an engineer/philosopher, not from one of the public critics of bioengineering and biotechnology.

But Koen's assessment (however brief) of the current state of bioengineering can be challenged. Doing so provides a third step toward a general philosophy of biotechnology. To repeat one more item from Chapter 15, Ana Cuevas Badallo, in an ambitious doctoral thesis (2000), discussed the role of the so-called *engineering sciences* in a new philosophy of technology that would be more adequate than any offered so far. After listing more than a dozen engineering sciences, classical and modern, she chose to focus on the most traditional, so-

called Strength of Materials. But her basic list (pp. 79–80), a very standard list in engineering education, extended from strength of materials to aeronautic engineering, systems of control, management as a part of engineering, and—our focus here—bioengineering and genetic engineering. And she ends her thesis this way: "Here I have analyzed only one theory among the engineering sciences, so the future is open to see if the proposed characterization is correct in relation to other cases—a task beyond our present scope. The conceptual framework presented here needs to be refined through studies of other engineering sciences and their relationships to other natural sciences, to mathematical sciences, and even to the social sciences" (p. 372; my translation).

I believe Cuevas offers a worthwhile qualification on Koen's offhand dismissal. Are there engineering sciences (not unlike cookbook formulas, but at a higher theoretical level) in biotechnology? Cuevas does not say, but her conclusion (above) hints that her thesis might be applicable in that area of engineering every bit as much as in structural engineering. To support this hint, I refer to four crucial discoveries in genetic engineering: cutting DNA strands using *restriction enzymes*; *recombining them*; proliferation of useful genetic materials through *polymerase chain reactions*; and so-called "knockout" or *gene inactivation* studies for the purpose of determining gene activities in a precise way. All of these discoveries are complex and have led to what outsiders might view as cookbook formulas somewhat parallel to strength of materials equations, but it is interesting that people have been awarded major *science* prizes for their discovery, however inseparable the discoveries are from practical goals. I make no claim to being a bioengineering or biotechnology expert, but those who are refer to these breakthroughs as *both* scientific *and* practically oriented in the sense described by Cuevas: Michel Morange says, "The experiment carried out at Stanford by David Jackson, Robert Symons, and Paul Berg and published in l972 in the *Proceedings of the National Academy of Sciences* marked the beginning of genetic engineering. In this article, Jackson, Symons, and Berg describe how they obtained *in vivo* a hybrid molecule containing both the DNA of the SV40 oncogene and the DNA of an altered form . . . that already included the *E. coli* galactose operon" (Morange, l998, p. 187).

According to Morange (1998, p. 186), others disagree and credit earlier work—of Werner Arber, Hamilton Smith, and Daniel Nathans, summarized by Arber (1979)—on the use of restriction enzymes to cut or cleave DNA at precise points, of which the Berg group's work was a "natural development."

The fact that Berg did not receive a Nobel Prize and his predecessors did does not detract from the point made here. Both accomplishments have been recognized (Berg won other prestigious prizes) *both* as important scientific breakthroughs *and* as key techniques for future practical work in genetic engineering.

Still following Morange (1998, p. 231), we come next to PCR, the polymerase chain reaction technique—which Morange says (p. 242), "More than any other technique, has changed the work of molecular biologists." Here is Morange's summary of how it has done so: "In 1983 Kary B. Mullis developed a technique for amplifying DNA called the polymerase chain reaction (PCR). [See Mullis, 1990.] PCR can amplify virtually any DNA fragment, even if it is present in only trace amounts in a biological sample, thus allowing it to be characterized. It can aid forensic medicine by characterizing DNA molecules present in biological samples such as hair, traces of blood, and so on. It is sufficiently sensitive to permit the detection and characterization of the rare DNA molecules that persist in animal or human remains thousands of years old. This technique also makes possible a genetic diagnosis on the basis of a single cell. . . . Finally, it permits the early detection of bacterial or viral infections" (p. 231).

All these practical applications led one seemingly jealous previous Nobel Prize winner to call PCR "a mere technical trick" when Mullis won his Nobel in 1993. But Morange (1998, p. 242) clearly thinks it *was* a significant scientific breakthrough as well as a significant breakthrough in genetic engineering.

In a more recent book, Morange (2001, pp. 64ff.) talks about a completely different technique, or set of techniques. The book focuses on gene *function* rather than genes in the abstract or genetic engineering; indeed, Morange says: "My description of gene function is . . . as concrete as possible, giving a precise image of their functions in the most fundamental life processes: development, aging, learning, behavior, the establishment of biological rhythms, and so on" (Morange, 2001, p. 4).

And in that context one particular technique, so-called "gene knockouts," seems particularly important to him. "Inactivating [a] gene makes it possible to see in which tissues and organs its action is necessary. Conversely, when the product of a gene has been sufficiently studied . . . [even] fully described, it may seem unnecessary to verify the function *in vivo* by a knockout experiment. However, knockout experiments . . . have produced more surprises than even the most

enthusiastic partisans of this new technique expected" (p. 64).

In this case (these cases), the practical payoff is not usually bioengineering but some scientific discovery that may have an impact, say, on clinical medicine. So I may be stretching in bringing this in here, but it does seem to me that such gene knockout experiments represent another case of the kind of theory-practice combination that might exemplify what Cuevas would be seeking in a more complete philosophy of biotechnology.

Summarizing what I have here suggested are first steps toward a comprehensive philosophy of biotechnology, I will first refer to a more recent paper of Cuevas (forthcoming), in which she takes great pains to show that many contributions need to be taken into account in an adequate philosophy of technology (in general). Even Bunge's applied science model sometimes works, as do approaches that make scientific advances dependent on technological or instrumental advances (e.g., Pitt, 2000)—and a whole host of other approaches; Cuevas is, reluctantly, even willing to say that "technoscience" constructivist approaches (see Hughes, 1988) are sometimes useful. Her point is not that her engineering sciences approach is better than the others. All are necessary, and complementary, for an adequate and complete philosophy of technology in general or any particular technology or set of technologies.

Here I have emphasized, in my approach to an adequate philosophy of biotechnology (including bioengineering), the ethics and politics of biotechnology and genetic engineering, debates about genetic reductionism, and approaches to an *engineering* philosophy of biotechnology for which I have borrowed ideas from Goldman, Koen, and Cuevas. Biotechnology, if we combine these views, is a part of "captive" engineering (Goldman); is necessarily related to the state of the art at any given time (Koen says current genetic engineering is deficient in this regard); and involves key bioengineering theories/techniques (where I have supplemented Cuevas with references to historian of genetics Michel Morange). As Cuevas Badallo says for *any* technology, I would say *biotechnology* is highly complex and has a variety of complicated relationships with genetics and other biological sciences.

A final surprise in all of this can be seen if we turn to the public furor over biotechnology. Far from being illegitimate, public concerns about biotechnology and genetic engineering ought to be expected—even welcomed. Biotechnology may be "the wave of the twenty-first century" (as some say), but if the twentieth

century has taught us anything, scientific and technological developments are fraught with social consequences. Originators of the Human Genome Project were wise to try to deal in advance with the ethical, legal, and social implications of the venture (the so-called ELSI program; see Marshall, 1996; and National Human Genome Research Institute, 1997); and promoters would do well to consider the same for bioengineering, genetic engineering, and biotechnology generally. If developments in biotechnology are to be truly valuable for society, there ought to be public input into their evaluation and management. This does not mean we have to take seriously every outspoken critic of biotechnology or genetic engineering; only that, in a democratic society, public discussion of such issues is welcome.

Sheldon Krimsky's writings open the door to exactly this, and after this long introduction, it's time now to get to Krimsky. He is a product of the Boston University philosophy department in the heyday of Marxists Robert Cohen and Marx Wartofsky (see Chapter 4, above), but he found his academic home at Tufts University in an environmental policy program. He was active in Cambridge-area efforts to control recombinant-DNA developments in the 1970s, and this led to long association with the Federal government's Recombinant-DNA Advisory Council (RAC). See the following Krimsky books: *Genetic Alchemy: The Social History of the Recombinant DNA Controversy* (1982); *Biotechnics and Society: The Rise of Industrial Genetics* (1991); and *Agricultural Biotechnology and the Environment: Science, Policy, and Social Issues* (1996).

What follows is long, selected, and severely truncated, and is taken from Krimsky's *Biotechnics and Society* (1991), Chapter 11 (pp. 205ff):

Biotechnology Assessment: Dilemmas and Opportunities

"Before the introduction of a new biotechnological product or licensing of a new technological production plant, its impact on the general welfare, health, economy, labour situation, culture and sociooeconomic structures, etc. should be studied. –Cary Fowler et al., 1988, Rural Advancement Fund International

"Biotechnology is a global issue. It cannot be assigned such attributes as positive, negative, or neutral. Like any other technology, it is inextricably linked to the society in which it is created and used, and will be as socially just or unjust as its milieu . . . rational biotechnology policy must be geared to meet the real needs of the majority of the world's people and the creation of more equitable and

self-reliant societies while in harmony with the environment. –The Bogeve Declaration, 1987

"Previous chapters in this book have shown how the industrialization of applied genetics has contributed to a new generation of social, ethical, legal and ecological problems. The R&D and industrial sectors in biotechnology have aggressively sought product opportunities in the tradition of other high-tech ventures like microelectronics, computers, and robotics. But these industrial revolutions cannot compare to the commercialization of genetics in the public apprehension associated with their successes. Geneticist Steve Gendel asks: 'Why has biotechnology become such a focus for ethical, social, and economic debate while other technologies are all but ignored?' His answer focuses on the subject matter. 'Clearly biological issues touch a sensitive aspect of our culture and lead to deeper and more passionate examination of issues than do issues raised by any other technology.' I would argue that part of the difference lies in the fact that traditional ways of addressing the externalities of industrialization. These challenges are confounding to government regulators and entrepreneurs who place their confidence in the established norms of social governance. . . .

Political Ideology And Biotechnology

"Environmental Traditionalists. Environmentalism, as distinguished from political and social ecology, is rooted in the constellation of laws that protect humans and segments of the ecosystem from the products and processes of industrialization. The vast majority of these laws that have been enacted at the federal level came in response to public concerns over the hazards of the chemical, nuclear, and fossil fuel industries. Environmental traditionalists advocate a modification of the current regulatory system to address the problems of biotechnology. Some modifications, additions, and adaptations to the established regulatory regime of FIFRA, TSCA, and to a lesser degree the Food and Drug Acts, have already been made in response to biotechnology. The vast body of environmental law has not been amended by Congress. However, minor modifications of the existing statutory framework are well within the purview of the traditionalist response to the biotechnology revolution.

"Reactionism. Among those who reject environmental traditionalism are individuals who advocate a libertarian model of technological innovation. According to this view, society should not assume the technology is hazardous before it is *proven* hazardous. Secondly, it is argued that the costs of pursuing

'phantom hazards' is too great for society to bear. They cite ice minus as an example. It took five years and millions of dollars of regulatory review and litigation before an outdoor field test was permitted for an organism with a 'mere' single gene deletion. The tradition of reactionism has attracted those who would eliminate the Delaney amendment for food additives, do risk-benefit balancing in assessing technological hazards, and place more emphasis on tort law and less on regulatory bureaucracy.

"Social Ownership. Proponents of social ownership or social directorship of biotechnology argue their case from either a capitalist or socialist perspective. From the capitalist perspective, social investment should reap social benefit, while private investment should reap private benefit. Since the entire field of biotechnology arose directly from federal funding of molecular biology, under the logic of the economic system the public sector should be a key beneficiary in the outcome. In support of this view Barry Commoner stated: 'We have to ask ourselves about the morality of allowing publicly produced knowledge to be taken over by the owners of capital.' This view is antithetical to the patenting of life-forms or the private appropriation of federally supported discoveries.

"From a socialist perspective, society will get the most out of biotechnology if its productive resources are directed by a state planning group or decentralized planning councils representing broad constituencies in society. Proponents of social ownership cite the direction that biotechnology takes under free market conditions. Profitability, and not social needs, dictates product development.

"Commoner, who advanced a similar argument for the direction of the energy industries, cited public control of technology at the sources of innovation and production as the solution. 'A fundamental question that any of us concerned with biotechnology have to deal with is the problem of governing the development of a new industry. I'm not talking about regulating its impact on the environment. I am talking about the social governance of the means of production.'

"Without socially directed industrial development, Commoner and others argue, biotechnology will serve the interests of large established industrial corporations (petro-chemical and agribusiness) and leave to pure chance the match between the productive capacity of the new technology and its contributions to the central problems of civilization (malnutrition, disease, environmental degradation, lack of inexpensive and clean sources of energy, prohibitively expensive health care).

A Fourth Way: Market Innovation And Social Selection

"Socialist solutions to the problems of postindustrial capitalism have lost much of their currency since the Reagan-Gorbachev era. With the world's major socialist economies (China and the USSR) exploring market alternatives, the rhetoric of centralized planning has far less appeal, even among democratic socialists. There is still much to be socialist about beyond the command economy and state ownership of the modes of production, particularly the public's role in determining the size and allocation of the federal budget for social needs. But state economic socialism does not provide a sensible solution to harnessing biotechnology for the masses—at least not in the advanced capitalist nations.

"What alternatives are there beyond the three cited for the governance of bio-technology? I shall describe a system of social guidance that I refer to as 'market innovation-social selection.' It is based on five premises.

1. The innovation sector and the social guidance sector shall be distinct. The main purpose of the former is to create new marketable ideas—to always be innovating—while the latter must evaluate these ideas within a highly articulated system of social directives.

2. The state shall expand its role in the assessment of new technologies. All new technologies must be evaluated on health and safety, ecological, equity, and ethical criteria.

3. Public participation in the assessment of new technologies shall involve all levels of political jurisdiction.

4. The state shall support maximum innovation in the private sector, but by a conscious process of selection, reinforce those innovations that meet important social needs and provide selective negative pressures against unneeded or unwanted innovations.

5. Only in cases where a robust system of private initiatives fails to meet public needs shall the state assume the role of innovator. However, in such cases (e.g., orphan drugs or recycling projects), innovation and social governance shall be the function of independent government

bodies.

"This system of social guidance for technology is modeled on Darwinian principles where two opposing processes (mutation and selection) provide the basis of growth, change, and balance. Innovation is essential for technological change. But the state's role in selecting among competing technologies has been too limited and weak, and leaves too much to the control and self-interest of the innovation (production) sector. The current system is too product-centered. As a consequence it fails to account for technological directions. Social choices about the broad goals of technology are often the result of, or held hostage to, microeconomic decisions. The position I am advocating builds on a nascent form of technology assessment that began nearly two decades ago."

Krimsky devotes a long section of his chapter to this fourth possibility, under the heading "Critical School of Technology Assessment," and in that section he looks at three "critical" approaches to particular biotechnological innovations, beginning with BGH or Bovine Growth Hormone.

"A technology is undesired by some constituency when it is perceived to offer a greater balance of negative to positive utility. The public responds to undesired technologies exclusively through the marketplace. As an example, suppose a new technology is developed for sex selection of children. It may be argued that this technology is not needed by society (there are no sound reasons for selecting the sex of a child) and that it is also unethical as it may create imbalances in the world population or reinforce misogynic social mores. But this argument will not convince everyone and there will most assuredly be a demand for sex selection if it is available. The 'mixed' column in Table 11.3 [omitted here] illustrates this scenario. Alternatively, there are technologies that some experts believe society needs but popular opinion is against, such as nuclear power. For commercial genetics, the social discussions over technology have become increasingly complex. In some instances, debates are fruitless because proponents construct basically incommensurate arguments derived from the different variables for technology assessment. A characteristic of such debates is that claims and counterclaims fall on unreceptive ears. There are ideological niters within each camp that treat information or analysis derived from the other as illegitimate. I shall illustrate these along with other issues of technology assessment by applying the assessment parameters in Table 11.2 to several early and promising products of biotechnology. The first case I shall consider is bovine growth hormone (BGH). . . ."

Krimsky then adds similar detailed discussions of herbicide-resistant plants and of developments involving human growth hormone (HGH). He then comes to a final conclusion: “Biotechnology has been responsible for a myriad of technological innovations covering multiple sectors of the economy. These innovations have been amply summarized in this and other works. At the root of these innovations is the conscious rearrangement of biological forms (biotechnics) through genetic controls (gentechnics). Microchanges in the fundamental chemical units of living entities are reflected m the macrochanges taking place in the reconfiguration of the industrial sector. The new symbols applied to genetic science speak to a mechanistic and instrumentalist vision of living things. Yanchinski’s terminology 'setting genes to work' and Yoxen's 'life as a productive force' are expressive of the links between the science of living forms and the technology of manufacture that have become the signature of the biotechnological revolution. Goodman et al. use the term 'bio-industrialization' to describe the 'increasing transfer and interchangeability of both industrial processes and inputs between the food, chemicals, and pharmaceuticals sectors.'

“Innovation investment, and development in applied genetics have been robust. The fervor of bio-industrialization is as strong in private as in public sector institutions. It can be felt at the state, federal, and international levels. Not since the discovery of antibiotics has there been this level of expectation associated with biomedical developments. Not since the introduction of hybrid seeds has there been as much excitement within industrial agriculture. The aggressive exploitation of genetic science for practical ends is by and large a healthy development. But equally important are the processes and social mechanisms through which selection of potential applications is carried out. I have argued that the current methods of assessing the impacts of biotechnology and for choosing among alternative technological paths have not been commensurate with the incentives to develop and market new products and to transform methods of production. There are several reasons for this.

“First, there is a confusion of roles. Technological innovation of commercial products should reside primarily with the private sector. The public sector roles should serve to protect society from misdirected technologies. Currently, public sector institutions are too closely identified with the development side of biotechnology. This has resulted in conflicts within federal and state governments over the appropriate regulatory stance.

"Second, universities have lost their role as independent sources of analysis, valuation, and assessment of new biotechnologies. The academic research community in applied genetics has become integrated into a system of commercial development that has brought industry, government, and the university into an unprecedented peacetime partnership.

"Third, the biotechnology revolution has emerged at a time when the social demands on technology are far more complicated than they once were. The social guidance systems have not kept pace with social attitudes. Productivity is only one of several competing values that form part of the public's assessment agenda for technological change. Greater attention is being placed on secondary impacts of technology beyond its direct effects on human health. A new powerful metaphor, Gaia, the organism of earth, is placing new demands on innovations in manufacture and production.

"There is also a new global economic perspective on the effects of technological change. If we modify our packaging materials or develop a microbial process for making cocoa, we may inadvertently but predictably accelerate the rapid depletion of the world's rain forests. These considerations, once the province of fringe ecotopians, have become normalized into public values. Thus, our assessment methods for technology are deficient because social expectations have changed. Periodically, there are examples where the regulatory sector is baffled by a public outcry over what is viewed as an orderly and statutorily correct response to a problem. For example, ALAR, a chemical used to control the ripening time of apples and shown to cause cancer in animals, was eliminated from use when significant segments of the public refused to purchase produce sprayed with the chemical. A similar reaction prompted emergency restrictions on the use of the pesticide ethylene dibromide (EDB) in grain products.

"I have shown that some of the concerns expressed about products derived by genetic engineering techniques fall outside the responsibility of regulatory bodies. Where a product has questionable or potentially negative human health effects or is a clear and present ecological hazard, it has issue-legitimacy within the existing regulatory sectors. However, for those products or technologies with second-order environmental effects, redistributive effects, or that raise ethical dilemmas there are no natural places toward which public debate is channeled. Our federal structure is not currently designed for the public to direct the course of technology, for constituencies to question the social utility of products that are not otherwise deemed hazardous, to evaluate the ecological impacts of

innovations in production, to propose directions for technological development or to solve complex ethical problems associated with new technologies. A market-dominated innovation system makes it extremely difficult for socially guided R&D programs to evolve. There is little guarantee, thus far, that the potential biotechnology offers will correlate with the hierarchy of social needs. Our examples are selective and do not tell the whole story. There are many applications of biotechnology that are not problematic and contribute quality or efficiency to systems of manufacture or the treatment of disease. Those are not the outcomes of biotechnology that place our current system of technology assessment to the test. The cases chosen in this analysis illustrate the complex problems of technological choice that biotechnology puts before us.

"Too many questions related to the effects of biotechnology are defined outside the responsibility of government. Too many of our agencies of government conceive of their role as promoting innovation and development rather than assessment and selectivity. Too many of those in whom we expect objectivity have vested interests in the financial success of a technology. The inevitable outcome of this situation is that organized efforts by nongovernmental groups give up working with federal agencies and work directly with the public and scientists lose their special status in society. We need new institutional models to examine the total system impact of innovations in biotechnology in a manner that responds to multiple constituencies. The assessment of innovations in biotechnology must rise above the current fragmentary approach defined by the regulatory sphere. Comments I made nearly a decade ago are as relevant today 'The developments in a field bursting with innovative ideas and [unexplored] potential will put to the test the social guidance systems we presently have. But more so, they will test the moral and scientific wisdom of technologically advanced countries on their capacity to counteract the adverse effects of genetic technology before they are realized and become part of the social and economic infrastructure of society.'"

In terms of *controversies*, this seems to involve a set of quadrants at least similar to ones in previous chapters:

Environmental Traditionalists

Reactionism

Social Ownership

A Fourth Way: Critical School of Technology Assessment=From Technology Assessment to Social, Guidance

Chapter 23

Paul Thompson and Agricultural Technologies

Here is what Thompson's online bio says: "Paul Thompson came to Michigan State in 2003 to assume a position in the Philosophy Department, with partial appointments in the Agricultural Economics and Resource Development Departments. Previously he held positions as Distinguished Professor of Philosophy and Director, Center for Food Animal Productivity and Well-Being, at Purdue University, and prior to that positions as Professor of Philosophy and Agricultural Economics and Director, Center for Science and Technology Policy and Ethics, at Texas A&M University. Professional Interests: American pragmatist approaches in practical ethics; Environmental ethics; Risks and ethics of agricultural and food biotechnology; Science policy; Philosophy of technology; Philosophy of economics."

Selected Thompson publications are included in the bibliography at the end. The following selections come from only one of Thompson' s several books.

Selection one, from *Agricultural Ethics* (1998, pp. 20–23): ". . . What seems likely to me is a regression to the traditionalist moralities of our feudal past. They have never completely left us for over 400 years, and they continue to be influential in agricultural issues today. Several chapters in this book discuss this 'new traditionalism' but the environmental ethics dimension of that discussion was the primary topic of *The Spirit of the Soil* (Thompson, 1995), and the central claims of that book are not repeated here. . . ."

(In a publicity blurb printed at the beginning of the book, Thompson, though he writes in the third person, says: "*The Spirit of the Soil* examines environmental problems in industrial agriculture and challenges environmentalists to think more deeply about the ethical dimensions of agriculture's impact on the environment. Professor Thompson considers environmental problems in industrial agriculture, such as the use of chemical pesticides and biotechnology, from an ethical perspective. He compares four 'world views'—productionism, stewardship, economics, and holism—which frame these issues, and the potential response to them according to different philosophical priorities. All four are found to have their inadequacies. . . . Thompson concludes his analysis with an open-ended and necessarily incomplete formulation of sustainability as the key goal for recapturing the spirit of the soil.")

Then quote number 1 continues:

The New Traditionalism

"Thus far we have identified two types of change and seen how each gives rise to moral concern about agricultural production. The first type of change is changing technology. New technologies produce unintended consequences, and our attempt to evaluate these unintended and uncertain consequences brings moral considerations to bear on production decisions in new and unsettling ways. Questions about food safety and environmental quality loom large in this category. We have also experienced a second type of change, however, in the application of morality itself. Extension of moral concern to non-human animals has raised questions about farm animal well-being and animal rights. Extension of moral concern to future generations has raised questions about the sustainability of agricultural production. Extension of moral concern to plant and animal species and to natural systems provides the basis for a radical environmentalism that portrays agriculture in a darkly unfavorable light.

"This survey covers many of the value issues that commonly appear in ethical reflections on agricultural production. It omits some issues that are of vital importance simply because they are more frequently related to agricultural distribution and consumption—world hunger and population issues, for example. Those who feel that our technical capability entails a responsibility to solve distribution and consumption problems that have been with us since the dawn of civilization may want to include these issues under the category of technological change. It is not likely that such problems will be resolved by innovative production technology. They address a different class of value concerns altogether and these, too, have been omitted from the volume. Readers should consult William Aiken and Hugh La Follette, *World Hunger and Moral Obligations*, 2nd edition (1995). I have written on the philosophical debate over world hunger in *The Ethics of Aid and Trade* (1992).

"Even excusing this omission, however, an approach aimed only at considering technology's consequences and the extension of moral concepts fails to touch on one question that has been prominent in every U.S. production policy debate since the turn of the century and has analogues in most industrialized nations around the world. What is the value of the family farm? Is there a moral obligation to save family farms? One might think that this question belongs in

the category of technological change. It is common knowledge that changes in production technology create several trends that militate against relatively small family farms. Technological innovation changes production efficiencies; this in turn changes economies of scale and, more important, creates the treadmill effect whereby farmers who innovate run faster to stay in the same place, while those who fail to innovate fail to survive. If small family farmers are technologically conservative (e.g., reluctant to adopt new technology) the treadmill effect constitutes a bias against them. Even when they are not conservative, the economic climate in which farm failures are accompanied by windfall profits to innovative farmers may well mean that successful farms grow larger. Technological change in other areas affect small farms, too. For example, transportation and information technology is partly responsible for the large supermarket chains that prefer to contract with large-scale suppliers.

"There is no disputing that technological change has made agriculture more competitive, and that this has sometimes made life more difficult for family farmers; but it has made life more difficult for harness makers, too. Simply noting these difficulties falls short of identifying a philosophical problem. Technological impact on the size distribution of farms is not morally significant unless we have some reason to think that the continued existence of family-type farms is valuable in the first place. This is not to say that the harm caused by farm structural change is insignificant. Enlightenment morality provides many reasons to think that harm to economically displaced individuals is very significant, but it is equally significant without regard to the occupation from which the individual is displaced. As such, while we may want to assure that suffering is minimized, or that losers are compensated, or that small farmers' rights are not violated, we have no reason so far to be concerned about small farms as institutions. Even if we talk about the economic health of rural communities, we do not find a basis for moral concern about the demise of family farms understood as a social institution, for a rural community may do just as well with a tire factory or a rendering plant on its outskirts as it does with a few hundred small farms.

"Enlightenment morality, however it is configured, aims to protect and advance human interests in universal terms. Although Kantian ethics, for example, can explain why it is important that individuals have a high degree of personal autonomy in choosing and pursuing their careers, Kantian ethical categories provide no basis for saying that it is more important for individuals to have a right to farm than to have a right to sell encyclopedias, to become doctors, or to

operate a business establishment. Indeed, part of the achievement of Enlightenment morality is that it separated moral standing from social role. It should come as no surprise that attempts to apply Enlightenment moral theories to a defense of the family farm become tortured.

"Why, then, is family farming singled out for special treatment, and why are masses of non-farmers in industrialized societies willing to spend enormous amounts of public funds to preserve what they perceive to be family farms? The second part of this question has psychological overtones that will not be addressed; the point is to find a moral basis for finding the life of the family farmer special. The most potent thinking on this subject has issued from Kentucky poet and essayist Wendell Berry. The reason that small farms are good is that they cultivate virtue in the character of the farm family. The reasons Berry gives for thinking that farming cultivates virtue do not easily survive condensation and summarization. They have to do with the way that farm families experience the unity and diversity of life. Each member of the family performs diverse roles that are specialized by age and sex. Age and sex are, in turn, precisely the factors that define one's place in the social order of the family. The family unifies these roles into an order that makes each person's duty in assuring farm survival easy to grasp. The diversity of tasks are also reflected in the changing of the seasons and in the breadth of the cultural practices, but these, too, are unified by the farm itself. The farm family is at one with nature, and each person both values and is valued by the role relationships that the production practices of the small farm demands. Similar roles bind all members of the rural community (Berry 1977, 1981, 1987).

"What we have in Berry's thought, then, is a revision of the old traditionalism of the feudal system. . . .

"In fact, Wendell Berry's literary efforts are representative of an attack on the individualism and universalism of Enlightenment morality that has been sounded in other quarters as well. Alisdair MacIntyre's *After Virtue* (1981) and *Habits of the Heart* (Bellah et al. 1985) by five co-authors have also taken up the pen against the way that Enlightenment morality fails to account for the historical and geographical rootedness of moral relationships. Both of these works have been linked to the defense of family farms (Comstock 1987). MacIntyre traces his preferred notion of virtue to the philosophy of Aristotle, and John Lyon offers an Aristotelian reading of Wendell Berry in a 1987 review (Lyon 1987). Communitarianism is the closest relative to neo-traditionalism in the

philosophical literature, and it is often taken to be a fundamental and important attack on Enlightenment interpretations of the concept of value (Sandel 1984). Assessing the validity of the communitarian critique of Enlightenment thought is also beyond the present scope."

Second selection, also from *Agricultural Ethics* (1998, pp. 138–141 and 156–157): "The utilitarian tradition makes welfare considerations philosophically fundamental and justifies rights claims in terms of impact upon general welfare. Thinkers within the utilitarian tradition have remained committed to the idea that consequences for all affected parties must be weighed in the calculation, and that benefits and harms (or now costs) are the rough units in which consequences are to be measured.

"The second strategy has deep roots and clearly inspired the framers of the U.S. Constitution to include a Bill of Rights. It can be found in the writings of Aquinas, Locke and Rousseau, but more recent advocates include Gewirth (1982) and Rawls (1971). Here, rights are the fundamental philosophical concept. As noted, the rights view takes it that there are traits—rights—that must be protected or guaranteed, and that the morality of an act is to be judged according to whether it successfully respects the rights of others. The dual implication of this approach is that some acts judged moral by utilitarians in virtue of producing the greatest good will be judged immoral by rights theorists when individual rights are sacrificed, while some acts that are clearly inefficient when judged by the utilitarian standard are fully consistent with the terms of morality laid down by rights theory. As such, there is a deep philosophical tension between utilitarian philosophers and those who have constructed moral theories based on a concept of rights.

Ethics and Biotechnology

"There are three closing points to be made with respect to ethics and biotechnology. First, the distinction between welfare and rights extends into the deepest levels of philosophy, but there is no necessary correspondence between *philosophical commitments* to welfare or rights and practical, *conceptual commitments* to the assertion or denial of specific rights claims, nor between either of these and the *political commitment* to groups organized around animal welfare or animal rights objectives. The logical and causal links between philosophical views and political activism are contingent upon other factors which make ethical views a poor predictor of an individual's opinion on

biotechnology.

"Second, although there are different philosophical beliefs and traditions to support rights philosophy, they converge on the belief that philosophies which fail to recognize the primacy of the individual over the general good abandon the most fundamental principles of ethics. As such, those who are philosophically committed to animal rights will conclude that social benefits from biotechnology are 'trumped' by harms to individual animals. Third, major figures in radical (e.g. animal rights) political organizations differ over which deeper philosophical principles best justify the radical initiatives on which they agree. These differences present opportunities for activists and biotechnologists to engage in more-sophisticated debate at the philosophical level than has hitherto taken place. Each of these three points is summarized below.

"Discussion of animal welfare and animal rights is confusing because the terms *welfare* and *rights* might refer to the deep philosophical tension between fundamentally opposing approaches to ethics, but they might refer to the more superficial distinctions already discussed. As just noted, no firm correspondence holds across levels. A utilitarian may well conclude that establishing a legal or custom right is the most efficient way to promote the greater good. A rights theorist who feels that no fundamental rights are at stake with animals may promote a welfare approach. There is certainly no correspondence between the philosophical and political levels, as some of the most radical activists are utilitarian (e.g. welfare-oriented) philosophers, while many rights theorists resist the extension of philosophical rights claims to non-humans.

"The potential for confusion is multiplied by the fact that there are several different philosophical theories that are often included under the rights banner. For the purpose of understanding animal rights views, however, the differences between these views are less important than the fact that they share a rejection of utilitarian emphasis upon making trade-offs between costs and benefits, at least where key rights are concerned. This point is made clear by Tom Regan in an article entitled 'The Case for Animal Rights' (1985).

"What has value for the utilitarian is the satisfaction of an individual's interests, not the individual whose interests they are. A universe in which you satisfy your desire for water, food and warmth is, other things being equal, better than a universe in which these desires are frustrated. And the same is true in the case of an animal with similar desires. But neither you nor the animal have any value in

your own right. Only your feelings do (p. 19).

"Regan goes on to criticize this view with a story in which the rich but stingy Aunt Bea is murdered and her wealth is distributed to needy people. Regan adopts the rights view because he thinks that utilitarianism justifies this act in virtue of the greater good achieved. Although this is a very incomplete argument for rights, it is a conclusion widely shared by rights theorists, including those who are unwilling to extend rights to animals. All those who argue philosophically for animal rights reject utilitarian ethics. The utilitarians themselves have extended moral concern to non-human animals for the simple reason that non-humans have feelings, too. Non-humans experience pain and satisfaction, though the character and degree of these feelings can be difficult to assess. For example, Peter Singer's well-known work on animals derives from the simple observation that some animals, including most agricultural species, undoubtedly feel pain. Singer's utilitarian views lead him to conclude that the suffering of non-human animals should be weighed against the benefits that humans derive from the use of animals. Singer's philosophical work on animal suffering denies the validity of animal rights, except in so far as rights claims are based on underlying consideration of tradeoffs. Singer does not think that animals have a right to life and, indeed, has argued that humane slaughter of an animal is not a serious ethical affront to non-human animals. Nevertheless, Singer believes that the scale of modern animal agriculture makes it impossible to raise animals under appropriate conditions and to slaughter them humanely. He has, consequently, continued to advocate radical reform of animal agriculture and he has continued to be associated with political groups allied under the banner of animal rights (see Singer, 1979). Peter Singer is therefore one person committed to radical reform at the political level but opposed to animal rights at the philosophical level.

"Singer's work has been criticized by philosophers such as Bernard Rollin and Tom Regan, who have found fault in the fact that Singer's reasoning permits abuse of individual animals whenever the compensating benefits for humans or for other animals are great. Rollin and Regan themselves differ, however, on the question of how much reform is called for. Rollin (1981) supports relatively modest reforms of agricultural production systems which would protect an animal's right to satisfy biological needs (Rollin, 1995). Regan (1983), however, argues that animals have a right to live out their natural lifespan, and though he does not stipulate this as an absolute right, Regan nevertheless feels that it is sufficient to require humans to practice vegetarianism under all but the most

extreme circumstances. Rollin is therefore an example of a person who might be classified as an animal welfare activist with respect to his political objectives, despite the fact that he is well-known for advocating a philosophical view of animal rights. Regan is clearly committed to animal rights both politically and philosophically.

Conclusion

"Although the philosophical distinction between welfare and rights may seem arcane to scientists working on biotechnology, seeing how the welfare/rights distinction is made at different levels of debate is crucial. A call for animal rights is not necessarily inimical to the interests of scientists, nor is a philosopher who, like Peter Singer, adopts an animal welfare rather than an animal rights perspective, necessarily supporting moderate reforms. Selections from the work of Singer, Rollin, and Regan are routinely taught in introductory philosophy classes that stress contemporary moral issues. These writings are attractive to philosophy instructors because they provide a clear contrast of how rights arguments differ from those that stress welfare or utility. A scientist who has obviously failed to master concepts taught in freshman philosophy classes will appear ignorant and unsophisticated to those individuals who received their most systematic exposure to animal issues in such classes.

"At this point in time, the relationship between concern for animal well-being and biotechnology is highly tentative. Individuals and groups associated with both animal welfare and animal rights (understood as a political distinction), which are already poised in opposition to scientists, have potential allies for political action in producer and environmental groups and have legitimate questions about the impact of genomic research on animals. To the extent that scientists come to be perceived as lacking compassion or as lacking the ability to address animal issues articulately, the stage is set for confrontation. However, biotechnology can also do much to improve the lot of animals. As such, the confrontational nature of this issue should not be regarded as fixed. Opportunities for communication and better understanding of the issues exist, and it is in the self-interest of scientists in biotechnology to conduct an open and thoughtful review of animal well-being issues (see Thompson, 1997a and b). . . .

Conclusion [on BST, pp. 156–157]

"The ethical controversy over BST arose because, like many technologies, it may

produce some effects that are unwanted. There is no reason to think that the unwanted consequences of BST are particularly dramatic or extreme, but the fact that decision makers within public research organizations and private companies can affect others makes these unwanted outcomes an issue of some significance. The significance has escalated, however, because of the food safety questions that have been raised, and because of the climate of uncertainty that they generated. It is the uncertainty issue that truly threatens to keep BST off the market at this writing, and it is one that the developers of the technology had no reason to expect.

“This, in turn, leads to the questions of trust that are crucial to democratic institutions. This is not to say that the success or failure of U.S. constitutional democracy hangs upon the BST decision, but this policy problem can be expected to recur in the future with respect to other technology. American society must resolve whether we can expect to develop biotechnology products in an orderly and efficient manner.”

Finally, I add an exchange with Hickman (see Chapter 14 above) in which Thompson differentiates his version of pragmatism from Hickman's: “My kind of pragmatism is particularly relevant with respect to problems in which technological artifacts, technically complex machinery or systems, and scientifically advanced forms of expertise figure prominently. Hickman’s book offers a number of arguments and observations that establish the relevance of my own more detailed and context specific studies, and for that I am appreciative. First, lingering influences of foundational epistemology and 'straight line instrumentalism' create a cultural climate in which complexity can lead to stupidity. Second, values continue to be sadly neglected when technology enters the picture. Third, the cult of expertise is with us still, and the best response is to open the black boxes and have a look. Opening the black boxes, however, requires attention to the specific context and to details. Hickman certainly does not oppose philosophy that does this; he welcomes it. But precious few black boxes actually get opened in the pages of Philosophical Tools.

“So, is Thompson just bitching about the fact that Hickman does Hickman style philosophy, rather than Thompson style philosophy, despite the fact that they agree on every important question of substance? Is the problem that Hickman should have written about agricultural biotechnology, rather than the book he did write? In my own defense here, I will assert that questions of emphasis and choice of topic should matter more to pragmatists than they do to unreconstructed

analysts or postmodernists. Dewey argued for a reorientation of disciplinary philosophy toward more specific engagement with problems of nonphilosophers. As Michael Eldredge (1998) has demonstrated convincingly, Dewey lived up to his own demands for an alteration of practice (as has Hickman, as anyone familiar with his yeoman service to unpopular causes and marginalized groups at Texas A&M University will readily attest). Yet for both Dewey and Hickman, that practice has mostly been engaged in causes and problems that would conventionally be characterized as social or political, rather than technological. As such, Hickman stops short, I would argue, of really extending his view into the philosophy of technology.

"In fact, the philosophical work being done in *Philosophical Tools for Technological Culture* is merely a propaedeutic for engagement with technological practice. When Hickman is called upon to illustrate productive pragmatism, he does not cite my work (or Don Ihde or Andrew Feenberg or Stan Carpenter or Kristin Shrader-Frechette or Andrew Light), but two very political examples in which philosophers play minimal roles: the old Office of Technology Assessment, and Randy Shaw's activism in San Francisco. Neither example tells us much about the reconstruction of philosophy, much less the philosophy of technology. . . .

"I am happy to be characterized as a fellow-traveler with Hickman, and I will probably find many occasions to cite this book. It is, nevertheless, something of a disappointment from the standpoint of pragmatic philosophy of technology. Neither pragmatic enough nor writing sufficiently *about* technological culture, Hickman fails to undertake a reconstruction of our field of philosophy on the principles that he advocates. Our current intellectual milieu, so depressingly like Dewey's own, demands a philosophical practice that engages technological problems. Dewey gave us the arguments for doing that, and Hickman reiterates those arguments in an updated dialog with a host of intellectuals who still do not get it. That is a step in the right direction, but it is not yet putting pragmatism to work."

As my selections earlier indicate, Thompson also has a focus on philosophy and agriculture more broadly than just agricultural biotechnology, with a large body of work to deal with. His writings on that are often technical, both in the technology assessment-statistical analysis sense and in his use of government documents. Some of these writings do not suit my framework here very well—for example, some of what I have already quoted, above, has little to do with

technology—but he has taken enough controversial stances on various broad issues for us to figure out where he would want to stand.

One final issue in this chapter. Thompson may at times seem to stand alone among philosophers associated with SPT in his focus on agriculture and even agricultural biotechnology. But as early as SPT's third president, Kristin Shrader-Frechette, I listed one of her publications (with Lynton Caldwell), *Policy for Land: Law and Ethics* (1992), that echoes some of Thompson's concerns. And still earlier, from the very beginnings of SPT, Stanley Carpenter had championed first "appropriate technology" and then later "sustainability" at many SPT conferences. And finally, in Chapter 21, we have seen Andrew Light champion restoration ecology (his efforts are shared by fellow editor of the Borgmann volume, Eric Higgs); that movement has caught on, not only with respect to demonstration projects outside big cities like Chicago, but also among some Midwestern farmers in the USA trying to restore prairies to something like the state they were in when the first white settlers moved west. Nor should I fail to mention that many philosophers in SPT share Thompson's interest in (if not necessarily his views on) the animal rights issue.

Controversies?

By his own account, Thompson is a pragmatist, though he and Hickman differ on what that means. For Thompson it means getting involved in regulatory processes, with respect to agriculture and agriculturally related biotechnologies. (In terms of liberal politics, I suspect Thompson is more centrist than Hickman, and far more than the near-socialism of Mead or Dewey.) Like Shrader-Frechette (in Chapter 3 above), Thompson's opponents are often bureaucrats not doing their job well in terms of protecting the public. But he also opposes activists who haven't done their homework. And Thompson has been critical of Borgmann, as well as Marxism.

In one sense, this completes my 30-year history of controversies within the Society for Philosophy and Technology. Thompson had not yet turned over the president's gavel in 2005, and his focus on biotechnology as applied in agriculture could be said to be the last major subfield to be explored within an academic philosophy *of* technology—and that, actually, by few SPT philosophers other than Thompson himself. However, I want to end the book with two challenges to the academic model.

The first comes from what amounts to a parallel field that never quite made it into the academic mainstream any better than philosophy *and* technology; it flies under several banners, but the best known group is the Popular Culture Association. With respect to technology, there is another group that does pretty much the same thing, the Humanities and Technology Association. These two associations, and others like them, emphasize *popular culture* within our technological society, rather than *technological culture* as a whole or on a grand scale. The challenge to SPT-type philosophizing here might aptly be characterized as Low Church versus High Church, or popular culture versus high culture—two themes that will come up in Chapters 24 and 25.

The second challenge is more direct. In the name of postmodernism, it challenges the very idea of academic respectability. I take up that topic in Chapter 25.

Chapter 24

Philosophy and "Quotidian" Technologies: Hickman and Light

In this chapter I look at a claim most commonly associated with John Dewey, who opposed dichotomized either-or thinking in every realm of thought. In the case at hand, Dewey opposed the standard distinction between High Art and the processes and products associated with normal everyday instrumentalities. Larry Hickman (see Chapter 14, above), taking a cue from Hannah Arendt, refers to them as "quotidian artifacts"—including not only the artifacts themselves but also their production and use. In another essay (in a volume edited by Lester Embree), Hickman is explicit about opposing traditional High Art to popular movies and TV. Andrew Light (see Chapter 21, above), in his *Reel Arguments* (2003), addresses some of the same issues in a single field, film and film criticism.

Hickman, in "The Phenomenology of the Quotidian Artifact" (1988), sets the tone for this chapter. He says: "In chapter four of *The Human Condition* Hannah Arendt suggests that quotidian artifacts, such as the tables and chairs that we utilize on a daily basis, serve to stabilize human life. Between the private vagaries (one might even say the randomness) of human subjectivity on the one hand and the 'sublime indifference of untouched nature' on the other, there is a man-made world protecting us from both.

"She continues: 'Only we who have erected the objectivity of a world of our own from what nature gives us, who have built it into the environment of nature so that we are protected from her, can look upon nature as something 'objective.' Without a world between men and nature, there is eternal movement, but no objectivity.'

"Arendt ultimately concludes that it is neither in the activities of *animal laborans*, whose goal is to break out of his servitude to nature and the earth, nor in those of *homo faber*, who is both creator of human artifice and, consequently, destroyer of nature, that we find the measure of all use-things. Rather, it is the activities of man the thinker and doer that provide such meaning. Her and his activities have no aim outside themselves. They allow for a continually receding horizon of human dreams, hopes, and self-definition. But man the thinker can neither succeed nor survive without *homo faber*, that is, without 'the help of the artist, of poets and historiographers, of monument-builders or writers, because

without them the only product of their activity, the story they enact and tell, would not survive at all.'

"The role of *homo faber* for Arendt is thus central to human life. It completes and supplants the activity of *animal laborans,* releasing him and her from their onerous tasks and stabilizing human life against the uncaring cycles of the household of nature. But it also renders palpable and permanent the various efforts of thinking man, rescuing him and it from the subjectivity of the private and unexpressed.

"To those of us who hold the view that the humanities and the social sciences have too long neglected the implications of the concrete moments of human experience during their long and severe bondage to an almost exclusive preoccupation with the abstract and transcendent features of our lives, Arendt's remarks are both suggestive and welcome. Her attention to concrete artifacts acknowledges and further excavates the very touchstone which has been lacking in large segments of the various traditions of abstract philosophy."

Hickman continues: "But how does such stabilization take place?

"Arendt has pointed the way to an answer with her suggestion that attention be turned to the functions of technical *quotidiana.* One such study was undertaken by Marshall McLuhan, who examined media as the extensions of man and laid bare what he called 'the folklore of industrial man.' One of McLuhan's best known theses was that changes in technological systems or paradigms alter the most fundamental ways in which human beings interact with their world; and that the agents of these changes are the quotidian artifacts that most of us ignore because of our very familiarity with them."

Referring to a number of more recent authors, Hickman pursues the theme and connects it to American Pragmatism: "Their work is especially important in the sense that they seek to continue the work of the American Pragmatists, C.S. Peirce, John Dewey, and G.H. Mead, whose work has never been thoroughly mined for its many insights into this area. In true pragmatic fashion they are, for example, more interested in the *terminus ad quem* than in the *terminus a quo* of objects, and even analyze domestic objects as special kinds of signs, in the Peircean senses of that term."

Hickman then launches into a long discussion of popular literature in terms of the

novels of John Updike, whom he calls the “most quotidian of contemporary American writers.” But Hickman is also interested in films or movies, and I will follow him and Andrew Light and start there.

Section One: "Film Criticism" versus the Movies and TV

In another essay, “Literacy, Mediacy and Technological Determinism” (1990), Hickman brings this kind of thinking to focus on what he takes to be a spurious opposition between art and film: “Those whom I designate 'text-type determinists,' including Albert Borgmann, grade texts into paper-based 'traditional' ones, which they claim to be superior because their use makes us critical, and mylar-, celluloid- and vinyl- based 'technological' ones, which they claim to be inferior because their use makes us lazy. Their argument is essentialist and determinist: it claims that texts have essences that determine the form of life of their users. Against them I advance the instrumentalist argument that texts have essences only in the functional sense that they comprise sets of constraints and sets of facilities. Regardless of their type, texts are tools which may be used to enhance delight and resolve difficulties; sorting them into inferior and superior types should be done on the basis of the extent to which this is possible. The development and use of critical intelligence is not uniquely linked to any one text-type. To be 'mediate' is to engage texts of all types, including traditional literary ones.”

Andrew Light, in his *Reel Arguments: Film, Philosophy and Social Criticism*, addresses some of the same issues in a single field, film and film criticism.

I quote from Douglas Kellner, another philosopher expert on these matters, as quoted on the outside of Light's book: “In *Reel Arguments*, Andrew Light dissects the discourses and politics embedded in a wide range of film ranging from Hollywood political thrillers to European art films. Light's interrogations show how philosophical scrutiny of films yields surprising insights and perspectives and how films are themselves more philosophical and political than most people are aware.”

Another tribute to the book comes from Charles Mills: “If you thought you had to choose between doing philosophy and going to the movies, think again. In this lively and accessibly written book, refreshingly free from the jargon of either side, Andrew Light demonstrates that you can do both. Whether it's the surveillance society or the urban wilderness, the politics of race and class or the

politics of environmentalism, films are definitely taking a position on socio-political issues—and Light provides an illuminating guide on how we can 'read' them philosophically."

Here is the way Light ends his book, in a chapter called "Spike Lee, Chico Mendes, and the Representation of Political Identity": "Conflicts over the meaning and implications of an identity exist for both the detached and attached varieties of political identity, and so both are important for trying to understand this kind of politics. A bad portrayal of any identity, especially one that fails to provide the motivation of characters depicting that identity, is an offense to the political commitment and motivations of actual people who hold these views. Part of the power of film, with its potential for portraying complex characters, is that it can rise above such failings and help us both to grasp the motivations of various political actors and groups and in turn enrich our understanding of our own moral, political, and social motivations. With this power comes responsibility, which, when exercised and balanced with lively and entertaining images, produces something truly beautiful" (p. 168).

Earlier in the book, Light had raised an issue about what he calls an "aesthetics of everyday life" by focusing on Wim Wenders's film, "Alice in the Cities." Light uses that discussion, among other things, to examine "an unfolding debate between Albert Borgmann and Andrew Feenberg, two philosophers who have written extensively on the possibility of technological reform for the purpose of enriching everyday life" (p. 56).

Introducing these participants to debates over the esthetic meaning of everyday life—Borgmann a neo-Heideggerian and Feenberg a neo-Marxist—suggests that we are dealing here, at bottom, with a fairly standard range of esthetic views, from "socialist realism" to the esthetic permissiveness of non-Communist socialist countries to a popular culture versus high culture split, where it is alleged to be necessary to impose "objective standards" of beauty to distinguish between what is popular but crass and the truly beautiful (in this case, with respect to films; the broader issue will come up in the next section).

Here I have followed Light and Hickman in beginning with film or the movies, but I now want to look at some other arenas in which it is alleged that there are pernicious dichotomies separating—in thought and valuation—higher from lower arts or technologies.

The other issues I look at are: arts and the media more broadly than just the movies (“high culture” versus “mass culture”); education, including Dewey's old nemesis, “classical education” (including the manner in which it is supposed to be taught), and so-called vocational education; and the contemporary health or health economics crisis (where I will contrast academic bioethics with approaches that deal with health care concerns in the real world of hospitals and other institutions heavily dependent on large pieces of medical equipment and the experts trained to use them).

Such pernicious dichotomies predominate in many other areas both of contemporary scholarship and of policy literature as it appears in the media, whether print or electronic.

Examples include the dichotomies involved in focusing concerns about environmental sustainability on global issues rather on the sustainability of local communities; or, similarly, of emphasizing so-called globalization at the cost of negative impacts on local economies, especially in less developed parts of the world. In general, this is an issue of focusing on big problems and proposed solutions at the expense of smaller local issues. However, covering so many topics with so many nuances in this short chapter would take away from the general focus of this book: namely, the contributions, or lack thereof, of philosophers associated with SPT to controversies over such issues. By limiting myself to four cases, both the points made and the controversies involved should be clearer.

Section Two: Popular Culture versus High Culture Generally

Two organizations dealing with technology in the broad sense grew up in the USA more or less simultaneously with SPT: the Humanities and Technology Association, and the Popular Culture Association. A few members of SPT, including myself, attended annual meetings of these two associations, as did a small number of other philosophers.

But the meetings were dominated by historians and English professors and social scientists, all convinced that popular culture has much to offer the scholar in terms of issues, institutions, groups, and agencies in contemporary society to be taken more seriously as objects of study than is customary in academia today. Sex in a variety of forms is a perennial topic, but so are popular magazines, barbershops, the kitchen, and so on and on. Taking “technology” in the broad

sense of the term, these activities, agencies, and institutions—including the tools of the trade and other aspects of the material culture thereof, along with the people and groups involved—seldom appear in the pages of SPT publications, except when the focus is some native culture or some period early in the history of modern technlogy. Hickman and Light and a handful of other SPT philosophers lament this omission; and at least Hickman laments it out of deference to John Dewey.

As in all other aspects of his thought, Dewey deplored dichotomized thinking, but nowhere more than in terms of the all too popular distinction between the "high art" of museums and the popular or everyday arts and crafts, between "serious" artists or writers and ordinary workers making a living by making and doing ordinary things. It's not that Dewey didn't recognize a difference between pedestrian (he sometimes called it "mechanical") work and work that is "meaningful": his hope, in fact, was that through appropriate changes in education or schooling, more workers—including non-paid workers in the home—would come to find their work meaningful. A large portion of Dewey's book, *A Common Faith* (1934), is devoted to that theme.

Robert Westbrook, in *John Dewey and American Democracy* (1991, pp. 387ff), after devoting several pages to the relationship between Dewey and Albert Barnes—the eccentric art enthusiast and founder of the Barnes Foundation outside Philadelphia, with its unique art education program favoring ordinary people rather than the elite of the city—devotes several more pages to Dewey's aesthetics best represented in *Art as Experience* (1934). I particularly like this long passage from Dewey that Westbrook quotes: "In order to *understand* the esthetic in its ultimate and approved forms, one must begin with it in the raw; in the events and scenes that hold the attentive eye and ear of man, arousing his interest and affording him enjoyment as he looks and listens: the sights that hold the crowd—the fire engine rushing by; the machines excavating enormous holes in the earth; the human-fly climbing the steeple-side; the man perched high in air on the girders throwing and catching red-hot bolts. The sources of art in human experience will be learned by him who sees how the tense grace of the ballplayer infects the onlooking crowd; who notes delight of the housewife in tending her plants, and the intent interest of her goodman in tending the patch of green in front of the house; the zest of the spectator in poking the wood burning on the hearth and in watching the darting flames and crumbling coals" (*Art as Experience*, pp. 10–11).

Later Westbrook draws out the radical political implications of Dewey's views on esthetics: "*Art as Experience* was not incidental to the radical politics that absorbed Dewey in the 1930s. Indeed, it was one of the most powerful statements of that politics, for it clearly indicated that his was not a radicalism directed solely to the material well-being of the American people but directed as well to the provision of consummatory experience that could be found only outside the circulation of commodities" (pp. 401–402).

And Westbrook backs up this conclusion with another long quote from *Art as Experience* (p. 346): "Oligarchical control from the outside of the processes and the products of work is the chief force in preventing the worker from having that intimate interest in what he does and makes that is an essential prerequisite of esthetic satisfaction. There is nothing in the nature of machine production *per se* that is an insuperable obstacle in the way of workers' consciousness of the meaning of what they do and enjoyment of the satisfactions of companionship and of useful work well done. The psychological conditions resulting from private control of the labor of other men for the sake of private gain, rather than any fixed psychological or economic law, are the forces that suppress and limit esthetic quality in the experience that accompanies processes of production."

Sociologist Herbert Gans, in *Popular Culture and High Culture* (1974), makes a case for mass culture; he is even explicit about rejecting some cultural reformers' claims to be educating people in the appreciation of esthetically preferable materials: "Subcultural programming is intended to give people *what they judge to be good rather than what they want*, and thus strives for the same level of excellence as high culture, except that the standards used to define excellence will differ among taste publics. The choice of good culture is not monopolized by the high culture public; most of the time, people from all taste publics want the art, information, and entertainment they judge to be good and, unless they are deliberately seeking escape, few will intentionally choose what they think is bad. Even so, one of the purposes of entertainment is to satisfy the wish for escape, among high culture publics as well as others, and I see nothing wrong with it. . . . [Indeed] to deprive people of escapist culture in the hope of reforming them is a spurious policy; it treats the effects of deprivation and not the cause" (p. 137).

Gans's view here depends on two sets of definitions he had provided earlier: differing "taste publics and cultures" (in Chapter 2, Gans lists five: high, upper middle, lower middle, low, and "quasi-low folk"—which he then elaborates on, admitting newer forms, such as "youth" and ethnic, encompassing not only

African-American but other subcultures related to other cultural origins); and the "subcultural programming" that he espouses.

Subcultural programming is defined (pp. 132–134) as a policy that would "enable audiences to find content [for example, on radio and TV, but also in other entertainment arenas] best suited to their wants and needs, thus increasing their aesthetic and other satisfactions, and the relevance of their culture to their lives." Gans goes on say it should "serve the taste publics which are poorly served today"—especially low taste publics and the elderly, but even middle-aged publics whose tastes do not match those of contemporary advertising-driven mass media.

Gans lists among the proponents of a "mass (or popular) culture critique" both authors on the left (he singles out Herbert Marcuse and other "new left" authors) and on the right (he lists Jacques Ellul among Europeans and Russell Kirk among Americans)—all of whom he accuses of a bias in favor of high culture standards. Perhaps because he was writing before the appearance of Daniel Bell's *The Cultural Contradictions of Capitalism* (1976), Gans does not specifically mention the latter's neo-conservative critique of the lack of cultural standards in "postindustrial" technological society. Nor does Gans discuss Dewey's (much less Hickman's later) rejection of any and all dichotomized thinking in terms of high and low cultures.

Section Three: Career or Vocational Training versus Lifelong Learning

This section will be short, but again Westbrook (pp. 173ff) is a good guide on Dewey's involvement in a "vocational education controversy" in the USA in the first decades of the twentieth century: "Just how radical Dewey's program for democratic education was became apparent in the arguments he advanced in the debate over vocational education which occupied American educators in the decade before World War I."

A couple of pages later, Westbrook details the adversaries in the debate: "Although vocational education won wide support, the supporters profoundly disagreed about the direction such industrial training should take. The most prominent issue was whether industrial education should be integrated into the existing public school system or made a separate system under separate control. Business and labor split cleanly on this issue, with businessmen acting as the strongest advocates of a dual system" (p. 175).

Westbrook continues: “Dewey was one of the most vocal opponents of the dual system. He feared, above all, that the kind of vocational education favored by businessmen and their allies was a form of class education which would make the schools a more efficient agency for the reproduction of an undemocratic society. . . . [Dewey] noted that 'those who believe in the continued existence of what they are pleased to call the 'lower classes' or the 'laboring classes' would naturally rejoice to have schools in which these 'classes' would be segregated. And some employers of labor would doubtless rejoice to have schools, supported by public taxation, supply them with additional food for their mills” (p. 175).

I mention this controversy, not because it has much salience today—vocational education supporters long ago won their separate system in spite of labor unions' and Dewey's opposition—but as an introduction to what has been a hot topic in recent decades in the USA, calls for basic educational reforms. And Dewey, as an advocate of what they oppose as “progressive education,” has been a favorite whipping boy for conservative back-to-basics reformers. The movement has culminated in President George W. Bush's No Child Left Behind program put in place throughout the country in the first decade of the twenty-first century.

I dealt briefly with this issue in Chapter 4 of my *Social Responsibility in Science, Technology, and Medicine* (1992). But Larry Hickman, in his *Philosophical Tools for Technological Culture* (2001), deals with the issues at greater length—all the while trying to be faithful to Dewey's legacy and to update it to deal with contemporary problems. In Chapter 5, Hickman takes on the religious conservatives who are so often associated with the idea of back-to-basics reforms. One feature of his discussion has to do with teaching creationism in the schools, so it's obvious that he was writing before the current version of that controversy, so-called “intelligent design” and opening up the classroom to discussion of that as an alternative to teaching evolution in biology classes. But more important is where Hickman and Dewey stand on educational methods.

Here is Hickman: “What Dewey called 'a loose, scrappy and talkative education' . . . (a type of education that, he lamented, its proponents have sometimes termed 'progressive') tends to reinforce the worst elements of this [opinion polling] situation. Where such practices prevail, there has been little success in 'converting prejudiced and emotional habits of mind into scientific interest and capacity' . . . .

“But if Dewey was against what is 'loose, scrappy and talkative' in education, he was equally opposed to rigid hierarchical educational structures. He regarded such structures as both anti-technoscientific and anti-democratic” (p. 111).

Hickman goes on: “Dewey argued that the interests and aptitudes of child and worker alike must be engaged, coordinated, and liberated through education that continues throughout a lifetime. Where this fails to occur, both study and work become dull, rote, and 'mindless’” (p. 113).

And: “The danger of the propagation of 'creation science' in the classroom and among the wider public is not, then, that evolution as fact and as theory will cease to be a part of the body of technoscientific knowledge. . . . The danger is rather to the capacities of affected individuals to appropriate the technoscientific attitude in ways that allow them to adjust to changing circumstances” (p. 113).

Summarizing this section perhaps too succinctly, we see an opposition between “progressive education” and a back-to-basics approach, and between both of those and Dewey's “experimental” method of learning, not only in the schools but in a “lifelong learning” to accompany workers throughout their careers. Again eschewing dichotomies, Dewey (and Hickman with him) want an educational approach that is both rigorous *and* experimental, preparing students and future workers for a constantly changing world. Echoing Dewey's earlier concerns, Hickman would say “vocational education” involves the worst of both worlds: it is typically doctrinaire in its teaching methods, and it fails to produce critical thinking in either the students subjected to it or the technically-trained workers who are its normal products.

Putting the matter this way suggests that I side with Dewey and Hickman, no questions asked. But my approach throughout this book has been to recognize that opponents have arguments to make in rebuttal—here, to Dewey and Hickman. There are eloquent defenders of back-to-basics educational approaches (and not just religious conservatives).

There are still some defenders of “loose, scrappy and talkative” progressive education (though Dewey and Hickman would be loath to call it “progressive”). And, probably most popular of all today, there are defenders of a view that education ought, before anything else, to prepare students—to *really* prepare students—for the careers they will be taking on; vocational education, rather than a minority venture for mostly poor students, should be the norm from

kindergarten through higher education.

Section Four: Technology in Academic and Real-World Bioethics

Daniel Callahan, for example in *The Tyranny of Survival* (1973), is one of the few bioethicists who ever expressed any interest in SPT. Others would include H. Tristram Engelhardt and Edward Erde, and to a lesser extent David Thomasma and Tom Beauchamp. (See, for example, *Research in Philosophy and Technology*, volume 3, 1980). Few philosophers in SPT have done work in bioethics as well—though there are a few women related to SPT, such as Anne Donchin, who have focused especially on the technologies affecting women. Donchin's edited volume, with Rosemarie Tong, and Susan Dodds (2004), is an example, as is her co-edited *Embodying Bioethics: Feminist Advances* (1999), a collection of essays based on presentations at the First International Conference on Feminist Approaches to Bioethics.

Judy Wajcman, summarizing feminism and technology in Sheila Jasanoff et al., *Handbook of Science, Technology, and Society* (1995, 1999), refers mostly to historians or sociologists of science and technology rather than to philosophers, and to almost no SPT philosophers, including those concerned with such issues as women and reproductive technologies.

Callahan's (1973) book is philosophical and it is also one of a very few that address the issue of technology's pernicious impact on contemporary medicine. After a serious examination of ethical and political issues raised by the increasing influence on contemporary medicine of expensive machines and the experts who manage them, Callahan maintains that writings about the autonomy of technology "make provocative bedtime reading but little more than that." People in present-day society are not going to do without their high-tech medicine. A decade later, Callahan would make a name for himself—would gain infamy rather than fame—for a related proposal: perhaps we *should* forgo high-tech medicine in our last stages of life and accept the inevitable. (His most famous supporter was Governor Richard Lamm of Colorado.)

Callahan also included an essay by Hans Jonas, "Toward a Philosophy of Technology," in *Hastings Center Reports* (February 1979); there Jonas espoused his famous post-Kantian "heuristics of fear"—ethics should "consult our fears" rather than our hopes when it comes to such technologies as genetic engineering. It may have been the case, however, that Callahan was thinking as much of Jonas

as of Jacques Ellul when he counseled skepticism about autonomy of technology theories that “make provocative bedtime reading” and proposed realism instead in assessing biomedical technologies.

But my main interest here focuses on what I perceive to be a high culture versus low culture split in what is now a vast literature on bioethics. The high ground, as we will see in the next chapter on STS studies, is the part of bioethics (or biomedical ethics or, more traditionally, medical ethics) that emphasizes theory. This approach has come to be almost canonized in Tom Beauchamp and James Childress's *Principles of Biomedical Ethics* (5th edition 2000 and counting).

With that I would contrast a case study approach that got its greatest impetus from Albert Jonsen and Stephen Toulmin's *The Abuse of Casuistry* (1988). Jonsen elaborated the approach in an article, “Practice versus Theory” (*Hastings Center Report*, 1990). And a Jonsen team put it into concrete form in *Clinical Ethics* (5th edition, 2001), a vademecum for busy practitioners.

I made my views clear in an article on these issues a few years ago (2000): “Another lesson (I said) has to do with the urgency of the real-world problems that bioethics faces—which are, after all, what got philosophers involved in the first place. Medicine and the health care system generally—including those parts of it that operate in open or covert opposition to the entrenched power of physicians and hospitals—face enormous problems today, from rampant inflation and calls for rationing to the questioning of the very legitimacy of high-technology medicine. All the while, doctors and nurses, etc., must continue to face life and death issues every day. . . .

“It is probably inevitable, given the structure of philosophy today as an academic institution, that philosophical bioethicists will continue narrow technical debates among themselves about ultimate justifications of bioethical decisions. But academicism and careerism in bioethics should be recognized for what they are—distractions . . . from the real focus of bioethics.”

For all the issues here, quadrants would seem to exhibit a pattern similar to earlier chapters:

Classical educators, critics defending "standards"

Progressives opposing dichotomies

Meritocracy, career education

Marxist "education for the revolution," other radical views

Next, and finally, I turn to “postmodernism” and the all-out attack on academicism—especially on the hegemony of science in our technological (or “technoscientific”) culture. It has turned out to be a somewhat ironic attack, since all the critics have become comfortably ensconced in academia; indeed, to the dismay of defenders of science, they have pretty much taken over some humanities departments in major universities.

Chapter 25

Postmodernism and the Social Construction of Technology: Raphael Sassower and Stephen Cutcliffe

It is possible to take many different cuts at this material, but I will limit myself to two. In the first part I will organize the chapter by focusing my remarks on one philosopher long active in SPT, Raphael Sassower. The point in that part will be to relate SPT philosophers to the tradition of postmodern attacks on academia roughly in the same time period as the rise of SPT. In the second part I will turn to another parallel movement (really two movements often treated together) under the heading of Science, Technology, and Society—though the more academic of these two movements sometimes prefers the label Science and Technology Studies. Here one author who is not a philosopher, Stephen Cutcliffe, but who has long worked alongside and with SPT, will play a prominent role; see especially his book, *Ideas, Machines, and Values: An Introduction to Science, Technology, and Society Studies* (2000).

Section One: Postmodernism

Here I can be relatively brief, because Sassower is practically the only philosopher active in SPT to take literary postmodernism seriously. In his *Narrative Experiments* (1989), co-authored with Gayle Ormiston (who never got involved in SPT), Sassower and Ormiston make the strongest possible claim, coming from academics, that *all* literary works, including those in science and technology, are no more than—as the title suggests—*narrative experiments*, attempts by authors to persuade *particular* audiences of their authority. In the process of defending this claim, Sassower also attacks Richard Rorty (see below), social constructionists of science and technology, and literary post-modernists for betraying their own insights: while attacking the hegemonic claims of analytic philosophy, science and technology, and traditional literary criticism, all three—Rorty, social constructionists, and postmodernists—end up privileging their own views.

Ormiston and Sassower, on the other hand, take great pains to demythologize not only technoscience and its defenders but also themselves and other critics, with an explicit appeal to a persuasiveness standard.

Here are Sassower and Ormiston: “The incessant generation of interpretations,

narratives, fictions, systems, and so on presupposes and embraces the concept of plurality. However, it is not the kind of plurality or pluralism championed by Rorty, for example, nor the criteria-bound interpretive pluralism promoted by certain adherents of the social study or sociology of science, nor the hierarchical pluralism advocated in certain trends of contemporary literary criticism. When Rorty distinguishes the post-Philosophical and Philosophical cultures he announces his preference for the post-Philosophical *over* the Philosophical. Notwithstanding his desire for philosophical pluralism, Rorty's *preference* for the post-Philosophical establishes a rank ordering within the plurality. Rorty uses the post-Philosophical as a comprehensive Meta-narrative, thereby *eliminating* the plurality of cultures.

"Today, certain sociologists and philosophers study the scientific enterprise by examining and stressing the social context of that enterprise (as exemplified by the so-called Edinburgh School) and, by doing so, introduce the concept of interpretive pluralism, with respect to both texts and actions, into the picture. Rejecting the claim that the scientific enterprise can be judged only with reference to its particular 'methodology,' Steve Woolgar and Steven Yearly, for example, emphasize the social environment in which research is constructed and attempt to distill a plurality of interpretations based on the 'facts' supplied by textual records and laboratory activities. In distinguishing between kinds of interpretations, where interpretation is a 'representational' device, they declare a preference for a sociological or anthropological approach that will reflect the 'real' nature of science. Arguing for the comprehensive character of 'enthnographical' or 'constructionist' accounts, they privilege their accounts on the basis, as Lyotard would say, of what they do, while at the same time, they *remain* devoted to 'the very idea' of 'science.'"

Despite what Sassower (from now on I will limit myself to him, as the SPT member) says, Rorty has recently, in *Achieving Our Country: Leftist Thought in Twentieth-Century America* (1997), come to a fairly nuanced position. He may attack it, but he admits that analytic philosophy still has its merits: "Nowadays, when analytic philosophers are asked to explain their cultural role and the value of their discipline, they typically fall back on the claim that the study of philosophy helps one see through pretentious, fuzzy thinking. So it does. The intellectual moves which the study of analytic philosophy trained me to make have proved very useful. Whenever, for example, I hear such words as 'problematize' and 'theorize,' I reach for my analytic philosophy" (pp. 130–131).

All that Rorty objects to in analytic philosophy (at least in this book) is its lack of imagination, its focus on "problems which no nonphilosopher recognizes as problems," and the fact that it is "largely invisible to the rest of the academy, and thus to the culture as a whole" (p. 125).

In addition, Rorty is as critical of literary postmodernism within the academy—with which he is often associated by critics—as he is of academic philosophy: "I have no doubt," he writes, "that cultural studies will be as old hat thirty years from now as was logical positivism thirty years after its triumph" (p. 132).

Again: "The Foucauldian academic Left in contemporary America is exactly the sort of Left that the oligarchy dreams of: a Left whose members are so busy unmasking the present that they have no time to discuss what laws need to be passed in order to create a better future": (p. 139).

Joseph Margolis (see Chapter 6, above) suggests one final item in this first section on the humanities, literary postmodernism, and related topics: Sassower is not the first philosopher associated with SPT to claim that the sciences, even the so-called hard sciences, are as subject to "interpretive pluralism" (echoing the social constructionists) as are the humanities. In *Pragmatism without Foundations: Reconciling Realism and Relativism* (1986), Margolis defends a "robust relativism" in terms very similar to Sassower (and Ormiston): "If there is no convincing way in which to provide a theory of knowledge and inquiry in which inquiry itself is completely transparent, . . . then, globally, there is no way to demarcate the realist and idealist elements of human knowledge. . . . We should then have to concede a hermeneutic dimension to all human science, including the physical sciences" (p. 27).

Margolis then attacks a stalwart of analytic philosophy, W.V. Quine: "The Quinean program is as much an extravagance as the Heideggerian—and for the same reason: it betrays its own most forceful insight" (p. 209). (Margolis takes Quine's most forceful insight to be its legitimation of *praxis*.) Margolis then goes on to discuss what he thinks is a unique overlap in the otherwise opposed views of Heidegger and Marx. (They may be opposed, but they are often joined in postmodern critiques of science and technology.)

Despite the anti-foundationalism of Margolis's pragmatic relativism, it retains a "measure of objectivity," an objectivity relativized to "the conditions of *praxis*."

Here is the overlap that Margolis finds: “That transcendental arguments . . . are a species of empirical argument . . . is, broadly speaking, the consequence of Heidegger's thesis of historicity; and that our best clue about the validity of such arguments lies within the stablest technological features of social *praxis* . . . is, broadly speaking, the consequence of Marx's thesis about the relation of production and consciousness” (p. 208).

In the end, Margolis finds “extravagances” in all three philosophers: Heidegger's pessimism, Marx's optimism about laws of history, and Quine's foundationalist physicalism—which Margolis sees as incompatible with any defensible pragmatism. (See his *Reinventing Pragmatism*, 2002.)

So there we have it. Margolis's severely analytical pragmatism comes to many of the same conclusions as Sassower's (and Ormiston's) *Narrative Experiments.*

Section Two: High and Low Church STS, with Critics of Both

Now I turn to Stephen Cutcliffe, especially in his *Ideas, Machines, and Values* (2000). Though a historian of technology rather than a philosopher, Cutcliffe was always close to SPT and gives it more credit in his book than any other historians and sociologists of technology. Aside from myself, most of the philosophers he credits with contributing to advances in STS studies are feminists such as Haraway—originally a primatologist—and Sandra Harding (see Chapter 12 and Feenberg's critique). Surprisingly, he omits Sheila Jasanoff, in spite of her lead role in publishing the *Handbook of STS*, but more importantly in spite of her very philosophical work on science, technology, and legal issues.

Cutcliffe begins the passage I find most relevant with a framework (pp. 79–82):

A Conceptual Framework of Analysis

“Although STS has always had multiple foci, the theme for STS 'subcultures' was first systematically explored by Juan Ilerbaig in an essay published in the *Science, Technology* & *Society Curriculum Newsletter* in which he described a split between more disciplinary, theory-oriented scholars, often led by European sociologists of science, and more interdisciplinary, issue-centered educators, commonly led by philosophers of technology and engineering ethicists. He further characterizes the dichotomy by attributing to the former a strong science orientation with a more descriptive approach, while noting the latter's technology

focus accompanied by normative or evaluative approaches. In a prompt rejoinder in a subsequent issue of the same newsletter, philosopher Steve Fuller characterized the split as a 'High Church-Low Church' distinction, a catchy turn of phrase that quickly caught on with some STS scholars. In this view Fuller recognized what he saw as an unfortunate division between those programs, often at the graduate level, with 'a discipline-centered, scholarly bent' and those with 'a problem-centered, social activist bent.' Far better in his mind would be an STS *movement* that would at once meld the activist strains of STS with the body of sustained 'critical' knowledge regarding science (and technology) generated by sociological scholars.

"Other scholars continued the discussion, including Leonard Waks, who emphasized the distinction between what he sees as the knowledge and empirically oriented 'academics' and the more 'meliorist,' or 'activist,' social movement educators. Waks would apparently add the historians of science and technology to the lists of the former, but Luis Pablo Martinez took issue with this assignment of historians in a thoughtful paper in which he argues for an 'activist' role for historians of technology because of their ability to 'contextual [ize] accounts of technological developments in the past.' Although speaking to a different audience in his presidential address to the Society for the History of Technology, Alex Roland argued much the same point in rationalizing the value of the history of technology. He views the field as a community of scholars that has amassed a knowledge base essential to understanding how technology contributes to societal and contextual change.

"Still other scholars have pushed the debate even further. Li Bocong, a philosopher in the Department of Science and Technology at the Chinese Academy of Sciences, has called our attention to the cultural split between already developed, even postindustrial, nations and those such as China still in the process of industrializing, and the implications this has for the STS field. Richard Gosden of the Department of Science and Technology Studies at the University of Wollongong in an essay in *Technoscience,* the newsletter of the Society for the Social Studies of Science, sees the High Church-Low Church distinction, which he characterizes as being 'principally oriented in their research either to the problem of 'truth,' or alternatively, to the problem of 'justice,' as being further fragmented into what he views as four 'corner posts' for the field.

He identifies these posts as:

1. the dominant form of 'justice' within our society, that is capitalism or market justice (MJ);

2. its catchall alternative of victim justice (VJ);

3. the dominant epistemological authority within our society of scientific positivism (SP); and

4. its epistemological antagonist—science-as-social-construction, scientific relativism (SR).

"Gosden accepts that this depiction of the STS field is overly neat and subject to further change as the boundaries continue to readjust themselves.

"Philosopher of technology Carl Mitcham has, in similar fashion to Gosden, depicted a matrix of four alternative approaches to STS in theory and practice. On one axis he breaks STS down into an academic field on one end and as a social movement on the other, while on the second axis the division is between those who are supportive of technoscience and those who are critical of its societal implications. Thus, the STS social action movement, on the one hand as a form of protest, 'vocally questions whether the development of technoscience is always beneficial to society,' while, as technological management on the other hand, it 'aspires to infuse the management of science and technology with more consciously focused policy analysis and more thoroughgoing rational administration.' Among academic programs there is a similar sort of split among those that tend to critique the technocratic society and those that 'seek to instill the new technoscientific society with a deeper public understanding of the science and technology on which it relies,' so that citizens can be 'active, intelligent participants in social decisions that affect their lives.'

"I have argued that, in addition to the High Church-Low Church distinction among STS programs, often characterized as Science and Technology Studies (S&TS) and Science, Technology, and Society (STS) respectively, there is a third approach often referred to as Science, Technology, and Public Policy (STPP) or sometimes Science, Engineering and Public Policy (SEPP). The first two are oriented toward the theoretical/explanatory and the social/activist respectively. In contrast, STPP programs take a professional orientation with a focus on analyses of large-scale socio-technical interactions and their management. They stress the need for, and training in, appropriate policy and management fields.

Independent of whether one conceptualizes STS in terms of varied steeple heights (Fuller), as a three-legged tripod (Cutcliffe), or as a four-cornered field bounded by dueling 'whipping posts' (Gosden), I believe it is fair to say that there are a variety of approaches to STS, many of which are admittedly overlapping and not necessarily mutually exclusive."

Cutcliffe goes on under another heading:

Crossing over the High Church-Low Church Aisle

"For STS, especially as it has developed within the academy, to have much societal consequence, it is necessary, and even fruitful, to begin within the 'academic' corner of STS where most of the so-called constructivist case studies reside. If we can accept, at least for the sake of argument, that these studies have in the main enhanced our understanding of technoscience as an inherently value-laden, multifaceted, and complex process, which suggests the real possibility of societally shaping science and technology, the question remains how best to move beyond the warehousing of ever more sophisticated cases. To translate effectively this already large, accumulated body of STS knowledge, it is possible for those STS academics 'critical' of the technoscientific society, as Mitcham would identify them, to push outward from their scholarship by outlining normative guidelines for action. Several examples of recent scholarship that I find instructive are illustrative of this movement."

Later (pp. 121–123) Cutcliffe provides examples: "The individual who has probably done the most from an STS perspective to argue for enhanced democratic participation in the technoscience decision-making process has been Richard Sclove, founder of the Loka Institute, a nonprofit, citizen-action think tank and network. Underlying Sclove's work and that of others who promote enhanced public participation in the science and technology process is a commitment to 'strong democracy.' The ideas central to this notion are drawn from the work of Benjamin Barber and expanded upon by Sclove in his book, *Democracy and Technology* [1995], in terms of 'design criteria for democratic technologies.'

"The first two and most general criteria set the tone and framework for those that follow. Thus, Criterion A states: 'Seek a balance among communitarian/cooperative, individualized and transcommunity technologies. Avoid technologies that establish authoritarian social relations,' while Criterion B

says: 'Seek a diverse array of flexibly schedulable, self-actualizing technological practices. Avoid meaningless, debilitating, or otherwise autonomy-impairing technological practices.' Subsequent criteria dealing with democratic politics and self-governance stress the local and the sustainable over the global and exploitive. '[Organizing] society along relatively egalitarian and participatory lines,' Sclove argues, would entail adopting most, if not all, of a series of 'strategies' that would include the need to 'map local needs and resources,' while 'reach[ing] out to political movements [to] build coalitions.' The initiation of 'democratic R&D and design,' combined with expanded 'civic technological empowerment,' would help to 'democratize corporations, bureaucracy, and the state.' Sclove concludes his analysis by asking a penultimate question: 'Is it realistic to envision a democratic politics of technology?' Throughout he draws on the Amish by way of a small-scale example, suggesting the answer is 'yes,' but the more telling point is his final question: 'Isn't it unrealistic not to?'

"As illustrative examples of his approach to democratizing science and technology, Sclove likes to point to two possible approaches beyond the admittedly limited and religiously motivated Amish. One, which has been in place for some time, is the so-called science shop, found at its most developed state in the Netherlands, the other being what are known as 'consensus panels,' European-style citizen advisory panels for science and technology policy. Although differing in approach, in both cases the intent is to provide expanded knowledge to, and to allow greater participation by, the general public.

"In the case of science shops, which are, in effect, university-based community research centers, academic faculty, staff, and students are available to provide research for organizations, whether they be environmental, labor, or other nonprofit types, which do not have the expertise nor the resources to conduct their own research on issues of local or regional import. Subsequently, such groups make use of this 'academic' research as part of their input into the decision-making process, thereby providing a way around the argument that the 'public' is not expert enough to contribute knowingly to the deliberations. Presently there are almost forty such science shops in the Netherlands, while numerous other nations including Denmark, Germany, England, and even theUnited States have developed similar community research centers. Most recently the Canadian Social Science and Humanities Research Council has initiated a national network of twenty-two community-based research centers called CURA (Community-University Research Alliances). There is even a newsletter coordinating activities among the informal network of such centers.

"Consensus conferences, pioneered in Denmark and conducted under the auspices of their Board of Technology, offer an opportunity for panels of everyday citizens who are nonstakeholders to inform themselves deeply on given topics in science and technology and then, following open discussion and debate, to reach a decision that is announced publicly as an advisory report at press conferences. Such reports are not binding, but they do stimulate broad popular debate and increase public understanding, and can help change policy and thus acceptance levels. They are offered as advisory input which the Danish Parliament can then act upon as it sees fit. The first such Danish consensus conference was held in 1987, and since then numerous others have been successfully conducted. By way of specific example, a 1989 citizens' panel on the Human Genome Project encouraged support for basic genetics research, but it also called for further work on the societal consequences and influenced the Danish Parliament to enact legislation prohibiting employment and insurance decisions based on genetic information. In March 1999 a Danish citizens' panel examined the issue of genetically engineered foods. While the panel stopped short of calling for a moratorium, they did call for stricter regulatory control, including better consumer labeling practices and restrictions on corporate monopolies with regard to genetic technologies.

"At least a dozen nations have now organized or are about to hold such citizens' panels. For example, Japan held a consensus conference on human gene therapy in March 1998 and is planning a second on the 'High Information Society.' Canada held a conference on food biotechnology in March 1999, while England held its second such meeting on the topic of radioactive waste disposal in May 1999. Other nations such as Australia and South Korea are considering holding similar consensus conferences on topics of import to them, further testifying to the value of this sort of mechanism for enhancing citizen participation in deliberations regarding important and potentially controversial technoscientific issues.

"In April 1997 [Cutcliffe concludes] Sclove organized the first such citizens' advisory panel in the United States on an experimental basis with NSF funding and the support of the Massachusetts Foundation for the Humanities and MIT's *Technology Review* magazine among others. Held on the campus of MIT, the conference explored the issue of 'Telecommunications and the Future of Democracy."

I have done brief historical sketches of developments in two related fields, laboratory studies (as part of the field called Social Studies of Scientific Knowledge to distinguish it from earlier sociology of science) and the Social Construction of Technology. I did this in an essay comparing alleged progress in these fields with alleged lack of progress in philosophy of technology. (See *Techné* 4:1, at spt.org/journal.) I repeat that material here as a complement to Cutcliffe:

From *Sociology Of Science To Sociology Of Scientific Knowledge (SSK)*

According to one source (Gaston, 1980), sociology of science as a subspecialty within sociology only dates back to the 1950s. From the mid-fifties until 1980, the field was dominated by one giant figure, Robert K. Merton, though his *On the Shoulders of Giants* (1965) is an eloquent defense of the claim that intellectual originators, no matter how creative they may seem, always owe enormous debts to those who have gone before them. Between the 1950s and the late 1970s, almost all sociologists of science felt that they owed a major debt to Merton. His model of objective science as requiring the sharing of information, mutual criticism, disinterestedness, and universalism (disregarding social characteristics in the recognition of the importance of contributions to science) became the basis of other sociologists' research. As Gaston summarizes the situation: "The model of a social system of science in which scientists pursue knowledge in a social environment, hoping and expecting to receive recognition for their original contributions, provides a multitude of research questions, what has come to be called 'Mertonian' sociology of science" (Gaston, 1980, p. 475). This approach continues to have its followers, most notably in the various forms of the Science Citation Index and cognate series, but hardly anyone today thinks of this tradition when referring to advances in social approaches to the study of science.

In 1979, Bruno Latour and Steve Woolgar published *Laboratory Life: The Construction of Scientific Facts*, and a new tradition was launched. One of its principal aims was to undercut the Mertonian model and the positivist philosophy that was perceived to lie at its core. Since then, the "sociology of scientific knowledge," as the field was renamed to emphasize its focus on the actual doing of scientific work rather than on allegedly authoritative products of successful scientific work, has been perceived by almost everyone in science and technology studies as one of the most prolific, rapidly advancing fields in all of academia. Joseph Rouse dates the revolution from the so-called "Edinburgh Strong Programme," associated especially with the names of Barry Barnes (1974)

and David Bloor (1976), and he goes on to list the fragments of later social constructivism as including "Bath relativism, ethnographic studies, discourse analysis, actor/network theory, and constitutive reflexivity" (Rouse, 1996, p. 1). But he and nearly every other commentator treats constructivism as an advancing, if not monolithic, field. Indeed, nearly everyone who is not unalterably opposed to it (see Gross and Levitt, 1994) thinks of the constructivist school(s) as advancing at an amazing pace.

What I want to do here is contrast later with earlier stages of one of these strands, laboratory studies. If we date this subspecialty in constructivist studies from Latour and Woolgar's *Laboratory Life* (1979), it is fairly easy to demonstrate that there have been a large number of later developments building on earlier ones. In Karin Knorr Cetina's summary in the *Handbook of STS* (1995), the developments extend Latour and Woolgar's examples, from Eisenstein (1979) on the printing press as a social agent of change, to Amann and Knorr Cetina (1990) on image interpretations in molecular biology, to Henderson (1991) on computer graphics, to Hirschauer (1991) on sex-change surgery, to broader sets of examples in Lynch's *Art and Artifact in Laboratory Science* (1985) and Latour's *Science in Action* (1987). (See Knorr Cetina, 1995, p. 155.) Indeed, it sometimes seems that any adequate list would be too long to summarize. (Knorr Cetina tries, in her 1995.)

It would take a churlish critic to deny that there has been progress here, and I have not even referred to advances in actor/network theory and similar approaches.

Nonetheless, even Knorr Cetina as the loyal chronicler of these advances admits that her favored approach, laboratory studies, has its limits. The most important ones she lists have to do with their microscopic focus on individual laboratories rather than on consensus building among larger groups of scientists; and with their failure to account for larger societal contexts that influence laboratory life (Knorr Cetina, 1995, pp. 161–162).

And of course this does not even mention criticisms by jealous defenders of science's progressivism (Gross and Levitt, 1994), who view what is alleged to be progress here as no more than an ever-broadening smear campaign against more and more hardworking scientists.

In concluding this section, it seems fair to say that advances in laboratory studies

continue right down to the present; but it is also fair to say that such studies have their limits and their critics.

Social Constructivist Studies Of Technology

Moving closer to a direct parallel to philosophy of technology, several sociologists (and sociologically-oriented historians) in the mid-1980s extended their constructivist studies, in an explicit way, to the study of technology, usually, of particular technologies.

It was this group of scholars whom Winner was attacking in his paper, "Upon Opening the Black Box and Finding It Empty" (1991). And representatives of this school have fought back. (See Bijker, 1993, and Aibar, 1996.)

Wiebe Bijker, in his summary of developments in the field in the *Handbook of STS* (1995), traces its roots to Thomas Hughes, the historian, in his masterly study, *Networks of Power: Electrification in Western Society, 1880–1930* (1983). Hughes then combined with Bijker and Trevor Pinch to edit the book that others often list as the beginning of the new tradition, *The Social Construction of Technological Systems* (1987). That does not leave much time for a great deal of development between 1987 (or even 1983) and Bijker's summary (1995). Nonetheless, people do perceive the constructivist study of technological systems as a rapidly advancing field.

But what kind of advance has there been? Bijker and John Law, in *Shaping Technology/Building Society* (1992), offer an answer. According to them, technology studies had earlier been "fragmented": there are internalist historical studies; there are economists who are concerned with technology as an exogenous variable; more productively, there are economists who wrestle with evolutionary models of technical change; there are sociologists who are concerned with the "social shaping" of technology; and there are social historians who follow the heterogeneous fate of system builders (p. 11).

By the end of the book, which summarizes the evidence in a somewhat heterogenous collection of essays, though written by leading figures in the field, Bijker and Law conclude that a "first step" has been taken in understanding "that technical questions are never narrowly technical, just as social problems are not narrowly social" (p. 306).

Back in the introduction, Bijker and Law had summarized the progress made so far: the last five years has seen the growth of an exciting new body of work by historians, sociologists, and anthropologists, which starts from the position that social and technical change come together, as a package, and that if we want to understand either, then we really have to try to understand both (p. 11).

In short, all that Bijker and Law are claiming as advances in the new field so far is that there has been a "development of an empirically sensitive theoretical understanding of the processes through which sociotechnologies are shaped and stabilized" (p. 13). But everyone knows that theoretical arguments are never-ending, and if there is to be any progress in this new field it will show up in detailed studies that confront theory with evidence. And Hughes had already displayed that process admirably, in *Networks of Power*, in 1983.

Winner, the critic of social constructionism (who also recognizes its merits), does his own history. (See *Science, Technology, & Human Values* 18:3, 1993, pp. 365–367.)

The plea frequently voiced by the social constructivists is that we open the 'black box' of historical and contemporary technology to see what is there (Pinch and Bijker 1987). The term *black box* in both technical and social science parlance is a device or system that, for convenience, is described solely in terms of its inputs and outputs. One need not understand anything about what goes on inside such black boxes. One simply brackets them as instruments that perform certain valuable functions.

"In my view, the social constructivists are correct in criticizing writers in the social sciences and humanities who have often looked upon technological developments as black boxes while neglecting any comprehensive account of their structures, workings, and social origins. To find more precise, detailed descriptions and explanations of the dynamics of technical change is a goal well worth pursuing.

"As they go about opening the black box, the historians and sociologists in this school of thought follow methodological guidelines established during the past two decades within the sociology of science, in particular an approach that studies the sociology of scientific knowledge (Collins 1983). In this mode of analysis, there is a strong tendency to regard technology as the lesser relative of science. Because science deals with the fundamentals of human knowledge, it is

considered the more elevated and significant topic. In that light, for both historians and sociologists, the 'turn to technology' is sometimes portrayed as a kind of intellectual slumming (Woolgar 1991). There is even some doubt that sociologists of scientific knowledge will benefit greatly from studying such grubby technological matters at all. Sociologists of science see social studies of technology as a new field in which to apply a powerful but as yet underutilized research apparatus that had been successful in studies of the sociology of scientific knowledge.

"From that vantage point, most past and contemporary work in the philosophy of technology is greeted with scorn. As Pinch and Bijker (1987) conclude in their widely cited survey, 'Philosophers tend to posit over-idealized distinctions, such as that science is about the discovery of truth whereas technology is about the application of truth. Indeed, the literature on the philosophy of technology is rather disappointing. We prefer to suspend judgment on it until philosophers propose more realistic models of both science and technology' (p. 19).

"In quest of 'more realistic' models of their own, social constructivists employ a methodological posture, 'the empirical programme of relativism,' commonly used in the sociology of science. Adapting this stance to the study of technology requires some modification. What social analysts do in this new focus is to study the 'interpretive flexibility' of technical artifacts and their uses. One begins by noticing that people in different situations interpret the meaning of a particular machine or design of an instrument in different ways. People may use the same kind of artifact for widely different purposes. The meanings attached to a particular artifact and its uses can vary widely as well. In this way of seeing, sociologists and historians must locate the 'relevant social groups' involved in the development of a particular technological device or system or process. They must pay attention to the variety of interpretations of what a particular technological entity in a process of development means and how people act in different ways to achieve their purposes within that process.

"I want to emphasize that social constructivism is by no means an entirely unified viewpoint. There are some important differences among its leading practitioners. For some who work in this perspective, the conventional distinction between technology and society has finally broken down altogether. In the approach of Michel Callon and Bruno Latour, for example, we find the methodological premise (eventually upheld as a basic social truth) that the modern world is composed of actor networks in which the significant social

actors include both living persons and nonliving technological entities."

Others like Trevor Pinch and Wiebe Bijker prefer to maintain the notion that society is an environment or context in which technologies develop. But despite such differences of emphasis, the basic disposition and viewpoint of social constructivism is fairly consistent.

"As a way of studying the dynamics of technological change, this approach does offer some interesting advantages. It offers clear, step-by-step guidance for doing case studies of technological innovation. One can present this method to graduate students, especially those less imaginative graduate students who need a rigid conceptual framework to get started, and expect them to come up with empirical studies of how particular technologies are 'socially constructed.' Indeed, the social constructivists promise to deliver a veritable gold mine of those most highly valued of academic treasures: case studies. They have studied the development of Bakelite, missile guidance systems, electric vehicles, expert systems in computer science, networks of electrical power generation and distribution, and several other corners of technological development. Research results usually indicate that technological innovation is a multicentered, complex process, not the unilinear progression depicted in many earlier writings. Another useful contribution of this approach is to reveal the spectrum of possible technological choices, alternatives, and branching points within patterns sometimes thought to be necessary. Social constructivist interpretations of technology emphasize contingency and choice rather than forces of necessity in the history of technology.

"Although they are not alone in doing so, the social constructivists have been quite helpful at calling into question the sometimes highly arbitrary distinctions between the social sphere and the technical sphere. In my view, the ability to break down such arbitrary distinctions opens up some interesting possibilities for those who want to understand the place of technology in human experience. For that reason alone, the literature in the new sociology of technology is well worth a philosopher's attention.

"As they proceed with their work, social constructivists are eager to call attention to the inadequacies of their predecessors, identifying their accomplishments as a clear advance over earlier ways of thinking about technology and society. Theirs is said to be a more rigorous, methodologically refined, and clear-sighted vision of technology and society than what came before.

"What are the significant points of comparison? Among the cast of characters, one would certainly have to include the whole range of thinkers who have written about the origins and significance of modem technology. Among those explicitly or implicitly criticized are sociologists of technology like William Ogburn, historians of technology like Lynn White, and a variety of economists who have written on the economic correlates of innovation. Not far in the background are the likes of Lewis Mumford, Jacques Ellul, Ivan Illich, members of the Frankfurt school of critical theory, and any number of Marxist social theorists, not to mention Marx and Engels themselves.

"As they refer to earlier generations of sociologists, the social constructivists often appear to be saying, 'Yes, these were, indeed, great thinkers, but they were wrong and we are right.' Whether or not this judgment comes to be accepted by the scholarly community as a whole, only time will tell. But the aspirations of social constructivism are fairly evident. Part of what is going on here is a social construction of knowledge that seeks to depict earlier and contemporary approaches as outmoded or dead. Clearly, one of the ways in which this approach can be said to be 'more complex' than previous ones has something to do with the Oedipus complex."

Winner rounds out his history with his main point, a serious criticism: "Before we join the swelling applause for social constructivism and anoint this school as the cutting edge in technology studies, we must pause to ask whether or not their approach does amount to an improvement over other approaches. Before we forget our Marx or our Mumford, Ellul, or Heidegger, it is important to notice what one gives up as well as what one gains in choosing this intellectual path to the study of technology and human affairs."

And what Winner says we give up is the *evaluative* stance of the earlier authors mentioned: they were willing to say what they found to be wrong with technological societies—especially *our* type of technological society—in ways that the social constructionists (Winner says constructivists) eschew as "unscientific." That is, in Sassower's terms, after de-privileging others' views, they give their own a privileged place. They want theirs to be *the* way of doing science and technology studies in academia. And of course non-academic social critics are thought to be worse even than scholars of older persuasions.

So finally we come to the set of *quadrants* we have been leading up to

throughout this book: *idealists* like Verene and Ferre are usually also academics, but Sassower and Ormiston would say their writings have no more authority than their ability to persuade; *social activists*, especially progressives like Mead (and myself) or Social Democrats like Michalos, either prefer not to worry about academic credentialing or despise that whole game as privileging academics over fellow-activist citizens; *academic philosophers*, historians, and philosophers of science and technology (Bunge's "exact philosophy" might be the most extreme example) do worry about "getting the story right," wanting their scholarship to be as sound as their scientist and engineer colleagues in academia; *radical critics* can also be academics (though some had difficulty holding jobs in US universities during the period of SPT's short history), while the most radical want to deprivilege academics.

I leave it to the reader and his or her sympathies to decide where postmodernists and social constructionists fit within this picture, though I am sympathetic toward Sassower's claim that they sometimes betray their own best insights in privileging their approaches as better than their predecessors.

A Concluding Essay On Quadrants And Discourse Synthesis In The Philosophy Of Technology

I want to end the book by expanding on ideas presented in my introduction. One key issue, for me, is the utility—or not—of Walter Watson's quadrant or four-pole analytical scheme in *The Architectonics of Meaning: Foundations of the New Pluralism* (1985). The other issue is the significance of the whole project.

1. A Quadrant Scheme and Discourse Synthesis

Watson's scheme has two aims. The first is to be comprehensive, to leave out no significant voice in whatever discourse is being analyzed. For example, Watson himself had to add a voice to those generally taken into consideration by his mentors, such as Richard McKeon—the voice he calls "creative," elevating Protagoras's approach among Greek philosophers to a position as a legitimate philosophy to stand alongside the philosophies of Plato and Aristotle and the Greek atomists. The second aim is to provide such a comprehensive framework as a kind of *global* map that will allow one to see where any particular thinker (philosopher or other) is "coming from," in that tired phrase, when he or she takes on an opponent on a controversial issue within a field of discourse.

For whatever reason, Harry Collins and Nicholas Mullins do not seem to have felt the need to do anything other than identify networks, with no organizing framework. But Collins does make comments—for example, about the "conservatism" of philosophers George Herbert Mead and John Dewey—that suggest that he is at least thinking about a *political* spectrum (though he is otherwise mostly silent about the salience of philosophers' places in the political spectrum).

What Watson's scheme allows us to see is the inadequacy of the traditional left-right political spectrum, as of *any* bipolar system. If one insists on linear spectra (possibly because that's easier to present in a book), with respect to politics there should be at least two such spectra crossing one another at right angles: left to right, and, at the center, at least two middle positions, not side by side but one above (or below) the other, creating another linear spectrum with all the possible variations of hue in a color spectrum. (See Rokeach, 1973, for an empirical sociology version; Cohen, 1962, for a political philosophy version.) Nearly everyone recognizes the limitations of overly simple bipolar spectra in all sorts of intellectual settings. Watson goes beyond this standard complaint, recognizing in

addition that, even within a four-pole system, there are many, many variations within each of the resulting quadrants. As the publishers note on the cover of his book, Watson intends his book to be "the first truly useful taxonomy of all ideas." That is surely an extravagant claim, but trying to be encyclopedic seems to me a noble goal.

So, at least, I said in my contribution to the McInnis volume mentioned in the introduction. (See Raymond McInnis, *Discourse Synthesis: Studies in Historical and Contemporary Social Epistemology,* 2001.) There I identified four historical patterns for achieving an encyclopedic integration of knowledge: *creating* order out of chaos, disciplinary *synthesis* (in McInnis fashion), integrating within a *comprehensive whole,* and *disciplinary* synthesis in Watson's Aristotelian mode. Defenders of one or another approach identify themselves by their *opposition* to (at least one of) the other approaches. This was based on some earlier ruminations of mine—the first version in conjunction with Cesar Cuello.

As I said in the introduction but will repeat here pretty much verbatim, that first effort is to be found in a Society for Philosophy and Technology publication (see Cuello and Durbin in *Techné 1:1*). We included there a note on methodology. We said that making explicit the methodology used in discovering the underlying assumptions of parties to *sustainability* debates in environmental philosophy can move us to a deeper level, toward links with predictable philosophies of technology. Knowing the risks, we nonetheless used Watson's scheme—without endorsing the exaggerated claim about "the first truly useful taxonomy of all ideas." Stripped of such an exaggerated claim, Watson's book seemed to offer us an interesting *hermeneutic*.

In Watson's view as I summarized it earlier and will repeat here in abbreviated form, every author or public speakers betrays his or her philosophical assumptions by differentially utilizing the four necessary components of any piece of literature:

> author's *perspective* (which may be entirely personal or that of a tradition and may be hidden even from the author);
>
> *objects* discussed;
>
> the text itself, and especially the *methods* that link items to one another; and

> the goals or *principles* (ideals, values, etc.) that drive or motivate the text, which almost always reflect sets of background assumptions, such as the cultural values influencing both individual authors and intellectual traditions.

According to Watson, authors or speakers who stress objectivity above the other three components employ a *scientific* writing style (not Watson's term). They tend also to use logical methods, invoke *reductionistic* aims, and try to avoid values as much as possible. Authors, on another hand, who consciously stress values and see the objects of their discourse as this-worldly shadows of otherworldly realities—typically linking the two by a method explicitly referred to as *dialectical*—Watson links to Plato. They tend to emphasize comprehensiveness, and often disparage narrow technical scientific knowledge. Authors, third, who stress method and discipline (in the school subject matter or *professional discipline* sense), and who emphasize the pigeonholing of objects within large *encyclopedic* schemes, Watson links to Aristotle.

The fourth perspective, as I said in the introduction, requires a little more elaboration. Authors in this group emphasize their own subjective *perspective*, their own *creativity*, as an end in itself. In terms of method, they often tend to be anti-methodical, to utilize any means that will move the narrative (story, drama, etc.) along. Watson links this group to the Greek Sophist Protagoras (for whom humans are "the measure of all things") and defends this as a philosophical perspective fully parallel with the other three.

Finally, it should be noted that Watson acknowledges that the four basic groups do not exhaust the stylistic field; many authors combine modalities. For example, as Watson recognizes, almost all the great philosophers of the modern period, after Descartes, have tended to use hybrid styles—though a hybrid style is recognizable, Watson thinks, as a joint use of two or more of the four basic styles.

This short summary of Watson's very complicated scheme—I am arguing—may be enough to suggest that a hermeneutic approach, roughly along Watsonian lines, can help discover philosophical presuppositions implicit in the language used in all sorts of *philosophical debates. However*, where Watson's aim seems to be Aristotelian, to pigeonhole authors, Cuello and I called our aim (in Watson's terms) *creative*. We wanted to *let the authors have their own say* about

what it is they want to emphasize in the sustainability debate.

Cuello and I went on to attempt to figure out the mostly implicit philosophies of technology latent in controversies over the meaning of the slogan, "sustainable development." In this book, I have recommended the same approach for *all the controversies* among philosophers of technology that I have taken up in this book.

Side note: though Collins feels no need for such a framework or background against which to situate the range (a truly incredible range!) of controversies that he chronicles, it seems to me that in at least two cases, his findings parallel mine and could well add details to the Watson scheme. I am thinking in particular of two epochs, Greek philosophy and the period roughly from the early nineteenth- to the early twentieth-century in Europe. This is most easily seen by looking at Collins's figures. If you combine figures 3.2 and 3.4 in Collins's chapter on Greek philosophy, to get the full picture from the original Greek schools to later recombined networks—and if you compare the result with Watson's admittedly oversimplified scheme—the results are more similar than Collins might want to admit. Then if you look at figure 12.2 in the chapter on the German university revolution—that is, at the American "schools" (loose sense) that developed from German university roots—once again there is a closer likeness to Watson's simplified scheme than a reader swept up in Collins's details might think.

I went on to make another attempt along these lines in another contribution to the SPT online journal *Techné* (1997), in the proceedings volume from a conference in Karlsruhe Germany earlier in 1997. (See Chapter 13 above.) My title was, "Advances in Philosophy of Technology?" (Note the question mark.)

Here are some excerpts: "Everything I have summarized so far in support of a claim that there have been advances in North American philosophy of technology since Bad Homburg is, actually, preparatory to the question I want to address in this paper. It should be obvious that there has been progress in the field of philosophy of technology in some sense. But exactly what do we mean when we speak of 'advances,' whether in the philosophy of technology or in any other similar field today? Is it just a matter of a continuing stream of new books and new journal articles published? I want to address this issue comparatively, by way of a comparison and contrast with developments in the philosophy of science and the sociology of science and technology.

"First, however, we need some definitions of what it may mean to speak of advancing or making progress in any academic field.

Scientific or quasi-scientific progress

"Discussing the rise of analytical philosophy in the early twentieth century, Bertrand Russell (1945) once claimed that, using logical techniques, analytical philosophy is "able, in regard to certain problems, to achieve definite answers" (in contrast with older philosophical approaches); in this respect, according to Russell, analytical philosophy's methods "resemble those of science." Like scientific advance, Russell was assuming, there can be similar philosophical progress, with one contribution building on others, and so on. In the United States at least, this has become the ideal of academic progress, with one article in a "leading" journal in a "cutting-edge" field worth more, in terms of merit and reward, than any other kind of publication, except possibly a "major" book reviewed (favorably) in all those leading journals.

Originality

"However, once this academic standard of progress was extended, by departmental committees and deans, to almost every field of higher learning it began to come under attack. An early and vituperous version can be seen in Jacques Barzun's *Science: The Glorious Entertainment* (1964). These critics maintain that, when the standard is applied in humanities fields such as literature, history, and the arts, and many of the critics lump philosophy together with other humanistic disciplines, it is totally inappropriate. The only measuring rod we can use in these fields (and, as we will see below, later postmodern critics now say this is true even in the sciences) is greater and greater originality, especially in terms of persuading whatever are perceived to be the relevant audiences.

Idealistic standards

"A few transcendentalist metaphysicians and theologians object to both the strict (progressive) academic standard and the much broader "originality" (postmodern?) standard as retrogressive chasing after increasingly trivial minutiae. The only real progress moves in the opposite direction, toward more and more comprehensive syntheses, ever closer approaches to truth or beauty or goodness (sometimes capitalized as Truth, Beauty, and Goodness).

"Such Hegel-like synthesizers are, I admit, rare today; but there are 'right-side-up' dialectical materialist neo-Hegelians and others who insist on real social progress as the only appropriate standard. . . .

Disciplinary/encyclopedic standards

"Finally, still others insist on what I would call an Aristotelian model, recognizing that academic fields are divided along disciplinary lines, each with its own standards. At least some of the sciences may meet the standard criterion of progress within limited domains, but most intellectual endeavors can make only 'intensive' or 'qualitative' progress, providing no more than a deeper appreciation of, or new insights into, old truths, traditional arts and crafts, and so on."

I should note here (as I did not in the original article) a non-pigeonholing aspect of this second scheme: upholders of one standard are often vitriolic in their opposition to others—sometimes to all three others. So, as above, hybrids are possible. For the best example, academics should recall how vitriolic defenders of the "progressive" or "best journal" standard are when viewing a candidate for a position such as tenure. If the candidate measures his or her own work by the postmodern/originality standard, we have the classic confrontation. But defenders of "standards," in this sense, often also oppose Aristotelians and Hegelians and Marxists, along with feminists, and so on and on.

It now seems to me that this scheme—and this last comment—has much to offer us in reflecting on the debates within SPT chronicled in this book. For example, the worries of Joe Pitt and the "new discipline" advocates in Chapter 18 seem to me to reflect the current cultural hegemony of science in (at least) North American universities, which is reflected in the last sentence of the previous paragraph. The reader is likely to recall, at this point, that I stand with those in opposition to that hegemony. But aside from my own views, applying Watson's scheme in this context would suggest that, in fact, American universities are more open than the science-hegemony culture would lead us to expect. Not only philosophers but professors in many humanities disciplines, in the social sciences, in schools of education, in the arts, and so on, get tenure and even full professorships, even though (sometimes because) their work reflects the standards of one of the other quadrants in my version of Watson's scheme here. Since that seems to me clearly to be the case, Joe Pitt and his friends (Chapter 9) seem simply to be carrying academic bickering to a larger stage; and the

proposed "new discipline" of philosophy of technology (Chapter 18) is actually going to end up including most of the work of the philosophers they would seem to want to leave out—or to force to take a more academic approach.

I made those first two proposals in very restricted contexts. In a more general sense, Watson's view boils down to this: in the Western philosophy-based intellectual tradition (and I would extend this to the *personal intellectual* development of anyone, including philosophers, within this tradition), everything begins with *narrative* (myth, the world view we grew up in, etc.); this is typically first challenged in an "idealist" phase, when newly-critical adolescents (and others similarly situated in terms of their intellectual upbringing, including in graduate school) see old world views as failing by their own idealistic standards (this I would call "challenge from above"); then at least some (again especially young) people challenge old myths "from below," subjecting them to quasi-scientific "does the world *really* work that way?" critiques; and finally a few thinkers (more mature individuals, typically in mid life) look at all three of these approaches—narrative, idealistic critique, and scientific critique—and attempt to fit all known kinds of discourse within an "encyclopedic/disciplinary" superframework.

That is, Watson 1: "Protagorean" [artistic], "Platonic" [values], "Democratean" [objectivist/scientific], and "Aristotelian" [methodical/disciplinary/encyclopedic] literary *emphases.*

Or Watson 2: (quasi-) scientific, originality, "comprehensive/idealistic," and disciplinary/encyclopedic *measures* of alleged *progress* in an academic field.

Each of these is an abstract, idealized four-pole at an extremely abstract level. The commonalities are these: we begin with a narrative taken for granted in a culture (for example, the culture of the department in which we do our graduate research and writing); this is often critiqued "from above" by idealists (which usually means people who try to hold the local culture to its own stated ideals or values—though sometimes the values are imported from outside); or from below by "scientific" types (usually saying they're more interested in facts than values); and this whole development is then examined from a disciplinary/encyclopedic perspective, especially by others or by senior members of the particular intellectual group who put together an encyclopedia or handbook for whatever it is the group is working on (including science). *What I would suggest is that, whatever the field—artistic, values/idealistic, scientific,*

encyclopedic/disciplinary—something like this four-pole is operative, in terms of relationships with the other narratives/fields. (Also, I happen to think, *within* specific literary/narrative approaches.) But we should not forget either Watson's warning, that people can utilize more than one approach or standard; or my warning, that nowadays people—especially philosophers—often take on a broad set of opponents.

What I am saying is that, *assuming narrative as basic*, most people most of the time will:

1. remain within a narrative framework uncritically, often glorying in it while also often resisting other approaches;

2. critique the dominant narrative/myth "from above," contrasting it with some ideal;

3. critique it "from below" in a scientific or quasi-scientific fashion; or

4. attempt to make sense of all three of the above approaches in a "disciplinary/encyclopedic" synthesis (which is typically interpreted as opposing the other approaches)—and *we should not forget the possibility of combining emphases. I maintain, along with Watson, that something like this four-pole analytical framework has tended to dominate throughout the history of Western literature.* Something like it may even represent something of a trans-cultural universal.

The typical model has four sets of values: 0,0/0,1/1,0/1,1, arranged in boxes:

0,0	0,1
1,1	1,0

In any case, in this book we have seen, among the controversies within SPT in the last 30 years, philosophers of technology line up somewhat as follows.

People Watson would characterize as *idealist* in some sense (remember that he

allows many variations)—following in the footsteps of some of the first intellectuals characterized as or characterizing themselves as philosophers of technology, especially Martin Heidegger and Jacques Ellul—would include Donald Verene with no qualifications (except that he explicitly links Ellul's thought with, for example, Hegel); Frederick Ferre, combining some analytical philosophy lessons from graduate school with a Whiteheadian process philosophy; Albert Borgmann's neo-Heideggerianism; and Carl Mitcham's attempt to link a Borgmann approach with Aristotelian categorical schemes. To some critics, Don Ihde would also fall in this quadrant, though two of his claims—that (1) phenomenological analysis is a genuine alternative to dominant analytical philosophy, and (2) that at least his version of that approach leads in the direction of *postmodern* multiculturalism and concerns for international tolerance and global environmentalism—share much with other quadrants. (We should recall that Watson endorses the idea of combinations—and at the same time recognize that the thought of Ferre, Borgmann, and Mitcham may also not be idealists in any pure Watsonian sense.)

Since Mario Bunge and Joe Pitt are such relentless critics of idealist thinking, I can list next the philosophers in what Watson calls the *science* quadrant—beginning with Bunge and Pitt as pure instantiations (though Pitt also calls himself a pragmatist). These would include Deborah Johnson, especially in her cooperation with engineering and computer professionals trying to regulate themselves or avoid regulation by government, including government regulators claiming to speak for the public; and Kristin Shrader-Frechette, though her calls for Rawlsian equity—as a counter to the false claims of cost-benefit regulators (often really promoters) of technological developments as value-free—clearly puts her at odds with many people in the science quadrant. Joseph Agassi started out as a fairly straightforward Popperian philosopher of science—clearly in Watson's science quadrant—though his contributions to SPT put him in a position of challenging (in Popper fashion?) everyone in all quadrants to become active in mass movements to head off a technological apocalypse. Agassi's student Raphael Sassower also moved away from Popperianism, but in the direction of postmodernism—which claims to stand outside such a quadrant-segmented universe (but doesn't, as we will see).

Next we can look at some political philosophers that Milton Rokeach and Carl Cohen would list as *socialists*, but who would probably prefer for themselves a label such as Social Democrats (Alex Michalos explicitly) or Progressives. Since we have encountered no Aristotelians except Mitcham in our survey (and he

combines his Aritsotelianism with a dominant idealism), my social democrat quadrant will fill the spot in Watson's scheme of Aristotelianism. Michalos is the most obvious dweller in this region, even though he has always been treated as pertaining to the science camp; the difference lies both in his untypical call for scientists and engineers to be socially responsible in their professional work and in his real-life political activities. Edmund Byrne is a left-of-center spokesperson for and critic of the American labor movement. Larry Hickman doesn't usually call himself a progressive, though opponents of his mentor, John Dewey, often blasted him for, among other things, what they perceive as the evils of "progressive education." I am explicitly Progressive (capital P), and Paul Thompson combines his pragmatism with work with (and criticism of) governmental regulators of agricultural technologies. I have here interpreted Sheldon Krimsky's advocacy of Critical Technology Assessment as social democratic because he sets it in opposition to Marxism (among other opponents). And Andrew Light, at least in his environmental pragmatism, seems to belong here.

That leaves the fourth Rokeach-Cohen political quadrant to *radicals* of various sorts, including Marxists such as Marx Wartofsky and Andrew Feenberg. Joseph Margolis calls himself a "non-reductive materialist" to distinguish himself from other materialists, presumably including Marxist dialectical materialists; indeed, in his philosophy of technology as I have reconstructed it here, Margolis explicitly opposes Marx—along with Bunge (science quadrant) and Heidegger (idealism). Some people would say that moves Margolis toward the social democracy quadrant, but I'm willing to put him down as a very complex non-Marxist radical because he disapproves of Dewey-type progressivism as "epistemologically naive." Langdon Winner, on the other hand, is almost *the* classical non-Marxist radical in SPT circles. Steve Goldman, here presented as a critic of engineers' claims to be doing no more than applied science, is another non-Marxist radical.

In Chapter 13, I argued that similar groupings can be found in Germany:

Huning and Lenk (professional ethics)

Schirmacher (Heideggerian)

Frankfurt/Habermas

Ropohl (systems) and Rapp (Bunge-influenced analytic)

And in Spain:

Echevarria (social democrat)

Ortega (existentialist)

Medina (Marxist influence)

Quintanilla (Bunge)

[The 1997 Karlsruhe conference proceedings, representing the current generation, are, as is the case in Spain, more diverse—though I doubt that even the most recent work, in either country, would escape the fundamental controversies reflected in the two quadrant formulations that summarize the situation here. The most recent generation in Spain would be less easy to locate; for example, Cuevas, though a Quintanilla disciple, is anti-Bunge, and Lopez Cerezo is strongly influenced by STS studies.]

Similarly, in Chapter 19, on Dutch schools of philosophy of technology, I discovered similar groupings. The Dutch schools, as presented by Tijmes (with detail interposed on the Twente team's summary of American work that they find interesting), sort out into an almost ideal set of quadrants:

Wageningen school and Brey (not Dreyfus summary, but social democrat work)

Schuurman (religious engineer) and Tijmes (Heidegger)

Achterhuis (on Feenberg)

Delft and Eindhoven

This leaves out Bijker and STS, but in Chapter 25, in spite of the constructivists' claim to be ideology-free, I find a similar grouping:

Bijker

(by definition no idealists, but recall Sassower)

Latour

Collins

2. The Significance (if Any) of the Project:

So we have arrived at the end of my project. But where is it that we have arrived? Isn't it obvious, a skeptic might ask, that philosophers from all sorts of perspectives would get interested in technology? And if they did, that their views would reflect standard controversies in the broader field, especially given enough time? Yes, this may be obvious. But within the limited scope of SPT over 30 years, it is easy to forget this. Philosophers, like all controversialists, get carried away by their arguments, and thus tend to focus just on the enemy in front of them. So keeping in mind a broad range of possibilities is a good suggestion.

But let's suppose that the skeptic is right, and philosophy of technology at least *ought* to reflect a broad range of controversies that have bedeviled philosophy since its beginnings in the West in ancient Greece. Setting aside the narrowness of some analytical philosophers in the twentieth century who would downplay the significance of any kind of philosophy they don't think meets their standards, *have philosophers of technology in the 30 years of SPT contributed anything really worthwhile either to academic philosophy in the broad sense or to society at large?*

1. I begin this look at the significance of issues with something academic, a look back at Joseph Margolis in Chapter 6. Margolis has had an interesting history in academic philosophy, taking on the biggest names in the business—Quine and Davidson and Putnam, as well as Rorty and Kuhn, not to mention Marx and Heidegger—doing so with an analytical style that, though dense, is always extremely well argued. His books come out with a regularity that is the envy of most academic philosophers, and from excellent presses. On the other hand, he has never received the recognition that he deserves. All that aside, his book on pragmatism (2002) is a tour-de-force, placing recent epistemological controversies in analytical philosophy in the widest (and deepest) possible context, while offering, for the future, an original way out of what he sees as the most profound dilemma lurking within these

controversies. But it was his contributions to SPT, summarized here in Chapter 6, which made clear beyond a doubt—to anyone who took the time to read them—that his solution is fundamentally *technological.* For Margolis, it is "the technological" in the human knower and what humans can know, that lets us see the shortcomings in the work of Putnam and Rorty and Bunge and Heidegger and Marx, as well as letting us see which insights from their works can contribute to a viable way out for the future. However difficult for the reader not expert in analytical philosophy to follow—and Margolis's style does make reading him difficult—here is surely a controversy in the philosophy of technology, from the earliest days of SPT, that ought to have captured the attention of even the most demanding analytical philosophers. I here count it as the *first significant controversy* within the scope of this book.

2. It is odd that Joe Pitt and his friends (Chapter 9) never referred to Margolis—indeed they also overlooked the even earlier work of Bunge—when they lamented the failures of SPT in its first decade. What Pitt says he wants (among other things) is a discussion of explanation in philosophy of technology to parallel those in philosophy of science. Well, it was there for him to see, in plain sight, in Margolis's contributions to SPT, and in Bunge's as well. (Overlooking Bunge—who in analytical circles at the time was considered to be *the* major figure doing philosophy of technology—is perhaps even more disconcerting than overlooking Margolis.) Is this just a matter of academic oversight, of being blinded in respect to the bigger picture by particular concerns? It might come as a surprise to some readers who have followed my essay all the way to this point, but I don't think Pitt was ignoring the obvious. He and his friends had a point.

3. And that brings me to what I consider the second *major controversy of wide interest* in my history of SPT. What Pitt and his friends in history and philosophy of science were concerned about was not the extent to which there was analytical philosophy in SPT, but the continued dominance in the society of what Mitcham (Chapter 1) calls "humanities philosophy of technology" in contrast to an engineering or technical approach. What Mitcham and others were saying is that no philosophy of technology is worth anything if it does not "take the measure" of technological culture as a whole. And this passion for a critique of technological culture did draw significant numbers of philosophers to

SPT; consider the contributions of Don Verene, echoing Jacques Ellul, in Chapter 16. In one sense this could be called just the mirror image of my first controversy—it might be said just to be the metaphysicians fighting back against the analysts. But as I see it, there is a bigger issue in play here—which I noted in particular in Chapter 16. It is the question whether or not metaphysical thinking of the traditional sort (that is, not counting so-called analytical metaphysics) continues to have any relevance in a technological culture. While Pitt and friends might hope it would just go away—might hope in particular that Heidegger and his disciples would just go away—the perennial relevance (or not) of traditional metaphysics is, and probably will continue to be, a major issue even in the most technologized of cultures.

4. There was still a third *major controversy* afoot in the earliest days of SPT. Our third president, and first woman president, Kristin Shrader-Frechette (see Chapter 3), started a trend in philosophy of technology that continues right down to the present. Her view amounted to a critique, simultaneously, of both the Heideggerians and those who had come to SPT from philosophy of science. Shrader-Frechette had worked for many years with technical commissions trying to control particular technologies (and not just nuclear technologies, as she was sometimes accused of); with respect to them, in book after book, she was a relentless critic of sloppy thinking, of masking pro-technology views behind a claim of value-free science (especially economics). At the same time, Shrader-Frechette was constantly challenging her fellow philosophers of technology to come down out of the clouds, to deal with technological regulators on their own turf and in ways they could understand. Nor was Shrader-Frechette alone within SPT in holding this view. Pitt often cites her as the exception to the rule when he calls for SPT philosophers to look at real-world efforts to control particular technologies rather than constantly talk about Technology with a capital T. But as we have seen—from Larry Hickman's pragmatism to that of Paul Thompson dealing with regulators of agricultural technologies, to philosophers of technology who joined forces with the environmental ethics movement, and even including the second of Pitt's pet hates, Langdon Winner—philosophers in SPT from the very beginning had wrestled with the problem of how to make philosophy relevant to the real world of controlling particular technologies in democratic ways. This continues to be a significant issue for philosophers, especially

environmental philosophers, where Shrader-Frechette has also directed much of her energy, and has been widely recognized as a leader in doing so.

5. This brings us to a second major oversight in Pitt's (Chapter 9) critiques of early philosophy of technology in SPT; I have in mind the work of Don Ihde (Chapter 10). Ihde had argued, simultaneously within and outside SPT, that there is another way of reading Heidegger—that fine-scale phenomenological analysis deserves a place alongside more standard analysis in academia. (Actually, Ihde thinks phenomenology is better than the standard mode of analysis dominant in the USA still today.) Pitt doesn't talk about this challenge to standard analytical approaches. Yet, in the mid 1980s this was a major issue in the American Philosophical Association (Mandt, 1986), and in the end Ihde and his fellow fighters for more openness won out. Analysis may still dominate in American philosophy, but other approaches—and not only phenomenology—have begun to be welcomed more every year, for example, at annual APA meetings from coast to coast. Still, there is *controversy* here, over what counts as academically acceptable philosophy. And the controversy in the larger discipline has played out, in almost exact parallel, within SPT.

6. When SPT began, there was a *major controversy* playing out in the broader culture, not only in the USA but worldwide, over the question whether our technosocial problems are or are not so fundamental that they require revolution rather than mere reform. The issue was broached most often by neo-Marxists of the New Left during the waning days of the Vietnam War, and it is reflected here in Chapters 4 (centered on the SPT presidency of Marx Wartofsky) and 12 (Andrew Feenberg). It might be thought that the end of the Cold War and the decline of Soviet Communism would have put an end, or at least dampened considerably the force of, this controversy. But Feenberg is by no means the only radical critic, inside or outside SPT, who believes that the battle has not been lost. Consider also Langdon Winner (Chapter 11), with his non-Marxist but still radical critique of technological developments, or even Albert Borgmann (Chapter 18), who views his neo-Heideggerianism as revolutionary. There is no doubt in my mind that this issue still has major salience, not least because it is so easy for Winner and Borgmann to get their work published. The same is true, to a lesser extent, for

Feenberg; and in Chapter 12 we have seen Feenberg ally himself with the radical feminist epistemology of Sandra Harding, who is more widely published than Borgmann or even Winner. The call for revolutionary thinking—along with opposition to it—is not likely ever to disappear in technological society.

7. Another peculiarity of the calls for a more respectably academic SPT brings up another major *controversy*. One of the biggest beneficiaries of the reform of the American Philosophical Association in the mid 1980s was American Pragmatism—in fact, traditional (non- or pre-analytical) American philosophy generally. The Society for the Advancement of American Philosophy grew almost in step with SPT, but its membership quickly outstripped ours many times over. It is now one of the most stable, and exciting, among many groups under the umbrella of the APA. When Larry Hickman (Chapter 14) became active in SPT, all the controversies that swirled around this revival (recall Margolis's critiques, in Chapter 6, of Dewey as epistemologically naive) were echoed within SPT. And Hickman took on his opponents, representing a good segment of the views represented in SPT (and others as well), with gusto. And, like Margolis, they fought back with equal force. This might seem to be a mere academic controversy, but in Hickman's view, following Dewey, it is a much larger issue—namely, of the enlistment of academics (not just philosophers) in the effort to improve our technosocial world, if not in radical, then at least in progressive ways. I would label this the controversy over the service dimension of academia, which has been with us since the formation of the American Association of University Professors (with support from Dewey).

8. In my contributions to SPT, I have pushed this service dimension even further (see Chapter 17, but also Chapter 14 on Hickman and Chapter 23 on Paul Thompson), urging philosophers, other academics, and technical professionals to join with activists to help bring about the social reforms called for in Dewey's Pragmatism. For me, this involves another important *issue*, whether the *professional* work of academics, including engineers and scientists and their professional societies, should include an activist dimension, or whether that should rather be considered to be something individuals do as citizens. This issue also comes up in Chapter 21 (Deborah Johnson), on engineering and computer ethics. It, fairly obviously, has connections with pragmatism (controversy 6 above)

as well as with calls for a more academically respectable SPT (Chapters 9, on Pitt, and 18, on calls for a new discipline of philosophy of technology using Borgmann's work as springboard); but in my mind this is not an academic issue. I think a democratic society has a right to expect its professionals to contribute to the improvement of society in more ways than just doing their jobs, however well. But I admit that this is a controversial point, even among social reformers.

9. Another issue I have been personally involved with in SPT has to do with the need for a philosophy of engineering as a significant (if not the most important) part of philosophy of technology. In that connection, I will merely remind the reader of Chapter 15, on philosophy of engineering, where a whole quadrant-like world of disagreements—exactly parallel to those in philosophy of technology more generally—can be found. In my mind, these are not just *academic issues.* For example, Steve Goldman's critical perspective on the "captive" character of engineering knowledge is intended to do more than just correct the naivete of philosophical characterizations of engineering as applied science; Goldman would clearly like to see engineers (and their managers) held more accountable for their deeds than they currently are. In that, he is very much like Sheldon Krimsky (Chapter 22), with his call for a Critical Technology Assessment of biotechnology.

10. Some might question whether controversies within and with respect to environmental ethics belong in this list—in spite of a series of joint panels at meetings sponsored by SPT and the International Society for Environmental Ethics (often promoted by Andrew Light). However, I see no reason to separate, here, SPT from ISEE controversies; they are all extremely important for contemporary society. In the text (Chapter 21), I talked about Baird Callicott's resistance to Light's environmental pragmatism. As I said there, the issue suggests a mild irony with respect to Light. On one hand, he pushes SPT (see Chapter 18) to become more academically respectable; on the other, he challenges Callicott as too academic, as too involved in theoretical debates to actually do anything to help solve urgent environmental problems in the real world. In part, this reprises earlier controversies (2, 3, and 7, in different ways). But this is a mere quibble by contrast with the major *environmental issues* our contemporary society faces—whether in terms of pressures to roll back environmental laws protecting the environment in the USA, global

issues such as climate change, or environmental degradation associated with world trade agreements (among many others). It seems to me that at least the SPT members who also work with ISEE have made significant contributions in this major controversial arena.

11. Chapter 24, on so-called quotidian technologies, raises many issues, but the principal one again has to do with academicism. There are echoes of issues 6 and 7, above, but what I would say here is that those philosophers in SPT who worry about everyday life in a technological or technoscientific world are deeply immersed in an age-old controversy over the standards to be used in evaluating any culture, including our own viewed from within. Dewey, in *The Quest for Certainty* and *Reconstruction in Philosophy*, takes on pretty much the entire history of Western philosophy. At least the anti-academics in SPT follow him in that. Collins dismisses this as out of the twentieth-century mainstream. And Margolis calls Dewey's early version of pragmatism naive.

12. Postmodernism and the social construction of technology in relation to SPT (Chapter 25) raise very similar issues; in my view, the main issue here is age-old, or at least as old as the rise of the universities in the West in the Middle Ages. It is the issue of the social contract—specifically the ever-changing *terms* of that social contract—between the broader culture and university culture. This issue echoes number 2, above, and it can be said to have been the core issue of SPT from the very beginning. That social constructionists have not appreciated the contributions of philosophy of technology generally, or SPT in particular, does not mean that they are right in their ignorance. (See Winner's controversy with social constructionists as reported in Chapter 25.)

13. Finally, it seems to me very significant that these controversies have salience all over the world, as illustrated here by the three national groups of philosophers with whom SPT has had the most contact—in Germany, the Netherlands, and Spain. (See Chapters 13 and 19.) Not only are these controversies worth getting involved in, as SPT members have from the beginning, but they have found others equally concerned wherever they have established institutional connections.

14. So for at least a dozen reasons, here summarized around a dozen important issues, I believe that philosophers in SPT have made important

contributions, not only to philosophy (in or outside academia) but to our contemporary world. This is, of course, just my personal opinion; but I said at the outset that what I offer here is an essay rather than the encyclopedic survey I originally set out to write.

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Stebbing, L. Susan. 1914. *Pragmatism and French Voluntarism*. Cambridge, UK: Cambridge University Press.

Stuhr, John J. 2000. *Pragmatism and Classical American Philosophy: Essential Readings and Interpretive Essays*. New York, NY: Oxford University Press.

West, Cornel. 1989. *The American Evasion of Philosophy: A Genealogy of Pragmatism*. Madison, WI: University of Wisconsin Press.

Chapter 7:

There are two volumes of essays in honor of Agassi, both edited by I.C. Jarvie and Nathaniel Laor in the Boston *Studies in the Philosophy of Science* series, vols. 161–162:

1995. Critical Rationalism, Metaphysics and Science. Dordrecht: Kluwer.

1995. Critical Rationalism, the Social Sciences and the Humanities. Dordrecht: Kluwer.

Books by Agassi in English that have some relevance to this chapter include:

1985. *Technology: Philosophical and Social Aspects*. Dordrecht, Netherlands: Reidel

1990. *Introduction to Philosophy: The Siblinghood of Humanity*. Delmar, NY: Caravan.

Also:

1966. "The Confusion between Science and Technology in the Standard Philosophies of Science." *Technology and Culture* 7:3 (July): 348–366.

See also:

Popper, Karl. 1945. *The Open Society and Its Enemies*. 2 vols. London, UK: Routledge.

_____. 1961. *The Poverty of Historicism*. 2nd ed. London, UK: Routledge.

Russell, Bertrand. 1959. *Common Sense and Nuclear Warfare*. New York, NY: Simon and Schuster.

_____. 2003. Man's Peril, 1954–56. Vol. 28 of Collected Papers. London, UK: Routledge.

On Pugwash, see their website: www.pugwash.org.

Chapter 8:

Edmund Byrne's publications include:

1990. *Work, Inc.: A Philosophical Inquiry*. Philadelphia, PA: Temple University Press.

1989. Edited with Joseph C. Pitt. *Technological Transformations*. Dordrecht, Netherlands: Kluwer.

1969. *Human Being and Being Human*. Englewood Cliffs, NJ: Prentice-Hall.

1968. *Probability and Opinion*. The Hague: Nijhoff.

1998. *Public Power, Private Interests: Where Do We Fit In?* AuthorHouse. Self-published.

The literature on work and justice that Byrne refers to, implicitly or explicitly, includes the following:

Barry, Brian. 1973. *The Liberal Theory of Justice*. Oxford, UK: Oxford University Press.

Brown, Alan. 1986. *Modern Political Philosophy: Theories of the Just Society*. New York, NY: Penguin.

Daniels, Norman, ed. 1974. *Reading Rawls*. New York, NY: Basic.

Huizinga, Johan. 1967. *Homo Ludens: A Study of the Play Element in Culture*. Boston, MA: Beacon.

Lichtenburg, Judith. 1984. "Workers, Owners and Factory Closings." *Report from the Center for*

Philosophy and Public Affairs (Fall), p. 12.

Narveson, Jan. 1989. *The Libertarian Idea*. Philadelphia, PA: Temple University Press.

Nozick, Robert. 1974. *Anarchy, State, and Utopia*. New York: Basic.

Rawls, John. 1971. *A Theory of Justice.* Cambridge, MA: Harvard University Press.

Sandel, Michael J. 1982. *Liberalism and the Limits of Justice*. Cambridge, MA: Cambridge University Press.

Sclove, Richard E. 1991. "The Nuts and Bolts of Democracy: Toward a Democratic Politics of Technological Design." In P. Durbin, ed., *Critical Perspectives on Nonacademic Science and Engineering.* Bethlehem, PA: Lehigh University Press. Pp. 239–262.

Solomon, Robert C., and Mark Murphy, eds. 2000. *What Is Justice? Classic and Contemporary Readings.* 2nd ed. New York, NY: Oxford University Press.

Terkel, Studs. 1972. *Working: People Talk about What They Do All Day and How They Feel about What They Do.* New York, NY: Random House.

Wolff, Robert Paul. 1977. *Understanding Rawls*. Princeton, NJ: Princeton University Press.

Chapter 9:

Joseph Pitt's books include a number of edited volumes:

1978. *New Perspective on Galileo.* Dordrecht, Netherlands: Reidel.

1985. *Change and Progress in Modern Science: 4th International Conference on the History and Philosophy of Science*. Dordrecht, Netherlands: Kluwer.

1987. Rational Changes in Science: Essays on Scientific Reasoning. Dordrecht, Netherlands: Kluwer.

1988. *Theories of Explanation*. New York, NY: Oxford University Press.

1989. With Edmund Byrne. *Technological Transformation*. Dordrecht, Netherlands: Kluwer.

1992. *Galileo, Human Knowledge, and the Book of Nature.* Dordrecht, Netherlands: Kluwer.

Also two of his own:

1981. *Pictures, Images, and Conceptual Change: An Analysis of Wilfred Sellars's Philosophy of Science*. Dordrecht, Netherlands: Reidel.

2000. *Thinking about Technology: Foundations of the Philosophy of Technology*. New York, NY: Seven Bridges.

And he is coeditor of:

2004. With Dhavad Saleh-Isfahani and Douglas Eckel. *The Production and Diffusion of Public Choice Political Economics: Reflections on the VPI Center*. Malden, MA: Blackwell.

Finally, I edited an author-critics number of *Techne*, the online journal of the Society for Philosophy and Technology, on Pitt's *Thinking about Technology*: 5:1, Fall 1999. See http://spt.org/journal.

Chapter 10:

Don Ihde's main works on philosophy of technology include:

1979. *Technics and Praxis*. Dordrecht, Netherlands: Reidel.

1983. *Existential Technics*. Albany, NY: State University of New York Press.

1990. *Technology and the Lifeworld: From Garden to Earth*. Bloomington, IN: Indiana University Press.

1993. *Philosophy of Technology: An Introduction*. New York, NY: Paragon House.

For a chapter on Ihde's philosophy of technology, see *Achterhuis* (2001), among the books in his series, below.

The ten volumes Ihde has included in his Indiana University Press series on the philosophy of technology to date:

Hickman, Larry. 1990. *John Dewey's Pragmatic Technology*.

Zimmerman, Michael E. 1990. *Heidegger's Confrontation with Modernity*.

Ihde, Don. 1990. *Technology and the Lifeworld.*

Ihde, Don. 1991. *Instrumental Realism.*

Crease, Robert P. 1993. *The Play of Nature: Experimentation as Performance*.

Feenberg, Andrew, ed. 1995. *Technology and the Politics of Knowledge.*

Hopkins, Patrick D., ed. 1999. *Sex/Machine: Readings in Culture, Gender, and Technology.*

Hickman, Larry. 2001. *Philosophical Tools for Technological Culture: Putting Pragmatism to Work.*

Achterhuis, Hans, ed. 2001. *American Philosophy of Technology: The Empirical Turn.*

Ihde, Don, and Evan Selinger, eds. 2003. *Chasing Technoscience: Matrix for Materiality*.

Chapter 11:

For background to this chapter, I chose Patrick Hamlett:

1992. *Understanding Technological Politics.* Englewood Cliffs, NJ: Prentice Hall.

Winner's book publications include:

1977. *Autonomous Technology: Technology-Out-of-Control in Political Thought*. Cambridge, MA: MIT Press.

1986. *The Whale and the Reactor: A Search for Limits in an Age of High Technology*. Chicago, IL: University of Chicago Press.

And as editor:

1992. *Democracy in a Technological Society*. Dordrecht, Netherlands: Kluwer.

Among his numerous other publications, Winner has attacked critics in the Social Construction of Technology school:

1993. "Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology." *Science, Technology, & Human Values* 18:3 (Summer): 362–378.

The article was originally Winner's presidential address at a conference of SPT, and can be found in:

J. Pitt and E. Lugo, eds., 1991. *The Technology of Discovery and the Discovery of Technology*. Blacksburg, VA: SPT.

And he has been attacked in return:

Aibar, Eduardo. 1995. "Technological Frames in a Town Planning Controversy: Why We Do Not Have to Drop Constructivism to Avoid Political Abstinence." *Research in Philosophy and Technology*, vol. 15. Greenwich, CT: JAI Press. Pp. 3–20.

_____. 1996. "The Evaluative Relevance of Social Studies of Technology." *Techne* 1:3–4. See http://spt.org/journal.

Woolgar, Steve. 1993. "What's at Stake in the Sociology of Technology? A Reply to Pinch and to Winner." *Science, Technology, & Human Values* 18:4 (Autumn): 523–529.

Chapter 12:

Andrew Feenberg's notes to his Harding review in *Science, Technology, & Human Values* (24:4, Autumn 1999: 483–494) offer the best set of references to his work and background. For

convenience, I have just left his own publications within his list.

Borgmann, Albert. 1984. *Technology and the Character of Contemporary Life*. Chicago, IL: University of Chicago Press.

Braverman, Harry. 1974. *Labor and Monopoly Capital*. New York, NY: Monthly Review Press.

Feenberg, Andrew. 1986. *Lukacs, Marx, and the Sources of Critical Theory*. New York, NY: Oxford University Press.

————. 1991. *Critical Theory of Technology*. New York, NY: Oxford University Press.

_____. 1995. *Alternative Modernity*. Berkeley, CA: University of California Press.

————. 1999. *Questioning Technology*. London, UK: Routledge & Kegan Paul.

Galison, Peter, and David Stump, eds. 1996. *The Disunity of Science*. Stanford, CA: Stanford University Press.

Goldmann, Lucien. 1973. *Lukacs et Heidegger*. Paris, France: Denoel/Gonthier.

Harding, Sandra. 1986. *The Science Question in Feminism*. Ithaca, NY: Cornell University Press.

————. 1991. *Whose Science? Whose Knowledge?* Ithaca, NY: Cornell University Press.

———. 1998. *Is Science Multicultural?* Bloomington, IN: Indiana University Press.

Hartsock, Nancy. 1983. "The Feminist Standpoint: Developing the Ground for a Specifically Feminist Historical Materialism." In *Discovering Reality*, edited by S. Harding and M. Hintikka. Dordrecht, Netherlands: Reidel.

Hirschhorn, Larry. 1988. *Beyond Mechanization*. Cambridge, MA: MIT Press.

Latour, Bruno. 1993. *We Have Never Been Modern*. Cambridge, MA: Harvard University Press.

Lukács, Georg. 1971. *History and Class Consciousness*. Cambridge, MA: MIT Press.

Marcuse, Herbert. 1964. *One-Dimensional Man*. Boston, MA: Beacon.

Noble, David. 1984. *Forces of Production*. New York, NY: Oxford University Press.

Pickering, Andrew. 1995. *The Mangle of Practice*. Chicago, IL: University of Chicago Press.

Sohn-Rethel, Alfred. 1978. *Intellectual and Manual Labour: A Critique of Epistemology*. London, UK: Macmillan.

Star, Susan Leigh. 1995. "The Politics of Formal Representations: Wizards, Gurus, and Organizational Complexity." In S. Star, ed., *Ecologies of Knowledge: Work and Politics*

in Science and Technology. Albany, NY: State University of New York Press.

Suchman, Lucy. 1987. *Plans and Situated Actions: The Problem of Human-Machine Communication*. Cambridge, UK: Cambridge University Press.

Winner, Langdon. 1986. *The Whale and the Reactor*. Chicago, IL: University of Chicago Press.

Also see:

Durbin, Paul T. 1994. "Toward Civilizational Change" [review of Feenberg's Critical Theory of Technology], in F. Ferre, ed., *Research in Philosophy and Technology*, vol. 14. Greenwich, CT: JAI Press. Pp. 290–293.

Light, Andrew. 1997. "Critical Theoriest of Technology: Feenberg on Marx and Democracy," in C. Mitcham, ed. *Research in Philosophy and Technology*, vol. 16. Greenwich, CT: JAI Press. Pp. 131–137.

Rothschild, Joan, ed. 1983. *Machina ex Dea: Feminist Perspectives on Technology*. New York, NY: Pergamon.

Wajcman, Judy. 1991. *Feminism Confronts Technology*. University Park, PA: Pennsylvania State University Press.

Chapter 13:

What follows is taken from the table of contents of the Techne (4:1–4 1997) version of the Karlsruhe 1997 conference proceedings (see http:// spt.org/journal); although I take it to be representative of the state of the art in Germany at the time, an international database would have to be searched to find books by the various authors to provide a proper set of references.

Part I:

Agazzi, Evandro (Fribourg), and Hans Lenk (Karlsruhe), "Advances in the Philosophy of Technology: Proceedings of a Meeting of the International Academy of the Philosophy of Science, Karlsruhe, Germany, May 1997; Introduction."

Hubner, Kurt (Kiel), "Philosophy of Modern Art and Philosophy of Technology."

Kornwachs, Klaus (Cottbus), "A Formal Theory of Technology?"

Lenk, Hans (Karlsruhe), "Advances in the Philosophy of Technology: New Structural Characteristics of Technologies."

Mainzer, Klaus (Augsburg), "Computer Technology and Evolution: From Artificial Intelligence to Artificial Life."

Part II:

Leiber, Theodor (Augsburg), "On the Impact of Deterministic Chaos on Modern Science and Philosophy of Science: Implications for the Philosophy of Technology?"

Poser, Hans (Technical U., Berlin), "On Structural Differences between Science and Engineering."

Schummer, Joachim (Karlsruhe), "Challenging Standard Distinctions between Science and Technology: The Case of Preparative Chemistry."

Part III:

Kanitscheider, Bernulf (Giessen), "Humans and Future Communication Systems."

Leidlmair, Karl (Innsbruck), "From the Philosophy of Technology to a Theory of Media."

Rammert, Werner (Free Univ., Berlin), "Relations that Constitute Technology and Media that Make a Difference: Toward a Social Pragmatic Theory of Technicization."

Rapp, Friedrich (Dortmund), "The Material and Cultural Aspects of Technology."

Ropohl, Gunther. (Frankfurt), "Philosophy of Socio-Technical Systems."

Tondl, Ladislav (Czech Academy), "Information and Systems Dimensions of Technological Artifacts."

Part IV:

Huning, Alois (Dusseldorf), "Preferences and Value Assessments in Cases of Decision under Risk."

Mohr, Hans (Stuttgart), "Technology Assessment in Theory and Practice."

Lenk, Hans (Karlsruhe), "Conclusion: Technological Responsibility and the Humanities; the University of Karlsruhe."

On Spain a more appropriate set of references can be culled from:

Mitcham, Carl. 1993. *Philosophy and Technology in Spanish Speaking Countries.* Dordrecht, Netherlands: Kluwer.

Mitcham lists the following Invescit-related books as representative of recent work in Spain. The same list appears in the text, but I think it should be repeated here:

Sanmartin, Jose. 1897. *Los nuevos redentores: Reflexiones sobre la ingenieria genetica, la sociobiologia y el mundo feliz que nos prometen* [The new redeemers: Reflections on genetic engineering, sociobiology, and the happy world they promise us]. Barcelona, Spain: Anthropos.

Mitcham, Carl. 1989. *Que es la filosofia de la tecnologia?* [What is the philosophy of

technology?]. Barcelona, Spain: Anthropos.

Vilanova, Santiago. 1988. *Chernobil: El fin del mito nuclear—El impacto informativo y biologico del mayor accidente de la industria electronuclear* [Chernobyl: The end of the nuclear myth—The information and biological impact of the great accident of the nuclear electric power industry]. Barcelona, Spain: Anthropos.

Lopez Cerezo, Jose Antonio, and Jose Luis Lujan Lopez. 1989. *El artefacto de la inteligencia: Una reflexion critica sobre el determinismo biologico de la inteligencia* [The artifact of intelligence: A critical reflection on the myth of the biological determination of intelligence]. Barcelona, Spain: Anthropos, 1989.

Andres Moya. 1989. *Sobre la estructura de la teoria de la evolucion* [On the structure of the theory of evolution]. Barcelona, Spain: Anthropos.

Medina, Manuel, and Jose Sanmartin, eds. 1990. *Ciencia, tecnologia y sociedad: Estudios interdisciplinares en la universidad, en la educacion y en la gestion publica* [Science, technology, and society: Interdisciplinary studies in the university, in education, and in public administration]. Barcelona, Spain: Anthropos.

Puig, Josep, and Joaquim Corominas. *La ruta de la energia* [Energy path]. Barcelona, Spain: Anthropos.

Sanmartin, Jose, Stephen H. Cutcliffe, Steven L. Goldman, and Manuel Medina, eds. 1992. *Estudios sobre sociedad y tecnologia* [Studies concerning society and technology]. Barcelona, Spain: Anthropos.

Ursua, Nicanor. 1993. *Cerebro y conocimiento: Un enfoque evolucionista* [Brain and knowledge: An evolutionist approach]. Barcelona, Spain: Anthropos.

Mitcham also mentions:

Quintanilla, Miguel Angel. 1989. *Tecnologia: Un enfoque filosofico.* Madrid, Spain: FUNDESCO.

Chapter 14:

For background, see:

Dewey, John. 1920. *Reconstruction in Philosophy*. New York, NY: Holt. Later editions 1948, 1957.

_____. 1925. *Experience and Nature*. Chicago, IL: Open Court.

_____. 1929. *The Quest for Certainty*. New York, NY: Minton, Balch.

_____. 1930. *Individualism, Old and New*. New York, NY: Minton, Balch.

_____. 1934. *A Common Faith*. New Haven, CT: Yale University Press.

_____. 1938. *Logic: The Theory of Inquiry*. New York, NY: Holt.

Mead, George Herbert. 1964. *Selected Writings*. Indianapolis, IN: Bobbs-Merrill.

Sleeper, Ralph. 1986. *The Necessity of Pragmatism: John Dewey's Conception of Philosophy*. New Haven, CT: Yale University Press.

Relative to Hickman himself, see:

Hickman, Larry A. 1990. *John Dewey's Pragmatic Technology*. Bloomington, IN: Indiana University Press.

_____. 2001. *Philosophical Tools for a Technological Culture: Putting Pragmatism to Work*. Bloomington, IN: Indiana University Press.

_____, ed. 1998. *Reading Dewey: Interpretations for a Postmodern Generation*. Bloomington, IN: Indiana University Press.

_____, and Thomas M. Alexander, eds. 1998. *The Essential Dewey*. 2 vols. Bloomington, IN: Indiana University Press.

In addition, I edited a special author/critics number on Philosophical Tools, in *Techne* 7:1 (Spring 2003); see http://spt.org/journal.

I also reviewed that book elsewhere; see:

Durbin, Paul T. 2004. "Book Review: Philosophical Tools for Technological Culture [Hickman] and American Philosophy of Technology [Achterhuis]." *Metaphilosophy*, 35:4 (July): 583–592.

Chapter 15:

For Mario Bunge's foundational view of technology, including engineering as applied science, see Chapter 5, above. What follow are the primary references in the text:

Cuevas Badallo, Ana. 2000. "Caracterizacion del conocimiento tecnologico y su desarrollo: Hacia un epistemologia de las ciencias ingenieriles." Doctoral thesis in the Department of Logic and Philosophy of Science, University of the Basque Country, San Sebastian, Spain.

_____. 2005. "The Many Faces of Science and Technology Relationships." *Essays in Philosophy* [online journal, Humboldt State University] 6:1 (January).

Dessauer, Friedrich. 1927. *Philosophie der Technik*. Bonn, Germany: F. Cohen.

_____. 1956. *Streit um die Technik. Frankfurt: J. Knecht*. Abridged version published by Herder, Freiburg, in 1959.

Durbin, Paul T., ed. 1991. Critical Perspectives on Nonacademic Science and Engineering. Bethlehem, PA: Lehigh University Press.

Florman, Samuel. 1976. *The Existential Pleasures of Engineering*. New York, NY: St. Martin's.

_____. 1981. *Blaming Technology: The Irrational Search for Scapegoats*. New York: St. Martin's.

Goldman, Steven L. 1987. "The History of Engineering Education: Perennial Issues in the Supply and Training of Talent." Available in MS from the National Technical Information Service (NTIS), Springfield, VA, but technically unpublished. A report prepared for the U.S. Congress Office of Technology Assessment. [Note: For Goldman's numerous citations, the MS must be consulted.]

Koen, Billy Vaughn. 1985. *Definition of the Engineering Method*. Washington, DC: American Society of Engineering Education.

_____. 1991. "The Engineering Method." In P. Durbin, ed., *Critical Perspectives on Nonacademic Science and Engineering*. Bethlehem, PA: Lehigh University Press. Pp. 33–59. This is an abbreviated version of the previous entry.

_____. 2003. *Discussion of the Method: Conducting the Engineering Approach to Problem Solving.* New York, NY: Oxford University Press.

Laymon, Ronald. 1991. "Idealizations and the Reliability of Dimensional Analysis." In P. Durbin, ed., *Critical Perspectives* (above). Pp. 146–180.

Noble, David F. 1979. *America by Design: Science, Technology and the Rise of Corporate Capitalism.* New York, NY: Knopf.

_____. 1984. *Forces of Production: A Social History of Industrial Automation*. New York, NY: Knopf. Paperback 1986, New York, NY: Oxford University Press.

Chapter 16:

For Donald Phillip Verene, see:

1997. *Philosophy and the Return to Self-Knowledge.* New Haven, CT: Yale University Press.

Also:

Glenn Magee, ed. 2002. *Philosophy and Culture: Essays in Honor of Donald Phillip Verene*. Charlottesville, VA: Philosophy Documentation Center.

For Frederick Ferre, there is a longer list of relevant books, plus one key article:

1988. *Philosophy of Technology*. Englewood Cliffs, NJ: Prentice-Hall. Second edition, University

of Georgia Press, 1995.

1996. *Being and Value: Toward a Constructive Postmodern Metaphysics*. Albany, NY: State University of New York Press.

1998. *Knowing and Value: Toward a Constructive Postmodern Epistemology*. Albany, NY: SUNY Press.

2001. *Living and Value: Toward a Constructive Postmodern Ethics*. Albany, NY: SUNY Press.

1995. "Philosophy and Technology after Twenty Years." *Techne* 1:1–2; see http://spt.org/journal.

Other pertinent references include:

Borgmann, Albert. 1984. *Technology and the Character of Contemporary Life: A Philosophical Inquiry*. Chicago, IL: University of Chicago Press.

Ellul, Jacques. 1964. *The Technological Society*. New York, NY: Knopf. French original 1954.

_____. 1980. *The Technological System.* New York, NY: Continuum. French original 1977.

Heidegger, Martin. 1977. *The Question Concerning Technology and Other Essays*. San Francisco, CA: Harper and Row.

Lovekin, David. 1990. *Technique, Discourse, and Consciousness*. Bethlehem, PA: Lehigh University Press.

Chapter 17:

Durbin, Paul. 1968. *Logic and Scientific Inquiry*. Milwaukee, WI: Bruce.

_____. 1968. *Philosophy of Science: An Introduction.* New York, NY: McGraw-Hill.

_____, ed. 1980, 1984. A Guide to the Culture of Science, Technology, and Medicine. New York, NY: Free Press.

_____, ed. 1991. *Critical Perspectives on Engineering and Science in R&D Settings*. Bethlehem, PA: Lehigh University Press.

_____. 1992. *Social Responsibility in Science, Technology, and Medicine.* Bethlehem, PA: Lehigh University Press.

_____. 1999. “In Defense of a Social-Work Philosophy of Technology." In C. Mitcham, ed., *Technology and Social Action*, volume 16 of *Research in Philosophy and Technology*. Greenwich, CT: JAI Press. The volume includes reactions and critiques.

_____. 2000. "SPT at the End of a Quarter Century: What Have We Accomplished?" *Techne* 5:2 (Winter): 1–12. See http://spt.org/journal.

_____. 2000. "Activist Philosophy of Technology: Essays 1989–1999." Available on Durbin website, www.udel.edu/Philosophy/pdurbin/Pub.html.

Chapter 18:

For Albert Borgmann, see:

1984. *Technology and the Character of Contemporary Life.* Chicago, IL: University of Chicago Press.

1992. *Crossing the Postmodern Divide.* Chicago, IL: University of Chicago Press.

1999. *Holding on to Reality: The Nature of Information at the Turn of the Millennium.* Chicago, IL: University of Chicago Press.

2000. "Reply to My Critics." In E. Higgs, A. Light, and D. Strong, eds., *Technology and the Good Life?* Chicago, IL: University of Chicago Press.

The Borgmann-based volume used in the text is:

Higgs, Eric, Andrew Light, and David Strong, eds. 2000. *Technology and the Good Life?* Chicago, IL: University of Chicago Press.

See also the special issue of *Techne*, edited by Phil Mullins, on Borgmann's *Holding on to Reality*: 6:1 (Fall 2002) at http://spt.org/journal.

Chapter 19:

The basic source for the text is:

Tijmes, Pieter. 1997. "Preface: Dutch Chandeliers of Philosophy of Technology." *Techne* 3:1 (Fall). Tijmes provides the summary of Dutch philosophy of technology that was used in the text; see http://spt.org/journal.

But see also:

Achterhuis, Hans, ed. 2001. *American Philosophy of Technology: The Empirical Turn.* Bloomington, IN: Indiana University Press.

Durbin, Paul T. 2004. "Book Review: Philosophical Tools for Technological Cultures [Hickman] and American Philosophy of Technology [Achterhuis]." *Metaphilosophy*. 35:4 (July): 583–592.

Verbeek Peter-Paul Verbeek. 2005. *What Things Do: Philosophical Reflections on Technology, Agency, and Design*. University Park, PA: Pennsylvania State University Press.

Chapter 20:

Baum, Robert J. 1980. *Ethics and Engineering Curricula*. Hastings-on-Hudson, NY: Hastings Center.

Chalk, Rosemary, Mark Frankel, and Sallie B. Chafer. 1980. *AAAS Professional Ethics Project: Professional Ethics Activities in the Scientific and Engineering Societies*. Washington, DC: American Association for the Advancement of Science.

Churchill, Larry. 1978. "The Role of the Stranger: The Ethicist in Professional Education." *Hastings Center Report*, 8:6:13–15.

Cranor, Carl F. 1992. *Regulating Toxic Substances: A Philosophy of Science and the Law*. New York, NY: Oxford University Press.

Durbin, Paul T. 1992. *Social Responsibility in Science, Technology, and Medicine*. Bethlehem, PA: Lehigh University Press.

_____. 1997. "Engineering Ethics and Social Responsibility: Reflections on Recent Developments in the USA." *Bulletin of Science, Technology and Society* 17: 2-3: 77–83.

Engelhardt, H. Tristram, Jr. 1986. *Foundations of Bioethics*. New York, NY: Oxford University Press.

_____. 1991. *Bioethics and Secular Humanism: The Search for a Common Morality*. London, UK: SCM Press, and Philadelphia, PA: Trinity Press.

Flores, Albert. 1977. "National Project on Engineering Ethics to Bring Together Engineers, Philosophers." *Professional Engineer* 47:8:26–29.

_____, ed. 1989. *Ethics and Risk Management*. Lanham, MD: University Press of America.

Harris, Charles E., Michael S. Pritchard, and Michael J. Rabins, eds. 2005. 3d ed. *Engineering Ethics: Concepts and Cases*. Belmont, CA: Thomson/Wadsworth.

Hollander, Rachelle. 1983. "Conference Report: Engineering Ethics." *Science, Technology, & Human Values* 8:1:25–29.

Jasanoff, Sheila. 1986. Risk Management and Political Culture: A Comparative Study of Science in the Policy Context. New York, NY: Sage.

Johnson, Deborah, ed. 1991. *Ethical Issues in Engineering*. Englewood Cliffs, NJ: Prentice Hall.

Layton, Edwin D. 1971. *The Revolt of the Engineers: Social Responsibility and the American Engineering Profession*. Cleveland, OH: Press of Case Western Reserve University.

Lenk, Hans, and Günter Ropohl, eds. 1987. *Technik und Ethik*. Stuttgart, Germany: Reclam.

Martin, Mike, and Roland Schinzinger. 1990. *Ethics in Engineering*. 2d ed. New York, NY:

McGraw-Hill.

Mitcham, Carl. 1992. *Engineering Ethics throughout the World: Introduction, Documentation, Commentary, and Bibliography*. University Park, PA: STS Press.

_____. 1991. "Engineering as Productive Activity: Philosophical Remarks." In P. Durbin, ed., *Critical Perspectives on Nonacademic Science and Engineering*. Bethlehem, PA: Lehigh University Press. Pp. 80–117.

Noble, David F. 1977. *America by Design: Science, Technology, and the Rise of Corporate Capital*. New York, NY: Knopf.

Shrader-Frechette, Kristin. 1991. *Risk and Rationality: Philosophical Foundations for Populist Reforms*. Berkeley, CA: University of California Press.

Winner, Langdon. 1990. "Engineering Ethics and Political Imagination." In P. Durbin, ed., *Broad and Narrow Interpretations of Philosophy of Technology*. Dordrecht, Netherlands: Kluwer. Pp. 53–64.

Chapter 21:

Andrew Light's books, some edited jointly with others, include:

1996. Ed. with Eric Katz. *Environmental Pragmatism*. London, UK: Routledge.

1997. *Space, Place, and Environmental Ethics*. Lanham, MD: Rowman & Littlefield.

1998. *Social Ecology after Bookchin*. New York, NY: Guilford.

2000. *Race, Class, and Community Identity*. Amherst, NY: Humanity Press.

2000. With Eric Higgs, and David Strong, eds. *Technology and the Good Life?* Chicago, IL: University of Chicago Press.

2000. *Beneath the Surface: Critical Essays on the Philosophy of Deep Ecology*. Cambridge, MA: MIT Press.

2003. *Environmental Ethics: An Anthology*. Malden, MA: Blackwell.

2003. *Moral and Political Reasoning in Environmental Practice*. Cambridge, MA: MIT Press.

2004. *Animal Pragmatism: Rethinking Human-Nonhuman Relationships*. Bloomington, IN: Indiana University Press.

On environmental ethics more generally than just the relation to technology:

Arnold, Ron. 1999. *Undue Influence: Wealthy Foundations, Grant-Driven Environmental Groups, and Zealous Bureaucrats That Control Your Future*. Bellevue, WA: Free Enterprise

Press.

Callicott, J. Baird. 2005. "Introduction" [to part 1, "Environmental Ethics". In Zimmerman et al., *Environmental Philosophy*, 4th ed. Upper Saddle River, NJ: Prentice Hall. Pp. 5–15.

_____. 1999. *Beyond the Land Ethic: More Essays in Environmental Philosophy*. Albany, NY: State University of New York Press.

Carson, Rachel. 1962. *Silent Spring*. Boston, MA: Houghton Mifflin.

Daly, Herman. 1993. *Valuing the Earth: Economics, Ecology, Ethics.* Cambridge, MA: MIT Press.

DesJardins, Joseph, ed. 1999. E*nvironmental Ethics: Concepts, Policy, Theory*. Mountain View, CA: Mayfield.

Dewey, John. 1929. *The Quest for Certainty*. New York, NY: Minton, Balch.

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