4

John Dewey as a Philosopher of Technology

Larry Hickman

The reigning historian of the philosophy of technology, Carl Mitcham, has written that the first publication in the field was Friedrich Dessauer's *Philosophie der Technik*, published in 1927.[1] That year also marked the appearance of Martin Heidegger's *Sein und Zeit* (*Being and Time*), which is widely accepted as the first major contribution to the field. Works on the subject by Ernst Jünger in 1932 and by José Ortega y Gasset in 1939 quickly followed.

Until recently, however, no one seemed to notice that American philosophy, or more specifically classical American pragmatism, had also made a solid contribution to the field.[2] I have argued that John Dewey's treatments of education, aesthetics, social and political philosophy, logic, and the philosophy of nature should also be read as contributions to a cultural critique of technology.[3] Some twenty years prior to the publication of the works of Dessauer and Heidegger, Dewey was already writing about a whole range of topics that today are considered central concerns within the philosophy of technology. Later, Dewey's books *Essays in Experimental Logic* (1916), *Experience and Nature* (1925), and *Art as Experience* (1934) all contained incisive critiques of technological culture.

To put this matter in perspective, it may help to recall that Dewey was born in 1859, the year of America's first successful oil well in Titusville, Pennsylvania, and the publication of Darwin's *Origin of Species*. He died in 1952, the year of the first hydrogen bomb test and the first mass marketing of the birth control pill. Dewey's ninety-two years thus spanned two major technological revolutions in America. At the time of his birth, America's economy was based to a great extent on wind, water, and wood. As he grew to maturity, he observed the shift to an economy of steel, coal, and steam. At the time of his death, America had entered the age of synthetics, electronics, and nuclear energy. The post-industrial society in which we now live was already present in rudimentary form.

I draw attention to these details because Dewey's work as philosopher of technology is of more than just historical interest. His analysis of human experience as transactional with, and within, its various overlapping contexts holds the promise of stimulating new ways of thinking about many of the concerns—especially the ones that involve our environment—that have only recently received the attention of professional philosophers.

The key to understanding Dewey's work as a contribution to the philosophy of technology is, I suggest, an appreciation of his contention that all inquiry or deliberation that involves tools

and artifacts, whether those tools and artifacts be abstract or concrete, tangible or intangible, should be viewed as instrumental: in other words, as a form of technology. In short, he understood that technology involves more than just tangible tools, machines, and factories. It also involves the abstract thought and cultural practices that provide the contexts for such things and make them possible. His view of this matter was based upon his broad characterization of technology, which served as the basis for the functional taxonomy of types of activity that I developed earlier and that may also be formulated as the *invention, development, and cognitive deployment of tools and other artifacts, brought to bear on raw materials and intermediate stock parts, with a view to the resolution of perceived problems*.[4]

This is my gloss on thousands of words that Dewey devoted to his characterization of technology. It is also quite close to his statement, provided as the epigraph to this chapter, that "technology" signifies all the intelligent techniques by which the energies of nature and man are directed and used in satisfaction of human needs; it cannot be limited to a few outer and comparatively mechanical forms. In the face of its possibilities, the traditional conception of experience is obsolete" (LW.5.270).

It might be objected that this characterization begs the question by identifying technology with "intelligent techniques." But what Dewey in fact accomplished by putting matters as he did was the very distinction between technology and technique that I attempted to work out earlier. He was also distinguishing between cases in which it appears that technology is being done but in which in fact something else, such as economic self-interest, has intervened. On this radical view, when such interventions occur, it is intelligence itself that suffers. I shall later discuss the factors that led to the resurgence of rubella as a public health problem in the 1980s as an example of just such a failure of intelligence.

Dewey's view of these matters constitutes a radical departure from the epistemology of the modern period of philosophy. At least since Descartes it had been generally accepted that the central problem of epistemology was the problem of skepticism: how is it that we can have certain or reliable knowledge of the world? Although the story of modern epistemology is long and complex, certain of its features stand out in high profile. As Descartes and other modern philosophers attempted to move out from under the influence of medieval scholastic thought, they faced the difficulty of constructing a foundation for science that offered the same level of certitude that scholasticism had claimed. Since their move was toward naturalism, however, they were obligated to locate certitude within nature, as opposed to the supernatural.

The best recourse seemed to Descartes and others to treat certainty as knowledge possessed by an *individual thinking mind*. Modern theories of knowledge and belief were thus designed to find ways of depicting states of affairs in a world that was assumed to exist separately from a thinking mind, and this in a way that would ensure that such depictions were reliable.

Like the late-nineteenth-century photographers who attempted to get ever better emulsions for ever more accurate photographs of a world outside and independent of their cameras, these epistemologists were attempting to get ever more accurate mental representations of a world that they thought was outside and independent of their minds. They characterized that world not just as independent of mind, but also as whatever it was without respect to whether or not it would ever be known by an individual mind. Now, some 350 years later, some epistemologists and philosophers of science are still doing this.

Dewey thought that this "picture theory" or "spectator theory" or knowledge was deeply flawed. He reasoned that knowing is not just the capturing of a picture or impression, but an active and experimental involvement of an entire organism (not just a "thinking substance" or even a brain) with the raw materials of its experience in such a manner that tools—including habits and concepts, for example—are brought to bear on those materials and new products are formed. And

he thought that the point of making these new products was not to take a more accurate picture representation of what was or had been the case (an external "state of affairs"), but rather to deal with felt problems and difficulties in ways that effected their resolution. He thought that inquiry is always launched for the sake of resolving some specific felt difficulty. When inquiry is successful, he argued, it produces a new product—a new outcome.

For Dewey there is no such thing as knowledge in general, but the production of new knowledge in specific cases, ranging from the most quotidian to the most abstract, involves technology just as surely as cases of problem-solving in chemical engineering. This is because we live forward in time in a world that is perilous at best and in continual need of being "tuned up." We have to keep turning out new knowledge-products, including new tools and methods, if we are to convert conditions that range all the way from what is merely irritating to what is life-threatening into situations that are stable, harmonious, and more nearly what we wish them to be.

For Dewey, therefore, one of the most important concerns of philosophy was not so much epistemology, or the attempt to deal with the problem of skepticism, but logic, or the theory of inquiry. Inquiry, he once wrote, is not so much a matter of "grasping antecedently given sureties" as it is a matter of experimentation, or "making sure" (LW.1.123).

Unlike modernist epistemology, Dewey's notion of inquiry emphasizes the use of raw materials and the tools that have been designed for the refinement of those materials. It also involves other tools whose purpose it is to refine and reconstruct tools that already exist, but that are simpler and more primitive. Inquiry also requires the production and stockpiling of intermediate parts, among which are relatively secure concepts and objects. The end or goal of inquiry is products that can be said to be finished in a relative sense of that term, that is, satisfactory until they are challenged by further experience and demonstrated to be in need of reworking or reconstruction.

It was by means of this view of the instrumental or productive role and function of inquiry in human experience that Dewey avoided the problems that had vitiated the work of many of his predecessors. His view avoids the problems of the empiricism advanced by John Locke, for example, since the central place that his instrumentalism gives to production allows it to undercut both the sensory atomism and the associationism on which such empiricism depends. The problem with putative sensory atoms, Dewey argued, is that they are not primitive at all. They are the products of reflection. And the problem with associationism is that its associations tend to be arbitrary if they are based on nothing more than an arrangement of sensory atoms.

His view avoids the difficulties of Cartesian rationalism, moreover, by treating productive inquiry as a public, observable enterprise that takes place within a community, and not as something that takes place within private, non-extended, albeit reified mind. Dewey called inquiry "an outdoor fact," and thought it no less natural and observable than activities such as chewing or walking.

It also avoids the pitfalls generated by the Kantian treatment of knowledge, especially the view that perceptual and conceptual contents have different origins, by treating perceptual and conceptual materials as functional aspects of ongoing inquiry, even as different portions or aspects of judgments. In Dewey's view, the perceptual is concerned with marking out and locating a problem in inquiry, whereas the conceptual is concerned with setting out possible methods of solution. That both types of materials function correlatively within organized inquiry is apparent from the structure of judgments, whose subjects, Dewey pointed out, tend to be perceptual and whose predicates tend to be conceptual.

Dewey worked out his extended technological metaphor for inquiry at great length in the introduction to his 1916 *Essays in Experimental Logic*. That essay is pervaded by technological figures. Here is a typical example:

> Hence, while all meanings are derived from things which antedate suggestion or thinking or "consciousness"—not all qualities are equally fitted to be meanings of a wide efficiency, and it is a work of art to select the proper qualities for doing the work. This corresponds to the working over of raw material into an effective tool. A spade or a watch-spring is made out of antecedent material, but does not pre-exist as a ready-made tool; and the more delicate and complicated the work which it has to do, the more art intervenes. (MW.10.354)

In the same essay Dewey asserted that "there is no problem of why and how the plow fits, or applies to, the garden, or the watch-spring to time-keeping. They were made for those respective purposes; the question is how well they do their work, and how they can be reshaped to do it better" (MW.10.354–55).

This passage contains several points that are important to the issue at hand, namely the relevance of philosophy as a tool for tuning up technological culture.

First, Dewey wanted to demystify those entities traditionally called "logical objects," "essences," and "ideals," by taking them out of the psychical or meta-physical realms they had occupied in the works of Plato and Frege, for example, and by treating them as so many tools in a toolbox. These tools include logical connectives and numbers, abstract terms such as "democracy," and essences such as "the family."[5] When it is understood that these entities are tools and the products of tools, then it will also be understood that they are open to reconstruction and reconfiguration. They will not be honored as essences that are deemed to be fixed and finished for all time.

Since Dewey's program is radical, its application would involve certain casualties. Among the big losers, to name just a few examples, would be Platonism in mathematics and the doctrine of original intent in constitutional law. This is because each of these positions, as it is usually articulated, depends upon the premise that its respective essence or ideal is absolute and fixed, and not instrumental and consequently in need of continuing reconstruction as circumstances dictate.

So Dewey argued that essences and ideals should be treated not as absolute and fixed, but instead as just more artifacts, constructed not so much *by* inquiry as arising *from* inquiry. They are not found within a chain of inference, but are instead the by-products of inference. In this way they are like agricultural implements that are developed and improved not as a direct consequence of farming but incidentally, as the by-products of tilling, planting, and harvesting.

In all this Dewey was developing a metaphor that would allow him to bring the various types of inquiry we term "successful" under one general formula. He worked out what was already implicit in the work of his fellow pragmatists Charles Sanders Peirce and William James. For those philosophers, all successful inquiry is productive of new outcomes that are more secure than the situations that occasioned the inquiry that produced them. This is true in the sciences, in the arts, in engineering, in agriculture, and in quotidian or everyday enterprises as well.

As Dewey argued in his 1938 *Logic*, the subject matter and the specific tactical methods of inquiry may be, and most likely are, different from one of these enterprises to the next; but each enterprise nevertheless participates within a more general strategic form of inquiry that he called the "general method of intelligence." Because his root metaphor was technological, however, Dewey was able to do explicitly what Peirce and James had done only implicitly. He was able, for example, to reconstruct the important categories of human activity traditionally termed "theory," "practice," and "production."

He did this by reconstructing the Aristotelian hierarchy of types of knowledge. Aristotle had lived in a world in which science was still only empirical and not yet experimental. In other words, Aristotle's science was observational, and not yet instrumental. Instrumentation was not yet viewed as an essential ingredient in science, nor as a source of insights into the pattern of successful inquiry. Aristotle therefore held theory, or contemplation, to be the highest form of knowledge and as such he regarded it as superior to practice, which he in turn regarded superior to production.

But because Dewey's emphasis was on the production of successful outcomes as the end of inquiry, he treated theory and practice as component parts within inquiry and as instruments for further production. He did not completely invert the Aristotelian schema, however, since he regarded theory and practice as phases of inquiry, whose outcome is the production of something new. In Dewey's view, theory and practice must cooperate if there is to be success in the production of new knowledge.

THREE OBJECTIONS

In talking to people about Dewey's program for tuning up our technological culture as I have sought to articulate it, several objections have been raised. I believe that they are based on misunderstandings not just of Dewey's critique of technology, but also of the problems and possibilities of our technological culture.

1) Some have claimed that it is an exaggeration to say that philosophical inquiry *is* a form of technology—an instrumentality—for the transformation of our technological culture. This objection seems to reflect the traditional view that philosophy has its own areas of interest, that technology has its own concrete areas of interest, and that despite some occasional areas of overlap, the two activities are fundamentally separate. What has philosophy got to do with the space program or the construction of bridges? The former has to do with human values, and the latter has to do with instrumental rationality.

A version of this view has been advanced by Jürgen Habermas, for example, who has tended to drive a wedge between what he has called the "knowledge constitutive interests" of science and technology on the one hand and the "communicative" and "emancipatory" interests of the human sciences on the other. Put more simply, this is the old "fact-value" split that was lamented by C. P. Snow in *The Two Cultures*.[6]

There are three things I want to say in response to this. First, one of Dewey's great insights was that philosophy has a special kind of productive function, since philosophy is a kind of general "liaison officer," as he put it, "making reciprocally intelligible voices speaking provincial tongues, and thereby enlarging as well as rectifying the meanings with which they are charged" (LW.1.306). In other words, philosophy can serve as a kind of translator that helps the various arts, sciences, engineering, and agriculture continue their discussions with one another. Just as philosophers of science help scientists within different disciplines talk to one another and learn from one another's methods, philosophers as critics of technological culture are in a position to perform this function on a more inclusive scale.

There are several very good reasons why it is up to philosophy to perform this task. As I have already indicated, philosophy contains as one of its parts logic, or the theory of the most general patterns of inquiry. And whereas inquiry within computer aesthetics and inquiry within materials science have different subject matters and different tactical methods, each contributes to and in turn receives the contributions of more general strategic methods of inquiry. Logic, as the theory of this general method of inquiry, serves as a facilitator.

Second, philosophy also involves metaphysics, which Dewey reconstructed as "a statement of the generic traits manifested by existence of all kinds without regard to their differentiation into physical and mental" (LW.1.308). "Any theory," he wrote, "that detects and defines these traits is therefore but a ground-map of the province of criticism, establishing base lines to be employed in more intricate triangulations (LW.1.309). For Dewey, metaphysics is anything but arcane: it has a connection to the objective world. The importance of the generic traits, he wrote, "lies in their application in the conduct of life: that is, in their *moral* bearing provided *moral* be taken in its basic

broad human sense" (LW.16.389). In short, philosophers at their best are not only involved in a criticism of culture, but, because the process is self-correcting, they are also involved in a criticism of criticisms of culture as well.

The material just quoted comes from well-known passages from Dewey's great book *Experience and Nature*. I therefore find it remarkable that several generations of philosophers could have read them without grasping their implications for technological culture.

Third, as I have already indicated, philosophy as a critique of technology does not honor the traditional dualisms of body and mind, tangible and intangible, concrete and abstract, except as they are required as tools of inquiry. The general pattern of inquiry, as laid out by Dewey in his numerous books and essays on logic, is a technological enterprise precisely because it utilizes raw materials upon which tools are brought to bear in a cognitive fashion in order to produce novel artifacts, namely situations that are determined to be more desirable than the ones with which it started.

But this general pattern applies to inquiry of all types, whether the primary focus is that part of our experience we call tangible or that other portion we call the intangible. In other words, this general pattern of inquiry fits cases that involve what we would call hardware, and it also fits cases that are patently conceptual. It applies to descriptions of how manufacturers proceed from iron ore and coal to intermediate and finished steel products, and it applies to descriptions of how writers move from the raw materials of their experiences and research interests to working drafts and thence to finished works of fiction and nonfiction. It applies to the construction of logical and mathematical proofs, and it applies in social and political inquiry.

This concern with the means and ends involved in the production of novel artifacts seems to me to be one of the most important of Dewey's insights about technology. Whenever and wherever techniques of production and construction are utilized, no matter whether the sphere is conceptual or material, there is, in Dewey's view, productive work being done. This is why Dewey regarded the public, or better yet, the many publics that make up what we normally call "the public," as products. They are created as responses to issues of common interest, and their members seek to secure the ends-in-view that they hold in common. It is hardly a secret that billions of dollars are spent each year, from Madison Avenue to Pennsylvania Avenue, to create, manage, and reconstruct such publics precisely as artifacts.

2) A second objection comes from people who are interested in the arts. A colleague once objected that it is a mistake to say that a writer at work on a novel is doing anything "technological." There is in back of this second objection, I think, just the same confusion of terms that plagued Dewey during his long career. When I call writing a novel a problem-solving or technological activity I mean only that there is inquiry going forward and that it is technological because just as in other types of inquiry there are raw materials, there are tolls that are deliberately or cognitively deployed and further refined for tasks at hand, there are artifacts produced, and those artifacts are the responses to perceived goals as those goals are themselves developed and refined during the course of inquiry.

Applied to the work of the novelist the pattern is clear. The raw materials are the experiences of the novelist and the experiences of others that she has at second hand. But the novelist doesn't utilize *all* her experiences, and so there is involved a process of abstraction, selection, and reconfiguration. Dewey thought that this happens in all types of inquiry. As a goal or procedure is set up to solve some problem, in this case the writing of a novel, some things are taken as the facts of the case. Then they are weighed, tested, tried, and refined, all with respect to the task at hand. During this process, the task itself is usually modified. This calls for a reevaluation of what have been taken as the facts of the case. Some formerly pertinent data are discarded; other data are seen for the first time to be relevant.

In the case of writing a novel, characters emerge and are developed, plots thicken and then thin again, and there is the production of a new artifact: a novel. (Beyond that, the novel takes its place as an artifact that is used in the construction of further products or artifacts: various publics that will be motivated to purchase the novel, as well as the lives that will be altered as a consequence of reading it.)

Although there is a confusion of terms present in this objection, I believe that there is something else as well. The objection betrays a concern that the "fine" arts be held in higher esteem—or at least a different kind of esteem—than those that are "merely technological." But to treat the fine arts in this manner is to cut short their full reach as instrumental to an enhanced appreciation of the materials with which they are concerned.

Another variety of this type of objection might take the following form: if writing a novel in fact falls under the definition of technology as it has been advanced (namely, *the invention, development, and cognitive development of tools and artifacts brought to bear on raw materials and intermediate stock parts, with a view to the resolution of perceived problems*), then why shouldn't the editors of a journal of automotive engineering accept for publication an essay on literary criticism? Writing novels and designing automobiles are, after all, both forms of technology.

This objection misses the point on two counts. First, even if we were to employ the popular and uncritical notion of technology as having exclusively to do with material culture, we still would not expect the editors of the journal of automotive engineering to publish essays on hydrology or coal research. Although both disciplines fit the common definition of technology, their practitioners have different interests and ends-in-view. Second, it might in fact be appropriate under certain circumstances for the editors of the automotive engineering journal to publish a literary-essay that explores some aspect of automobiled life in a way that would inform and expand the horizon of automotive engineers. To deny this would be to honor the "fact-value" split about which Dewey continually complained, and which has retarded the resolution of many of our most pressing social problems.

Dewey took a significant risk when he reconstructed the term "technology" in the way that I have described. He took the risk that he would be labeled an uncritical follower of what some have termed "Enlightenment rationality." He also took the risk that he would be thought to have attempted a reduction of all human cognitive activity to one grey, amorphous discipline. But he seems to have thought the risk worth taking since the perceived benefits were so great. Repairing the old fact-value, technology-culture split was one such benefit. And naturalizing technology was another.

3) A third and related objection is that if we treat technology as inclusive of conceptual tools and artifacts as well as those that are tangible and material, then we have just taken technology so broadly that *everything* is included. Drawing the net of this objection somewhat more tightly than Carl Mitcham's articulation of it, however, the intuition is that we must reserve the term technology for operations with hardware, or perhaps also for the kind of software that can be held in the hand, or put on a bookshelf, or loaded in a computer, so that we can differentiate what happens in those regions from what happens in religion or poetry, for example. The idea behind this objection is that religion and poetry are "spiritual," whereas technology is not.

As I hope to have demonstrated, what is strictly technological—what involves inquiry into technique, tools, and artifacts—constitutes but a small part of the experience of most people. That portion or phase of experience that I called "technical" is a much larger part, to be sure; but the most prevalent feature of experience is what is immediate, that is *non-cognitive and non-instrumental* organic. This is a far cry from "just turning everything into technology."[7] But because the misunderstanding has been so profound, perhaps more needs to be said.

First, I believe that this objection rests on an explicit ontological dualism that is itself unten-

able. If what is "spiritual" is of value, then it would seem worthwhile to find ways of allowing it to penetrate all of our experiences. And if "technology" fails to be "spiritual," then its development has somewhat been cut short. Dewey rejected dualities of this type because he thought that they "formulated recognition of an impasse in life; an impotence in interaction, inability to make effective transition, limitation of power to regulate and thereby to understand" (LW.1.186).

Second, we cannot identify the technological with the cognitive *as such*, since there is cognitive work that does not involve tools except in a highly attenuated and analogous sense of the term. In retrospect, anthropologists may wish to speak metaphorically of the opposed thumb as a tool that the higher primates used to make the transition from savanna to forest. But the notion of an organic structure as tool is parasitic on the notion of extra-organic structure as tool. To reverse the relation would be anachronistic.

Nevertheless, once we begin to reflect on the ways in which tools are invented, developed, and utilized, it is possible to read the script forward in such a way that mathematical and logical objects, for example, are accepted as legitimate cases of tools. When this occurs, then the last nail goes into the coffin of Platonism. These are more or less the conclusions that Dewey reached during his decade at the University of Chicago, 1894–1904, and that formed the core of his productive pragmatism.[8]

Third, whether or not we use the term "spiritual" to designate religious practice, the undeniable fact is that religions, too, utilize tools, instruments, and artifacts of various types to effect their chosen ends. The leaders of the Roman Catholic Church long ago understood the importance of relics, the bread and wine of the Eucharist, incense, gilded altars, and other material artifacts, together with certain techniques such as the confession, as tools that could be used for the maintenance and enlargement of a believing public. Moreover, the cases in which the Church has retarded or rejected the advances of science in the name of what is "spiritual" have represented some of its greatest embarrassments. The case of Galileo, who was finally pardoned in 1992, some 359 years after being condemned as a heretic, is but one example of this phenomenon.

FOUR ADVANTAGES

I believe that there are several advantages of thinking about philosophy in the sense in which Dewey understood it, and as I have tried to expand upon that understanding, that is, as a tool for tuning up technology. I shall discuss four of these advantages. The first is what I shall call the *felicities of genetic analysis*; the second is the enormous *ecological power* gained by treating human technological activity as continuous with other natural activities; the third is that we get *off the foundationalist hook*; and the fourth is that we are able to generate *stable platforms for social action*.

1) First, this broad view of philosophy as criticism of technology opens up a whole new area of inquiry, namely the genetic analysis of conceptual tools. Just as there is a vestige in the modern plow of the bent stick, there is a vestige in the square root of minus one of the marks made on the wall of an ancient shepherd's fold in order to compare the number of outgoing sheep in the morning to the number of incoming sheep in the evening. And it is hardly surprising that organisms with ten fingers, counting thumbs, would operate in much of the world with number systems of base ten.[9]

This genetic approach to technology rejects the claims of scientific realism, namely that there is a prefigured reality "out there" waiting to be discovered, just as it is, in and of itself, apart from any contribution on the part of inquiry. It argues instead that the conceptual tools of science, including those we call scientific laws, are constructed, but not that they are constructed out of nothing.

When they are sophisticated and complex, they are constructed out of tools and intermediate stock parts that are already on hand. In some cases, such as in mathematics, they are primarily relations of relations, or abstractions of abstractions. And the most primitive of such tools are constructed out of the rawest of raw empirical materials, namely, felt needs and desires and flashes of insight or accident.

Why is this felicitous? Because it helps get philosophy out of the box it has often found itself in during its long career and out into the world of human affairs where it can do the work of criticism and reconstruction. It helps philosophy to link up with disciplines such as sociology, anthropology, archeology, and paleontology and thereby to focus its considerable energies upon real problems. It is also felicitous because it helps us get out from under the positivist-scientistic burden, the one that claims that the methods of the physical sciences provide "master narratives" that are somehow independent of such histories.

2) A second advantage of the view I am advancing is that it leads us to look for continuities between the adjustive activities of human beings and the adjustive activities of other natural organisms. This has profound consequences for environmental philosophy. Technology "naturalized" as I have described it, as inquiry into the techniques that human beings utilize to accommodate themselves to their environments and to alter those environments to their needs, functions as a kind of linkage or bridge to similar activities undertaken by higher primates, and even by "lower" non-human animals. It is not something above or apart from nature, but rather the cutting edge of evolutionary development.

I wish I could report that this last point is a minor one and that it has little import for the future of technoscientific education. James Moore, one of the team that worked with Martin Marty and R. Scott Appleby on the "Fundamentalisms" project, reported that by 1984 the Institute for Creation Research had a mailing list of some 75,000, an annual budget of $1.2 million, and a publication list of some fifty-five books that together had sold over one million copies.[10] As later as 1993, one of the largest technical universities in the United States, on whose faculty I was employed for two decades, still had engineering faculty who publicly defended "creation science," thus denying the type of continuity thesis that I have just put forward. In its place they argued for a strong version of supernaturalism that cuts technology off from its roots in the evolution of non-human nature. It is difficult to determine how successful these engineers were in moving their students to accept their arguments, but when the campus newspaper polled students regarding which one book they would choose to have with them in the event of a major disaster that destroyed their civilization, the majority of those polled chose the Bible over other presumably more practical tomes such as *The Foxfire Book*.[11]

This point directly addresses a different sort of objection, namely that if we treat philosophy as a tool for tuning up technological culture, as Dewey recommended that we do, then we have thereby become too preoccupied with one kind of philosophical activity, namely the type that is designed to alter the physical environment, at the expense of another kind of philosophical activity, namely the one by means of which we accommodate ourselves to our environments by means of certain "spiritual" exercises. This is similar to a charge that was brought against Dewey by first-generation critical theorists and others during his lifetime, and it is a charge that is still advanced against him during our own time. Put succinctly, it is that Dewey was a latter-day proponent of "Enlightenment rationality" who urged the domination of nature, and who ignored "spiritual" values or thought them nothing more than impediments to greater levels of efficiency.

It is correct to say that an awareness of this split between what have been called "technologies of environmental domination" and what some have called "technologies of the self" is important for understanding the history of technology, as well as the history of the philosophy of technology. But this is also a point on which Dewey's critics have profoundly misunderstood his work.

The fact is that we can identify two poles or dimensions *within* human experience. One is concerned with the alteration of circumstances that are relatively external to us, organically speaking. Another is the pole that is primarily concerned with the accommodation of ourselves as organisms to such circumstances. Although the first of these poles has sometimes been characterized as the domination of nature, it has also been characterized in some technophobic circles as "technology" *simpliciter*. Because Dewey lived in the wake of Darwin, however, and because he was interested in constructing a new form of naturalism that would take into account continuities within nature, he looked for a way to define technology with sufficient breadth that it could include this second pole of experience. This second pole has been the concern of thinkers such as Max Scheler and Michel Foucault, and it has been advanced in some strains of Buddhism. It also had an important place in Dewey's thinking.

In the first few pages of his 1934 book, *A Common Faith*, Dewey made this point clear. It is significant that such a clear statement of the matter appears in Dewey's only book on the philosophy of religious experience. Here is Dewey's remark:

> While the words "accommodation," "adaptation," and "adjustment" are frequently employed as synonyms, attitudes exist that are so different that for the sake of clear thought they should be discriminated. There are conditions we meet that cannot be changed. If they are particular and limited, we modify our own particular attitudes in accordance with them. Thus we accommodate ourselves to changes in weather, to alterations in income when we have no other recourse. When the external conditions are lasting we become inured, habituated. . . . The two main traits of this attitude, which I should like to call accommodation, are that it affects *particular* modes of conduct, not the entire self, and that the process is mainly *passive*. It may, however, become general and then it becomes fatalistic resignation or submission. There are other attitudes toward the environment that are also particular but that are more active. . . . Instead of accommodating ourselves to conditions, we modify conditions so that they will be accommodated to our wants and purposes. This process may be called adaptation.
>
> Now both of these processes are often called by the more general name of adjustment. But there are also changes in ourselves in relation to the world in which we live that are much more inclusive and deep seated. They relate not to this and that want in relation to this and that condition of our surroundings, but pertain to our being in its entirety. Because of their scope, this modification of ourselves is enduring. . . . It is a change *of* will conceived as the organic plenitude of our being, rather than any special change *in* will. (LW.9.12–13)

In this passage Dewey deftly undercuts the traditional philosophical problem of the inner and the outer, the mental and the physical, by locating it in the context of his critique of technology. Viewed as a part of a larger picture, habits are tools of adjustment. A habit is something that has a certain generality of application. It is something that has been tried out and found to be capable of serving certain purposes. Viewed from this perspective, as habits of a sort, hammers and saws become continuous with the other habits developed over millennia by higher order primates, for example, in their attempts to adjust to changing environmental conditions. Viewed in this perspective, to say that human beings are uniquely technological animals is not to place them outside and above nature, but within nature and a part of it. Our activities differ from those of our non-human relatives and ancestors not in kind, but only in level of complexity.

Habits are found throughout nature, but only human beings have reached the level of complexity that allows such a high level of self-control with respect to their deliberate formation, development, retention, and modification. It is for this reason—our ability to engage in the self-controlled manipulation of habits—that we human beings are able to reach very high levels of efficiency. We not only accommodate ourselves to environing conditions, but we also adapt environing conditions to our needs. These two activities taken together Dewey calls *adjustment* or

growth, and he identifies the inquiry that is involved with such adjustment with technology in his broad sense of the term.

3) Here is a third advantage of Dewey's view of philosophy as a tool for tuning up technology. If knowing is a technological activity, then we are off the foundationalist hook. "Certainty" becomes an honorific term that is restricted to narrow non-existential doctrine. The laws of mathematical addition and subtraction are "certain" in this honorific sense not because they correspond to "the furniture of the world," to use Bertrand Russell's infelicitous phase, but because a great deal of work has been focused on a very narrow area of inquiry, that is, one that is so narrow as to exclude actual existence. As for the remaining domains of inquiry, which constitute the vast majority of the locations where technoscientific work is done, reconstruction continues to be done on the assumption that further improvements can be made in existential affairs and in the laws that are developed and employed to characterize them. "Fallibilism" and "probability" replace "certainty" as key operational terms.

4) Fourth, this view has the advantage of providing secure and steady platforms for the improvement of situations that are not as we wish them to be. It is not that we "look for" solutions in the sense of keeping our eyes open, or even that we wait for them to appear, as Heidegger told us that a "*Holzweg*" or clearing in a forest might just appear. If we are to flourish, we must construct hypotheses in a deliberate and intelligent fashion. Knowing is not so much a matter of "finding out" as it is a matter of "making sure." On this view, the kind of inquiry that leads to greater control of problematic social and political situations is also a type of technological undertaking, since it involves an active construction of desirable outcomes through the use of the tools and artifacts that are proper to that domain of knowledge-getting. Not only science itself, but the philosophy, sociology, and politics of science become important technological undertakings.

It is instructive to note the ways in which Dewey's view on this matter contrasts with that of Heidegger. Heidegger writes of a waiting readiness for a clearing to appear in the forest. Dewey writes of sharpening our tools in order to engage conditions that are not what we wish them to be. In one case we get a kind of watchfulness before the incomprehensibility of Being. In the other we get active management of problematic situations.

Critics of technology, such as Heidegger and his followers, have often said that it is technology that constitutes the major human problem. But what they have usually meant is that there are too many techniques, tools, and artifacts and that those things prevent our involvement in more proper occupations such as those that are religious, or "spiritual" in a broad sense, that is, that are concerned with what Heidegger termed "the shepherding of Being." I believe that Dewey would have agreed that technology constitutes the major human problem, but for reasons that are radically different from the ones just given. He thought of technology as inquiry into techniques, tools, and artifacts. And he thought that techniques are among the habits that are necessary to the continuance and growth of human life. He therefore thought that the major human problem was improving intelligence, which he identified with technology. And this means no more or less than developing better and more productive methods of inquiry into our techniques, our tools, and our artifacts.

Following Dewey's lead, I have characterized technology as *the invention, development, and cognitive deployment of tolls and other artifacts, brought to bear on raw materials and intermediate stock parts, to resolve perceived problems.* I have also argued that philosophy is one of the most effective tools we have for tuning up technology.

In addition, I have argued that what are commonly called the "theoretical sciences" such as chemistry and biology are no less cases of this type of activity than what are commonly called "material technologies" such as mechanical engineering and crop science. Theoretical knowing, such as that involved in mathematics, is no less a case of technological activity than is the type of knowing that is involved with concrete, practical outcomes such as building bridges. Because the

theoretical is also artifactual, even what is sometimes called "pure research" is a type of technology.

So whereas the narrow characterizations of technology often tend to draw a line between material artifacts and everything else, which is commonly called science or even culture, and whereas some phenomenological accounts often tend to draw a line between what is practical and what is theoretical, I want to draw a line between what is involved in and a conscious result of intelligent, reconstructive activity, on the one side, and what is merely passive, rote, and uncritically accepted on the other. It seems to me that by dividing things up as I have, we achieve a kind of continuity within the domain of human enterprises that increases our power to effect meaningful adaptive change, that we are able to develop a wider appreciation for the ways that human beings function in and as a part of nature, and that we are able to see the relevance and make more sense out of genetic or historical studies.

If the program that I have outlined is a viable one, then philosophy is indeed an important and effective instrument for tuning up our technological culture. In the chapters that follow, this program will be examined in more detail.

NOTES

1. Mitcham points out that two earlier works had "philosophy of technology" in their titles, but their aims were really quite restricted. These were Ernst Kapp's book *Grundlinien einer Philosophie der Technik* (1877) and Eberhard Zschimmer's *Philosophie der Technik* (1913). See *Philosophy and Technology*, ed. Carl Mitcham and Robert Mackey (New York: Free Press, 1972), 22.

2. Some very recent monographs on the philosophy of technology still ignore Dewey's contribution to the field. As I was writing this chapter, for example, I received a copy of Joseph C. Pitt's *Thinking about Technology: Foundations of the Philosophy of Technology* (New York: Seven Bridges Press, 2000), which contains no mention of Dewey.

3. Hickman, *Dewey's Pragmatic Technology*.

4. This characterization has certain advantages over some of its alternatives. In *Thinking about Technology*, for example, Joseph C. Pitt defines technology as "humanity at work." (p. xi) Pitt's definition does, of course, have the advantage of generality. Further, as he indicates, it also obviates the problems that Jacques Ellul generated when he treated technology as a thing with an essence. On the downside, however, Pitt's definition does not appear on its face to preserve the distinction that I established in the first section of the chapter, namely, the distinction between technology and technique. In other words, it does not preserve the distinction between cognitive and non-cognitive deployment of tools and other artifacts.

On pages 10 and 11, Pitt criticizes the definition advanced by Emmanuel Mesthene, whose work I will discuss in chapter 7, "Populism and the Cult of the Expert." Curiously, Pitt objects to Mesthene's notion that technology is "the organization of knowledge for the achievement of practical purposes" (Mesthene *Technological*, 25) on the grounds that the phrase "organized knowledge" is redundant. Given the fact that our culture is currently suffering the splintering effects of increased specialization, this is a remarkable claim. One of the great needs of our milieu is precisely that what currently counts as knowledge be not only expanded, but better organized as well. Pitt then repeats with emphasis his definition, "*technology is humanity at work*" (p. 11). The idea, he writes, is that technology must involve the activity of humans, as opposed to organisms such as beavers or aliens, and that it must also involve "their deliberate and purposeful use of tools, taken in the general sense" (p. 11).

Two things about Pitt's gloss on his own definition are striking. First, his gloss seems to amplify what is in the definition to the point of significant revision. It adds the terms "deliberate" and "purposeful," for example. Nevertheless, the amplified definition still fails to capture the distinction I made between what is technological (cognitive) and what is technical (habitual), since it is quite possible to work mechanically in ways that are both deliberate and purposeful. Assembly line workers and farm laborers must do this daily. Of course play can be purposeful and deliberate as well.

Second, there is no acknowledgment that technology is involved not just in the use of tools but also in their

invention and development; that tools must be applied in certain ways and not others; and that the problem that initiates inquiry is a function of a situation that involves inquiry with a particular perspective.

David Rothenberg, in an interview published in *A Parliament of Minds: Philosophy for a New Millennium*, ed. Michael Tobias, J. Patrick Fitzgerald, and David Rothenberg (Albany: SUNY Press, 2000), does not provide much help in this regard. "What is technology? It's really the whole history of tools that human beings have used to live in the world" (p. 169). This definition, if it is intended to be one, provides scant guidance concerning how to sort out the underlying differences, for example, between Greek warships and contemporary spacecraft.

5. See Larry A. Hickman, "Making the Family Functional: The Case for Legalized Same-Sex Domestic Partnerships," *Philosophy of the Social Sciences* 29, no. 2 (June 1999): 231–47; a revised and enlarged version of "Making the Family Functional: The Case for Same-Sex Marriage," in *Same-Sex Marriage: The Moral and Legal Debate*, ed. Robert M. Baird and Stuart E. Rosenbaum (Amherst, N.Y.: Prometheus Books, 1997), 192–202.

6. C. P. Snow, *The Two Cultures* (Cambridge: Cambridge University Press, 1959).

7. Carl Mitcham has noted that one response to my interpretation of Dewey's critique of technology in *John Dewey's Pragmatic Technology* involved the claim of reductionism. He thinks that "[my] reply to one possible formulation of the charge of reductionism does not consider the possibility that if all life is technological then the concept of technology becomes vacuous." See Mitcham, *Thinking through Technology*, 75. I hope to have put that objection to rest with the fourfold taxonomy I have developed in this chapter.

8. Mathematical objects have been developed within the sphere of the philosophy of mathematics. See Philip J. Davis and Reuben Hersh, *The Mathematical Experience* (New York: Houghton Mifflin, 1981).

9. See John D. Barrow, *Pi in the Sky: Counting, Thinking, and Being* (Oxford: Clarendon Press, 1992). See especially chapter 2, "The Counter Culture." This is an excellent introduction to the history of counting.

10. James Moore, "The Creationist Cosmos of Protestant Fundamentalism," in *Fundamentalisms and Society: Reclaiming the Sciences, the Family, and Education*, ed. Martin E. Marty and R. Scott Appleby (Chicago: University of Chicago Press, 1993), 12–49.

11. Eliot Wigginton, ed., *The Foxfire Book* (New York: Doubleday, 1972).